SCIENCE

THE MAIN BOOK

2023

SECOND TERM

BY A GROUP OF SUPERVISORS

معاك
Ma3ak App

Interactive E-learning Application

EL-MOASSER SERIES

2nd prep.

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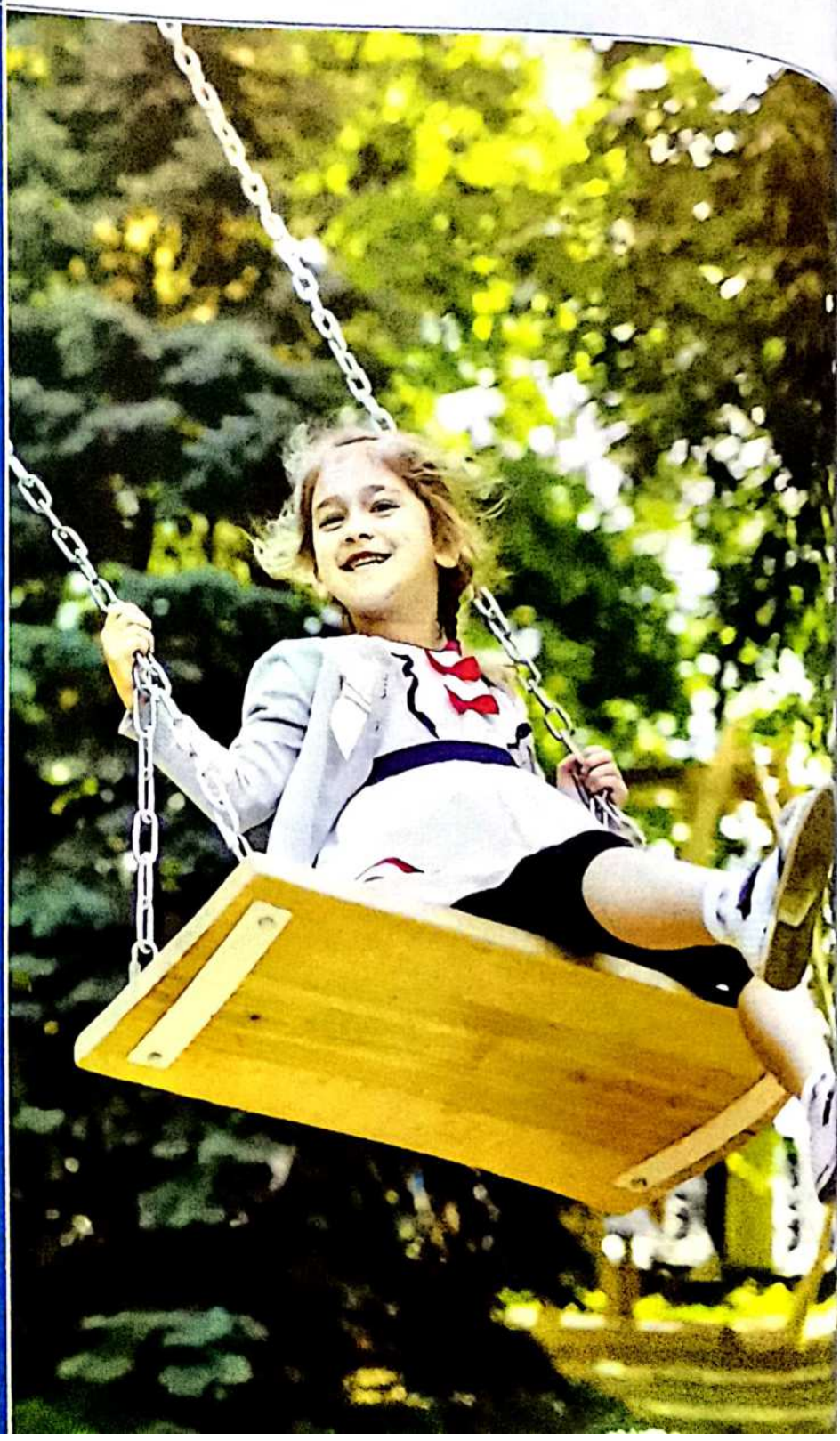
UNIT 1

Periodic Motion



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LESSON 1

Oscillatory Motion

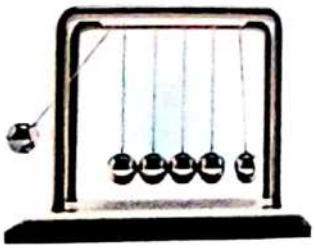
Have you ever thought about motion and its types ?

There are two types of motion, which are :

- Transitional motion.

(Which you have studied in the last year)

- Periodic motion.

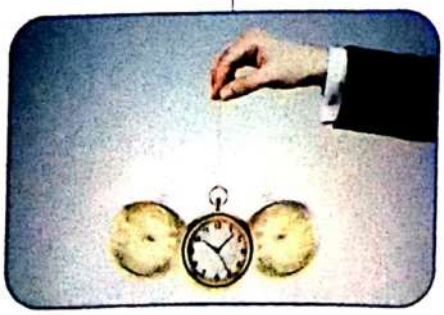


Periodic motion:

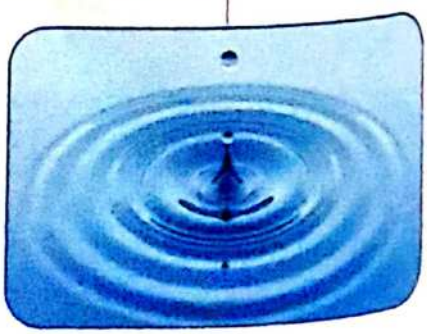
It is a motion, which is regularly repeated in equal periods of time.

Examples of periodic motion

A Oscillatory motion.



B Wave motion.



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In this lesson, we will study :

1. *The concept of oscillatory motion.*
2. *Graphical representation of the oscillatory motion.*
3. *Properties of oscillatory motion.*

1 The concept of oscillatory motion :

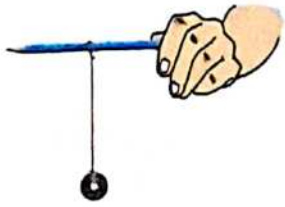
Activity 1 Defining the concept of oscillatory motion :

Materials and tools:

- A pencil.
- A 30 cm long thread.
- A metallic piece.
- A stop watch.

Steps :

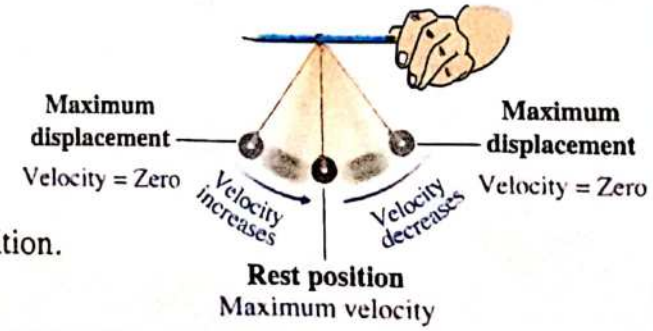
1. Make a simple pendulum as shown in the figure. (A metallic piece, which is tied to one end of a thread, while the other end is tied to a pencil).
2. Hold the pencil with your left hand, and pull the metallic piece (the oscillating body) to the right side, then leave it.
3. Record the time taken by the metallic piece to repeat its movement several times.



Rest position

Observations :

1. The oscillating body moves on both sides around its rest position. This motion is repeated in equal time intervals.
2. The displacements of the oscillating body around its rest position are equal.
3. The velocity of the oscillating body reaches its **maximum** value when it passes its **rest position** and **decreases** gradually when it goes far from it until it **reaches zero** at the **maximum displacement** on both sides of rest position.



Conclusion:

The oscillating body moves around its rest position, where the motion is repeated through equal intervals of time which is known as **"Oscillatory motion"**.

Oscillatory motion:

It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.

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➲ The relation between the velocity of an oscillating body and its kinetic energy :

The kinetic energy ⊜ $\frac{1}{2}$ (mass × squared velocity) = $\frac{1}{2}$ mv^2

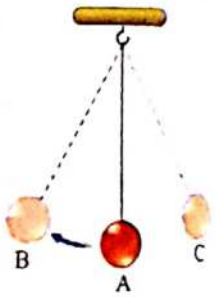
The kinetic energy of an oscillating body is directly proportional to :

- The **mass** of the oscillating body.
- The **squared velocity** of the oscillating body.

So, the kinetic energy **increases** when the velocity of the oscillating body **increases** and vice versa (assuming that its mass is not changed).

Exercise 1

The opposite figure represents an oscillatory motion for a simple pendulum. Answer the following questions :



a. The maximum velocity of the pendulum is at point(s) ..... (A – B – C – C & A)

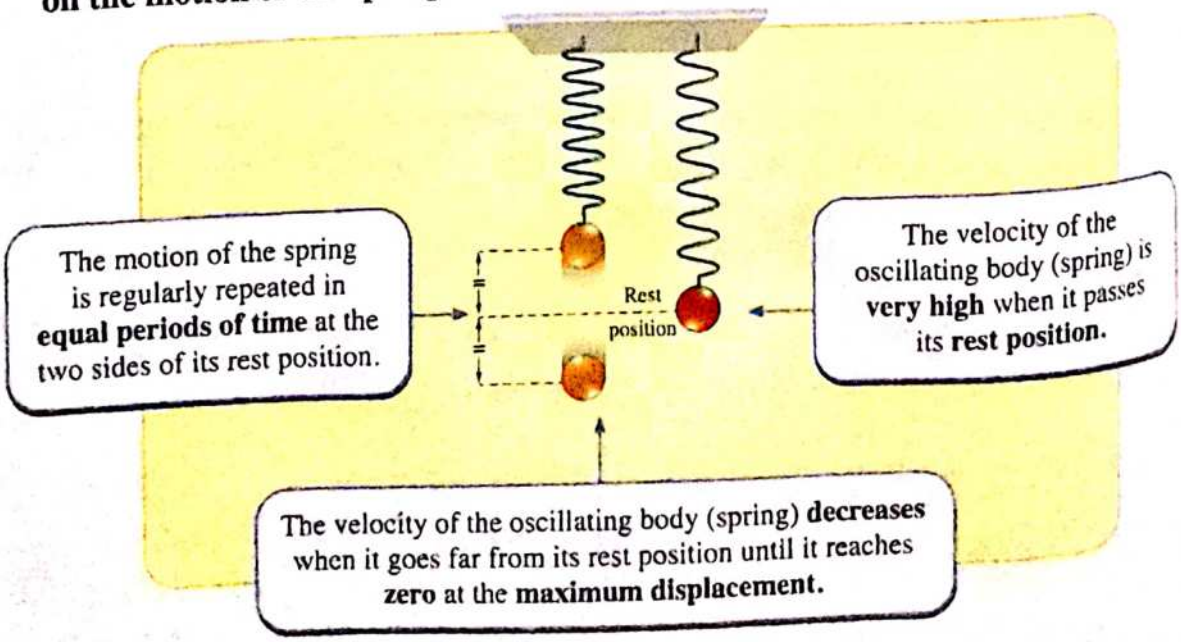
b. The maximum kinetic energy of the pendulum is at point(s) ..... (A – B – C – C & B)

c. The kinetic energy of the pendulum vanishes (equals zero) at point(s) ..... (A – B – C – B & C)

Answer

a. A **b.** A **c.** B & C

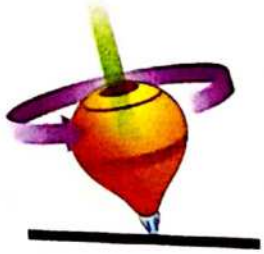
➲ The following figure refers to the application of the concept of oscillatory motion on the motion of the spring :



Examples of the oscillatory motion :

Note

The motion of a rotary bee is considered as a **periodic motion** only, because it is repeated regularly at equal time intervals, but it is not an **oscillatory motion**, because it is not repeated on the two sides of its rest position.



Rotary bee

Enrichment information

Examples of oscillatory motion :

- *The movement of the Earth's crust during earthquakes.*
- *The movement of atoms in molecules.*

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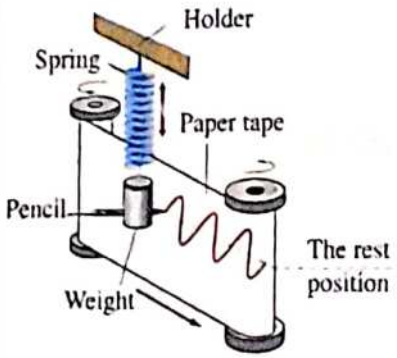
2 Graphical representation of the oscillatory motion :

The oscillatory motion of the spring can be represented graphically as shown in the following activity :

Activity (2) Graphical representation of the oscillatory motion :

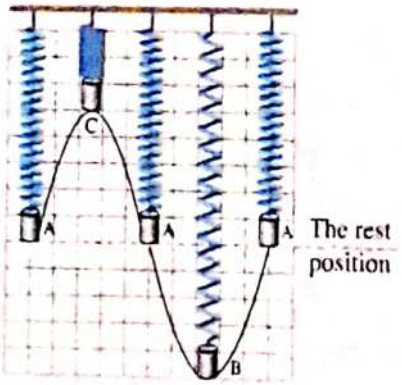
Materials and tools :

- A smooth paper tape rolled around two rolls.
- Spring.
- Weight.
- Holder.
- Pencil.

Steps	Figure	Observation
1. Fix the pencil to the weight, then tie the weight at one end of the spring. 2. Tie the other end of the spring at the holder, so that the pencil's tip touches the midpoint of the paper tape (as shown in the fig.). 3. Pull the weight downwards and leave it, then roll the paper tape regularly.		The pencil draws a curved shape on the paper tape as shown in the figure.

Conclusion:

The motion of the weight which is called the simple harmonic motion is considered the simplest form of oscillatory motion.

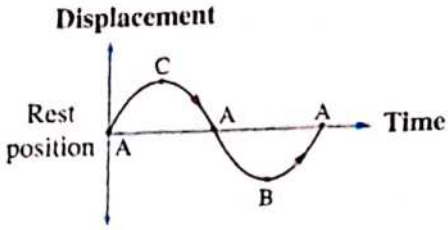


Graphical representation of the oscillatory motion
(Simple harmonic motion)

TRY to answer worksheet (1) in the Notebook

Note

In the simple harmonic motion : the **velocity** of the oscillating body is **inversely proportional** to its **displacement** away from its rest position (A), *i.e.* the velocity of the oscillating body **increases** as it approaches the rest position (point A) and vice versa.



3 Properties of oscillatory motion :

Properties of oscillatory motion are expressed in terms of many concepts, such as :

1. **Amplitude**
2. **Complete oscillation**
3. **Periodic time**
4. **Frequency**

1 Amplitude

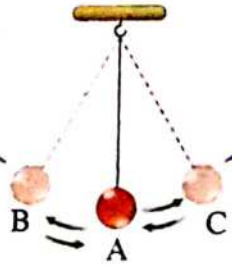
The maximum displacement that the pendulum makes when it oscillates from its rest position (A) :

On the left side at point (B)

The displacement $\overrightarrow{AB}$ **equals** the displacement $\overrightarrow{BA}$

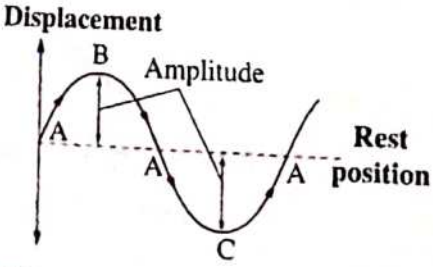
On the right side at point (C)

The displacement $\overrightarrow{AC}$ **equals** the displacement $\overrightarrow{CA}$



The displacement $\overrightarrow{AB}$ = The displacement $\overrightarrow{AC}$

- Each of the displacements ($\overrightarrow{AB}$, $\overrightarrow{BA}$, $\overrightarrow{AC}$, $\overrightarrow{CA}$) is called **"Amplitude"**, which is represented by the opposite graph.



Amplitude :

It is the maximum displacement achieved by the oscillating body away from its rest position.

- The measuring unit of the amplitude is metre (m).

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What is meant by ...?

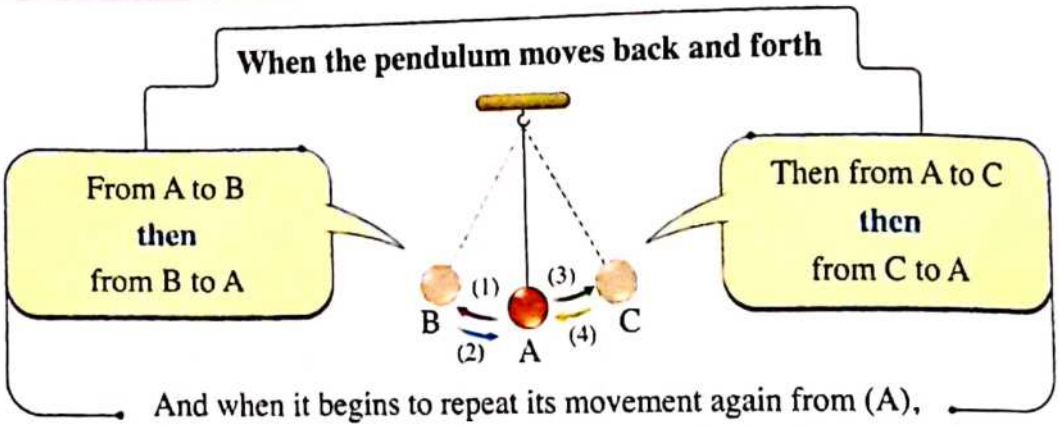
The amplitude of an oscillating body is 20 cm.

➲ This means that the maximum displacement of the oscillating body away from its rest position is 20 cm (0.2 m).

The maximum displacement of the oscillating body is 4 cm.

➲ This means that the amplitude of the oscillating body is 4 cm (0.04 m).

2 Complete oscillation

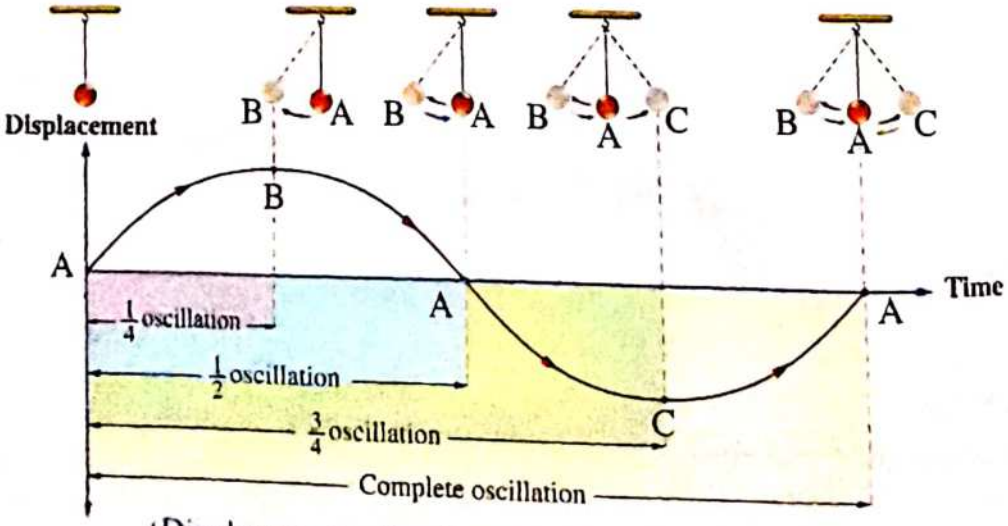


And when it begins to repeat its movement again from (A), it is said that it has made **a complete oscillation.**

Complete oscillation:

It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.

➲ **The following graph refers to the relation between the displacement and the time taken for a simple harmonic motion of a simple pendulum.**



(Displacement - time) graph of oscillatory motion

From the previous figure, we conclude that :

– The complete oscillation is represented by this form :

A $\xrightarrow{(1)}$ B $\xrightarrow{(2)}$ A $\xrightarrow{(3)}$ C $\xrightarrow{(4)}$ A

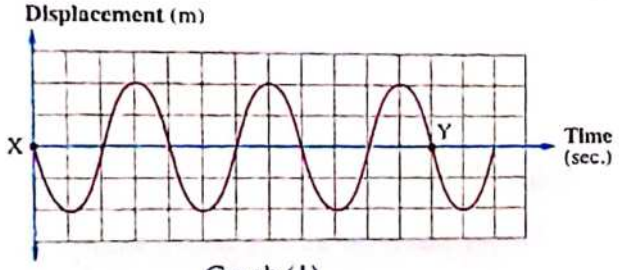
– The complete oscillation includes four successive displacements (amplitudes).

Amplitude = $\frac{1}{4}$ Complete oscillation

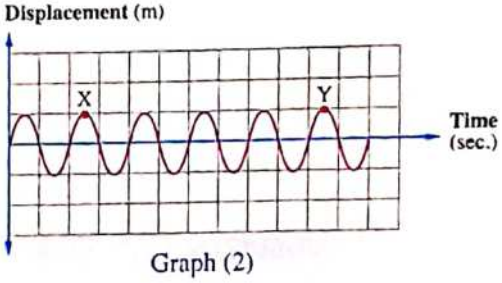
Distance of one complete oscillation = 4 × amplitude

Exercise 2

The two following graphs represent two different motions of a simple pendulum.



Graph (1)



Graph (2)

1. In which graph, the amplitude is larger ?

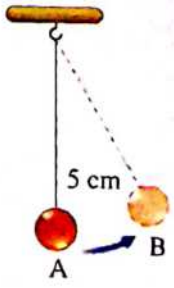
2. How many complete oscillations exist between the points X and Y represented on both graphs ?

Answer

1. Amplitude of graph (1) is larger than the amplitude of graph (2).
2. The number of complete oscillations between points X and Y are :
   - In graph (1) : three (3) complete oscillations.
   - In graph (2) : four (4) complete oscillations.

Exercise 3

In the opposite figure, calculate the distance covered by the pendulum to make 3 complete oscillations.



Answer

Distance of one complete oscillation = 4 × amplitude

= 4 × 5 = 20 cm.

Distance of 3 complete oscillations = 3 × 20 = 60 cm = 0.6 m.

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Exercise 4

Calculate the amplitude of a simple pendulum which covers a distance of 80 cm to make one complete oscillation.

Answer

$$\text{Amplitude} = \frac{1}{4} \text{ complete oscillation}$$

$$= \frac{1}{4} \times 80 = 20 \text{ cm} = 0.2 \text{ m.}$$

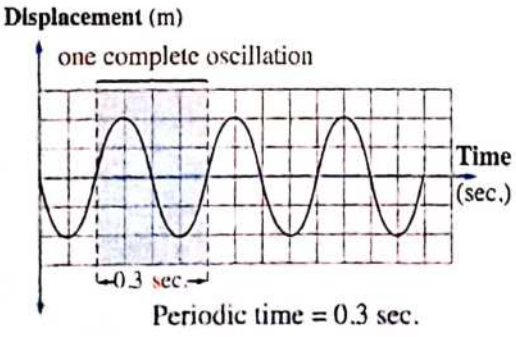
3 Periodic time (T)

Periodic time :

It is the time taken by an oscillating body to make one complete oscillation.

Measuring unit

Second (sec.)



Periodic time = 0.3 sec.

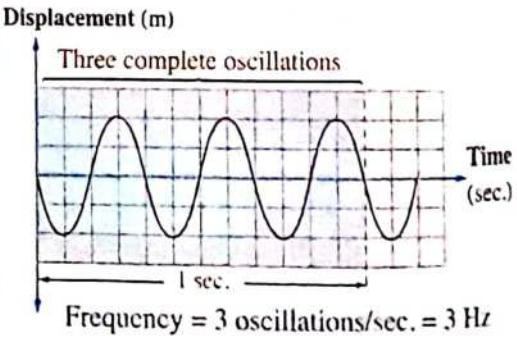
4 Frequency (F)

Frequency :

It is the number of complete oscillations produced by an oscillating body in one second.

Measuring unit

Oscillation/sec. Or **Hertz (Hz)**
"Related to the German scientist Hertz"



Frequency = 3 oscillations/sec. = 3 Hz

Illustrating graph

What is meant by ...

The periodic time of an oscillating body is 0.2 sec.
This means that the time taken by this oscillating body to make one complete oscillation is 0.2 sec.

The frequency of an oscillating body is 20 Hertz.
This means that the number of complete oscillations produced by the oscillating body in one sec. is 20 complete oscillations.

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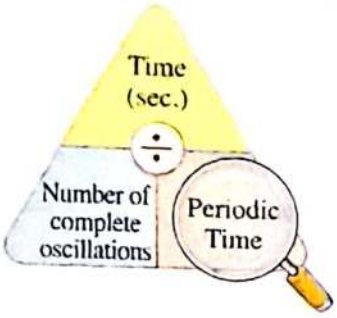
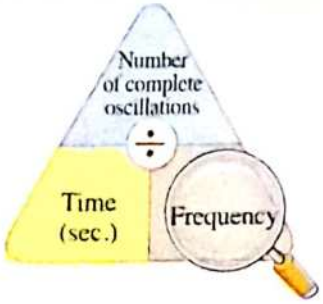
Law used

Periodic time = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$





What is meant by ... ?

The time taken by a spring to make 60 complete oscillations is 1 minute.

This means that the periodic time of this spring is $\left(\frac{1 \times 60}{60}\right)$ which equals 1 sec.

The number of complete oscillations made by an oscillating body in 1 minute is 60 complete oscillations.

This means that the frequency of the oscillating body is $\left(\frac{60}{1 \times 60}\right)$ which equals 1 Hz.

Note

The value of the periodic time will be equal to that of the frequency when the number of complete oscillations made by the oscillating body equals to the time taken by second.

For illustration :

The scientist Higenz designed the pendulum watch, considering that the pendulum oscillates at constant frequency, whatever the amplitude changes.

Multiples of Hertz :

From the Multiples of Hertz

Kilohertz (KHz) — **Megahertz (MHz)** — **Gigahertz (GHz)**

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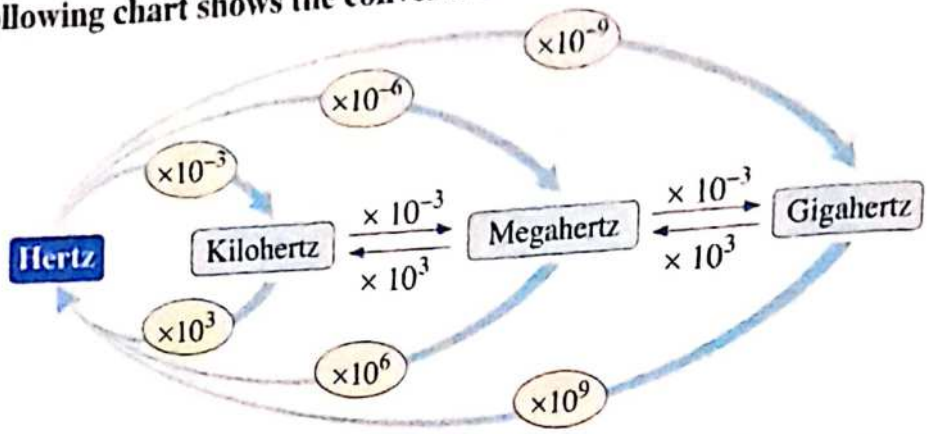
➲ **The following chart shows the conversions of these multiples :**



- Kilohertz = 1×10^3 Hertz - Megahertz = 1×10^6 Hertz - Gigahertz = 1×10^9 Hertz

The relation between periodic time and frequency of an oscillating body:

I **Periodic time (T)** = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

II **Frequency (F)** = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

by multiplying the two previous equations I , II we find that :

$$\text{Periodic time (T)} \times \text{Frequency (F)} = \frac{\cancel{\text{Time in seconds}}}{\cancel{\text{Number of complete oscillations}}} \times \frac{\cancel{\text{Number of complete oscillations}}}{\cancel{\text{Time in seconds}}}$$

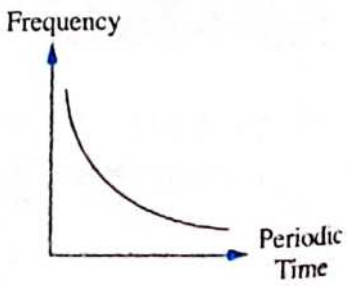
$$\therefore \text{Periodic time (T)} \times \text{Frequency (F)} = 1$$

From this

Periodic time (T) = $\frac{1}{\text{Frequency (F)}}$ **Frequency (F)** = $\frac{1}{\text{Periodic time (T)}}$

➲ **From the previous explanation, we conclude that :**

- The frequency of an oscillating body is the reciprocal of the periodic time.
- Frequency is inversely proportional to the periodic time.
  (***i.e.*** frequency decreases by increasing the periodic time and vice versa) as shown in the opposite graph.



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Problem

Calculate the periodic time and the frequency of an oscillating body that makes 300 complete oscillations in half a minute.

Solution

Time in seconds = $0.5 \times 60 = 30$ sec.

Periodic time (T) = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}} = \frac{30}{300} = 0.1$ sec.

Frequency (F) = $\frac{1}{T} = \frac{1}{0.1} = 10$ Hz.

Guidelines to solve problems :

Periodic time = Time of complete oscillation.

So, **Periodic time** $\ominus$ $4 \times$ time of amplitude.

From the last relation, we can conclude that :

Time of amplitude $\ominus$ $\frac{1}{4}$ periodic time.

Problem

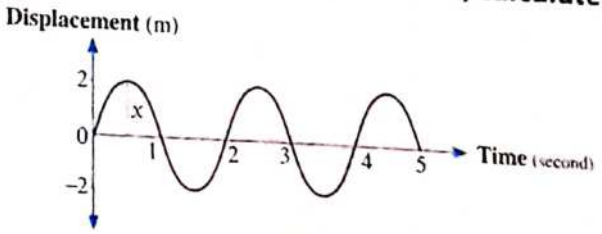
From the opposite figure of the oscillatory motion of a simple pendulum, calculate :

(1) Amplitude.

(2) Periodic time.

(3) Time of amplitude.

(4) Frequency in megahertz.



Solution

(1) Amplitude (X) = 2 m

(2) Periodic time (T) = Time of one complete oscillation = 2 sec.

(3) Time of amplitude = $\frac{1}{4}$ periodic time = $\frac{1}{4} \times 2 = 0.5$ sec.

(4) Frequency (F) = $\frac{1}{T} = \frac{1}{2} = 0.5$ Hz $= 0.5 \times 10^{-6}$ megahertz.

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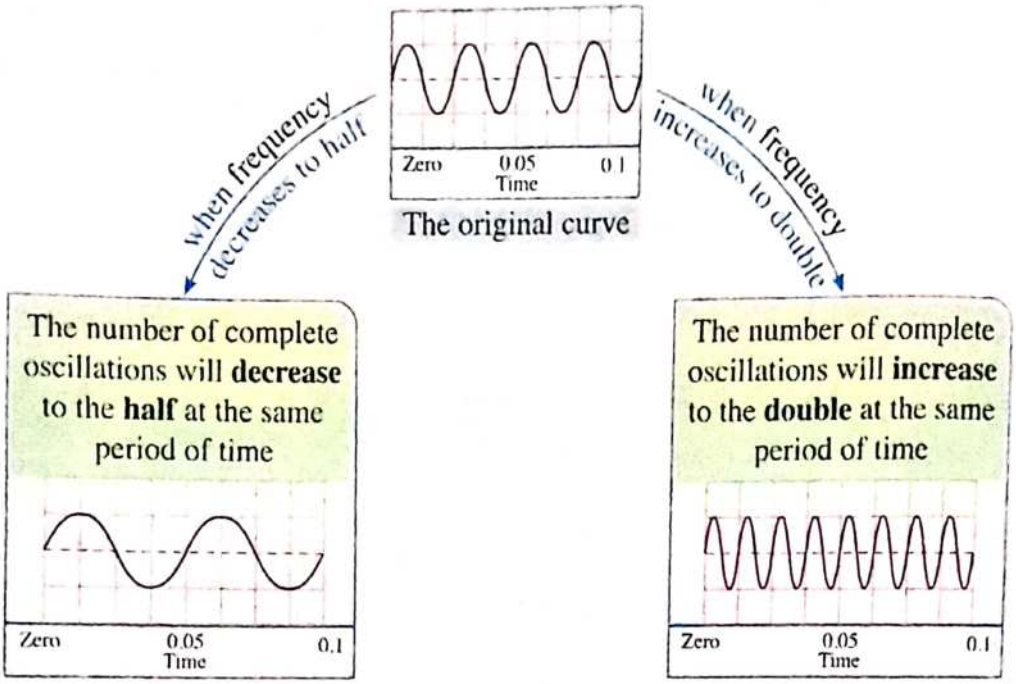
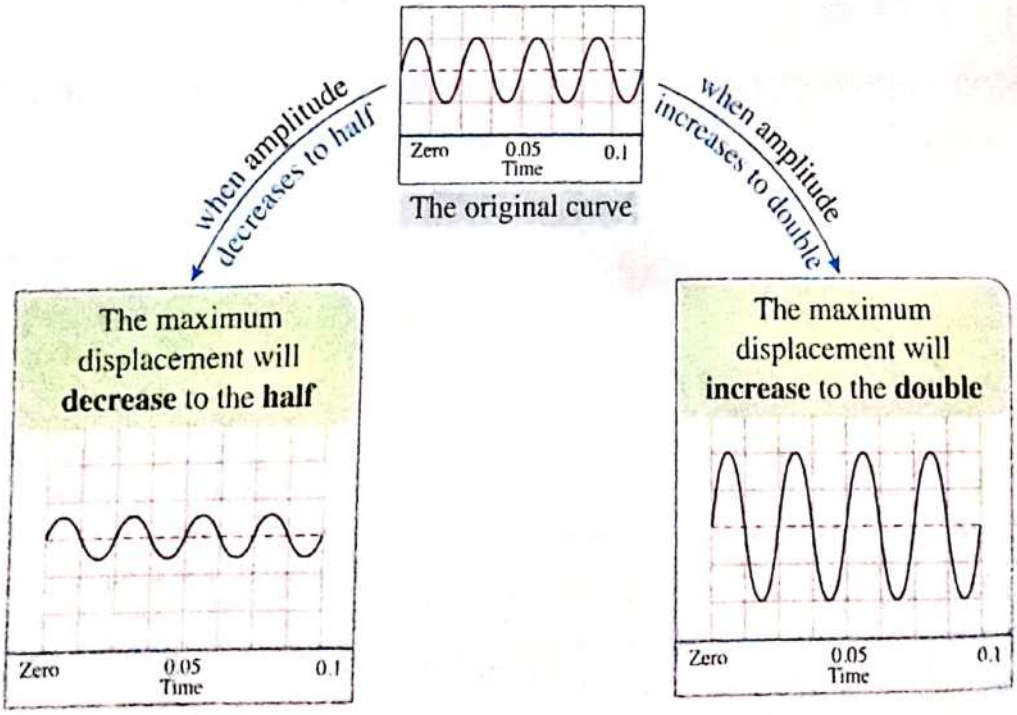
Guidelines to draw a graph :

1 How to draw a graph for a simple harmonic motion of an oscillating body when frequency changes and the amplitude is constant.

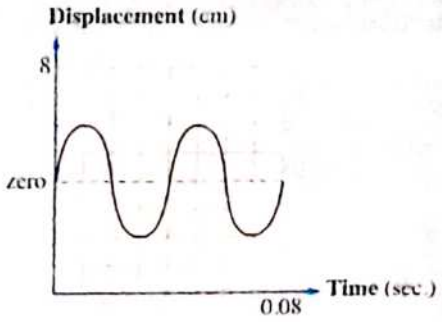


2 How to draw a graph for a simple harmonic motion of an oscillating body when the amplitude changes and the frequency is constant.



Exercise 5

The opposite figure represents the motion of an oscillating body :

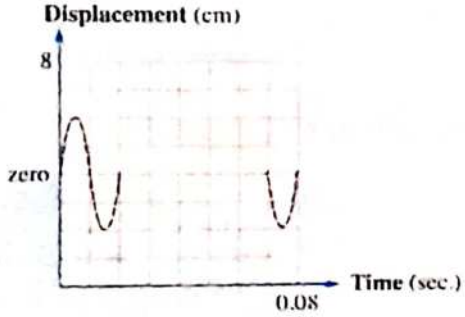


1. ***Find the periodic time of the oscillating body.***
2. ***Redraw the figure showing double of the frequency and the same amplitude.***
3. ***Redraw the figure showing double of the amplitude and the same frequency.***

Answer

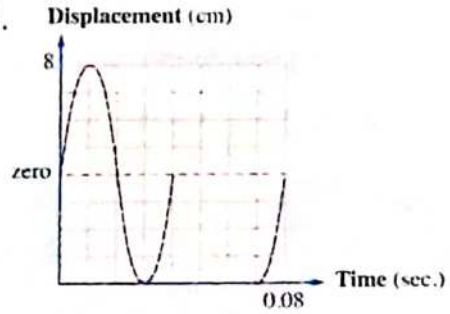
1. Periodic time (T) $= \dfrac{\text{Time in seconds}}{\text{Number of complete oscillations}} = \dfrac{0.08}{2} = 0.04$ sec.

2.

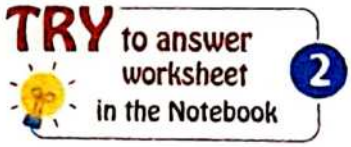


(Complete the figure by yourself)

3.



(Complete the figure by yourself)



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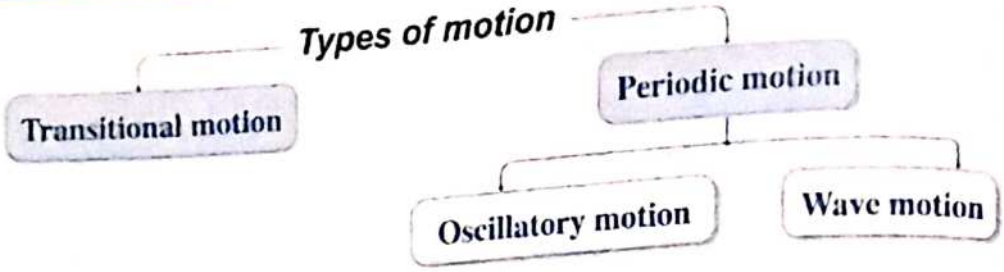
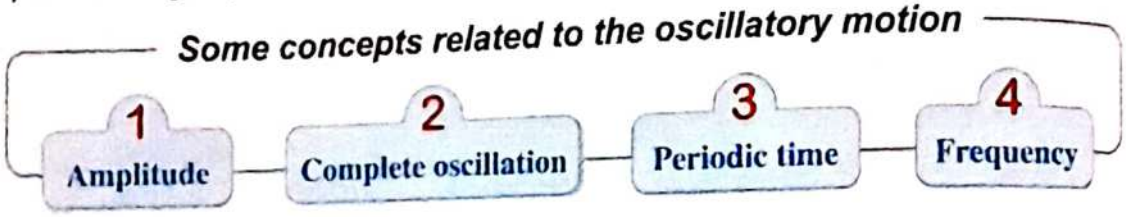
Remember Lesson One



Periodic motion :
It is a motion, which is regularly repeated in equal periods of time.

Oscillatory motion :
It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.



(1) Amplitude :
It is the maximum displacement achieved by the oscillating body away from its rest position.

(2) Complete oscillation :
It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.

(3) Periodic time :
It is the time taken by an oscillating body to make one complete oscillation.

(4) Frequency :
It is the number of complete oscillations produced by an oscillating body in one second.

Periodic time $= \frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

Frequency $= \frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

Frequency (F) $= \frac{1}{\text{Periodic time (T)}}$

Periodic time (T) $= \frac{1}{\text{Frequency (F)}}$

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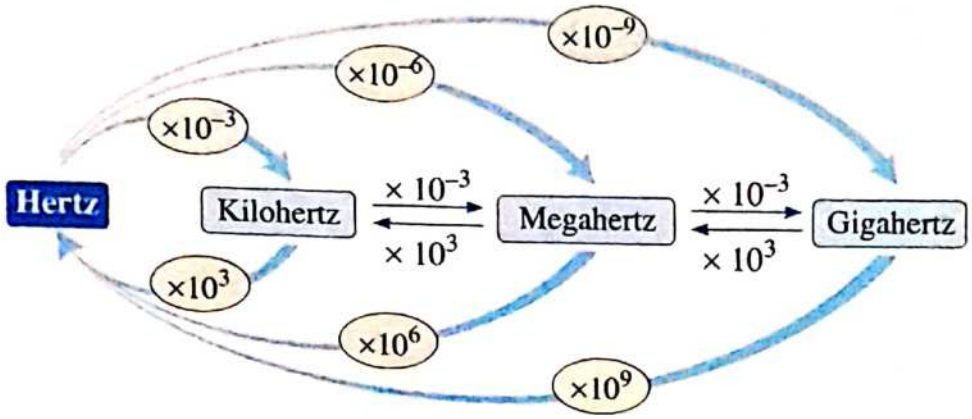
✪ Conversions of Hertz :



- Kilohertz = 1×10^3 Hertz - Megahertz = 1×10^6 Hertz - Gigahertz = 1×10^9 Hertz

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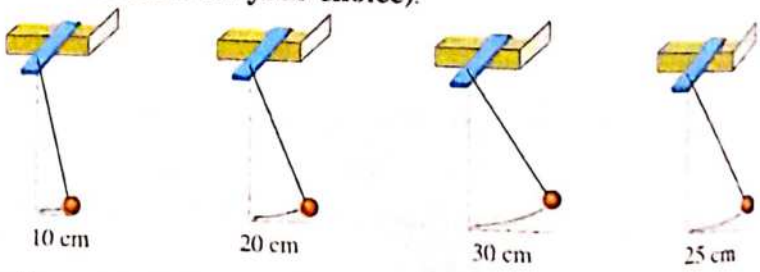
Questions ? on lesson One

• Remember • Understand • Apply ⁂ Higher skills 📖 School book questions

Interactive Exercises

1. Choose the correct answer :

1. The movement of a swing is known as .....
   a. transitional motion. b. oscillatory motion.
   c. wave motion. d. circular motion.
2. The oscillating body moves at the two sides of its rest position, so its velocity .....
   a. decreases when it goes far from its rest position.
   b. increases when it goes far from its rest position.
   c. will reach its minimum value when it passes its rest position.
   d. remains constant.
3. Kinetic energy $= \frac{1}{2} \times$ .....
   a. $\frac{m}{v^2}$ b. mv^2 c. m^2v^2 d. mv^3
4. All of the following are examples of oscillatory motion, except .....
   a. motion of a string. b. motion of a tuning fork.
   c. motion of a car. d. motion of a simple pendulum.
5. The amplitude of the simple pendulum is ..... of a complete vibration.
   a. four times b. a quarter c. a half d. double
6. 📖 The following figures describe the oscillation of a simple pendulum of amplitude = ... **(Mention the reason for your choice)**.
   a. 30 cm
   b. 25 cm
   c. 20 cm
   d. 10 cm



7. Which motion of the following represents a complete oscillation for the given simple pendulum ? .....
   a. C ⟶ B ⟶ A ⟶ B
   b. A ⟶ B ⟶ C ⟶ B ⟶ A
   c. A ⟶ B ⟶ C ⟶ B
   d. B ⟶ C ⟶ B ⟶ A

8. The maximum displacement achieved by the oscillating body away from its rest position is .....

a. amplitude. b. frequency. c. periodic time. d. complete oscillation.

9. The complete oscillation includes ..... displacement(s).

a. one b. two successive c. three successive d. four successive

10. The periodic time is the time of ..... oscillation.

a. $\frac{1}{4}$ b. $\frac{1}{2}$ c. $\frac{1}{5}$ d. one complete

11. If the periodic time of an oscillating body is 0.1 sec., so the number of complete oscillations in one minute is .....

a. 10 b. 600 c. 120 d. 60

12. The number of complete oscillations produced by an oscillating body in one second is known as .....

a. periodic time. b. amplitude.

c. frequency. d. time of amplitude.

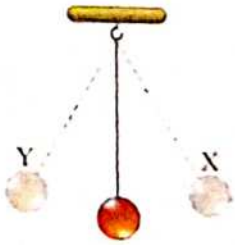
13. The frequency of the oscillating body is measured by a unit called .....

a. Hertz. b. watt/m. c. decibel. d. m/sec.

14. The result of multiplying the frequency of an oscillating body by its periodic time equals ..... **(Mention the reason for your choice).**

a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{1}{3}$ d. 1

15. In the opposite figure, when the ball of the pendulum moves from (X) to (Y) in a duration of 0.02 seconds, the frequency equals ..... Hertz. **(Mention the reason for your choice).**



a. 0.04 b. 0.02

c. 25 d. 50

16. If the frequency of an oscillating body is 6 Hz, the periodic time is .....

a. 3 sec. b. 6 sec. c. $\frac{1}{3}$ sec. d. $\frac{1}{6}$ sec.

17. If the periodic time of an oscillating body is $\frac{1}{6}$ second, this means that .....

a. the oscillating body makes 6 complete oscillations in one minute.

b. the frequency of the oscillating body equals 6 Hz.

c. the oscillating body makes 360 complete oscillations in one minute.

d. (b) and (c) are correct.

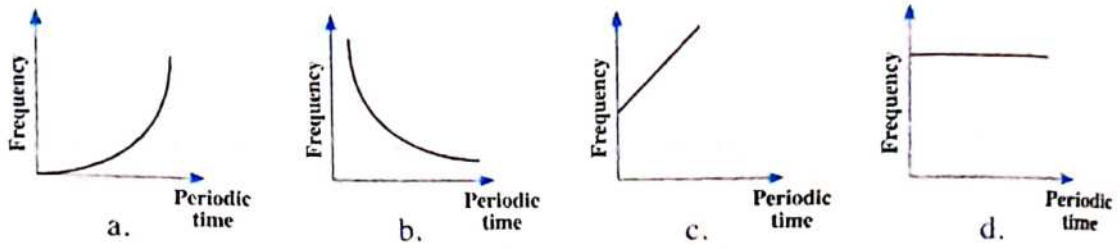
18. The periodic time of an oscillating body which makes 240 oscillations in one minute equals .....

a. 1 sec. b. $\frac{1}{4}$ sec. c. $\frac{1}{2}$ sec. d. 4 sec.

19. A simple pendulum makes 540 complete oscillations in a minute, so its frequency is ..... Hz.

a. 3 b. 6 c. 9 d. 12

20. Which of the following graphs represents the relation between frequency and periodic time ? .....



21. 1 Gigahertz = ... Kilohertz.

a. 10^2 b. 10^3 c. 10^6 d. 10^9

22. If the frequency of an oscillating body is 5 Hz, so the product of multiplying its frequency by its periodic time equals .....

a. 1 b. 5 c. 10 d. 25

23. In the opposite figure, if the maximum displacement done by the spring away from its rest position is 3 cm. Using the figure calculate :

1. The vertical distance covered by the spring through 3 complete oscillations equals ..... cm.

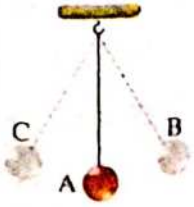
a. 3 b. 12 c. 24 d. 36

2. The frequency of the spring equals ..... Hz.

a. 0.2 b. 0.4 c. 2.5 d. 5

2. Put (✓) or (✗) and correct what is wrong :

1. The oscillatory motion is regularly repeated through equal intervals of time. ( )
2. The motion of stretched string is a wave motion. ( )
3. The motion of a swing is an example of periodic motion. ( )
4. The oscillation of the tuning fork is an example of the periodic motion. ( )
5. The kinetic energy of the simple pendulum decreases by increasing its velocity. ( )
6. The velocity of the oscillating body reaches its maximum value when it passes its rest position. ( )
7. The simple harmonic motion is a form of the oscillatory motion. ( )
8. In the opposite figure, the motion from C to A to B to A is a complete oscillation. ( )



9. The amplitude is measured in a metre. ( )

10. Frequency is the number of complete oscillations produced by the oscillating body in one second. ( )
11. The frequency of the oscillating body is the reciprocal of the periodic time. ( )
12. The oscillating body of frequency 360 Hz makes 180 complete oscillations in half a minute. ( )
13. A vibrating body makes $\frac{1}{4}$ complete vibration in $\frac{1}{64}$ sec., its frequency is 6 Hz. ( )

3. Write the scientific term of each of the following :

1. The motion which is regularly repeated in equal periods of time.
2. ( ) The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time.
3. The maximum displacement achieved by the oscillating body away from its rest position.
4. The motion of an oscillating body when it passes by a fixed point in its path two successive times in the same direction.
5. The time taken by the oscillating body to make one complete oscillation.
6. The measuring unit of the periodic time.
7. ( ) The number of complete oscillations produced by the oscillating body in one second.
8. The measuring unit of frequency.

4. Complete the following statements :

1. ..... motion is the motion which is regularly ..... in equal periods of time.
2. There are two types of periodic motion which are ..... motion and ..... motion.
3. The velocity of the oscillating body reaches its maximum value when it passes its .....
4. The kinetic energy of the oscillating body reaches its ..... value when it passes its rest position.
5. The movement of a swing is an example of ..... motion because it repeats its movement in ..... periods of time.
6. The movement of ..... , ... and ..... are examples of oscillatory motion.
7. The motion of rotary bee is not considered as a/an ..... motion although it is a/an ..... motion.
8. The simple harmonic motion is an example of the .....
9. The amplitude is ..... and its measuring unit is .....
10. The complete oscillation includes ..... successive maximum displacements, each one is called .....
11. Frequency = $\frac{\text{.....}}{\text{Periodic time (seconds)}}$

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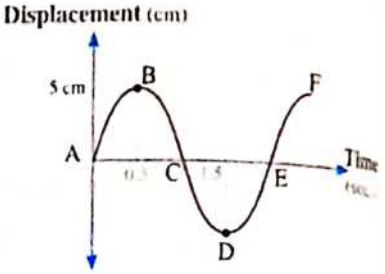
12. For the memorial of the scientist Hertz, the measuring unit of frequency is ..... which is symbolized by .....
13. Megahertz equals ..... Hz and gigahertz equals ..... Hz.
14. The periodic time is the time of ..... and its measuring unit is .....
15. Frequency is ..... proportional to the periodic time.
16. If the maximum displacement achieved by the oscillating body away from its rest position is 0.2 cm which is made in 0.5 second, so its amplitude is ..... and the periodic time is .....
17. When an oscillating body makes 600 complete cycles per a minute, its frequency equals .....
18. If the periodic time of an oscillating body is 0.2 seconds, so the time taken to do 5 complete oscillations is .....
19. The opposite figure represents the oscillatory motion of a spring. Answer :



a. The amplitude = ...
b. The periodic time = ...
c. The complete oscillation is represented between points A, ... , C , D and .....

20. (Frequency × Periodic time) – 1 = ...

5. Give reasons for :

1. • The oscillatory motion is considered as a periodic motion.
   • The motion of planets around the Sun is considered as a periodic motion.
2. The motion of spring is considered as an oscillatory periodic motion.
3. The velocity of the body is taken as a measure of its kinetic energy.
4. The kinetic energy of a pendulum is maximum when the pendulum passes its rest position.
5. The motion of the rotary bee is a periodic motion only, but it is not an oscillatory motion.
6. The periodic time of an oscillating body decreases as the number of complete oscillations increases at the same time.
7. Frequency × Periodic time = 1
8. The frequency of the vibrating body decreases by increasing the periodic time.

6. Define each of the following :

1. Periodic motion.
2. Oscillatory motion.
3. Amplitude.
4. Complete oscillation.
5. Periodic time.
6. Frequency.

7. What is meant by .... ?

1. The maximum displacement achieved by an oscillating body is 6 cm.
2. The amplitude of an oscillating body is 4 cm.
3. The periodic time of a tuning fork is 0.5 sec.
4. The time taken by a spring to make 60 complete oscillations is 1 minute.
5. The frequency of a simple pendulum is 50 Hertz.
6. The number of complete oscillations made by an oscillating body in a duration of 10 seconds is 500 complete oscillations.
7. The oscillating body makes 30 complete oscillations in one second.
8. The oscillating body makes 240 complete oscillations in half a minute.

8. What happens when .... ?

1. The oscillating body passes its rest position during its movement (concerning its velocity).
2. Increasing the velocity of the pendulum (concerning its kinetic energy).
3. Number of oscillations produced by a vibrating body increases.
4. The number of complete oscillations equals to the time taken by the vibrating body to make these oscillations.

9. Mention the unit used for measuring each of the following :

1. Periodic time. 2. Amplitude. 3. Frequency.

10. Mention the mathematical relation between each of the following :

1. Amplitude and complete oscillation of an oscillating body.
2. Periodic time and number of complete oscillations made by an oscillating body in a certain time.
3. Frequency and number of complete oscillations made by an oscillating body in a certain time.
4. Frequency and periodic time.
5. Number of complete oscillations and time taken to complete them.
6. Time of complete oscillation and time of amplitude.

11. Problems :

1. Calculate the periodic time of a source that makes 600 oscillations in one minute.

2. Calculate the time of making amplitude of a source that makes 600 oscillations in one minute.

3. Calculate the frequency of a simple pendulum which makes 720 complete oscillations in 90 seconds.

4. Calculate the number of complete oscillations that are made by a body in 2 minutes if its frequency is 6 Hz.

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5. If an oscillating body makes 480 complete oscillations in one minute, calculate :

a. Frequency. b. Periodic time.

6. Calculate the frequency of an oscillating body in megahertz, if its periodic time is 0.2 seconds.

7. If the frequency of an oscillating body is 10 Hz, find :

a. Its periodic time.

b. The time taken to make 300 complete oscillations.

c. The number of complete oscillations that this body makes in a minute.

12. Study the following figures, then answer the questions :

(1) Which of the following figures doesn't represent an oscillatory motion ? .....

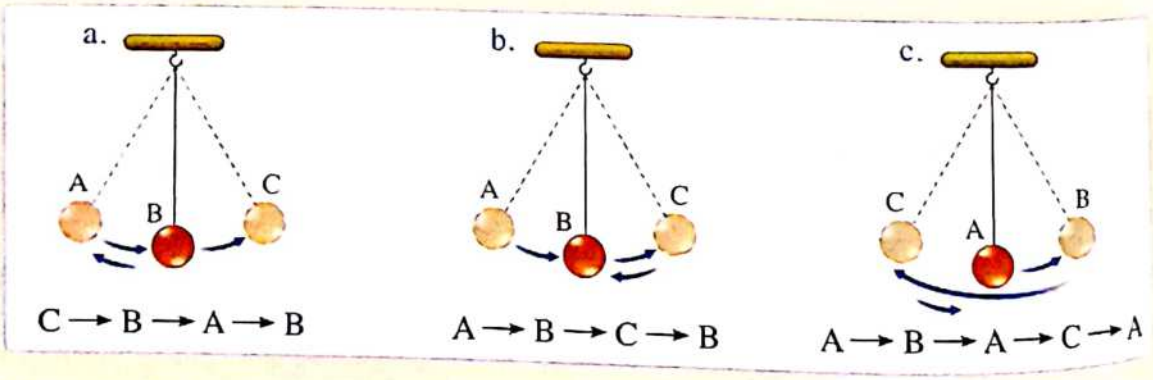
Fig. (a)

Fig. (b)

Fig. (c)

Fig. (d)

(2) Which of the following figures represents a complete oscillation ? .....



(3) From the opposite figure, choose the correct answer :

a. The periodic time = ...

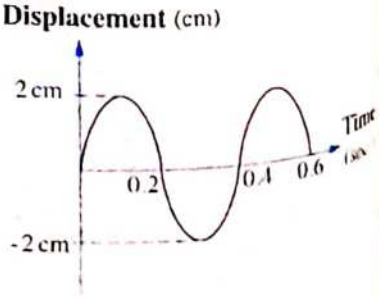
[0.2 sec. - 0.4 sec. - 0.6 sec. - 0.4 m]

b. Frequency = ...

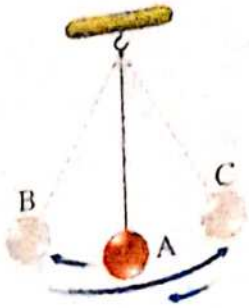
[0.2 sec. - 0.4 Hz - 2.5 cycle/sec. - 0.4 m]

c. The amplitude = ...

[0.2 sec. - 0.4 sec. - 2 cm - 0.4 cm]



(4) From the opposite figure, complete :



a. Point (A) represents .....

b. The distance $\overline{AB}$ represents .....

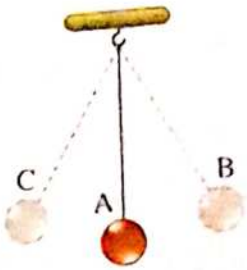
c. The motion of the pendulum

(A ⟶ B ⟶ C ⟶ A) represents .....

and the time of this motion is called .....

(5) The opposite figure shows a simple pendulum released from point (B) to move freely.

Complete the following questions :

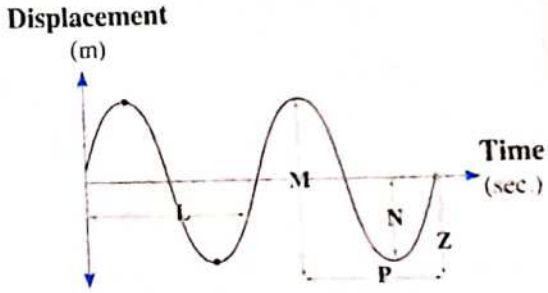


a. The oscillating body has its maximum kinetic energy at point(s) .....

b. The velocity of the pendulum is minimum at point(s) .....

c. If the pendulum takes 0.2 second to move from (A) to (B), so its periodic time is .....

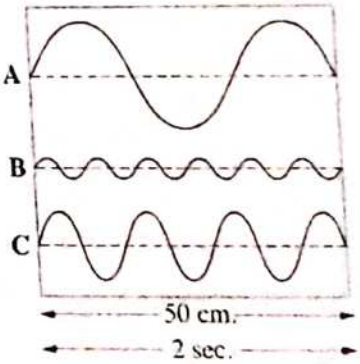
(6) The opposite figure represents an oscillatory motion for a simple pendulum. Choose the letter that denotes :



a. The oscillation of the pendulum forming $\frac{3}{4}$ complete oscillation. (.....)

b. The amplitude. (.....)

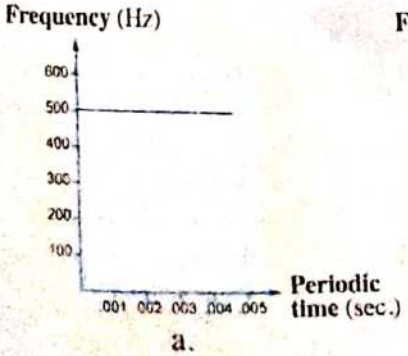
(7) The opposite figure represents three simple harmonic motions (A , B and C), which one has :



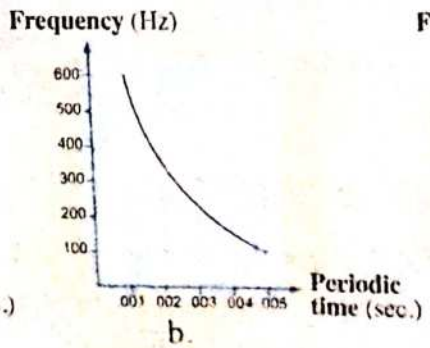
a. The largest frequency.

b. The largest amplitude.

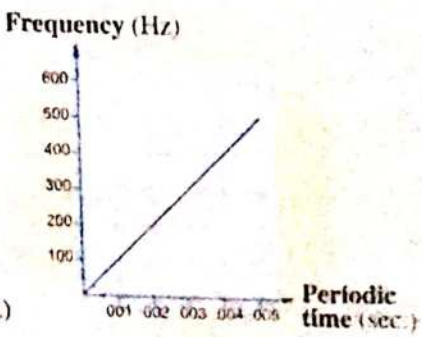
(8) Which of the following graphs expresses the relation between frequency and periodic time ? Why ?



a.



b.



c.

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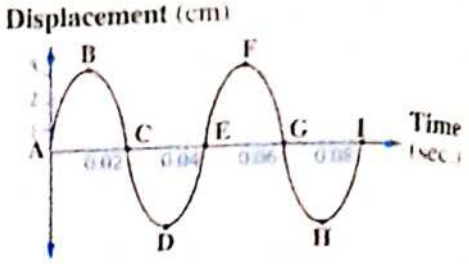
⁂ **(9) The opposite figure represents an oscillatory motion.**

Find :

a. The amplitude.

b. The periodic time.

c. The frequency.

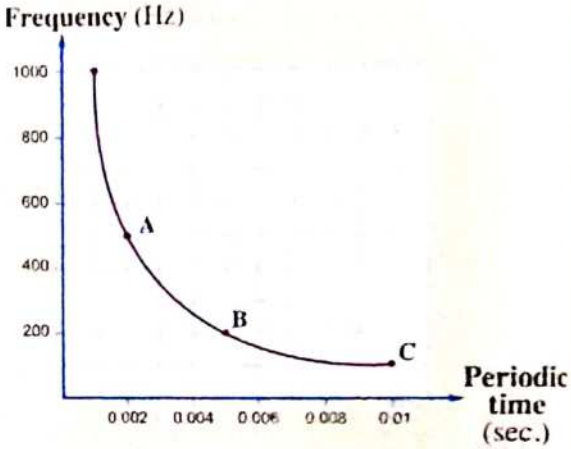


⁂ **(10) From the opposite figure :**

a. Determine the number of complete oscillations which made by **(A)**, **(B)** and **(C)** in one second.

b. Determine the periodic time of the oscillating body **(B)**.

c. What is the type of the relation between the frequency and periodic time ?



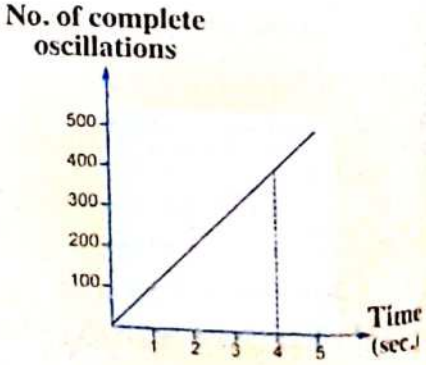
⁂ **(11) The following graph shows the relation between the number of complete oscillations made by an oscillating body and the time in seconds. From the graph find :**

a. The number of complete oscillations made by the oscillating body after 4 seconds.

b. The time in which the oscillating body makes 200 oscillations.

c. The frequency of the oscillating body.

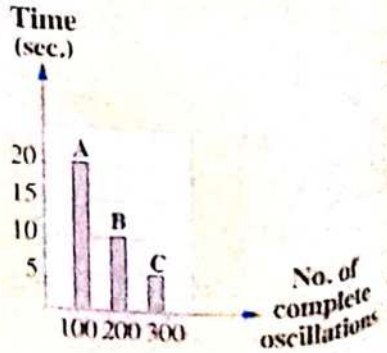
d. The periodic time.



⁂ **(12) The opposite figure indicates the oscillatory motion for three bodies (A) , (B) and (C) :**

a. Which of these bodies has a very high frequency ?

b. What is the value of the periodic time of the body (B) ?



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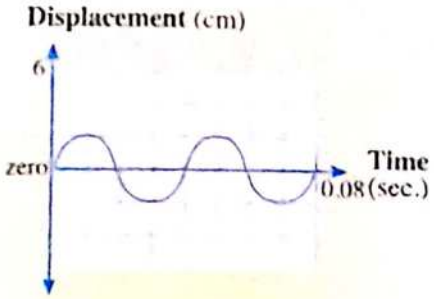
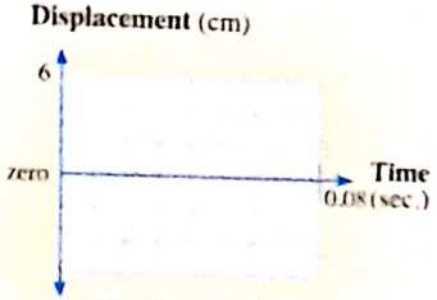
∴ (13) **The opposite figure represents the motion of an oscillating body. Using the figure :**

a. Find the periodic time of the oscillating body.

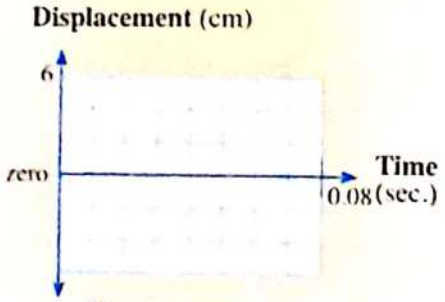
b. Redraw the figure in graph paper 1, showing double of the frequency and the same amplitude.

c. Redraw the figure in graph paper 2, showing the same frequency and double of the amplitude.





Graph paper (1)



Graph paper (2)

13 When do the following cases happen ?

1. The motion of a body is a periodic motion.
2. The periodic motion is an oscillatory motion.
3. The velocity of a pendulum reaches its maximum value.
4. The kinetic energy of a pendulum reaches its minimum value.
5. The value of the periodic time of a vibrating body is equal to its frequency.

14. Creative thinking :

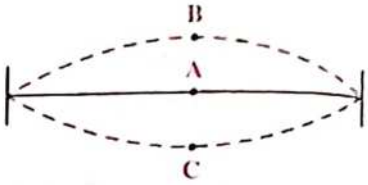
(X) , (Y) and (Z) are three examples of oscillatory motion (motion of the pendulum, motion of the spring and motion of a string) out of order.

If (X) doesn't represent the motion of the pendulum or the spring and (Y) doesn't represent the motion of the pendulum or the string, analyze these data to find out which symbol represents each motion.

Thinking Skills Questions

1. Choose the correct answer :

1. In the opposite figure, if the string transfers from A to B in 5 sec., so its frequency equals to .....



a. 5 Hz.
b. 5×10^{-3} Megahertz.
c. 5×10^{-9} Gigahertz.
d. 5×10^{-5} Kilohertz.

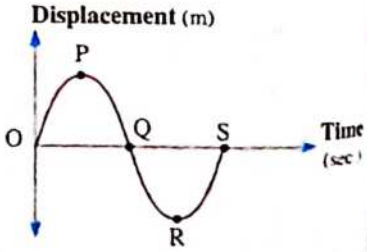
2. The ratio between the time of amplitude to the periodic time equals .....
a. 1 : 2 b. 2 : 1 c. 1 : 4 d. 4 : 1

3. The ratio between periodic time of two oscillating bodies, the first makes 9 complete oscillations in one second and the other makes 3 complete oscillations in one second equals .....
a. $\frac{1}{3}$ b. $\frac{1}{9}$ c. 6 d. 12

4. An oscillating body makes 20 successive displacement in one second, so its periodic time = ... sec.
a. 0.05 b. 0.2 c. 0.1 d. 5

5. If the time of amplitude of an oscillating body increases to double, so the time of complete oscillation increases to .....
a. double. b. 3 times. c. 4 times. d. 5 times.

6. The opposite figure represents the motion of an oscillating body, its frequency is 50 Hz, so the period of time which it takes between the points (P) and (Q) equals ..... sec.



a. 0.02 b. 0.01
c. 0.05 d. 0.005

7. If the periodic time of the body (1) is double the periodic time of the body (2) , so the ratio between the frequency of the body (2) to the frequency of the body (1) equals .....
a. 1 : 1 b. 1 : 2 c. 2 : 1 d. 1 : 3

2. A simple pendulum makes 1200 complete oscillations in a minute where every complete oscillation covers a distance 20 cm. Calculate :

a. Amplitude.
b. Frequency.
c. Periodic time.
d. The time of 16 successive displacement.

3. The opposite figures represent the two motions of two oscillating bodies at the same period of time :

a. What are the similarities between them ?

b. What are the differences between them ?

(Give a reason)

Fig. (1)

Fig. (2)

4. Which figure represents the relation between the velocity and the time of an oscillating simple pendulum, if its rest position is symbolized by letter (A) ? (Give a reason for your choice)

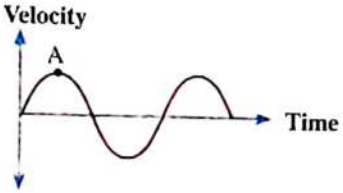


Fig. (1)

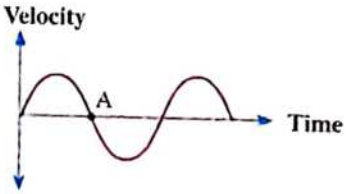
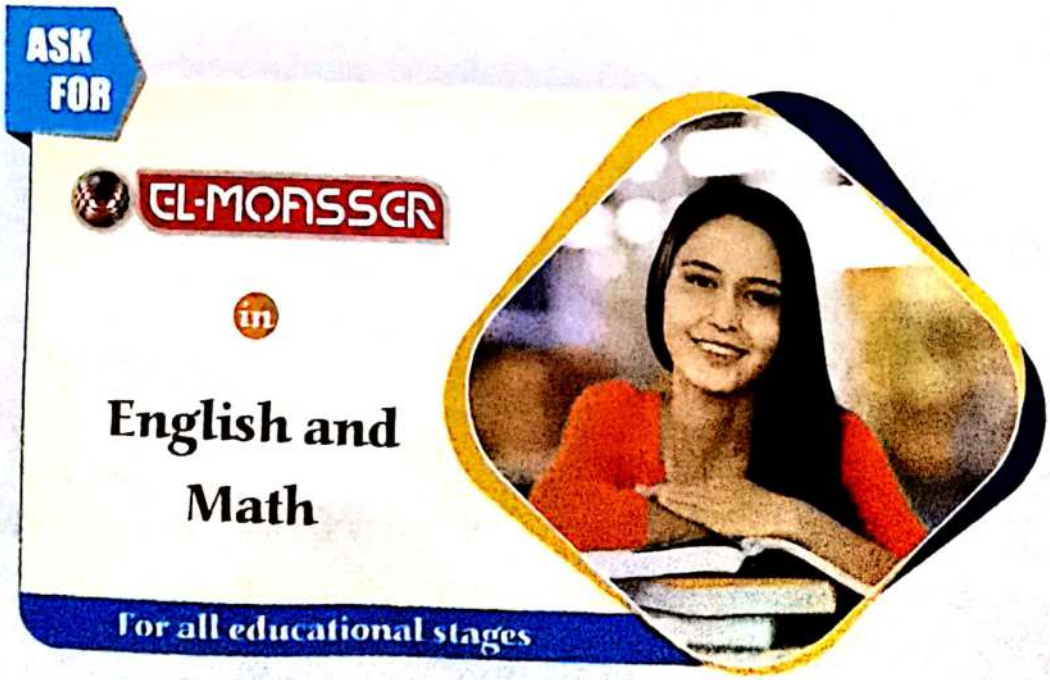


Fig. (2)



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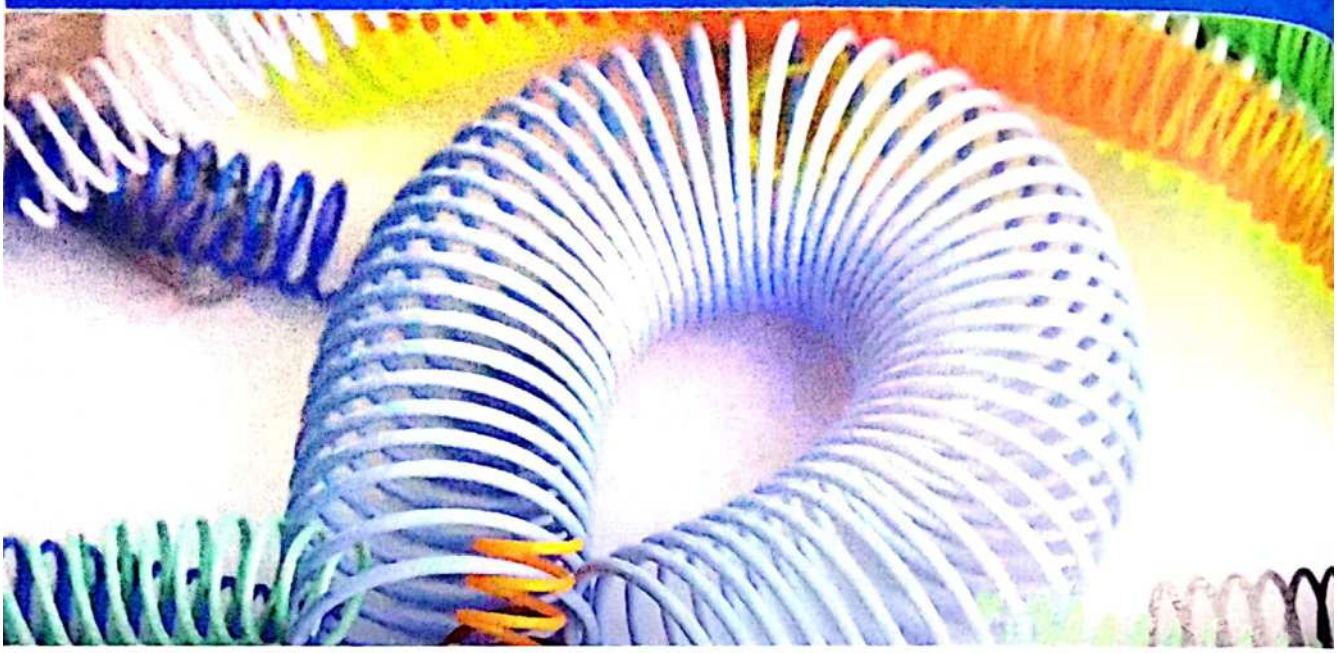
LESSON 2

Wave Motion



What is meant by waves ?

- If you throw a stone in water or when a drop of water falls on a surface of still water, a disturbance will be occurred.
- This disturbance will transfer from a drop to another on the water surface which appears in the form of concentric circles.
- These concentric circles are known as **water waves**.
- The propagation of these circles on the water surface represents **wave motion**.

▶ In this lesson, we will study :

1. *The role of waves in transferring energy.*
2. *The concept of wave motion.*
3. *Types of waves.*
4. *Some concepts related to wave motion and its properties.*

To recognize the concept of wave motion, we should know the wave and the role of waves in transferring energy.

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1 The role of waves in transferring energy :

Activity 1 Defining the concept of wave and its role in energy transfer :

Procedures	Figure	Observation
1. Arrange the dominoe's pieces in a row at equal distances from each other. 2. Push the first piece.	Dominoe's pieces	The pieces fall one after the other, as well as they don't change their positions after falling.

Explanation :

1. When the first domino piece falls, it will transfer its energy to the second piece, which falls transferring its energy to the third one and so on.
2. The transfer of energy continues and the pieces do not change their positions in the row.

Conclusion:

Pushing the first piece of domino creates a disturbance that propagates and transfers energy in the direction of propagation and this is known as the wave.

The wave :

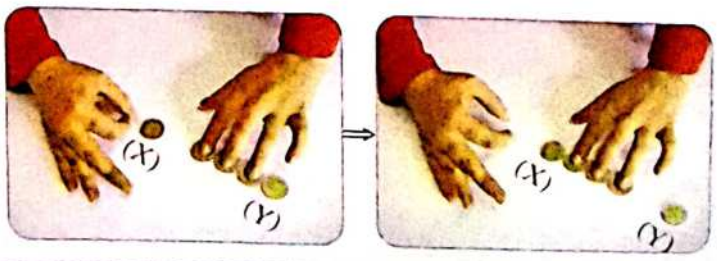
It is the disturbance that propagates and transfers energy in the direction of propagation.

Exercise 1

How do you explain the motion of the coin (Y) when the coin (X) is pushed, though they never touch ?

Answer

- The coin (Y) moves as a result of the transfer of the energy of the movement of coin (X) to it through the rest of the fixed coins with the fingers of the hand.



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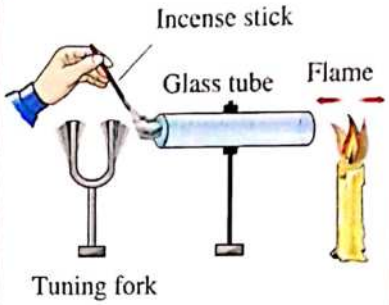
2 The concept of wave motion :

Activity (2) To conclude the concept of wave motion :

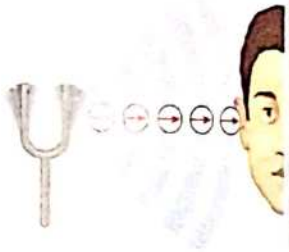
Materials and tools :

- Open-ended hollow glass tube 30 cm long.
- A burning incense stick.
- A candle.
- A tuning fork.

Procedures	Figure	Observations
1. Fix the glass tube horizontally. 2. Put the burning candle at one end of the tube and the incense stick at the other end (as shown in the figure). 3. Hit the tuning fork and place it near the incense stick.		1. The flame of the candle vibrates to right and left 2. The smoke of burning incense stick does not appear from the other end of the tube.

Explanation :

1. Energy is generated when the tuning fork vibrates. This energy is transferred by the medium particles (air and smoke particles) through the tube to the flame of the candle in the form of sound waves (as shown in the figure).
2. The medium particles vibrate without moving from their places during the propagation of sound waves, which carry energy to the candle flame.



Propagation of sound waves which produced by a tuning fork

Conclusion:

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as wave motion and the direction of progression of the wave is known as the line of wave propagation.

Wave motion :

It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.

The line of wave propagation :

It is the direction of progression of the wave.

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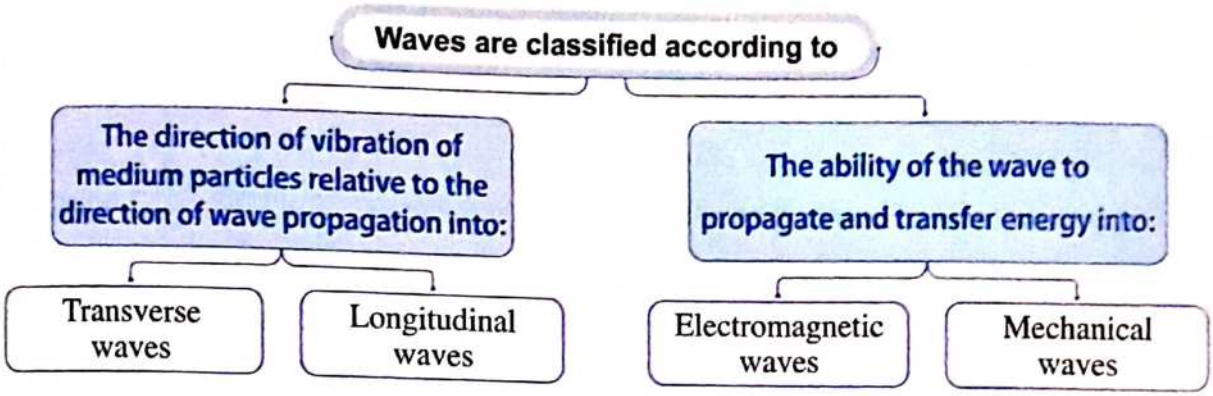
G.R. ***Sea beaches erosion is caused by the waves of water.***

Because the waves of water transfer the energy in the same direction of their propagation, then hitting the beaches strongly leading to their erosion.

3 Types of waves :



FIRST Transverse and longitudinal waves :

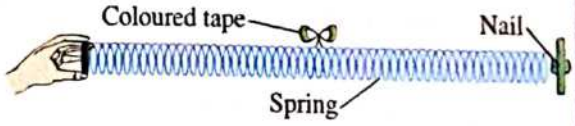
Activity 3 To know the concept of transverse and longitudinal waves :

Materials and tools :

- Spring.
- Coloured tape.
- Nail.

Procedures :

1. Tie the coloured tape in the middle of the spring.
2. Fix one end of the spring to a wall using the nail (as shown in the figure).



3. Move the free end of the spring up and down or right and left perpendicular to the axis of the spring.

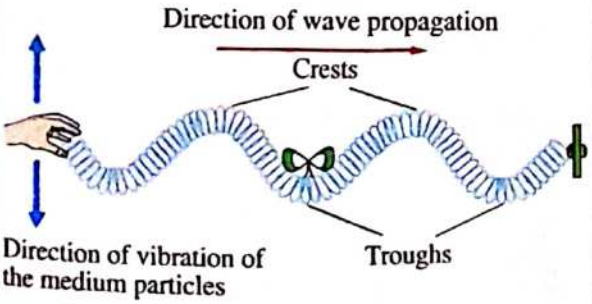


Figure (1)

4. Push and pull the other coil rings.

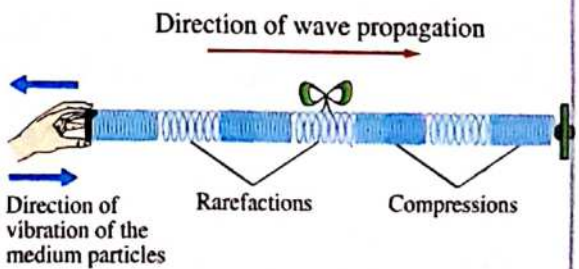


Figure (2)

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Observations	
The coloured tape vibrates in its place **in a direction perpendicular** to the direction of the movement of rings of spring which move up and down forming crests and troughs.	The coloured tape vibrates in its place **along the direction** of the movement of rings of spring which are too close to each other in some areas forming compressions and are faraway from each other in some areas forming rarefactions.

Explanation :

If we considered that the movement of rings of spring represents wave motion,

So :

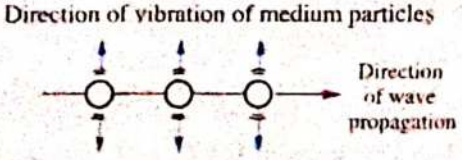
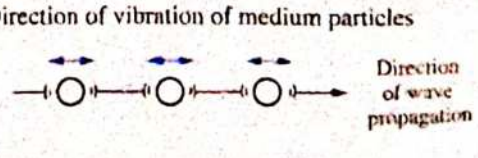
Direction of movement of rings of spring **represents** **the direction of wave propagation.**

Direction of vibration of coloured tape **represents** **the direction of vibration of medium particles.**

Conclusions:

- During the wave propagation, the medium particles vibrate around their rest positions without transferring.
- The wave at which the medium particles vibrate in a direction perpendicular to the direction of wave propagation is called **transverse wave** as in figure (1).
- The wave at which the medium particles vibrate along the direction of wave propagation is called **longitudinal wave** as in figure (2).

From the previous activity, we can compare between transverse and longitudinal waves as follows :

Transverse wave	Longitudinal wave
Transverse wave : It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	***Longitudinal wave :*** It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
Illustrating figure	
	

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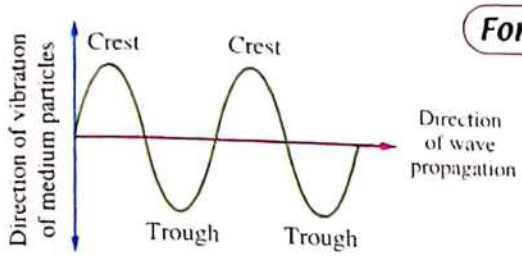
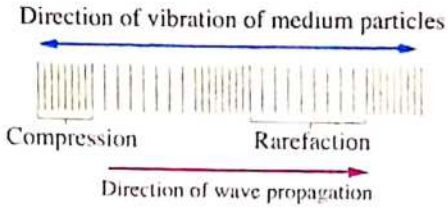
Formation



It is formed from :
crests and troughs.

Crest :
It is the highest point of the particles of the medium in the transverse wave.

Trough :
It is the lowest point of the particles of the medium in the transverse wave.



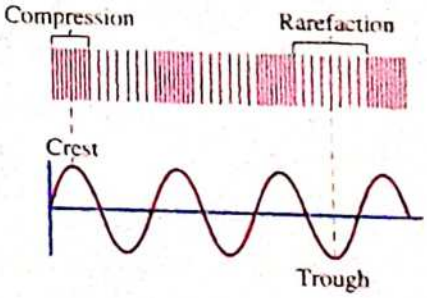
It is formed from :
compressions and rarefactions.

Compression :
It is the area in the longitudinal wave at which the medium particles are of the highest density and pressure.

Rarefaction :
It is the area in the longitudinal wave at which the medium particles are of the lowest density and pressure.

Note

In the wave motion curve :
- The crest of the transverse wave is equivalent to the centre of **compression** of the longitudinal wave.
- The trough of the transverse wave is equivalent to the centre of **rarefaction** of the longitudinal wave.



Real Life application : *Physiotherapy tubs (Jacuzzi) :*

Description
- It is a tub where water moves in the form of circular waves and it is found in most health clubs.

Uses of Jacuzzi
- It is used to treat :
1. Sprains and cramps by using hot water.
2. Nervous tension by using cold water.

SECOND Electromagnetic and mechanical waves :

Electromagnetic waves :

They are waves which do not need a medium to propagate, where they propagate through vacuum.

Mechanical waves :

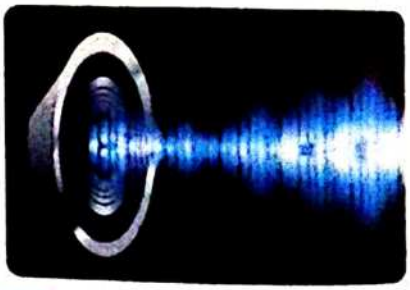
They are waves which need a medium to propagate, where they do not propagate through vacuum.

Types

- They are **all transverse** waves, such as :
  - Visible light waves.
  - Infrared waves.
  - Radio waves (used in radars).

- They may be :
  - **Transverse** waves : as water waves.

  - **Longitudinal** waves : as sound waves.



Velocity of propagation

- They propagate by a velocity = 3×10^8 m/sec. in vacuum but their velocity decreases when they transfer in media.

- They propagate with a velocity is **much less than** the velocity of electromagnetic waves in media.

G.R.

Radio waves are transverse electromagnetic waves.

They are transverse because the particles of the medium vibrate perpendicular to the direction of wave propagation forming crests and troughs and electromagnetic because they propagate through vacuum.

Sound waves are longitudinal mechanical waves.

They are longitudinal because the particles of the medium vibrate along the direction of wave propagation forming compressions and rarefactions and mechanical because they need a medium to propagate through.

G.R.

- ***Hearing thunder after seeing lightning although they both happen at the same time.***

Because the light of lightning is electromagnetic waves, while the sound of thunder is mechanical waves, where the velocity of propagation of electromagnetic waves is much greater than the velocity of propagation of mechanical waves in air.

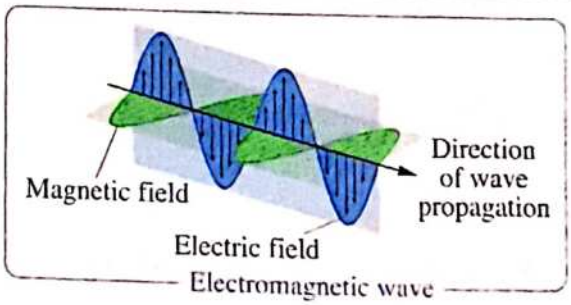
Lightning and thunder

- ***We can't hear the sound of solar explosions, but we can see the light coming out of them.***

Because the sound is mechanical waves, which can't propagate through vacuum between the Sun and the Earth, while the light is electromagnetic waves, which can propagate through vacuum.

Enrichment information

- *Electromagnetic waves are a type of transverse waves that can propagate in free space.*
- *They consist of electric field and a magnetic field perpendicular to each other and to the direction of wave propagation.*



Electromagnetic wave

Exercise 2

Choose :

1. ..... is/are mechanical waves.
   a. Water wave only b. Sound wave only c. Microwave only d. Both (a) and (b)
2. Radio waves .....
   a. are transverse mechanical waves. b. are longitudinal waves.
   c. propagate through vacuum. d. need a medium to propagate through.
3. All of the following are electromagnetic waves except ..... waves.
   a. light b. sound c. infrared d. radio

Answer

1. d 2. c 3. b

TRY to answer worksheet 3 in the Notebook

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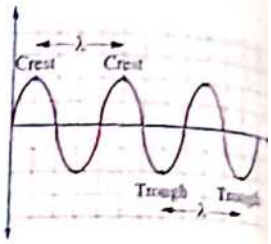
4 Some concepts related to wave motion and its properties :

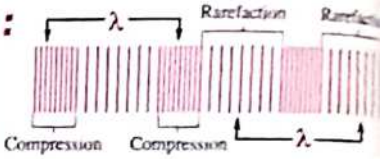
1 Wavelength. 2 Wave amplitude. 3 Wave velocity. 4 Wave frequency.

1 Wavelength (λ) :



The wavelength (λ) of the transverse wave :
It is the distance between two successive crests or troughs.

The wavelength (λ) of the longitudinal wave :
It is the distance between the centres of two successive compressions or rarefactions.



- The measuring unit of wavelength (λ) is "**metre**".

Laws used for determination the wavelength (λ) :

1. Wavelength of a transverse wave = 2 × the horizontal distance between the successive crest and trough.

2. Wavelength of a longitudinal wave = 2 × the distance between the centres of successive compression and rarefaction.

3. Wavelength = $\frac{\text{The distance covered by waves}}{\text{Number of waves}}$

Exercise 3

Determine the wavelength of the following :

1. A transverse wave, the distance between its successive crest and trough = 5 metres.
2. A longitudinal wave, the distance between the centre of the first compression and that of the third compression = 15 metres.

Answer

1. Wavelength = 2 × the horizontal distance between the successive crest and trough
   = 2 × 5 = 10 metres.
2. ∵ Number of waves = 2
   ∴ Wavelength = $\frac{\text{The distance covered by waves}}{\text{Number of waves}} = \frac{15}{2} = 7.5$ metres.

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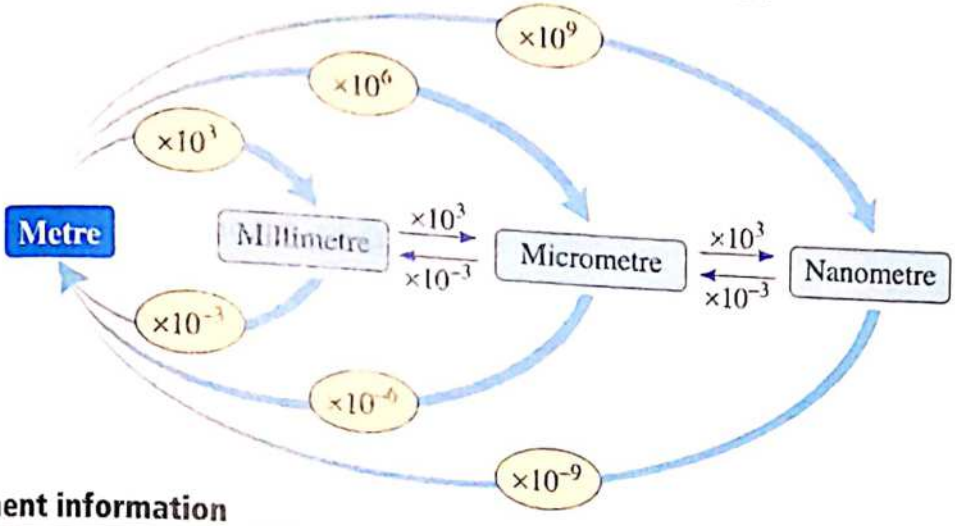
Fractions of metre :

From the Fractions of Metre

Millimetre (mm) — Micrometre — Nanometre

➲ **The following chart shows the conversions of these fractions :**



Enrichment information

The wavelength of some electromagnetic waves is :

- *Visible light 380 : 700 nanometres.*
- *Microwaves 10^6 : 10^9 nanometres.*
- *Infrared rays 10^3 : 10^6 nanometres.*

What is meant by ...?

The wavelength of a transverse wave is 1 micrometre.

➲ This means that the distance between two successive crests or two successive troughs in such wave is 1 micrometre (1×10^{-6} m).

The wavelength of a longitudinal wave is 1 millimetre.

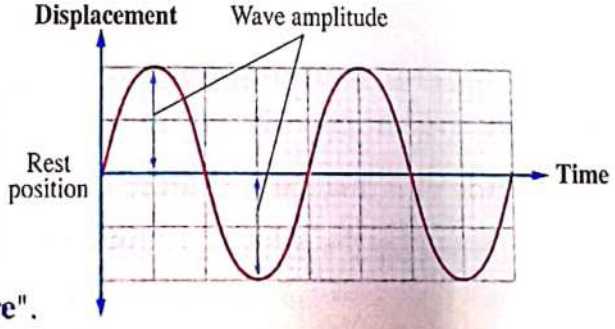
➲ This means that the distance between the centres of two successive compressions or two successive rarefactions in such wave is 1 millimetre (1×10^{-3} m).

TRY to answer worksheet 4 in the Notebook

2 Wave amplitude :

Wave amplitude :

It is the maximum displacement achieved by the medium particles away from their rest positions.



- The measuring unit of wave amplitude is "**metre**".

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Law used for determination of the wave amplitude :

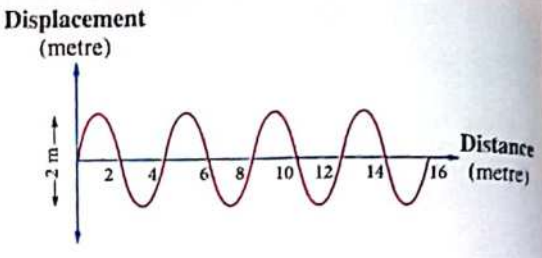
∵ The vertical distance between the crest and the trough of a wave = 2 × Wave amplitude

∴ Wave amplitude = $\frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$

Exercise 4

From the opposite figure, determine :

1. Wave amplitude.
2. Wavelength.



Answer

1. Wave amplitude = $\frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$

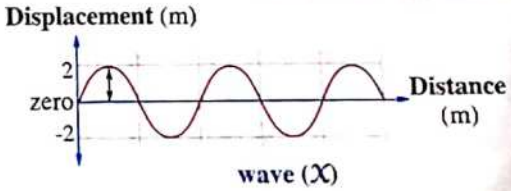
$= \frac{2}{2} = 1$ metre.

2. Wavelength = $\frac{\text{The distance covered by waves}}{\text{Number of waves}}$

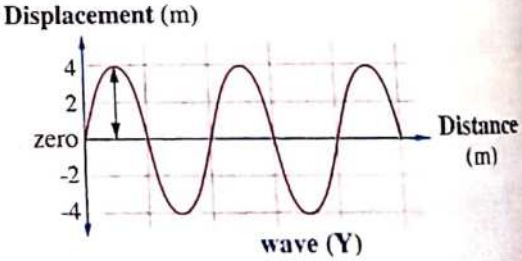
$= \frac{16}{4} = 4$ metres.

Exercise 5

Compare between the two waves (X) and (Y) related to the amplitude.



wave (X)



wave (Y)

Answer

- Amplitude of wave (X) = 2 m.
- Amplitude of wave (Y) = 4 m.

∴ Amplitude of wave (Y) is larger than that of wave (X).

What is meant by ...?

Amplitude of a mechanical wave is 3 cm.

This means that the maximum displacement achieved by the medium particles away from their rest positions in such wave is 3 cm (0.03 m).

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3 Wave velocity (V) :

• The velocity of the transfer of the energy carried by the wave is represented by wave velocity.

Wave velocity (V) :

It is the distance covered by the wave in one second.

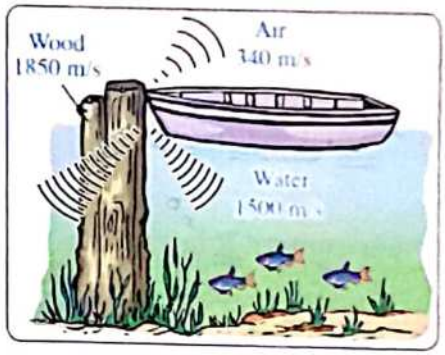
• The measuring unit of wave velocity is "**metre per second (m/s)**".

➲ **Wave velocity can be determined by the relation :**

$$\text{Wave velocity (V)} = \frac{\text{Distance covered by the wave in metres (m)}}{\text{Time in seconds (s)}}$$

• Wave velocity is constant through the same medium, but it changes from one medium to another, as follows :

• The velocity of sound waves through air = 340 m/s
• The velocity of sound waves through water = 1500 m/s
• The velocity of sound waves through wood = 1850 m/s



Different sound speeds through different media

i.e. The velocity of sound through solids > The velocity of sound through liquids > The velocity of sound through gases (air).

What will happen if ...?

Sound waves transfer from air to water.

➲ The velocity of sound waves will increase.

What is meant by ...?

The distance which is covered by a wave in water through one minute $= 9 \times 10^4$ metre.

➲ This means that the wave velocity = 1500 m/s.

Which can be calculated by the following law :

$$V = \frac{9 \times 10^4}{60} = 1500 \text{ m/s.}$$

4 Wave frequency (F) :

We have learned in the first lesson, the meaning of the frequency of an oscillating (vibrating) body, now we can define the frequency of the wave as follows :

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Wave frequency :

It is the number of complete waves produced from the source in one second.

- The measuring unit of frequency is "**Hertz**".

Periodic time of the wave :

It is the time taken to make one wave.

- The measuring unit of periodic time is "**Second**".

Wave frequency can be determined by the relation :

$$\text{Wave frequency} = \frac{\text{Number of complete waves}}{\text{Time in seconds (s)}}$$

So, $$\text{Periodic time of the wave (T)} = \frac{1}{\text{Frequency (F)}}$$

Enrichment information

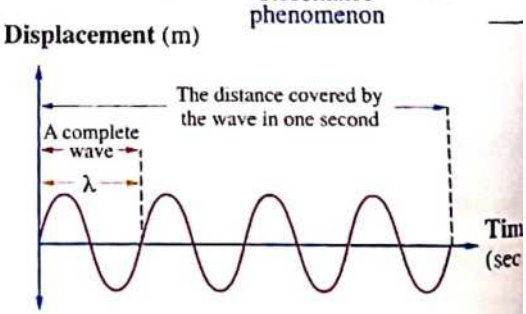
- *The tide waves, which are known as Tsunami waves have wavelength = 200 km, amplitude = 30 m and move with velocity = 800 km/hour.*
- *A glass cup is shattered when its natural frequency is equivalent to the frequency of a nearby sound source, as the amplitude of the oscillation of the cup particles becomes too large. This phenomenon is known as Resonance.*

Resonance phenomenon

Law of wave propagation :

It is the relation between the wave velocity (V), its frequency (F) and its wavelength (λ) .

From the opposite figure :



$$\text{The distance covered by the wave in one second} = \text{Number of complete waves in one second} \times \text{The length of a complete wave}$$

Therefore $$\text{Wave velocity (V) "Metre/second"} = \text{Frequency (F) "Hertz"} \times \text{Wavelength (λ) "Metre"}$$

This relation is known as the **law of wave propagation** and it can be applied for all types of waves

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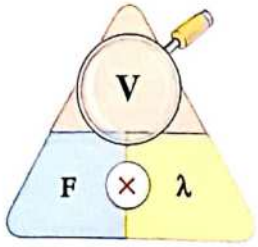
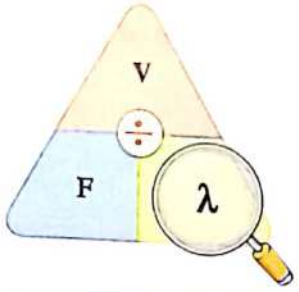
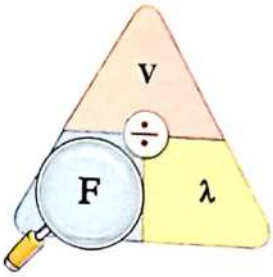
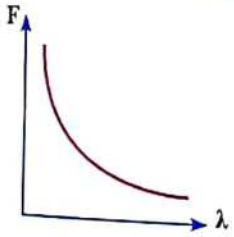
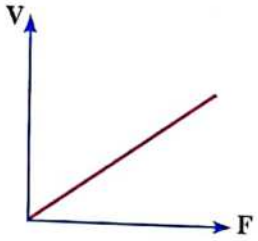
To calculate the wave velocity, wavelength and frequency :

Wave velocity	Wavelength	Frequency
		
$V = F \times \lambda$	$\lambda = \frac{V}{F}$	$F = \frac{V}{\lambda}$

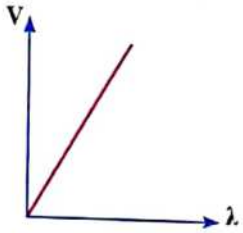
Notice that



- Frequency (F) is inversely proportional to wavelength (λ) **at constant wave velocity.**



- Wave velocity (V) is directly proportional to frequency (F) **at constant wavelength (λ).**



- Wave velocity (V) is directly proportional to wavelength (λ) **at constant frequency (F).**

G.R. ***The wave velocity of light and radio waves is the same although their frequencies are different.***

Because both of them are electromagnetic waves that have the same velocity in vacuum so, the multiplying of frequency and wavelength of each of them = constant value = 3×10^8 m/s.

Exercise 6

Calculate the wavelength in metre for a visible light wave of frequency 5×10^{14} Hertz and velocity of 3×10^8 m/s.

Answer

$$\text{Wavelength } (\lambda) = \frac{\text{Wave velocity (V)}}{\text{Frequency (F)}}$$

$$= \frac{3 \times 10^8}{5 \times 10^{14}} = 6 \times 10^{-7} \text{ metre.}$$

Problems

1 ***A longitudinal wave is produced by a spiral spring where the distance between the first and the fourth rarefactions is 18 cm.***
Find the wave velocity if the frequency of such wave is 20 Hertz.

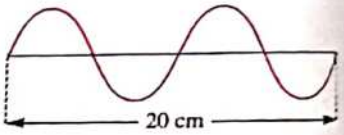
Solution

3 waves are formed between the first and fourth rarefactions.

$$\therefore \text{Wavelength } (\lambda) = \frac{\text{Distance covered by waves}}{\text{Number of waves}} = \frac{18}{3} = 6 \text{ cm} = 0.06 \text{ m.}$$

$$\therefore \text{Wave velocity (V)} = \text{Frequency (F)} \times \text{Wavelength } (\lambda)$$
$$= 20 \times 0.06 = 1.2 \text{ m/s.}$$

2 ***From the opposite figure, calculate the velocity of the wave if its frequency is 25 Hertz.***



Solution

The figure shows two waves of length 20 cm.

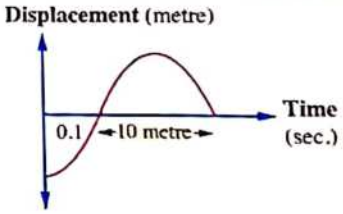
$$\therefore \text{Wavelength } (\lambda) = \frac{\text{Distance covered by waves}}{\text{Number of waves}} = \frac{20}{2} = 10 \text{ cm} = 0.1 \text{ m.}$$

$$\therefore \text{Wave velocity (V)} = \text{Frequency (F)} \times \text{Wavelength } (\lambda)$$
$$= 25 \times 0.1 = 2.5 \text{ m/s.}$$

3 ***From the opposite figure, calculate :***

1. The number of waves in the figure.

2. The wave velocity.



Solution

1. The number of waves = $\frac{3}{4}$ wave.

2. $\because$ The time of $\frac{1}{4}$ oscillation = 0.1 sec.

$\therefore$ Periodic time (T) = $4 \times 0.1 = 0.4$ sec.

$$\text{Frequency} = \frac{1}{\text{Periodic time}} = \frac{1}{0.4} = 2.5 \text{ Hz.}$$

Wavelength (λ) = 2 × the horizontal distance between the successive crest and trough
$= 2 \times 10 = 20$ metres.

$\therefore$ Wave velocity (V) = Frequency (F) × Wavelength (λ)
$= 2.5 \times 20 = 50$ m/s.

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Comparison between oscillatory (vibrational) motion and wave motion :

Oscillatory motion	Wave motion
- It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.	- It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.
- **Complete oscillation** is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.	- **Wave** is the disturbance that propagates and transfers energy in the direction of propagation.
- **Amplitude** is the maximum displacement achieved by the oscillating body away from its rest position.	- **Wave amplitude** is the maximum displacement achieved by the medium particles away from their rest positions.
- **Frequency** is the number of complete oscillations produced by an oscillating body in one second.	- **Wave frequency** is the number of complete waves produced from the source in one second.
- **Periodic time** is the time of one complete oscillation.	- **Periodic time of the wave** is the time taken to make one wave.
- **Velocity of the oscillating body** decreases when it goes far from its rest position.	- **Velocity of the wave** is constant through the same medium, but it changes from one medium to another.
Examples : - Pendulum motion. - Motion of spring. - Motion of tuning fork.	**Examples :** - Motion of mechanical longitudinal sound waves. - Motion of mechanical transverse water waves. - Motion of electromagnetic transverse light waves.

TRY to Answer worksheet
- General Exercise of the School Book on Unit 1
- Model exams on Unit 1

in the Notebook

5

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Remember Lesson Two

The wave :

It is the disturbance that propagates and transfers energy in the direction of propagation.

Wave motion :

It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.

The line of wave propagation :

It is the direction of progression of the wave.

Transverse wave :

It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.

Crest :

It is the highest point of the particles of the medium in the transverse wave.

Trough :

It is the lowest point of the particles of the medium in the transverse wave.

Longitudinal wave :

It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.

Compression :

It is the area in the longitudinal wave, at which the medium particles are of the highest density and pressure.

Rarefaction :

It is the area in the longitudinal wave, at which the medium particles are of the lowest density and pressure.

Electromagnetic waves :

- They are waves which do not need a medium to propagate, where they propagate through vacuum.
- They are all transverse waves, such as :
  - Visible light waves.
  - Infrared waves.
  - Radio waves.

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Mechanical waves :

- They are waves which need a medium to propagate, where they do not propagate through vacuum.
- They may be :
  - Transverse waves : as water waves.
  - Longitudinal waves : as sound waves.

The wavelength (λ) of the transverse wave :

It is the distance between two successive crests or troughs.

Wavelength of a transverse wave = 2 × the horizontal distance between the successive crest and trough.

The wavelength (λ) of the longitudinal wave :

It is the distance between the centres of two successive compressions or rarefactions.

Wavelength of a longitudinal wave = 2 × the distance between the centres of successive compression and rarefaction.

$$\text{Wavelength} = \frac{\text{The distance which covered by waves}}{\text{Number of waves}}$$

Wave amplitude :

It is the maximum displacement achieved by the medium particles away from their rest positions.

$$\text{Wave amplitude} = \frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$$

Wave velocity :

It is the distance covered by the wave in one second.

$$\text{Wave velocity (V)} = \frac{\text{Distance covered by the wave in metres (m)}}{\text{Time in seconds (s)}}$$

Wave frequency :

It is the number of complete waves produced from the source in one second.

Periodic time of the wave :

It is the time taken to make one wave.

Law of wave propagation :

$$\text{Wave velocity (V)} = \text{Frequency (F)} \times \text{Wavelength } (\lambda)$$

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Questions on lesson Two

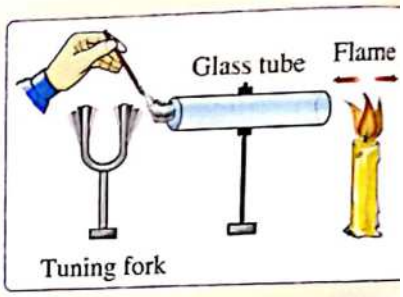
Remember · Understand · Apply · Higher · School book questions

1. Choose the correct answer :

1. Wave is the disturbance that propagates and transfers energy .....
   a. in the direction of propagation.
   b. in a direction opposite to that of propagation.
   c. in a direction perpendicular to that of propagation.
   d. no correct answer.

2. In wave motion, ...
   a. medium particles move.
   b. the waves move carrying the force.
   c. medium particles vibrate without transferring from their places.
   d. medium particles vibrate around their rest positions.

3. In the opposite figure, when hitting a tuning fork, the particles of air in touch with it .....
   a. don't move.
   b. vibrate perpendicular to the direction of wave propagation.
   c. vibrate in the direction of wave propagation with changing their places.
   d. vibrate in the direction of wave propagation without changing their places.



4. All of the following are the properties of mechanical waves, except .....
   a. they are longitudinal or transverse waves.
   b. they don't propagate through vacuum.
   c. they don't need a medium to propagate through.
   d. water and sound waves are examples of these waves.

5. ..... are mechanical waves.
   a. Radio waves only
   b. Light waves only
   c. Microwaves and sound waves
   d. Water waves and sound waves

6. Radio waves .....
   a. are transverse mechanical waves.
   b. are longitudinal waves.
   c. propagate through vacuum.
   d. need a medium to propagate through.

7. All of the following are electromagnetic waves, except ..... waves.
   a. light b. sound c. microwave d. radio

8. If the light speed is compared with the sound speed, which of these statements is correct ? .....
   a. Light speed equals sound speed.
   b. Light speed is higher than sound speed.
   c. Light speed is lower than sound speed.
   d. Sound speed is higher than light speed.

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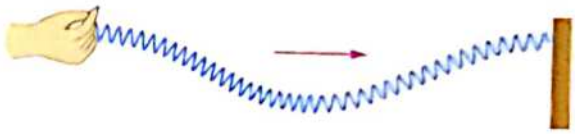
9. Transverse wave consists of .....
   a. compressions and rarefactions.
   b. troughs and rarefactions.
   c. compressions and crests.
   d. crests and troughs.

10. The longitudinal wave consists of .....
   a. compressions and rarefactions.
   b. troughs and rarefactions.
   c. compressions and crests.
   d. crests and troughs.

11. In the opposite figure, the particles of the medium (the coil) vibrate .....
   a. to the right only.
   b. upwards only.
   c. to right and left.
   d. upwards and downwards.



12. Water waves are transverse waves, because the particles of the medium .....
   a. vibrate perpendicular to the direction of wave propagation.
   b. do not vibrate.
   c. don't need a medium to propagate through.
   d. vibrate along the direction of wave propagation.

13. All of the following are transverse waves, except ..... waves.
   a. water b. light c. sound d. radio

14. The electric bell produces pulses of .....
   a. compressions and rarefactions.
   b. crests and troughs.
   c. crests and rarefactions.
   d. compressions and troughs.

15. Scientists saw the explosions that occur on the Sun surface, but they couldn't record the sound of these explosions because the sound .....
   a. doesn't travel from up to down.
   b. needs a medium to travel through.
   c. is mechanical waves that propagate in a definite direction.
   d. is electromagnetic waves that don't propagate through free space.

16. Sound waves are longitudinal waves, because the particles of the medium .....
   a. don't need a medium to propagate through.
   b. don't vibrate.
   c. vibrate along the direction of wave propagation.
   d. vibrate in a direction perpendicular to the direction of wave propagation.

17. The highest point of the particles of the medium in the transverse wave is known as the .....
   a. crest. b. compression. c. rarefaction. d. trough.

18. Rarefaction is the area at which the medium particles .....
   a. don't vibrate.
   b. are too close to each other.
   c. are faraway from each other.
   d. vibrate up and down.

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19. Jacuzzi is a tub of physiotherapy, where water moves in the form of ..... waves.
a. circular b. longitudinal c. oval d. radio

20. All the electromagnetic waves have the same ..... in vacuum.
a. velocity b. amplitude c. frequency d. periodic time

21. The distance between two successive crests or two successive troughs in the transverse wave is .....
a. wavelength. b. wave velocity. c. amplitude. d. frequency.

22. The distance between the centres of the second and the fourth compressions is .....
a. the wavelength of longitudinal wave.
b. double the wavelength of longitudinal wave.
c. double the wavelength of transverse wave.
d. four times the wavelength of longitudinal wave.

23. If the distance between the centre of the third compression and the centre of the fifth compression on the wave propagation is 20 cm, then the wavelength of this wave is .....
a. 40 cm. b. 20 cm. c. 10 cm. d. 5 cm.

24. 1 millimetre equals all the following values, except .....
a. 1×10^{6} nanometre. b. 1×10^{3} micrometre.
c. 1×10^{-3} metre. d. 1×10^{-3} micrometre.

25. ..... is the maximum displacement of medium particles away from their rest positions.
a. Wavelength b. Frequency of the wave
c. Amplitude of the wave d. Wave velocity

26. ..... is the measuring unit of wave velocity.
a. Metre b. Metre/second c. Second d. Hertz

27. Velocity of sound waves through air = ... m/s.
a. 1850 b. 1500 c. 3×10^{8} d. 340

28. Sound velocity is the greatest through .....
a. vacuum. b. solids. c. liquids. d. gases.

29. The distance that is covered by the wave in one second is called .....
a. wave velocity. b. wave frequency. c. wavelength. d. wave amplitude.

30. The periodic time of a tuning fork which makes 240 waves in one minute equals .....
a. 1 sec. b. 4 sec. c. $\frac{1}{2}$ sec. d. $\frac{1}{4}$ sec.

31. The mathematical relation between the velocity and wavelength is .....
a. velocity = frequency × wavelength. b. velocity = wavelength / frequency.
c. wavelength = frequency / velocity. d. velocity = frequency / wavelength.

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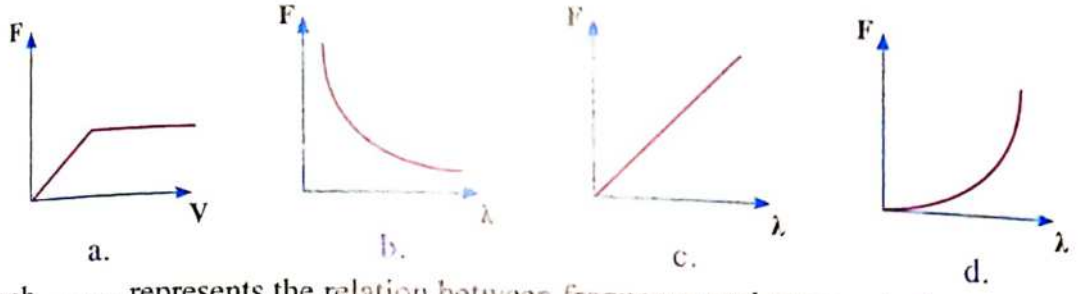
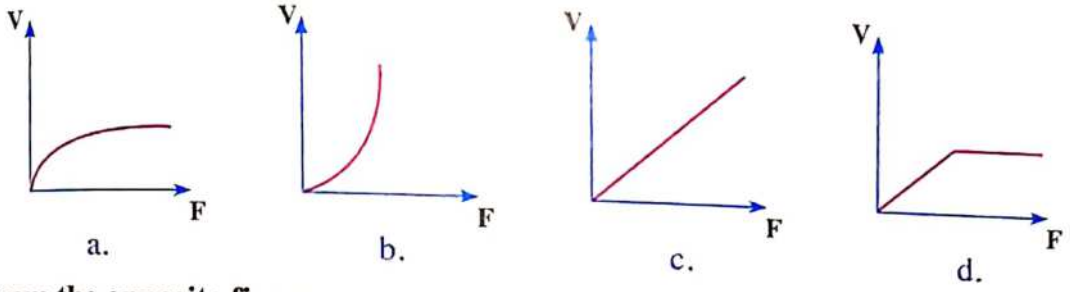
32. Graph ..... represents the relation between frequency (F) and wavelength (λ) for a wave which moves in the same medium.



a. b. c. d.

33. Graph ..... represents the relation between frequency and wave velocity at constant wavelength.



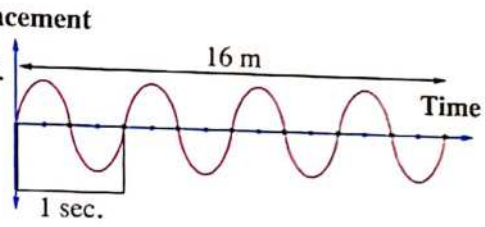
a. b. c. d.

34. **From the opposite figure :**

Wave frequency and velocity are ..... respectively.

a. (16 Hz , 4 m/sec.) b. (16 Hz , 1 m/sec.)

c. (1 Hz , 4 m/sec.) d. (4 Hz , 1 m/sec.)



35. A girl stands watching water waves, she saw 4 waves passing in 2 seconds. The wavelength of each wave is 0.5 m, so :

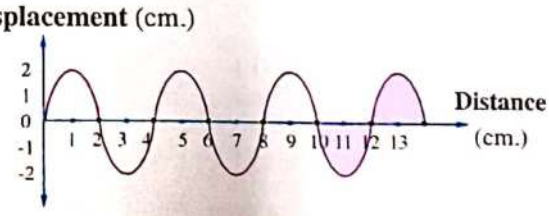
1. Wave frequency = ...

a. 2 Hz. b. 4 Hz. c. 4 m/sec. d. 0.25 m/sec.

2. Wave velocity = ...

a. 1 m/sec. b. 0.2 m/sec. c. 4 m/sec. d. 0.25 m/sec.

36. **In the opposite figure :**



1. The wavelength of the wave equals ..... cm.

a. 2 b. 4

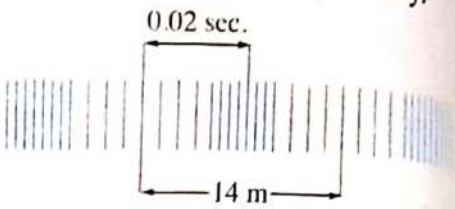
c. 5 d. 6

2. The amplitude of the wave equals ..... cm.

a. 1 b. 3 c. 2 d. 4

37. The wavelength and velocity of the opposite longitudinal wave are ..... respectively.

a. (14 m , 350 m/sec.)
b. (7 m , 700 m/sec.)
c. (7 m , 0.14 m/sec.)
d. (14 m , 0.28 m/sec.)



2. Put (✓) or (✗) :

1. Propagation of water waves on the surface of a pond when thrown a stone into, it represents an oscillatory motion. ( )
2. The motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction is known as the oscillatory motion. ( )
3. Waves are classified according to the ability to propagate and transfer energy into mechanical waves and longitudinal waves. ( )
4. Water waves are mechanical waves, because they propagate through vacuum. ( )
5. Light and sound waves are examples of electromagnetic waves. ( )
6. A transverse wave is formed of crests and troughs. ( )
7. Water and light waves are examples of transverse waves. ( )
8. Crest is the highest point of the particles of the medium in the transverse wave. ( )
9. Sound waves are transverse waves, which propagate through media in the form of compressions and rarefactions. ( )
10. The wavelength of a transverse wave is the distance between the two successive crests or troughs. ( )
11. The distance between the first crest and second crest is longer than the distance between the second trough and third trough. ( )
12. 4 nanometre = 400×10^{-11} metre. ( )
13. Nanometre is bigger than micrometre. ( )
14. Amplitude of a wave is the time taken for one wave. ( )
15. The distance covered by the wave in one second is called wave velocity. ( )
16. The measuring unit of wave velocity is m/sec., while that of wavelength is Hertz. ( )
17. The frequency of a wave is directly proportional to its wavelength when it propagates through the same medium. ( )
18. Wave velocity is constant in the same medium and differs from one medium to another. ( )
19. Sound velocity through liquids is more than that through gases. ( )
20. Wave velocity = Wave frequency × Number of waves in one second ( )
21. Radio waves and light waves have the same frequencies in vacuum. ( )
22. We can apply law of wave propagation for all types of waves. ( )

3. Correct the following statements without changing the underlined parts :

1. The movement of the clock pendulum is an example of wave motion.

2. In wave motion, medium particles move from their places.
3. Waves are classified according to the direction of vibration of medium particles into mechanical and electromagnetic waves.
4. Mechanical waves are those waves that do not need a medium to propagate such as radio waves.
5. Light waves and sound waves are examples of electromagnetic waves.
6. Compression is a part of a wave at which the medium particles are far apart from each other.
7. 🕮 The transverse wave is a disturbance in which the particles of the medium vibrate in the same direction of wave propagation.
8. Wave frequency is the number of amplitudes that are done by the source in a minute.
9. The velocity of sound waves through water = 340 m/s.
10. Wavelength = $\frac{\text{Wave velocity}}{\text{Periodic time}}$
11. 🕮 A body of frequency 200 Hz makes a complete oscillation in 200 seconds.

4. Write the scientific term of each of the following :

1. A disturbance that propagates and transfers energy along the direction of propagation.
2. The periodic motion produced as a result of the vibration of the particles of the medium at a certain moment in a definite direction.
3. The direction of progression of the wave.
4. The waves which need a medium to propagate.
5. • The waves which do not need a medium to propagate.
   • A type of waves that can propagate through vacuum.
6. Waves, in which the particles of the medium vibrate perpendicular to the direction of propagation without transferring from their positions.
7. The highest point of the particles of the medium in the transverse wave.
8. The lowest point of the particles of the medium in the transverse wave.
9. Waves, in which the particles of the medium vibrate in the same direction of wave propagation.
10. The area in the longitudinal wave at which the medium particles are of the highest density and pressure.
11. The area in the longitudinal wave at which the medium particles are faraway from each other.
12. A design is composed of a tub, where water moves in the form of circular waves for treating sprains and cramps.
13. The distance between two successive crests or troughs.
14. The distance between the centres of two successive compressions or two successive rarefactions.

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15. The measuring unit of wavelength.
16. The maximum displacement of the medium particles away from their rest positions.
17. The distance covered by the wave in one second.
18. The measuring unit of wave velocity.
19. The number of complete waves produced from the source in one second.
20. The time taken to make one wave.
21. The relationship between wave velocity, frequency and wavelength in the wave motion.
22. The measuring unit of the frequency.

5. Complete the following statements :

1. In wave motion, the waves transfer ..... from the vibrating source to the medium ..... in their propagation direction.
2. When the tuning fork oscillates , ... is generated and travelled in the form of sound waves.
3. The molecules of the medium ..... during the passing of waves in the direction of wave propagation without ..... from their rest positions.
4. 🕮 Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
5. Waves are classified according to the direction of vibration of medium particles relative to the direction of wave propagation into ..... and ..... waves.
6. The mechanical waves are classified into ..... and ..... waves.
7. ..... waves do not need a medium to propagate through, such as ..... waves.
8. ..... waves need a medium to propagate through, such as ..... and ..... waves.
9. 🕮 Radio waves are considered as ..... waves that propagate through free space with a velocity of .....
10. Transverse wave consists of ..... and .....
11. In the ..... waves, the particles of the medium oscillate perpendicular to the wave propagation direction, while in the ..... waves, the particles of the medium oscillate along the wave propagation direction.
12. Trough is the ..... point of medium particles in the ..... wave.
13. The maximum point of the particles of a medium of a transverse wave is called ....., while the maximum displacement of the simple pendulum from its rest position is called .....
14. The longitudinal wave consists of ..... and .....
15. ..... is the area in the longitudinal wave at which the medium particles are of the highest density and pressure.
16. 🕮 The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
17. Jacuzzi is used to treat ..... and cramps by using hot water and ..... by using cold water.

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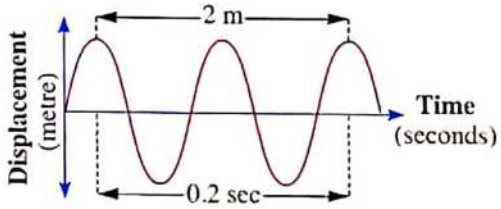
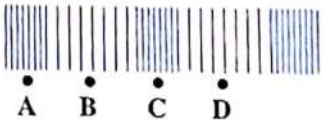
18. The wavelength of the transverse wave is the distance between .....
19. The wavelength of the longitudinal wave is the distance between .....
20. The amplitude of the wave is the ..... displacement of the medium particles away from their .....
21. The velocity of sound waves through air is ..... than its velocity through liquids, while its velocity through solids is ..... than that through liquids.
22. ..... is the measuring unit of wavelength, while ..... is the measuring unit of wave velocity.
23. Wave frequency is the number of complete ..... produced from the source in one .....
24. Wave frequency = $\frac{\text{.....}}{\text{Time in seconds}}$
25. A vibrating source makes 500 waves in 10 seconds, where the wavelength of the wave is 20 cm, so that :
    a. Its frequency equals ..... b. Wave velocity equals .....
    c. The periodic time of the wave equals .....
26. **From the opposite figure :**
    a. Wavelength = ... metre.
    b. Periodic time = ... second.



27. Wave velocity = ... × .....
28. The frequency of the wave = $\frac{\text{.....}}{\text{Periodic time}} = \frac{\text{Wave velocity}}{\text{.....}}$
29. a. The opposite figure represents ..... wave, its wavelength is the distance between ..... or .....
    b. If the wave velocity is 340 m/s. and the distance between A , B = 0.85 m , so the wave frequency = ... Hz.



6. Give reasons for :

1. Wave motion is considered as a periodic motion.
2. When a billiard ball strikes a similar second one at rest, the second ball moves while the first one stops.
3. The flame of a candle vibrates forward and backward if we put the candle in front of a loudspeaker.
4. Sound waves are mechanical waves, while radio waves are electromagnetic waves.
5. Water waves are transverse mechanical waves.
6. The waves produced due to vibration of a string are transverse mechanical waves.
7. Sound waves are longitudinal mechanical waves.

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8. We see lightning before hearing thunder.
9. Jacuzzi is considered a natural bath.
10. We can't hear the sound of solar explosions, but we can see the light coming out of them.
11. Astronauts use wireless devices to talk to each other on the Moon surface.
12. The guard dogs sleep with one of their ears on the floor.
13. As the frequency of the wave in the same medium increases, its wavelength decreases.
14. The velocity of light waves equals the velocity of radio waves, although the difference in their frequencies.

7. Define each of the following :

1. The wave.
2. Wave motion.
3. The line of wave propagation.
4. Transverse wave.
5. Crest.
6. Trough.
7. Longitudinal wave.
8. Compression.
9. Rarefaction.
10. Electromagnetic waves.
11. Mechanical waves.
12. The wavelength of transverse wave.
13. The wavelength of longitudinal wave.
14. Wave amplitude.
15. Wave velocity.
16. Wave frequency.

8. What is meant by ... ?

1. The wavelength of a sound wave is 30 cm.
2. The distance between two successive crests in water waves is 10 cm.
3. Amplitude of a mechanical wave is 5 cm.
4. The distance covered by a visible light wave in space in two seconds equals 6×10^8 metres.
5. Velocity of light is 300000 km/s.
6. Velocity of sound = 340 m/s.
7. Frequency of a longitudinal wave is 600 waves/second.

9. What is the mathematical relationship between ... ?

1. Wave frequency and number of complete waves produced by a source in a certain time.
2. Wave frequency and wavelength.
3. Wave velocity and wavelength.
4. Wave velocity and distance covered by wave.

10. What does each of the following relationship indicate ?

1. $\frac{\text{Distance covered by the wave}}{\text{Time (seconds)}}$
2. $\frac{\text{Number of complete waves}}{\text{Time (seconds)}}$
3. 1/ Frequency
4. Wave frequency × Wavelength
5. $\frac{\text{Wave velocity}}{\text{Frequency}}$
6. $\frac{\text{Number of waves} \times \text{Wavelength}}{\text{Time}}$

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11. What happens when ... ?

1. You throw a stone in water.
2. You move the free end of a horizontal spiral spring fixed from the other end perpendicular to its axis.
3. The vibration of the particles of a medium in a direction normal (perpendicular to) the direction of wave propagation.
4. Propagation of a wave in a medium as pulses of compressions and rarefactions (concerning the particles of the medium).
5. The distance between two successive crests of a transverse wave is doubled.
6. Sound wave travels from air to water (concerning its velocity).
7. The increase in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant.
8. The frequency and velocity of wave propagation decrease to quarter (concerning the wavelength).

12. Compare between :

1. Transverse waves and longitudinal waves.
2. Mechanical waves and electromagnetic waves.
3. Wave velocity and wavelength (concerning the measuring unit).
4. Frequency and amplitude of the wave (concerning the definition).
5. Oscillatory motion and wave motion.

13. Problems :

1. Sound waves of frequency 200 Hertz and wavelength in air 1.7 metre. **Calculate :**
   a. The velocity of sound waves propagation in air.
   b. The wavelength of these waves when they propagate in water with velocity 1500 m/s.

   _____

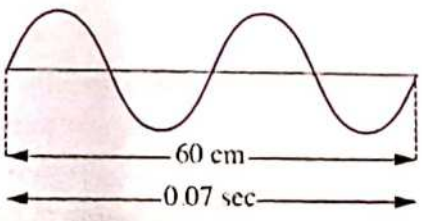
2. The velocity of the propagation of a sound wave through wood is 1800 m/s. Find the frequency of the sound source if the wavelength of the produced wave is 6 metres.

   _____

3. If the frequency of a sound wave in air is 660 Hertz and the distance between the centres of the second and the seventh compressions is 2.5 metres, calculate the velocity of the sound through air.

   _____

4. The opposite figure shows a transverse wave.
   From the given information, find the velocity of propagation of such wave in (metre/second).



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5. A tuning fork knocked with a frequency = 260 Hz
A person heard it when he/she was located at a distance = 17 metre faraway it.
If the velocity of sound in air = 340 m/s. Find the number of produced waves from this fork till it reaches the ear of the person.

6. If you know that water waves propagate with a velocity = 8 m/s. and they make 20 waves in a time = 5 sec. Calculate the distance between the first crest and the third crest of these waves.

14. Variant questions :

(1) Mention the uses of :

1. Jacuzzi.
2. Radio waves.

(2) Arrange the media (water - iron - oxygen) ascendingly according to the ability of transferring sound waves.

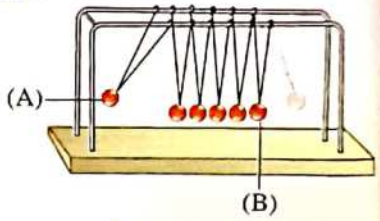
(3) Cross the odd word out, then state the relation among the remaining words :

1. Sound wave - Light wave - Radio wave - Infrared wave.
2. Pendulum motion - Spring motion - Rotary bee motion - Stretched string motion.

15. Study the following figures, then answer the questions :

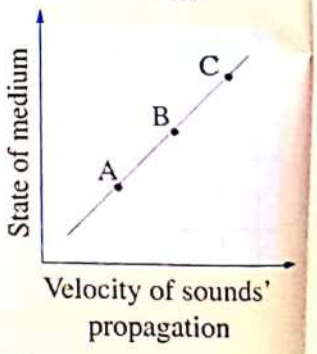
(1) From the opposite figure :

What is your explanation for the movement of the ball (B) when the ball (A) colloides the other balls although ball (A) does not touch the ball (B) ?



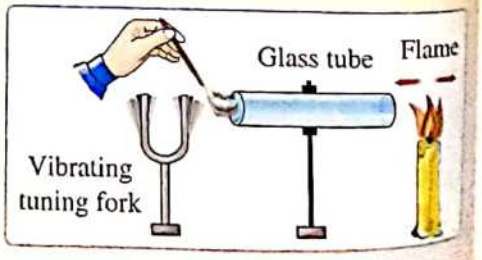
(2) Complete the missing parts in the table by observing the graph.
(the states of the media are gases, solids and liquids)

Point	A	B	C
State of medium	.....	.....	.....



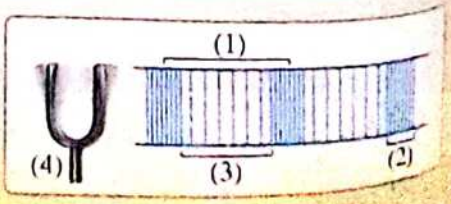
(3) From the opposite figure :

What is your explanation for the disappearance of the smoke of burning incense stick from the other side of the tube inspite of the vibration of the flame of the candle ?



(4) Examine the opposite figure, then answer the following questions :

1. What does this figure show ?
2. Label the figure.



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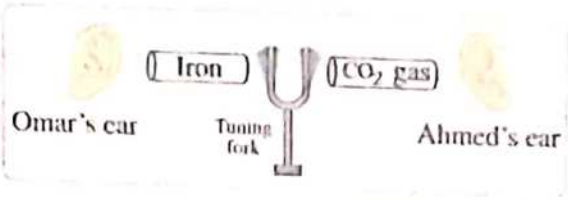
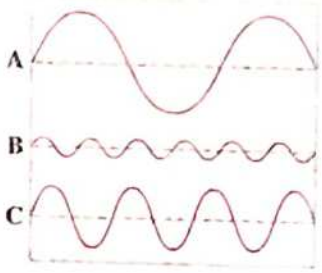
(5) From the opposite figure :

1. What is the type of waves produced from the tuning fork ?
2. To any of Ahmed or Omar, the sound will reach faster ? (Give a reason for your answer).



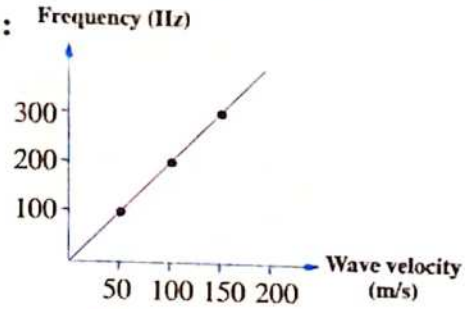
(6) The opposite figure represents three transverse waves (A , B and C) which one has :

1. The largest frequency.
2. The smallest amplitude.
3. The longest wavelength.

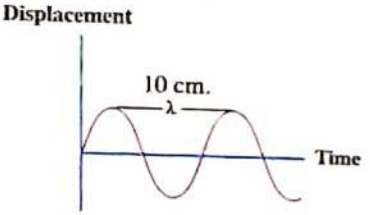


(7) Look at the opposite graph, then conclude the following :

1. The relation between frequency and wave velocity.
2. The wave velocity when frequency is 200 Hz.
3. From two different points, calculate the wavelength of such wave.

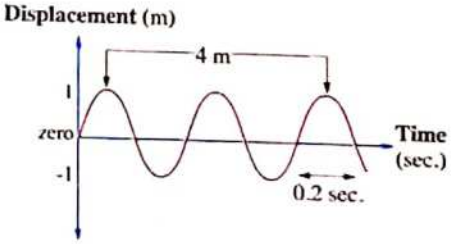


(8) In the opposite figure, what is the kind of this wave and what is its velocity of propagation when it produces 600 vibrations in a minute?



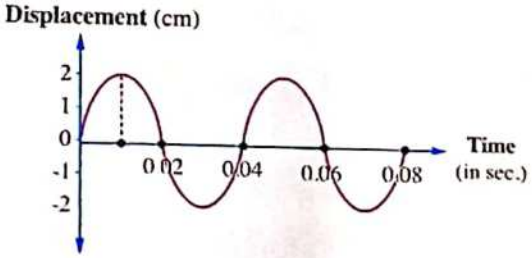
(9) From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



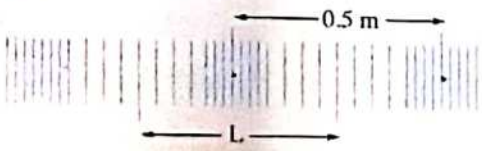
(10) The opposite figure shows the relation between the displacement and the time in a transverse wave that takes place in water with velocity of 20 metres/second. From the labelled figure, find the value of :

1. Amplitude.
2. Frequency.
3. Wavelength.



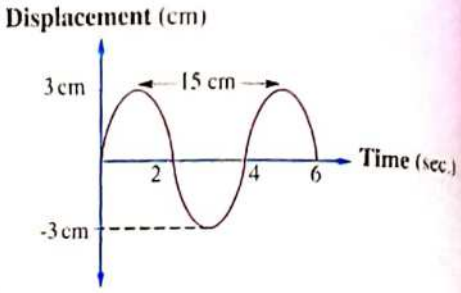
(11) A sound source of frequency 660 Hz produces the given wave. Calculate :

1. The distance (L) and what does it indicate ?
2. The velocity of the sound wave.



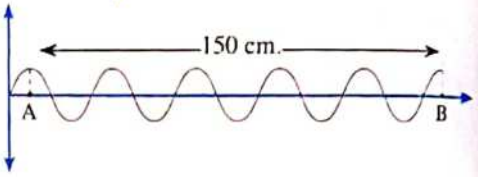
(12) From the opposite figure :

1. Define the amplitude and find its value from the figure.
2. Define the wavelength in this case and find its value.

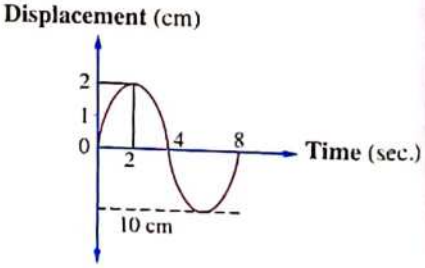


(13) The opposite figure represents a wave :

1. What is the type of this wave ?
2. Calculate its wavelength.
3. If the time of propagation of such wave between A and B is 10 seconds, calculate its frequency and periodic time.



(14) The opposite figure represents the relation between the displacement in metres and time in seconds from the drawing, answer the following questions :



1. Amplitude = ...
   a. 2 cm. b. 3 cm.
   c. 4 cm. d. 8 cm.
2. Periodic time = ...
   a. 1/8 cycle/sec. b. 0.25 Hz
   c. 4 sec. d. 8 sec.
3. Frequency = ...
   a. 1/8 Hz b. 0.25 Hz c. 4 sec. d. 8 cm.
4. Wavelength = ...
   a. 1/8 Hz b. 0.25 Hz c. 4 cm. d. 10 cm.
5. Wavelength in metres = ...
   a. 1/8 cycle/sec. b. 0.25 Hz c. 1 m. d. 0.1 m.
6. Wave velocity = ...
   a. 1 m/s. b. 0.2 m/s. c. 4 m/s. d. 0.0125 m/s.

16. Creative thinking :

Write down ten different scientific terms, where every term consists of two words, one of them is "wave".

Thinking Skills Questions

1. Choose : What do you deduce about sound velocity in different media ? .....

a. Velocity of sound through solids is equal to that in liquids.

b. Velocity of sound through gases is faster than in liquids.

c. Velocity of sound through liquids is faster than in solids.

d. Velocity of sound through solids is faster than in gases.

2. Write the scientific term of the following :

The ratio between wavelength of a wave and its periodic time.

3. Calculate the frequency of a water wave if the time between two successive crests is 0.2 second.

4. Calculate the velocity of a transverse wave in which every 11 crests pass by a certain point in one second. Knowing that the wavelength of this wave is 30 cm.

5. An oscillating source produces a pulse every $\frac{1}{4}$ second, if the wavelength of the produced waves is 2 cm. Calculate :

a. Frequency of the oscillating source.

b. Wave velocity of the produced waves.

6. Two waves of the same type and spread in one medium, if their frequencies are 512, 256 respectively. Find the ratio between their wavelengths.

7. A stone is thrown into a lake, 40 waves are formed in the form of concentric circles within 4 seconds, if you know that the radius of the outer circle is 2 metres, calculate :

a. The wavelength.

b. The velocity of wave propagation.

8. If you know that the wavelength of the blue light is 5×10^{-7} metres and the wavelength of the orange light is 6×10^{-7} metres, and the velocity of light through air is 3×10^{8} m/s, calculate the ratio between the frequency of the blue and orange lights.

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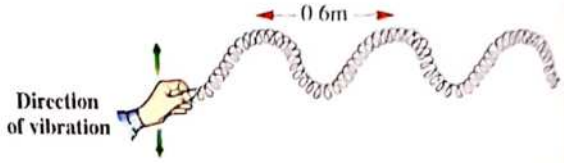
9. If the velocity of light waves is 3×10^8 m/s and the velocity of sound waves through air is 333 m/s, calculate the amount of time between seeing lightning and hearing thunder, if the phenomenon occurs at a height of 1.5 kilometre.

10. The opposite figure shows the propagation of a wave, its frequency is 2.5 Hz, calculate :



a. The wave velocity.

b. The time taken by this wave to cover a distance of 3 metres in the spring.

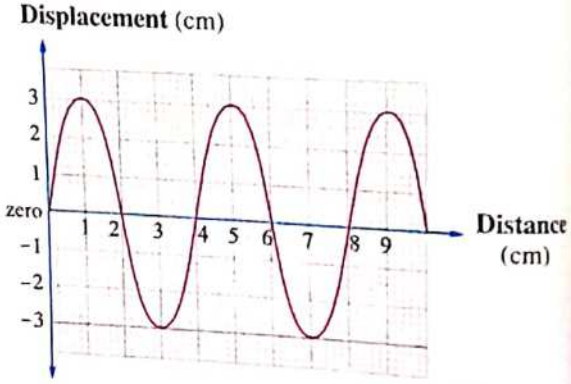
11. From the opposite figure :

(1) **Calculate :** a. The wavelength.

b. The wave amplitude.

(2) What is the frequency of this wave, if its velocity is 10 cm/s ?

(3) Redraw the curve in a graph paper taking into consideration decreasing of the wave amplitude to half and increasing the wavelength to double.



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Project .
On UNIT ONE

A project to develop the analytical thinking

"Analyzing relationships"

* **Complete the following sentences :**

1. The train during passengers transportation is like the wave in .....
.....
2. Radio waves for a radar are like infrared waves for .....
.....
3. Pendulum movement in a clock is like a string movement in .....
.....
4. The type of electrons movement around the nucleus is like the type of movement of .....
.....
5. The relation between frequency and wavelength at a constant wave velocity is like the relation between .....
.....
6. In the graphic representation of wave motion, the crest of light wave is corresponding to .....
.....
7. The oscillatory motion of a pendulum is like .....
.....
8. The playground for the football is like the medium for .....
.....
9. The light speed in water is less than its speed in .....
.....
10. The periodic time of a body makes 150 complete oscillations in 15 seconds is larger than the periodic time of a body makes .....
.....

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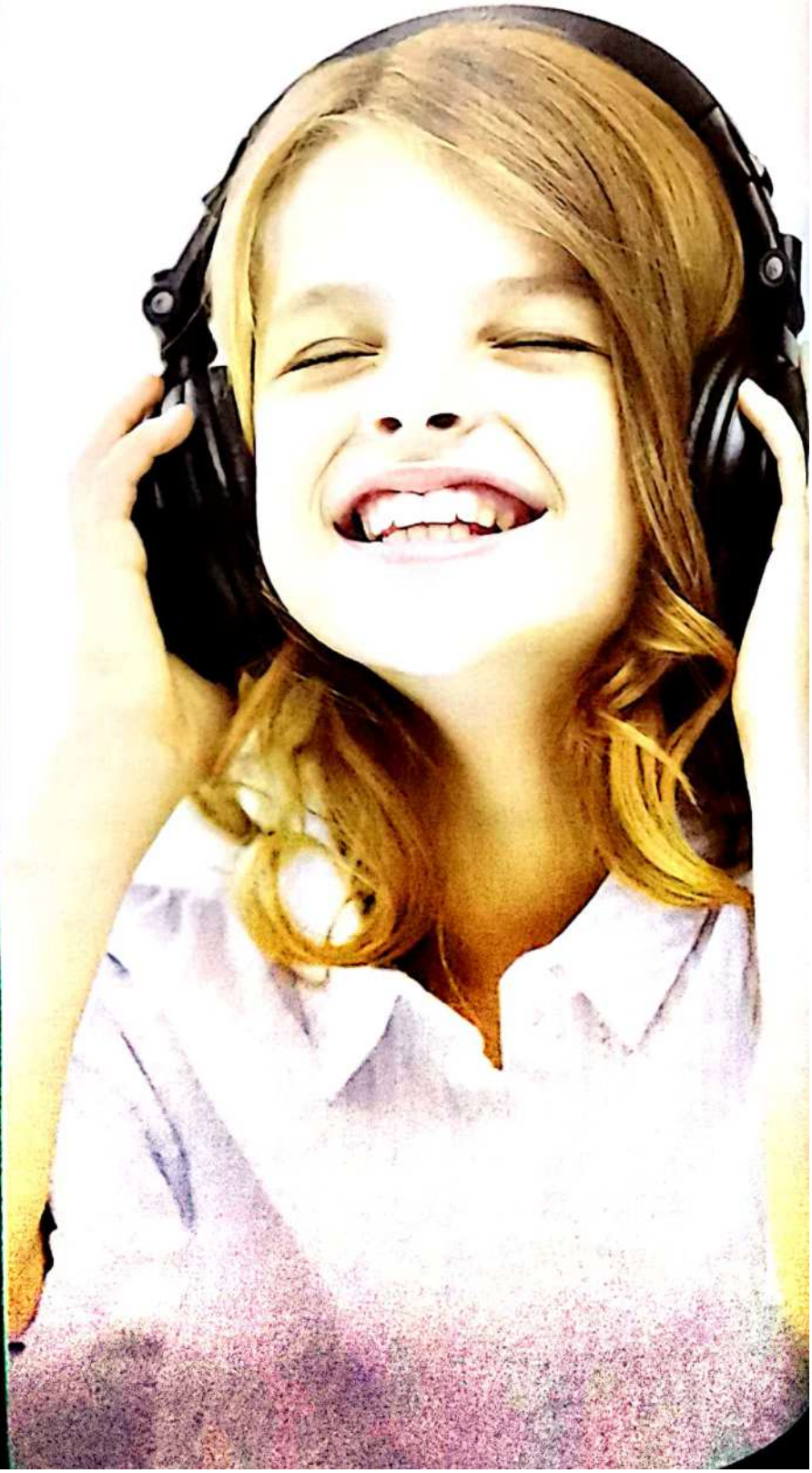
UNIT 2

Sound and Light



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Lesson 1 Properties of Sound Waves.
Lesson 2 Wave Nature of Light.
Lesson 3 Reflection and Refraction of Light.

Unit Objectives :

By the end of this unit, students will be able to :

- Identify the wave nature of sound.
- Conclude some properties of sound like; sound pitch, sound intensity and sound quality.
- Use materials and tools to illustrate the factors affecting the pitch and intensity of sound.
- Compare between sound waves according to their frequency.
- Appreciate the value of sound in our life.
- Appreciate the importance of science and technology in sound.
- Identify the wave nature of light.
- Conclude the laws of reflection and refraction of light.
- Describe some natural phenomena related to light reflection and refraction.
- Appreciate the importance of light to human life and society.
- Like to work with others in small co-operative groups.
- Appreciate the value of co-operative and team work.
- Recognize the interaction between science, technology and society.
- Become objective, honest and highly precise when carrying out scientific experiments.

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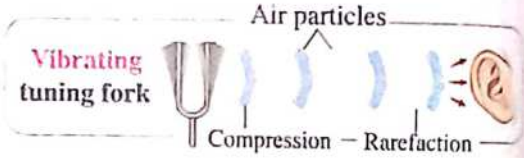
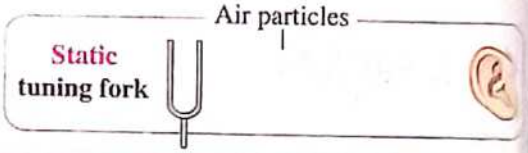
LESSON 1

Properties of Sound Waves

How is sound produced ?

Sound is produced due to the vibration of a body, while sound stops when the vibration of this vibrating body stops.





Sound :

It is an external factor (or stimulus) that affects the ear causing the sense of hearing.

The nature of sound waves

- ***Sound waves are mechanical longitudinal waves.*** G.R.
  - They are **mechanical waves,** because they need a medium (as air) to propagate through.
  - They are **longitudinal waves,** because the medium particles vibrate in the same direction of wave propagation forming compressions and rarefactions.
- ***Sound waves propagate through media as spheres of compressions and rarefactions, whose centre is the source of sound.***

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G.R. ***We hear sound from all directions that surround the sound source.***
Because the sound travels through air as spheres of compressions and rarefactions, whose centre is the source of sound.

What is meant by ...?

The wavelength of a sound wave is 1.5 m.

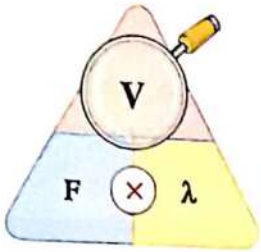
➲ This means that the distance between the centres of two successive compressions or two successive rarefactions in such wave is 1.5 m.

Sound velocity

- Sound travels through air at a velocity **340 m/sec.**
  (It may exceed or become less than this value)

➲ **Sound velocity can be calculated by using waves propagation law as follows:**

Sound wave velocity (V) "metre/second" = Frequency (F) "Hertz" × Wavelength (λ) "metre"



Enrichment information

The velocity of sound through air depends on :

- *The temperature of air.*
- *The humidity in air.*

Problems

1 ***Sound waves are produced from a vibrating tuning fork of frequency 512 cycles/sec. If the wavelength of these waves is 60 cm, calculate its velocity through air.***

Solution

Sound wave velocity (V) = Wave frequency (F) × Wavelength (λ)

$$= 512 \times \frac{60}{100} = 307.2 \text{ m/sec.}$$

2 ***Calculate the wavelength of a sound wave propagating through sea water with velocity 1500 m/sec. knowing that its frequency is 10 kilohertz.***

Solution

Frequency (F) = $10 \times 10^3 = 10000$ Hz.

$\because$ Sound wave velocity (V) = Wave frequency (F) $\times$ Wavelength (λ)

$\therefore \lambda = \frac{V}{F} = \frac{1500}{10000} = 0.15$ m.

Audible sounds

Sounds heard by the human ears are classified into two types :

1 Musical tones

- They are tones of uniform frequency and comfortable to be heard.
- **Examples :** Violin, piano and reed pipe.

Violin

Piano

Reed pipe

2 Noises

- They are sounds of non-uniform frequency and uncomfortable to be heard.
- **Examples :** Drill, loudspeakers and horns of cars.

Drill

Loudspeakers

Horns of cars

Real Life application : *Ear plugs :*

Ear plugs made of silicon are sold in pharmacies.
They take the shape of the external ear canal, where these plugs are used to avoid the hazards of noise in loud places.

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Properties of sound waves

The human ears can differentiate between the sounds that reach it through three different properties (characteristics), which are :

1. Sound pitch
2. Sound intensity
3. Sound quality (type)

1 Sound pitch

Sound pitch :

It is the property by which the ears can distinguish (differentiate) between harsh and sharp voices.

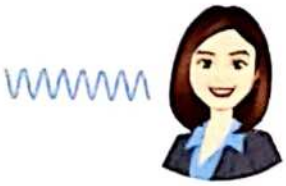
- Sound is described as **high** pitched or **low** pitched sound, where :

High pitched sound is sharp (soft).

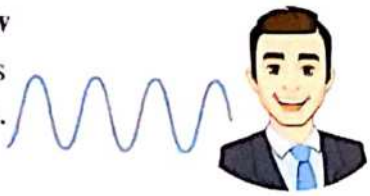
Low pitched sound is harsh (rough).

So, it is said that :

- The voice of woman is **high pitched** as it is sharp.

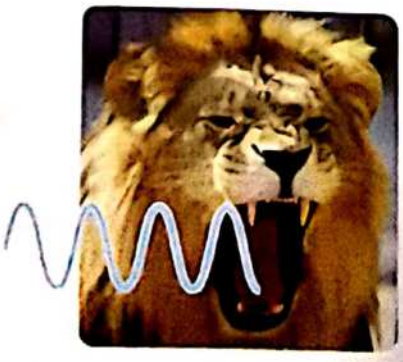


- The voice of man is **low pitched** as it is harsh.



- Similarly, the voice of the lion is **harsher than** that of sparrow.

High pitched sound



Low pitched sound

NB As the sound pitch (level) gets higher, the sharpness of voice increases.

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Activity 1 To illustrate the concept of sound pitch and its relation with sound frequency :

Materials and tools :

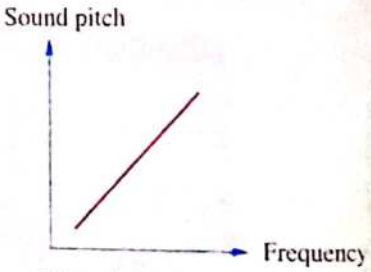
- Big-sized book.
- Rubber string (or band).
- Two pencils.

Steps	Figure	Observations
1. Tie the rubber string around the book and put the two pencils below it (as shown in the figure). 2. Press on the string by the forefinger of the left hand at 10 cm from one of the two pencils, then vibrate this segmented part of the string by the forefinger of the right hand. 3. Repeat the previous step by increasing the length of the vibrating segmented part of the string several times.		• The sound pitch changes as the length of the vibrating segment changes, where : - The sound becomes more sharper as the length of the string decreases. - The sound becomes more harsher as the length of the string increases. • The number of vibrations produced in one second (frequency) decreases by increasing the length of the string.

Conclusions:

- The sound pitch is a property of sound by which the ear can distinguish between harsh and sharp voices.
- The sound pitch depends on the frequency of the sound source.
- The sound pitch increases by increasing the frequency and vice versa.

Sound pitch ∝ Frequency



The relation between sound pitch and frequency

Therefore :

The sharp tones have high frequency, while the harsh tones have low frequency.

So : By increasing the length of the string (vibrating segmented part). → The frequency **decreases**. → The sound becomes **low pitched** (harsh).

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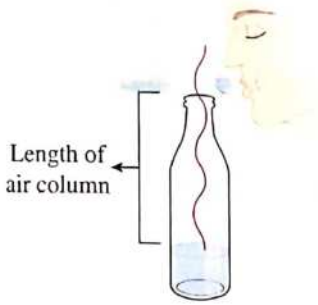
Producing sound from vibration of air column :

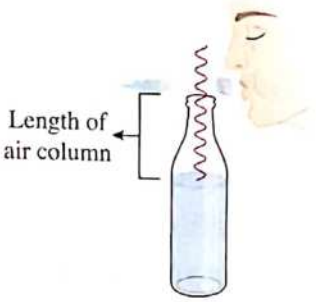
- We have explained how sound is produced from vibration of strings similarly, sound can be produced from vibration of air columns.
- In case of vibration of air columns, the sound pitch depends on the **length of the vibrating air column**.

As the length of the vibrating air column increases, the sound frequency decreases, so the harshness of sound increases.



Harsh sound

As the length of the vibrating air column decreases, the sound frequency increases, so the sharpness of sound increases.



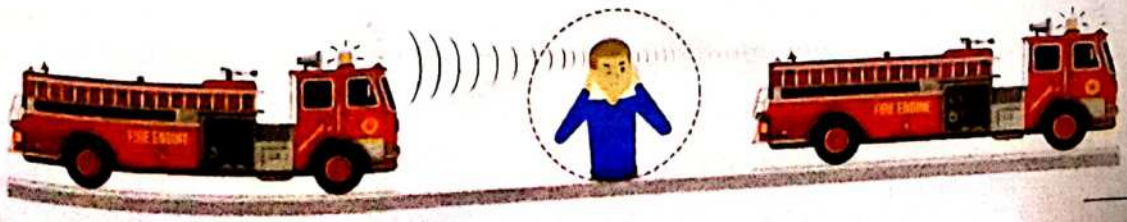
Sharp sound

NB Frequency increases by decreasing the length of air column and vice versa.

So : By increasing the length of the vibrating air column. → The frequency **decreases**. → The sound becomes **low pitched** (harsh).

Enrichment information

Doppler's effect : It is the apparent change in the frequency of a sound wave for an observer moving relative to the source of sound wave.
It is heard when a vehicle (car fire) sounding a siren approaches you gradually, the sound pitch increases and decreases suddenly as it moves away.



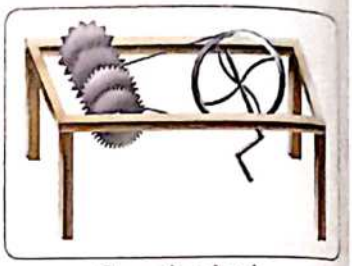
Question

Complete :

1. The frequency of the vibrating string is ..... proportional to its length.
2. By decreasing the length of the vibrating air column, the frequency ..... and the sound becomes .....

Determining the pitch of a tone by using Savart's wheel :

Savart's wheel is used to determine the pitch (frequency) of an unknown tone.

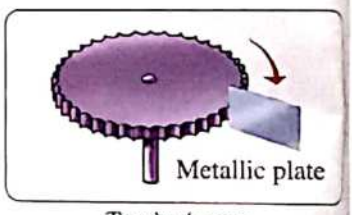


Savart's wheel

Steps for determining the pitch of a tone using Savart's wheel :

1. Listen to the tone you want to determine its pitch till your ears get used to it.

2. Rotate Savart's wheel at the same time one of the gears teeth contacts a flexible metallic sheet (as shown in the opposite fig.).



Toothed gear

3. Increase the speed of rotation till you hear a sound similar to that of the unknown tone.

4. Calculate the number of cycles (turns) (d) taking place in a specific duration and by knowing the number of gear teeth (n), you can determine the frequency of the tone, as follows :

$$\therefore \text{Sound frequency (F)} = \frac{\text{Number of cycles (turns) (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

So :

- By **increasing** the **speed of rotation** (with fixing the number of gear teeth). →
- By **increasing** the **number of gear teeth** (with fixing the speed of rotation). →

→ The frequency **increases.** → The sound becomes **high pitched** (sharp).

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Problems

1 ***Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.***

Solution

Time (t) = $2 \times 60 = 120$ seconds.

$$\text{Frequency (F)} = \frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}} = \frac{960 \times 30}{120} = 240 \text{ Hz.}$$

2 ***If the frequency of the sound produced by touching a metallic plate with a gear in Savart's wheel is 100 Hz. Calculate the number of the gear teeth, if the wheel rotates at a speed of 120 cycles/minute.***

Solution

$$\text{Frequency (F)} = \frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$100 = \frac{120 \times \text{No. of gear teeth (n)}}{1 \times 60}$$

$$\text{No. of gear teeth (n)} = 100 \times \frac{60}{120} = 50 \text{ teeth.}$$

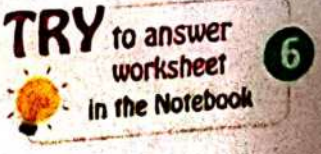
3 ***Calculate the time in minutes taken by Savart's wheel to make 600 cycles, if the frequency of the sound produced by touching a metallic plate with a gear of 60 teeth is 300 Hz.***

Solution

$$\text{Frequency (F)} = \frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$300 = \frac{600 \times 60}{t}$$

$$\text{Time (t)} = \frac{36000}{300} = 120 \text{ seconds} = 2 \text{ minutes.}$$



2 Sound intensity (I) :

Sound intensity :

It is the property by which the ears can distinguish (differentiate) between strong or weak sounds.

- The measuring unit of sound intensity is "$watt/m^2$".

Example :

Whispering is described as a weak sound

Shouting is described as a strong sound

So that,
whispering has **less intensity** than shouting.

- The intensity of sound at a certain point is measured by the quantity of sound energy falling perpendicularly in one second on a unit area at that point.

(If the sound energy is high, it gives a strong sound, but if it is low, it gives a weak sound).

- Due to the wide range of sound intensity heard by humans and the variance in sensitivity to sound intensity from one person to another, scientists agreed to express the **level of sound intensity** or **noise intensity** by using Decibel scale.

- The measuring unit of the level of sound intensity (noise intensity) is **"Decibel"**.

Enrichment information

The following table shows that : As sound intensity increases, noise intensity increases.

Sound source	Sound intensity ($watt/m^2$)	Noise intensity (decibel)
- Quiet sounds like whispering and rustling of trees.	1×10^{-12}	zero
- Loud sounds like the sound of a motorbike.	1×10^{-6}	60
- Deafening sounds like that of jet planes.	1×10^{3}	150

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Factors affecting the sound intensity

1. The distance between the ear and the sound source
2. The amplitude of vibration of the sound source
3. The area of the vibrating surface
4. The medium density through which the sound travels (propagates)
5. The wind direction

Now, we are going to study each of these factors individually :

1 The distance between the ear and the sound source

If you stand in front of your classmate, who produces a sound, then you move away from him gradually.

You notice that, the intensity of sound becomes fainter gradually as you move farther away from the sound source.

This is because :

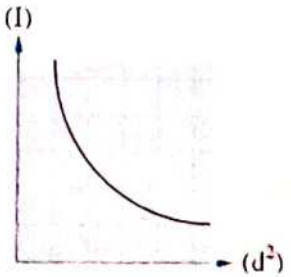
Intensity of sound (I) at a point is inversely proportional to the square of the distance (d^2) between that point and the sound source and this is known as **"The inverse square law of sound".**

The inverse square law of sound:

The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source.

$$\text{Sound intensity} \propto \frac{1}{\text{Square of the distance}} \quad \text{i.e. } I \propto \frac{1}{d^2}$$

This relation can be represented by the opposite graph.



What happens when ...?

The distance between the sound source and ear increases twice.

➲ The intensity of sound decreases to quarter.

The distance between the sound source and ear decreases to half.

➲ The intensity of the sound increases to four times its value.

G.R.

- ***The intensity of sound increases four times when the distance between the sound source and the ear decreases to its half value.***
- ***It is preferred to sit in the first rows more than in the back rows in lecture classes,*** Because sound intensity is inversely proportional to the square of the distance between the ear and the sound source.

2 The amplitude of vibration of the sound source

Activity (2) **To identify the effect of the amplitude of the sound source on the sound intensity :**

Steps	Figure	Observation
1. Fix one end of a ruler on the edge of a table by your right hand. 2. Pull the other end of the ruler downwards, then leave it free. 3. Notice the sound produced by the vibration of the ruler.		The intensity of sound decreases as time passes.

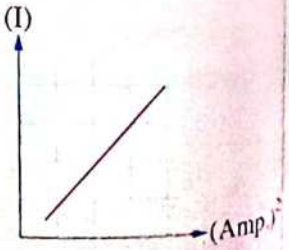
Explanation :

The amplitude of the ruler decreases gradually as time passes.

Conclusions:

- Sound intensity decreases gradually by decreasing the amplitude of the vibration.
- Sound intensity is directly proportional to the square of the amplitude of the vibration of the sound source.

Sound intensity ∝ Square of the amplitude



- This relation can be represented by the opposite graph.

i.e. When the amplitude increases 2 times, the intensity of sound increases 4 times.

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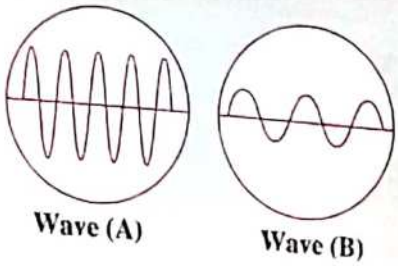
Exercise 1

Compare between the two given waves, concerning the pitch and intensity of sound.

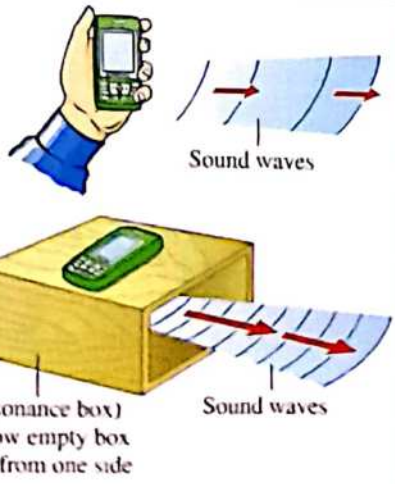


Answer

- Sound pitch : Wave (A) has higher pitch (sharper) than wave (B).
  [Because the frequency of wave (A) is more than that of wave (B)].
- Sound intensity : Wave (A) has more intensity (stronger) than wave (B).
  [Because the amplitude of wave (A) is larger than that of wave (B)].

3 The area of the vibrating surface

Activity (3) To identify the effect of the area of the vibrating surface on the sound intensity :

Steps	Figure	Observation
1. Hold your mobile, which is adjusted to the vibrating mode in your hand, then ring on it from another mobile. 2. Put the phone on an empty box, which is opened at one of its sides to work as a resonance box. 3. Compare between the intensity of sound that is produced in each case.		The sound produced from the phone which is placed on the resonance box, is stronger than that produced from the phone which is held.

Explanation :

The resonance box increases the vibrating surface area.

Conclusion:

Sound intensity increases by increasing the vibrating surface area when the source of sound touches a resonance body (box).

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Note

We notice in the stringed musical instruments such as the guitar and the violin that the strings are fixed above an empty wooden box (resonance box) to increase the sound intensity.

Violin

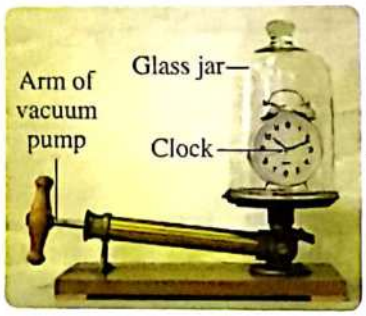
G.R. | ***Sound intensity increases when the sound source touches a resonance box.***
Due to the increase in the vibrating surface area.

4 The medium density

Activity (4) **To identify the effect of the medium density on the sound intensity:**

Materials and tools :

- Air vacuum pump.
- Glass jar.
- Sound source (alarm clock).

Steps	Figure	Observations
1. Ring the alarm clock, then put it on the air vacuum pump and cover it by the glass jar.		1. The sound is heard clearly.
2. Evacuate (pump out) the air inside the jar gradually (by pulling the arm of the vacuum pump outwards).		2. The sound intensity decreases gradually until it stops as the air is pumped out of the jar.

Explanation :

The air density decreases as you pull the air vacuum pump outwards, so the sound intensity decreases.

Conclusions:

- Sound intensity decreases by decreasing the density of the medium and vice versa.
- Sound intensity is directly proportional to the density of the medium in which sound travels.

G.R. | ***Sound intensity in case of the presence of carbon dioxide gas as a medium is higher than that in case of air.***
Because the density of carbon dioxide gas is more than that of air since the intensity of sound is directly proportional to the density of the medium.

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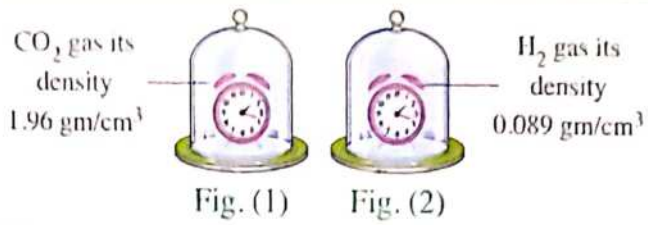
Exercise 2

In which one of the two opposite figures, the heard voice is more intense ? (Give a reason).



Answer

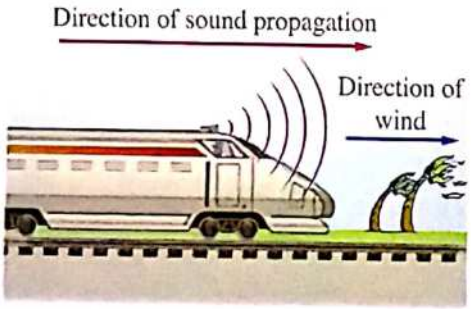
- In fig. (1), because the density of CO_2 gas is higher than that of H_2 gas and the sound intensity increases by increasing the density of the medium in which sound travels.

Enrichment information

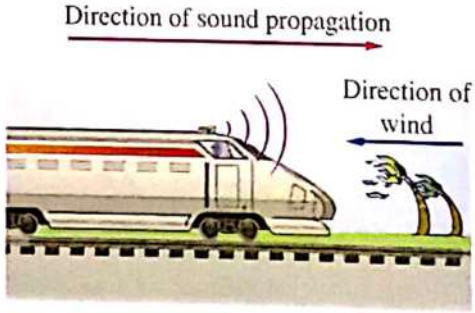
Sound intensity of a fired shot on the top of a mountain is less than that at its foot (bottom) because the density of air at high regions is less than that at the ground.

5 The wind direction

The intensity of sound increases when the direction of sound waves propagation is in the same direction of wind.



The intensity of sound decreases when the direction of sound waves propagation is in the opposite direction of wind.



TRY to answer worksheet 7 in the Notebook

3 Sound quality (type)

Sound quality (type) :

It is the property by which the human ear can distinguish (differentiate) between different sounds according to the nature of the source even if they are equal in intensity and pitch.

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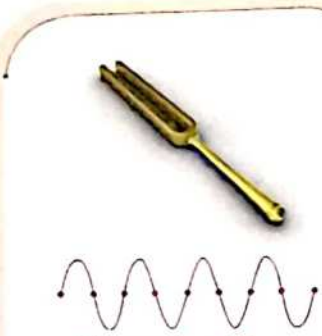
➲ **How can human ears distinguish between sounds from different sources [such as : tuning fork, violin and piano] ?**

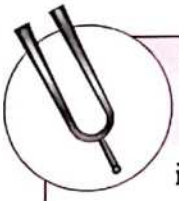


Tone produced from a vibrating tuning fork

Tone produced from a violin

Tone produced from a piano

➲ **To understand the quality of sound, notice this example :**



The tone produced from a vibrating tuning fork

is a pure simple tone known as **the fundamental (basic) tone.**

On the other hand

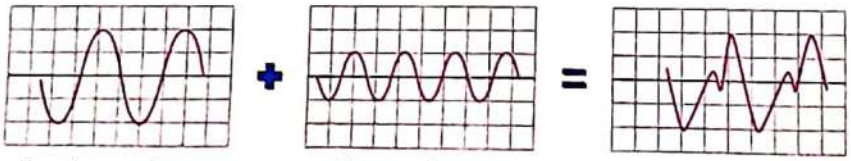
The tone produced from a violin or a piano

even if they are equal in pitch and intensity, they are **complex tones.**

- **These complex tones** are composed of a fundamental tone associated by other tones higher in pitch and lower in intensity known as **"harmonic tones"** .
- **These harmonic tones** differ from one source of sound to another depending on the natur of the sound source.

Harmonic tones :

They are tones that accompany the fundamental (basic) tone but they are higher in pitch and lower in intensity, and differ from one instrument to another.



Fundamental tone (pure simple tone) + Harmonic tone (higher in pitch and lower in intensity) = Complex tone

G.R. ***The human ears distinguish between sounds from different sources even if they are equal in intensity and pitch.***

Due to the difference in the harmonic tones that associate the fundamental tone produced from the source of sound.

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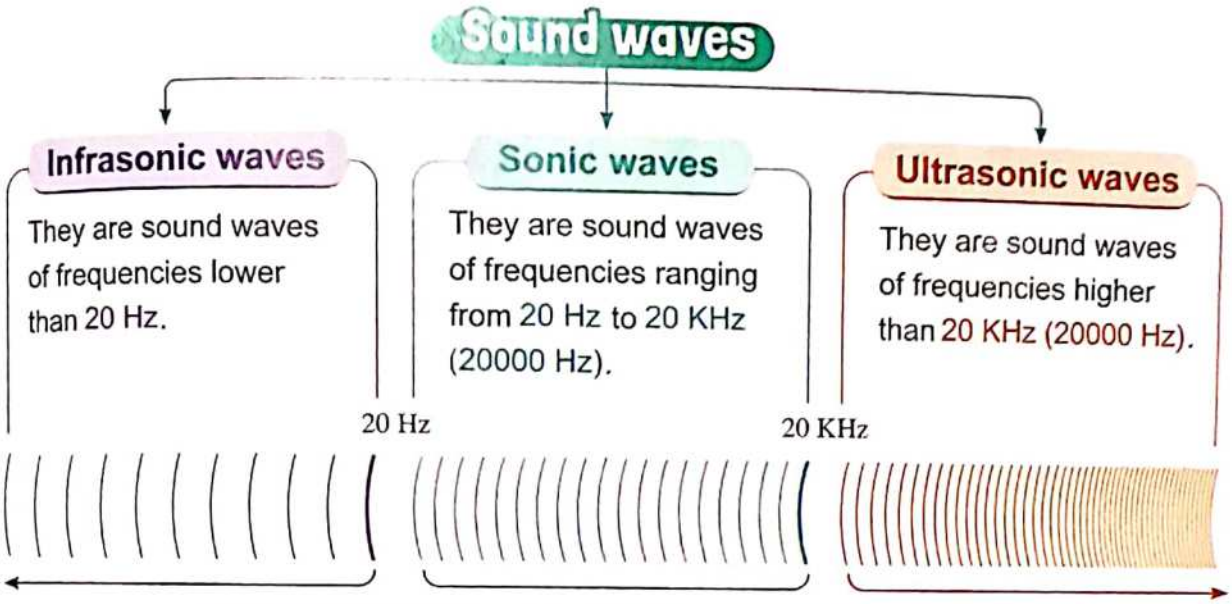
Comparison between sound waves according to their frequencies :

- The human ears are affected by sounds of a frequency ranges between 20 Hz - 20 KHz.
- Based on the frequencies of sounds that the human ear recognizes, sound waves are classified as in the following diagram :



Such as :

The waves accompany the blowing of storms that precede rainfall and the human ear cannot hear them.

The waves that human ear can distinguish between them and can hear them.

Some animals such as bats, dogs and dolphins can hear ultrasonic waves and the human ear cannot hear them.

G.R. ***Some sound waves can't be heard.***

Because the frequencies of these waves are lower than 20 Hz or higher than 20 KHz, so the human ears cannot hear them.

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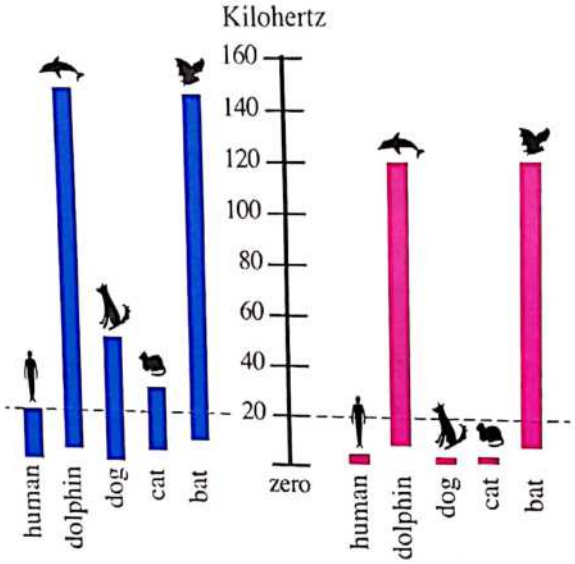
The following figure shows the range of the produced and heard sounds by some living organisms.



The range of heard sounds The range of produced sounds

For example :

- Dogs can hear all sounds produced by man **G.R.**

  Because the range of sounds produced by man lies within the range of sounds heard by dogs.

- Man can't hear sounds produced by a dolphin (or a bat) **G.R.**

  Because a dolphin (or a bat) produces ultrasonic waves, while the human ears can't hear sounds of frequencies more than 20 kilohertz.

Enrichment information

- *When the Ethiopian chickens that live in Africa depart their home suddenly, this gives an indication of rainfall the day after.*
- *This is explained by their high sensitivity to the infrasonic waves associating weather changes preceding rainfall.*
- *On the other hand, some sea creatures like shrimp and whales produce ultrasonic waves as sound shots to kill the fish they feed on.*

Ethiopian chicken

Some Real Life applications: of ultrasonic waves :

Ultrasonic waves are used in several medical, industrial and military fields such as :

Field	Uses	Figures
1 Medical :	1. Breaking down kidney and ureter stones without any surgical interventions (operations). 2. Diagnosis of male prostate gland tumors and its effect on bladder. 3. Discovering malignant tumors.	Sonar
2 Industrial :	Sterilization of food, water and milk as ultrasonic waves are characterized by their high ability to kill some types of bacteria and stop the action of some viruses.	Milk sterilizer
3 Military :	The discovery of landmines.	

Enrichment information

When ultrasonic waves collide with landmine, it vibrates. And due to this vibration it produces waves that travel through the Earth's surface to be discovered by using a specialized laser device.

TRY to answer worksheet 8 in the Notebook

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Remember Lesson One

Sound :

It is an external factor (or stimulus) that affects the ear causing the sense of hearing.

Sound wave velocity (V) = Wave frequency (F) × Wavelength (λ)

The human ears can differentiate between the sounds through three different factors, which are :

1. Sound pitch.
2. Sound intensity.
3. Sound quality.

Sound pitch :

It is a property by which the ear can distinguish between harsh and sharp voices.

$$\text{Sound frequency (F)} = \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

Sound intensity :

It is the property by which the ear can distinguish between sounds either strong or weak sound.

Factors affecting the sound intensity :

1. The distance between the ear and the sound source.
2. The amplitude of vibration of the sound source.
3. The area of the vibrating surface.
4. The density of the medium through which the sound travels (propagates).
5. The direction of the wind.

The inverse square law of sound :

The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source.

The intensity of sound :

- Is inversely proportional to the square of the distance between the sound source and the ear
- Is directly proportional to the square of the amplitude of vibration of the sound source.
- Is directly proportional to the density of the medium, in which the sound travels or propagates.
- Increases when the sound source touches a resonance body (box).
- Increases when the sound direction is in the wind flow direction and vice versa.

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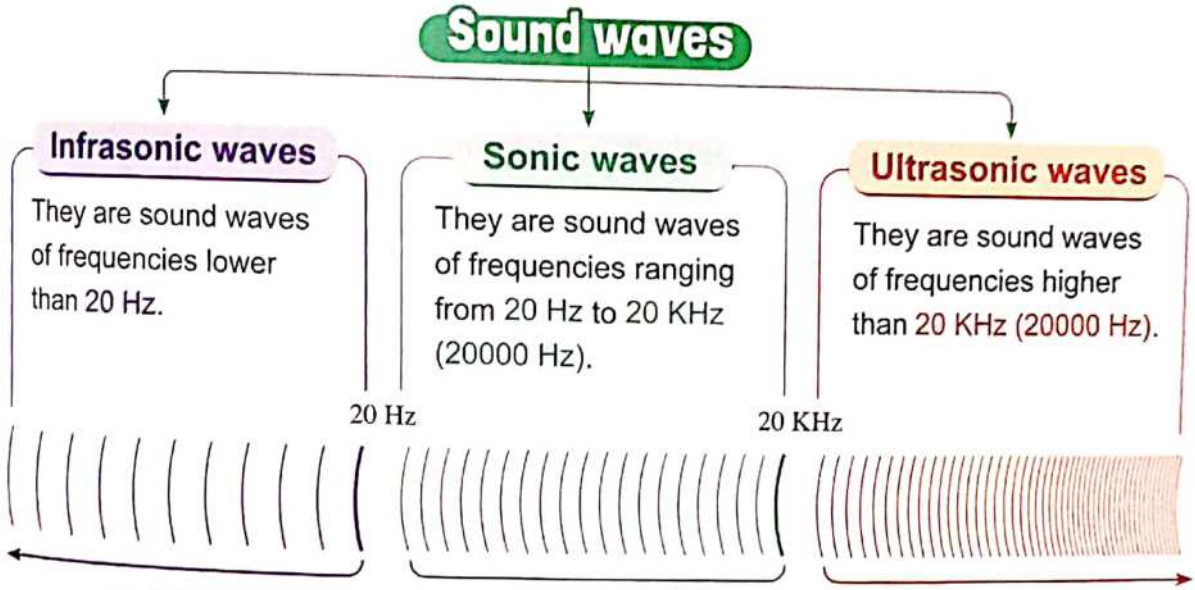
Sound quality (type)

It is the property by which the human ear can distinguish between different sounds according to the nature of the source even if they are equal in intensity and pitch.

Harmonic tones :

They are tones that accompany the fundamental (basic) tone, but they are higher in pitch and lower in intensity, and differ from one instrument to another.



Such as :

The waves accompany the blowing of storms that precede rainfall and the human ear cannot hear them.

The waves that human ear can distinguish between them and can hear them.

Some animals such as bats, dogs and dolphins can hear ultrasonic waves and the human ear cannot hear them.

Questions on lesson one

● Remember ● Understand ● Apply ● Higher skills 📖 School book questions.

Interactive Exercises

1. Choose the correct answer :

1. Sound waves travel through all the following, except .....
   a. solids. b. liquids. c. gases. d. space.
2. Sound waves do not travel through .....
   a. water. b. air. c. vacuum. d. wood.
3. The sound produced from the school bell is considered as ..... waves.
   a. longitudinal b. electromagnetic
   c. transverse d. longitudinal and transverse
4. All of the following indicate the nature of sound waves, except that .....
   a. it is mechanical longitudinal waves.
   b. it propagates as spheres of compressions and rarefactions.
   c. its velocity through air is 430 m/s.
   d. it is produced due to the vibration of bodies.
5. Before using modern technology in communication, people in desert were putting their ears on the ground to hear the sound of horses of their enemies at very far places because .....
   a. sense of hearing is stronger than sense of vision.
   b. the velocity of sound through solids (ground) is greater than that through air.
   c. sound travels faster than light.
   d. sound of horses' feet is very loud.
6. The sound velocity is measured in ..... unit.
   a. Hertz b. metre c. decibel d. metre/second
7. 📖 A sound travels in air with velocity 330 metre/sec. and has a wavelength 0.1 metre, its frequency equals .....
   a. 330 Kilohertz. b. 3300 Hertz.
   c. 33 Kilohertz. d. 330 Hertz.
8. All of these sounds are of uniform frequency, except the sound of .....
   a. violin. b. guitar. c. loudspeakers. d. piano.
9. The voice of Adham differs from that of Sara because they are different in .....
   a. age. b. intensity. c. pitch. d. kind.
10. The human ears can often differentiate between the voice of the man and that of the woman, because .....
    a. the voice of a woman is often high pitch and sharp.
    b. the voice of a woman is often low pitch and sharp.
    c. the voice of a woman is often high pitch and rough.
    d. the voice of a man is often high pitch and sharp.

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11. The sound pitch increases by .....
a. the decrease in frequency.
b. the increase in frequency.
c. the increase in amplitude.
d. the increase in the distance between the ear and the sound source.

12. We can prove that the pitch of sound depends on the frequency of vibration of the sound source by using ..... with knowing the number of cycles (turns) and the number of gear teeth.
a. the resonance box
b. a stretched string of fixed length
c. Savart's wheel
d. the tuning fork

13. The frequency of the vibrating string ..... to its length.
a. equals
b. is inversely proportional
c. is directly proportional
d. has no direct relation

14. Sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
a. stronger
b. sharper
c. weaker
d. harsher

15. A student rotates Savart's wheel with different velocities, the velocity which gives more rough sound is .....
a. 20 rotation/sec.
b. 300 rotation/min.
c. 6 rotation/sec.
d. 10 rotation/sec.

16. The frequency of sound produced from a plate touching a gear of 20 teeth in Savart's wheel when the wheel rotates 300 cycle/minute equals ..... Hz.
a. 300
b. 15
c. 6000
d. 100

17. As the number of teeth of the gear in Savart's wheel increases, the ..... of the produced sound increases.
a. amplitude
b. intensity
c. frequency
d. quality

18. As the velocity of the rotation of the gear in Savart's wheel decreases, frequency decreases, consequently the ..... of the sound decreases.
a. pitch
b. type
c. amplitude
d. intensity

19. The frequency of the sound produced from Savart's wheel depends on .....
a. the speed of rotation and number of gear's teeth.
b. the distance between the gear and you only.
c. the volume and the mass of the gear.
d. the number of the used gears.

20. The scientific term that expresses the strength and the weakness of sound is .....
a. the frequency of sound.
b. the pitch of sound.
c. the quality of sound.
d. the intensity of sound.

21. The intensity of sound is directly proportional to .....
a. the square of the distance from the source.
b. the square of the amplitude.
c. the distance from the source.
d. the sound velocity.

22. The intensity of sound weakens as we go away from its source, because .....

a. $I \propto \frac{1}{d}$ b. $I \propto d$ c. $I \propto \frac{1}{d^2}$ d. $I \propto d^2$

23. When the distance between the sound source and the ears is doubled, the sound intensity .....

a. decreases to its half. b. increases twice.

c. increases four times. d. decreases to its quarter.

24. The measuring unit of sound intensity is .....

a. m/sec. b. watt/m^2. c. decibel. d. Hertz.

25. All of the following are factors affecting sound intensity, except the .....

a. amplitude of vibration. b. medium density.

c. frequency. d. wind direction.

26. The resonance box increases the intensity of sound because it .....

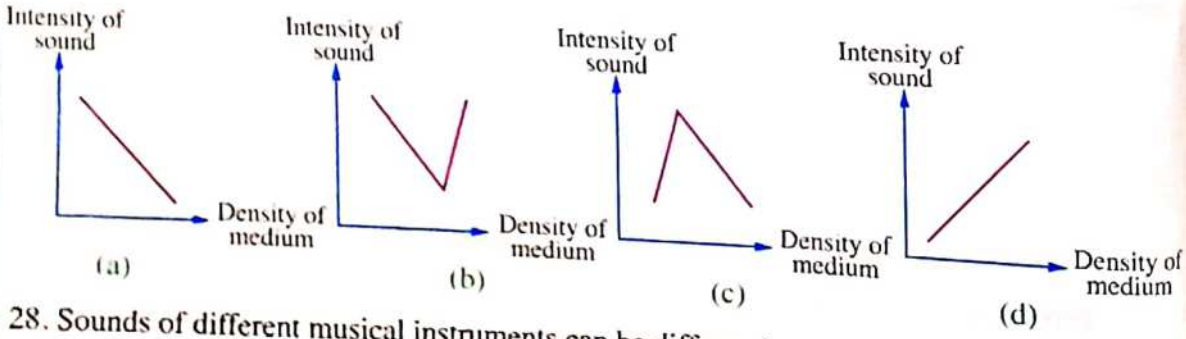
a. decreases the vibrating surface area.

b. increases the vibrating surface area.

c. increases the frequency of the produced sound.

d. decreases the pitch of the produced sound.

⁂ 27. The figure ..... represents the relation between the sound intensity and the density of the medium.



28. Sounds of different musical instruments can be differentiated from each other by .....

a. frequency. b. harmonic tones. c. fundamental tone. d. sound intensity.

29. The human ear can distinguish between sounds that are equal in pitch and intensity if their sources are different, because the fundamental tone is accompanied by harmonic tones, which are .....

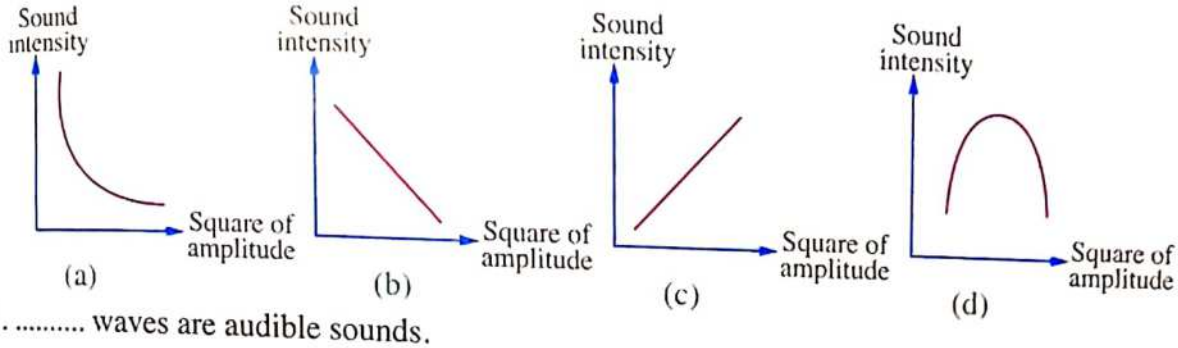
a. higher in intensity and frequency.

b. lower in intensity and higher in frequency.

c. lower in intensity and frequency.

d. higher in intensity and lower in frequency.

30. The figure ..... represents the relation between the intensity of sound and the square of amplitude of vibration of a vibrating body.



31. ..... waves are audible sounds.

a. Infrasonic b. Ultrasonic c. Sonic d. Ultraviolet

32. The human ear can distinguish sounds of frequency .....

a. 50 KHz. b. 30 KHz. c. 300 Hz. d. 5 Hz.

33. The dolphin's trainer uses a whistle producing a sound which can be heard by dolphins and cannot be heard by man, the frequency of such sound equals ..... Hertz.

a. 20 b. 2000 c. 1000 d. 25000

34. A sound wave of frequency 30000 cycle/sec. is called ..... wave.

a. sonic b. infrasonic c. ultrasonic d. radio

35. The frequency of the point (X) is equal to ..... Hertz.

Ultrasonic waves
X
Sonic waves
Infrasonic waves

a. 20 b. 20000

c. 200 d. 2000

36. Ultrasonic waves are used in the following fields, except .....

a. breaking down kidney and ureter stones. b. sterilizing food.

c. discovering landmines. d. avoiding the hazards of noise in loud places.

37. Doctors use waves, which have frequency ..... to break down kidney and ureter stones.

a. less than 20 Hz b. equal to 20 Hz c. more than 20 KHz d. equal to 20 KHz

2. Choose from column (B) the best match in column (A) :

(A)	(B)
1. The sound pitch	a. is the characteristic, by which the ear can differentiate between the sounds as strong or weak.
2. The quality of sound	b. is the property, by which the ear can distinguish between sharp and rough sounds.
3. The sound intensity	c. is the number of the complete vibrations in one second.
	d. is the characteristic, by which the ear can distinguish between sounds from different sources even if they are equal in intensity and pitch.

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3. Put (✓) or (✗) and correct the incorrect ones :

1. The sound of the electric bell is the highest when it is put under a bell jar evacuated from the air. ( )
2. The sound velocity through liquids is less than that through gases. ( )
3. If the speed of sound through air = 340 m/sec. and the frequency of a vibrating body = 170 Hz, so the wavelength = 2 metres. ( )
4. The human ears can distinguish between sounds through two different factors only sound pitch and sound type. ( )
5. As the length of the vibrating string decreases, the frequency of the produced sound increases. ( )
6. The type of sound depends on the distance between the ears and the sound source. ( )
7. The sound intensity becomes fainter gradually as we move towards the source of sound. ( )
8. As the distance between the ears and the sound source is doubled, the intensity of sound increases four times. ( )
9. As the amplitude of a vibrating body is doubled, the intensity of sound increases four times. ( )
10. The sound intensity decreases, when the source of sound touches an empty box. ( )
11. The intensity of sound will be stronger, if sound direction is against the air flow. ( )
12. The ear can distinguish between sounds of different sources of the same frequency and intensity by their fundamental tones. ( )
13. The sound quality is the property by which the ears can distinguish between strong and weak sounds. ( )
14. Sonic waves have frequencies ranging from 20 Hz to 20000 Hz. ( )
15. Sonic waves are used in sterilizing food substances. ( )
16. Sound wave of frequency 15000 Hz is audible sound. ( )

4. Write the scientific term of each of the following :

1. The external factor which affects the ears causing the sense of hearing.
2. Longitudinal waves produced due to the vibration of bodies and stop when the vibrating bodies stop their vibration.
3. The distance which is covered by the sound waves in one second.
4. A tone of regular frequency that is produced from reed pipe.
5. A tone of irregular frequency that is produced from loudspeakers.
6. • A property of sound by which the ears can distinguish between sharp and rough sounds.
   • A property of sound that is directly proportional to the frequency of the sound source.
7. An instrument used to determine the frequency of unknown sound tone.

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8. • The characteristic by which the ears can differentiate between strong and weak sounds.
   • The property of sound that is directly proportional to the square of the amplitude of vibration of the sound source.
9. Sound intensity at a certain point is inversely proportional to the square of the distance between this point and the source of sound.
10. The measuring unit of the sound intensity.
11. The measuring unit of noise intensity.
12. The material used for making ears plugs.
13. The property by which the human ears can distinguish between sounds from different sources even if they are equal in intensity and pitch.
14. The tones accompanying the fundamental tone but they are higher in pitch and less in intensity.
15. 🕮 Sound waves of frequencies less than 20 Hertz.
16. Sound waves of frequencies more than 20000 Hertz.
17. Sound waves of frequencies ranging between 20 to 20000 Hz.
18. Sound waves which accompany the blowing of storms that preceding rainfall.
19. Sound waves which are used in breaking kidney and ureter's stones.
20. Sound waves used for sterilization of the food and water.

5. Complete the following statements :

1. Sound originates from ..... of bodies.
2. Sound is considered from ..... waves , because it needs a medium to travel through.
3. Sound waves propagate through the medium as spheres of ..... and .....
4. Sound wave velocity = ... × .....
5. The velocity of sound through solids is ..... than that through gases and its velocity through gases is ..... than that through liquids.
6. Sound wave which propagates through air with velocity 340 m/sec. and of frequency 20 Hertz, its wavelength equals .....
7. Musical tone is a sound of ..... frequency which is produced from ..... and .....
8. ..... is a sound of ..... frequency, which is produced from electric digger.
9. Ear plugs made of ..... are used to avoid the hazards of ..... in loud places.
10. The human ears can differentiate between the sounds through three different factors, which are sound ..... , sound ..... and sound .....
11. Sound of woman is ..... so it is said that she has ..... pitched sound.
12. Sound of a lion is ..... so it is said that he has ..... pitched sound.
13. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
14. The sound pitch depends on the ..... of the .....
15. The sound pitch is a property by which the ear can distinguish between ..... and ..... voices.

16. The frequency of the vibrating string is ..... proportional to its length.
17. Savart's wheel is used to determine the ..... of unknown sound tone.
18. When turning Savart's wheel with a speed of 600 rotation/minute, using a gear of 30 teeth, the frequency of the produced sound is .....
19. In Savart's wheel by using the same gear, the sound produced will be sharper by increasing its .....
20. In Savart's wheel, frequency = $\frac{\text{Number of cycles} \times \text{.....}}{\text{.....}}$
21. Shouting is a sound of ..... intensity, while whispering is a sound of ..... intensity.
22. The measuring unit of the sound intensity is ..... , while that of noise intensity is .....
23. Among the factors affecting the sound intensity are ..... , ... and .....
24. The intensity of sound at a certain point is measured by the quantity of sound energy falling ..... in one second on ..... at that point.
25. The sound intensity at a point is ..... proportional to the square of the distance between that point and the sound source, which is known as .....
26. When the distance between the sound source and the ear ..... two times, the sound intensity decreases to its .....
27. When the amplitude of sound wave vibration is doubled, the intensity of sound ..... four times.
28. The sound intensity ..... by decreasing the density of the medium and ..... when the vibrating body touches a ..... box.
29. The intensity of sound ..... when the direction of sound waves propagation is in the opposite direction of wind.
30. The human ears can distinguish between sound from sources which are similar in frequency and intensity due to ..... tones which associate the ..... tone.
31. The fundamental tone is lower in ..... and higher in ..... than the harmonic tones.
32. The ..... of sound is a property by which the ears can distinguish between sound of different sources even if they are equal in ..... and .....
33. The frequency of sonic waves ranges between ..... Hz and ..... Hz, while the frequency of infrasonic waves is ..... Hz and also, the frequency of ultrasonic waves is ..... Hz.
34. The human ears can't detect the sound waves of frequencies less than ..... and that of frequencies more than .....
35. ..... sound waves accompany the blowing of storms that preceding rainfall.
36. Some animals such as ..... , ... and ..... can hear ultrasonic waves.
37. ..... waves are used in medical diagnosis and in breaking ..... and ..... stones.

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6. Give reasons for

1. The guardian dog puts its ears on the ground when it sleeps at night.
2. Sound can be heard from all surrounding directions.
3. The violin player changes the length of strings during his play.
4. The difference in frequency between the musical note (tone) and noise.
5. The sound of drill and loudspeaker is uncomfortable to be heard.
6. Some construction workmen use ear plugs made of silicon.
7. The tuning fork of frequency 251 Hz gives rougher sound than that produced by another tuning fork of 512 Hz.
8. • The intensity of sound decreases four times as the distance between the ear and sound source is doubled.
   • It is preferred to sit in the first rows more than sit in the back rows in lecture classes.
9. • The intensity of sound decreases as the amplitude of the vibrating source decreases.
   • The sound intensity which produced from a vibrating ruler will be decreased as time passes.
10. The intensity of sound increases when the sound source touches a resonance box.
11. The strings of a musical lute are fixed on a hollow wooden box.
12. 🕮 Sound travelling in air has less intensity than that travelling in carbon dioxide.
13. 🕮 The piano sound differs from that of the violin even if they have the same intensity and pitch.
14. Dogs can hear all sounds produced by man.
15. Man can't hear all sounds produced by dolphins.
16. Some sound waves cannot be heard by man.
17. The infrasonic waves are used for weather forecast.
18. • 🕮 The use of ultrasonic waves in milk sterilization.
    • Ultrasonic waves are used to sterilize food and water.
19. The ultrasonic waves have medical uses.

7. What is meant by each of the following ?

1. Sound.
2. 🕮 The wavelength of a sound wave = 1.5 m.
3. 🕮 Sound pitch.
4. Sound intensity.
5. Decibel.
6. The inverse square law of sound.
7. Sound quality.
8. Harmonic tones.
9. Infrasonic waves.
10. 🕮 Sonic waves.
11. Ultrasonic waves.

8. What happens when ... ?

1. Both the frequency and velocity of wave propagation decrease to quarter of their value (concerning the wavelength).

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2. • You decrease the length of the violin string during playing (concerning the sound pitch).
   • The number of rotations per second of Savart's wheel increases.
3. The distance between the sound source and the ears increases twice.
4. • The quantity of sound energy falling perpendicular in one second on a unit area increases.
   • The amplitude of vibration of a sound source increases (concerning the sound intensity).
5. You put a vibrating tuning fork on a resonance box (concerning the sound intensity).
6. Operating an electric bell under a bell jar connected to a vacuum pump, then pump the air out of the jar gradually.
7. The density of the medium decreases (concerning the sound intensity).
8. The sound direction is in the direction of air flow (concerning the sound intensity).
9. The sound direction opposes the direction of air flow.
10. • The frequency of sonic waves decreases less than 20 Hz.
    • The frequency of sonic waves increases more than 20000 Hz.

9. What does these relations indicate ?

1. $\frac{\text{Distance covered by a sound wave}}{\text{Time in seconds}}$
2. $\frac{\text{Number of rotations}}{\text{Time in seconds}} \times$ Number of gear teeth in Savart's wheel
3. Sound intensity (I) $\propto \frac{1}{\text{Square of the distance between the ear and the sound source } (d^2)}$
4. Sound wave frequency × Wavelength

10. Problems :

1. A sound source produces 3600 cycles in 3 minutes. If its wavelength is 17 metres, find the velocity of this sound waves.
2. Calculate the wavelength of a sound wave of frequency 17 Hz, if the distance travelled by this wave in one second is 340 metres.
3. Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear. Calculate the number of teeth of the gear.
4. Calculate the number of the gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz and the wheel rotates 30 cycles/min.
5. Find the number of rotations in 2 minutes made by Savart's wheel producing sound of frequency 300 Hz, if a metallic plate touches one gear of 100 teeth.
6. Savart's wheel produces a sound of frequency 200 Hz when a metallic plate touches a gear having 50 teeth. Find the time in minutes taken by the wheel to make 360 rotations.

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11. Variant questions

(1) Mention the factors on which the sound intensity depends. Show the relation between the sound intensity and each factor.

(2) Write down the mathematical relation that joins between each of the following :

1. Frequency, sound velocity and wavelength.
2. The sound frequency and the number of teeth of the gear in Savart's wheel.

(3) Mention one function or importance of Savart's wheel.

(4) What is the scientific basis on which the following depends ?

The strings of the musical lute are fixed on a hollow wooden box.

(5) Mostafa rotates three toothed gears of Savart's wheel which differ in the number of their teeth as shown in the following table and he touches each gear alone by a thin metal plate :

Gear	The first	The second	The third
Number of teeth	50	90	115

Answer the following questions :

1. The roughest sound is produced when the metal plate touches the ..... gear.
2. Calculate the frequency of sound produced when the metal plate touches the second gear which has 90 teeth and rotates by a rate of 200 cycles/min.

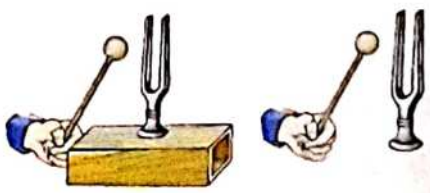
(6) Compare between sonic, ultrasonic and infrasonic waves.
From the point of view of :
- Their frequencies.
- Hearing by man.

(7) A person stands near an apparatus producing different sounds.
It produces sounds of the following frequencies : 10 Hz, 15 Hz, 25 Hz, 50 Hz and 25000 Hz, which of these sounds will be heard by man ? Why ?

(8) Sonar instrument produces ultrasonic waves :

1. What are the frequencies of such waves ?
2. Mention four uses of such waves.

(9) Ahmed knocking on a tuning fork which installed on a resonance box, and when he repeated this step without using a resonance box he found that the produced sound is different in the two cases.
- Is this difference in the sound pitch or in the sound intensity ? Give a reason.



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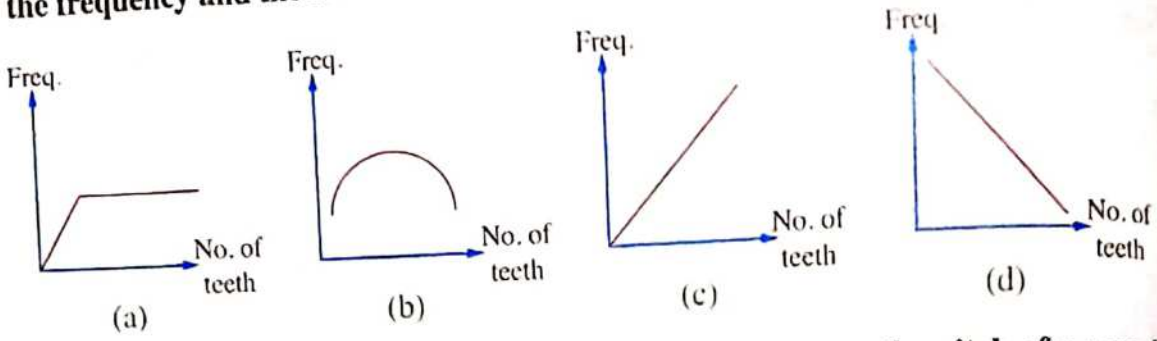
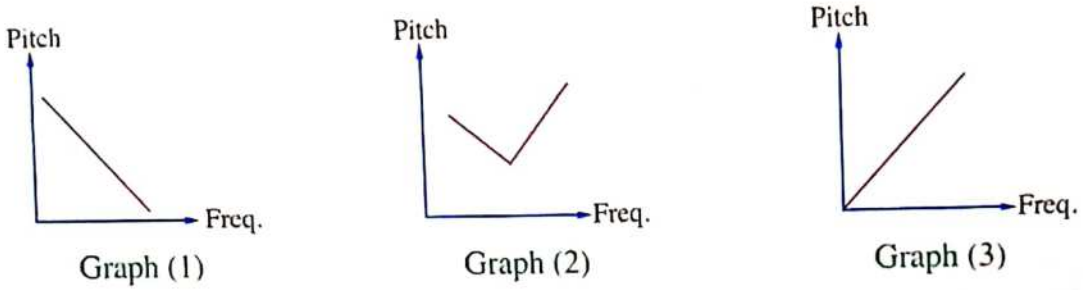
12. Study the following figures, then answer the questions

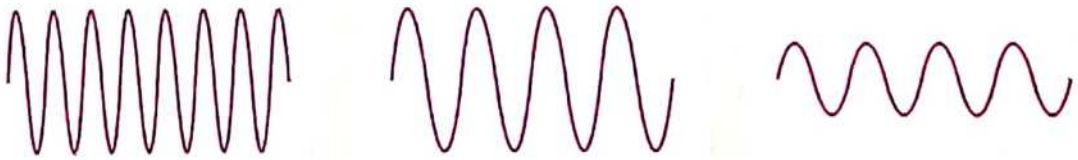
(1) In Savart's wheel, which of the following graphs represents the relation between the frequency and the number of gear teeth at constant speed ?



(2) Which of the following graphs represents the relation between the pitch of a sound and its frequency ? Why ?



(3) Using the following figures, compare from the point of view of sound intensity and pitch between.



Wave (A) Wave (B) Wave (C)

1. Sound wave (A) and sound wave (B).
2. Sound wave (B) and sound wave (C).

(4) Hoda pulled a stretched string from the middle as in the figure :

Hoda showed that the sound intensity is to be strong at case .....

(a) Small amplitude (b) Large amplitude

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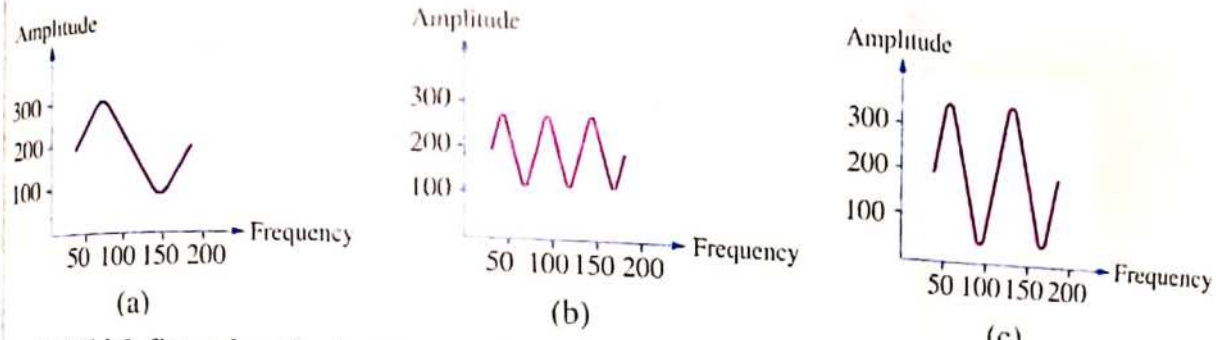
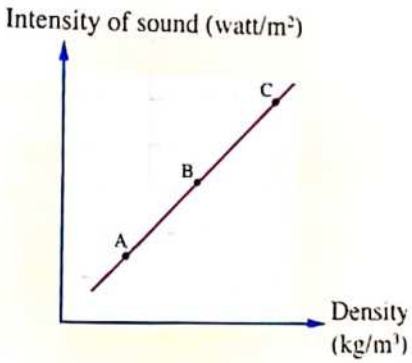
(5) The following graphs represent three different sound waves :



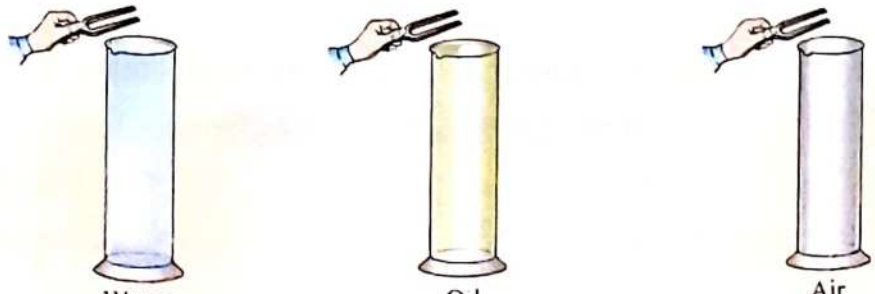
1. Which figure has the largest amplitude ?
2. Which figure represents a sharper tone ? Why ?
3. Which figure represents a harsher tone ? Why ?
4. Which figure represents sound of higher intensity ? Why ?
5. **Complete :**
   a. As the amplitude increases, the sound becomes .....
   b. As the frequency of sound decreases, the sound becomes .....

(6) During an experiment to find the relation between the density of media (A , B and C) and the intensity of sound, complete :

1. The medium which gives strong sound is .....
2. The medium which gives faint sound is .....



(7) There are three cylinders of volume 100 cm^3, the 1st is full of water of density 1 gm/cm^3, the 2nd is full of oil of density 0.8 gm/cm^3 and the 3rd is full of air of density 0.01 gm/cm^3, tab a tuning fork of a known frequency and touch the upper edge of each cylinder, so :



1. The sound of the highest intensity is the cylinder number ..... (Give a reason)
2. The factor affecting the intensity of sound in this case is .....

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∴ **(8) Study the given table and answer the following questions :**

Area	Waves
3	Ultrasonic waves
y	
2	Sonic waves
X	
1	Infrasonic waves

1. Complete the following :

(1) The frequency of point (X) is ..... Hz.

(2) The frequency of point (y) is ..... Hz.

2. Choose :

(1) Frequency is ..... in area (1).

a. 15 Hz b. 22 Hz c. 2000 Hz d. 25000 Hz

(2) Frequency is ..... in area (2).

a. 15 Hz b. 22 Hz c. 25000 Hz d. 30000 Hz

(3) Frequency is ..... in area (3).

a. 15 Hz b. 22 Hz c. 2000 Hz d. 25000 Hz

(4) Dogs and dolphins can hear ..... waves.

a. infrasonic b. sonic c. ultrasonic d. (b) and (c)

(5) Bats can hear ..... waves.

a. infrasonic b. sonic c. ultrasonic d. (b) and (c)

(6) Medical diagnosis instruments are made by using waves in ..... area.

a. first b. second c. third d. (a) and (b)

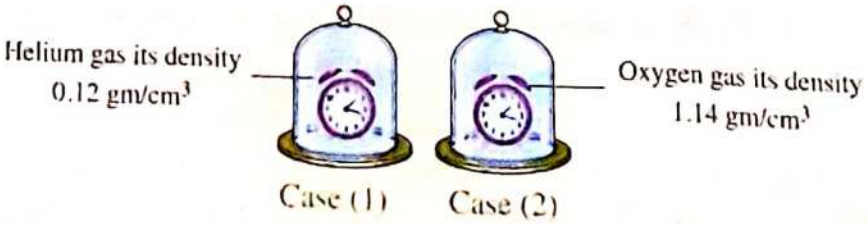
∴ **(9) The following figures refer to three different sound waves.**

Wave (a) Wave (b) Wave (c)

Choose from these waves the wave produced from ... (Give a reason) :

1. Tuning fork.
2. Hammer.
3. Musical instrument.

• **(10) Compare between the sound intensity of alarm in the following two cases, give a reason.**



Thinking Skills Questions

1. Calculate the wavelength of a wave produced by a tuning fork that vibrates in air if its tone is matched with a tone produced from Savart's wheel which rotates 1800 cycles/2 minutes known that the number of its gear teeth is 34 teeth.

2. If the teeth number of a Savart's wheel gear is 50 teeth and it rotates 300 cycles/min. to produce a certain tone. What is the number of rotations in 1.5 minutes of another wheel to produce the same tone if its gear teeth number is 60 teeth ?

3. Calculate the ratio between the sound intensity at two points far from the sound source by 2 m , 6 m.

4. Suppose that there is an electromagnetic wave and another sound wave that has the same frequency. Which of them has longer wavelength ? Why ?

5. Calculate the ratio between the frequencies of two different tones produced from Savart's wheel at the same period of time if you know that the number of teeth of the two gears of the wheel is 60 , 80 and the number of cycles of each of them in the experiment is 80 , 90 respectively.

6. If the intensity of sound produced from a source at a distance (d) metre from a person = (I) watt/m^2, so the sound intensity at a distance ($\frac{1}{2}$ d) = ... I

a. $\frac{1}{4}$ b. $\frac{1}{2}$ c. 1 d. 4

7. Give a reason for :
The intensity of sound when firing a shot on the mountain top is less than it on the base of the mountain.

8. Savart's wheel consists of four serrated gears and the distances between its teeth are equal, if you know that their radii are 3, 6, 9, 12 cm respectively. which gear produces the sharpest sound when it touches a metal plate while rotating at a regular speed.

9. **A dolphin produces sound waves in the air their frequencies range between 10 KHz to 120 KHz, calculate :**

a. The velocity of the sharpest sound wave that the dolphin produces.

b. The shortest wavelength of a sound produced by the dolphin.

c. The wavelength of the harshest sound wave that the dolphin produces in the water (knowing that the velocity of sound through water is 1500 m/s).

10. **The two following figures represent two sound waves, calculate the ratio between the sound intensities of fig. (1) and fig. (2).**

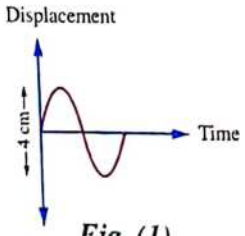


Fig. (1)

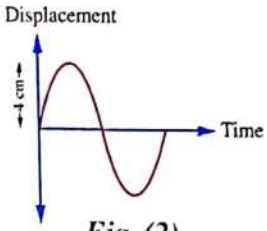


Fig. (2)

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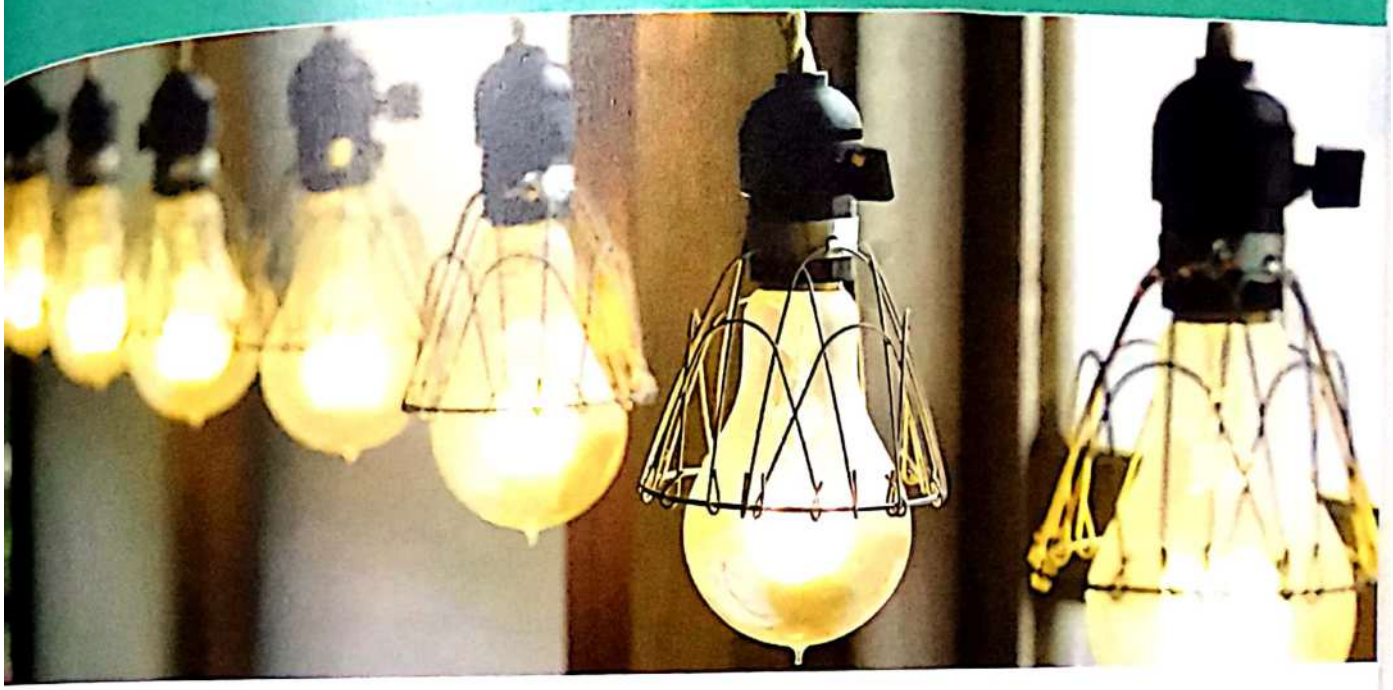
LESSON 2

Wave Nature of Light



What is the nature of light waves, and what are its properties ?

Light is a form of energy, and it can be reflected from objects and falling on eyes causing vision.

Light :

It is an external factor (or stimulus) that affects the eye causing the sense of vision.

In this lesson, we will study :

1. Nature of light waves.
2. Analysis (or splitting) of white light.
3. Energy of light waves.
4. Light behaviour through different media.
5. Light travels in straight lines.
6. Light intensity (brightness).

1 Nature of light waves :

- Light waves are electromagnetic transverse waves **G.R.**

They are **electromagnetic waves**, because they propagate through vacuum and they are **transverse waves**, because the medium particles vibrate perpendicular to the direction of the wave propagation forming crests and troughs.

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- The velocity (speed) of light waves through vacuum (free space) = 300000 km/sec. (3×10^8 m/sec.).

The speed of light :

It is the distance covered by light in one second.

$$\text{Speed of light} = \frac{\text{Distance [m]}}{\text{Time [sec.]}}$$

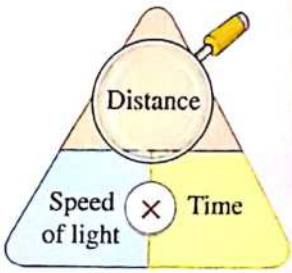
Problem

Calculate the distance between the Earth and the moon, if you know that the reflected sunlight on the moon's surface reaches the Earth after 1.3 sec.

Solution

$\because$ Speed of light $= \frac{\text{Distance}}{\text{Time}}$

$\therefore$ Distance = Speed of light × Time



$\because$ Speed of light through vacuum $= 3 \times 10^8$ m/sec.

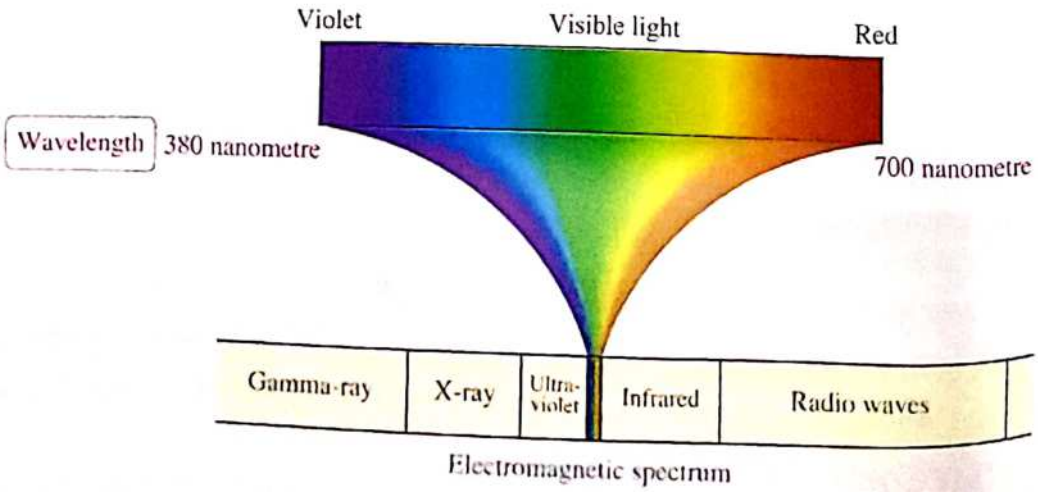
$\therefore$ The distance between the Earth and the moon $= 3 \times 10^8 \times 1.3 = 3.9 \times 10^8$ m

$= 3.9 \times 10^8 \times 10^{-3} = 3.9 \times 10^5$ km

From the figure below, we can define the visible light as follows :

The visible light :

It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometre.



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Enrichment information

Al-Hassan Ibn Al-Haitham was the first scientist who :
- established the science of light.
- discovered the pin hole box which helped in developing the optical camera.
- explained how vision occurs.

2 Analysis (or splitting) of white light :

The Sun is the main source of light energy on the Earth's surface.

Analysis of white light :

It is the splitting of white light into seven colours called spectrum colours.

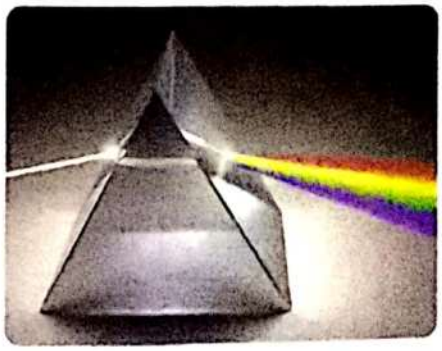
1. If you put a compact disc (CD), on a table, whose glistening surface faces sun rays (a source of white light).
2. You observe the formation of seven colours.
3. This is due to the analysis of white light into seven colours.

- White light consists of a mixture of seven colours which are known as "Spectrum colours".

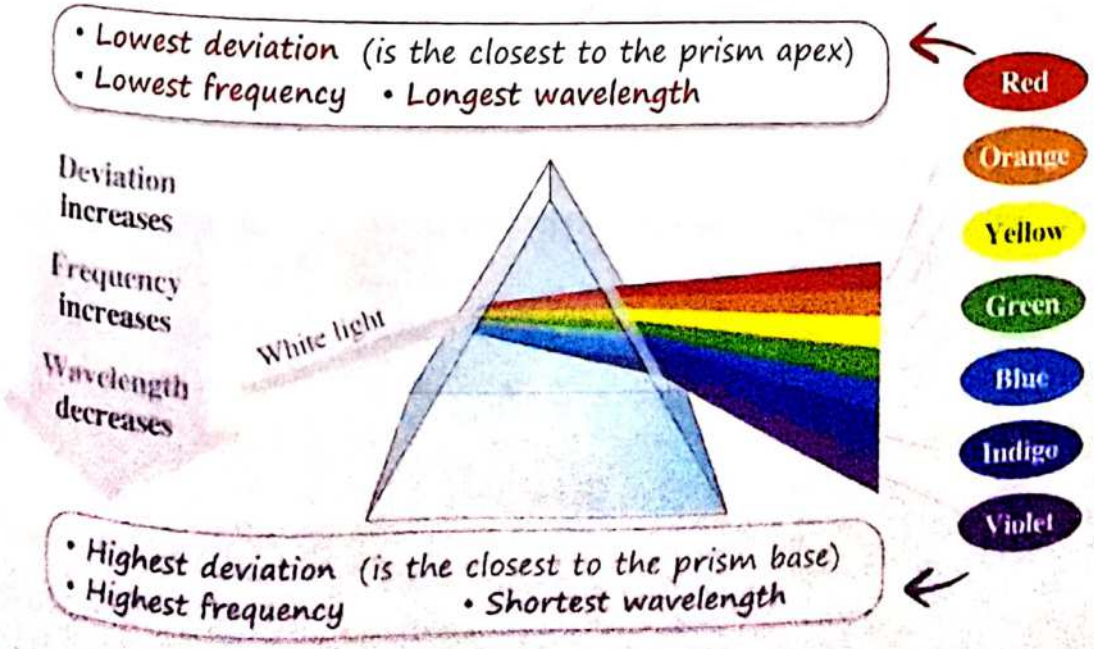
Compact discs

- These colours are : Red - Orange - Yellow - Green - Blue - Indigo - Violet.

* **Similarly,** when the white light falls on a triangular glass prism, it is analysed into seven spectrum colours which are constant in speed and different in :
- Wavelength. - Frequency. - Angle of deviation.
(As in the figure).



Triangular glass prism



3 Energy of light waves :

The German scientist Max Planck proved in 1900 that :

- The energy of light waves is composed of energy quanta known as "Photons".
- The energy of the photon (E) is **directly** proportional to the frequency of the light wave (F).

$$\text{Photon energy} \propto \text{Photon frequency}$$
$$\text{Photon energy} = \text{Constant} \times \text{Photon frequency}$$

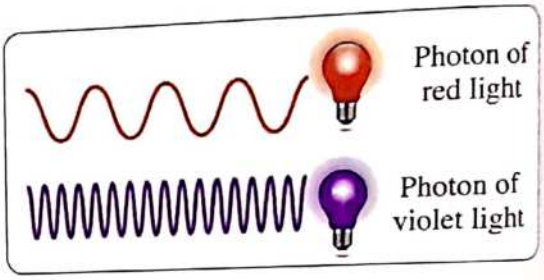
- The constant value is known as Planck's constant.

$$\therefore \quad \text{Photon energy} \equiv \text{Planck's constant} \times \text{Photon frequency}$$

Exercise

Which one has a greater energy, the photon of red light or the photon of violet light ?

Given that the frequency of red light is less than that of violet light.



Answer

The energy of the photon of red light is smaller than the energy of the photon of violet light, because the energy of the photon is directly proportional to the frequency.

Real Life applications : *of the uses of light :*

TRY to answer worksheet in the Notebook 9

➲ **Light is used in home decorations like :**

Spot lights :

That illuminate artifacts.

Ornamented lamps :

That bring happiness and joy to the place.

Stand lamps :

That concentrate light for reading.

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4 Light behaviour through different media :

Light transmits through different media with variable degrees.

Media can be classified according to their ability to allow light to pass through, into :

A	B	C
Transparent medium	Translucent (semi-transparent) medium	Opaque medium

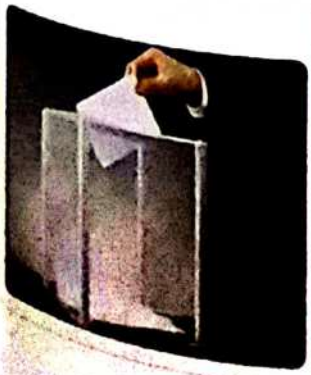
Transparent medium :

It is the medium, which permits most light to pass through.

- Objects can be seen clearly through transparent medium.

Examples :

- The clear glass.
- Air.
- Pure water.



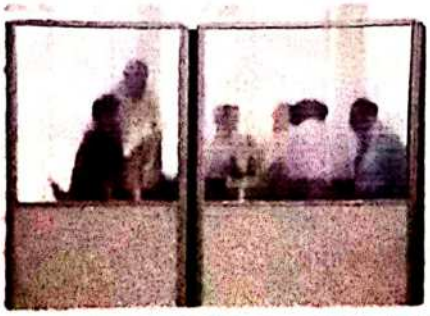
Translucent medium :

It is the medium, which permits only a part of light to pass through and absorbs the remaining part.

- Objects can be seen through translucent medium less clearly than the transparent one.

Examples :

- Frosted (flint) glass.
- Tissue paper.



Opaque medium :

It is the medium, which doesn't permit light to pass through.

- Objects can't be seen through opaque medium.

Examples :

- Plant leaves.
- Foil paper.
- Milk.
- Carton.
- Black honey.
- Books.
- Wood.
- Metals.
- Human skin.

Note

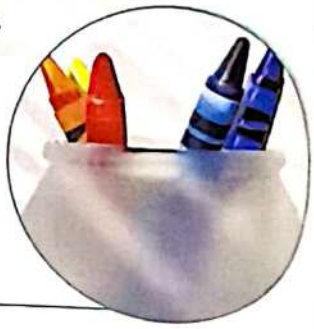
By increasing the thickness of the transparent medium, the quantity of light that passes through it decreases.

Give a reason ?

1. **The clothes pins can be seen clearly before and after placing them in a transparent plastic bag.**

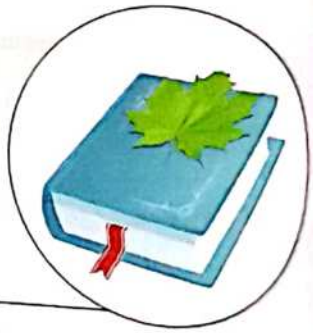
Because both of air and transparent plastic bag are transparent media, which allow light to pass through them.

2. **When we put the crayons in desk trim made of flint glass, the upper part of them is visible, while the bottom does not look as clear.**



The upper part of crayons is visible, because the air is a transparent medium, which allows light to pass through it, while the bottom does not look as clear, because of the flint glass is a translucent medium, which permits only a part of light to pass through and absorbs the remaining part.

3. **When a leaf is placed on the title of a book we cannot see this title.**



Because the leaf is an opaque medium that doesn't permit light to pass through it.

4. **Not seeing the impurities that may found (exist) in black honey (molasses).**

Because the black honey is an opaque medium that doesn't permit light to pass through it.

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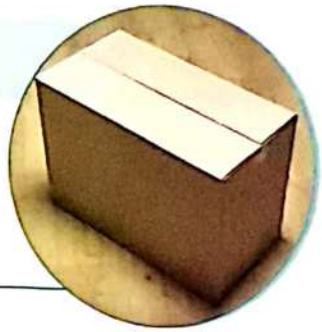
5 **Although water is a transparent medium, we cannot see fish at the bottom of the River Nile.**

Because the thickness of water at that point (the bottom) is large enough to prevent light from passing through.

6 **Carton is an opaque medium.**

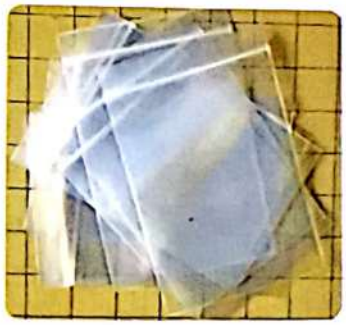
Because it doesn't permit light to pass through and objects can't be seen inside it.



What happens when ...?

Several transparent plastic strips are put on a sheet of graph paper "for the clearness of visibility".

- Clearness of visibility of the sheet of graph paper decreases gradually until it can't be seen, according to the number of the transparent plastic strips and their thickness, when they increase, the quantity of light that passes through them decreases.



Question

Compare between transparent, translucent and opaque media :

Points of comparison	Transparent medium	Translucent medium	Opaque medium
Definition :	.....	.....	.....
Examples :	.....	.....	.....
	.....	.....	.....
	.....	.....	.....

5 Light travels in straight lines :

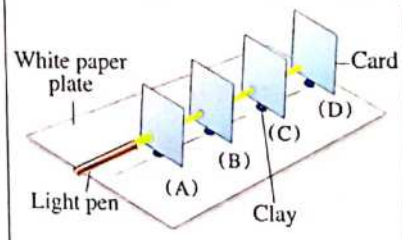
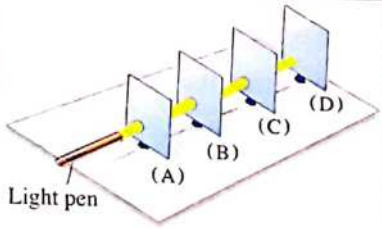
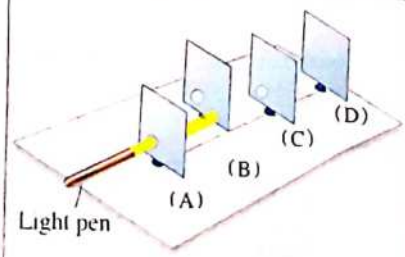
Light propagates (travels) through transparent media in straight lines whose thickness can be controlled.

Light travels in straight lines

Activity 1 To demonstrate (show) the propagation of light in straight lines :

Materials and tools :

• Four cards. • Pieces of clay. • White paper plate. • Light pen.

Steps	Figures	Observations
1. Make identical holes in the three cards [A , B , C] (as shown in figure 1). 2. Fix the four cards using clay on the white paper plate, where the holes lie on straight line. 3. Allow light of the light pen to pass through the hole of card (A).	 Figure (1)	• The light ray passes through the holes in straight line and a light spot is formed on the card (D).
4. Repeat the previous steps by replacing the cards with others have wider holes (as shown in figure 2).	 Figure (2)	• The area of the formed light spot increases by increasing the size of the holes.
5. Move the card (B) to the left (as shown in figure 3).	 Figure (3)	• The light ray cannot pass through the card (B), so a light spot disappears on the card (D).

Conclusion:

Light travels through transparent media in the form of straight lines, whose size (thickness) can be controlled.

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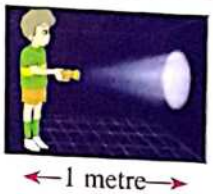
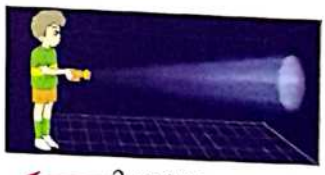
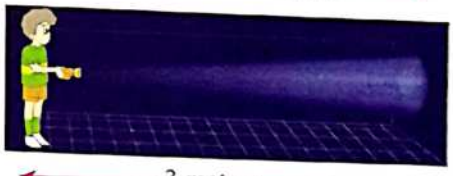
Enrichment information

Solar and lunar eclipses can be explained according to the travelling of light in straight lines.

6 Light intensity (brightness) :

Activity 2

- **To illustrate the concept of light intensity.**
- **To show the light intensity of a surface changes by changing the distance between the surface and the light source.**

Steps	Figures	Observation
1. Stand at 1 meter away from a wall in a dark room and direct the light of a torch towards it. 2. Increase the distance between you and the wall to 2 metres, then 3 metres.	 1 metre  2 metres  3 metres	The light intensity of the light spot formed on the wall decreases as the distance between you and the wall increases.

Explanation :

The light emitted from a light source propagates in all directions and as the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.

Conclusion:

The quantity of light falling perpendicular to a unit area of a surface in one second is called "Light intensity".

Light intensity :

It is the quantity of light falling perpendicular to a unit area of a surface in one second.

Light intensity of a surface decreases as the distance between the surface and the light source increases.

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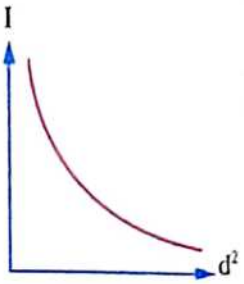
➲ **From the previous activity, we can conclude the inverse square law of light :**

The inverse square law of light :

The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.



$$\text{Light intensity} \propto \frac{1}{d^2}$$

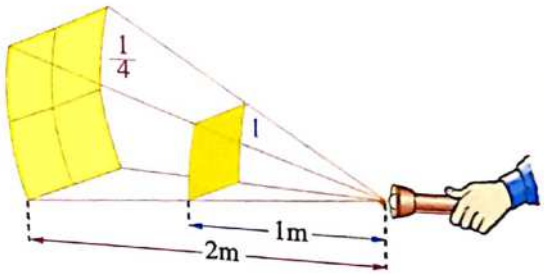
What happens when ...?

The distance between the light source and a certain surface is doubled.

➲ The light intensity decreases to its quarter.

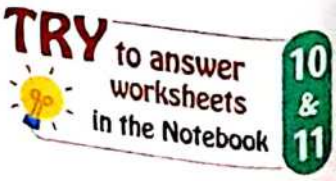
The distance between the light source and a certain surface decreases to half.

➲ The light intensity increases to four times.



G.R. ***The intensity of light increases four times when the distance between the light source and the wall decreases to its half value.***

Because the light intensity is inversely proportional to the square of the distance between them.



Remember Lesson Two

Light :

It is an external factor which affects the eye causing the sense of vision.

The speed of light :

It is the distance covered by light in one second.

The visible light :

It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometre.

Analysis of white light :

It is the splitting of white light into seven colours called spectrum colours.

Energy of light wave :

Photon energy = Planck's constant × Photon frequency

Transparent medium :

It is the medium which permits most light to pass through it.

Translucent (semi-transparent) medium :

It is the medium which permits only a part of light to pass through it and absorbs the remaining part.

Opaque medium :

It is the medium that doesn't permit light to pass through it.

Light intensity :

It is the quantity of light falling perpendicular to a unit area of a surface in one second.

The inverse square law of light :

The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

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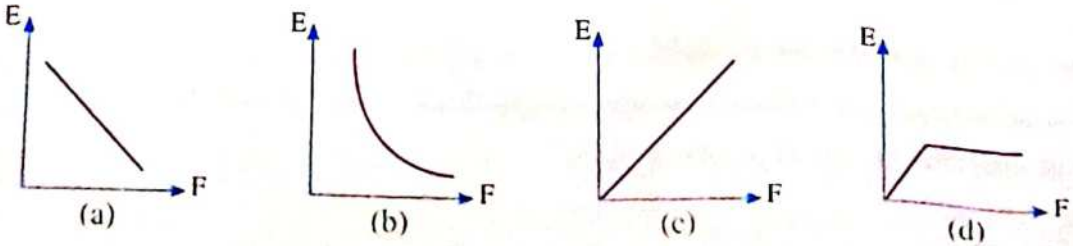
Questions ? on lesson Two

Interactive Exercises

● Remember ● Understand ● Apply ● Higher skills 📖 School book questions.

1. Choose the correct answer :

1. 📖 Light waves are ..... waves.
   a. mechanical transverse
   b. electromagnetic transverse
   c. electromagnetic longitudinal
   d. mechanical longitudinal
2. Which of these characteristics is not applied on light ? .....
   a. It is an electromagnetic wave.
   b. It needs a medium to travel through.
   c. It travels in straight lines.
   d. It has the ability to stimulate the sense of vision.
3. The distance that light travels in a second is .....
   a. light frequency.
   b. light speed.
   c. light intensity.
   d. light energy.
4. The main source of light on the Earth's surface is the .....
   a. Sun.
   b. moon.
   c. star.
   d. candle.
5. White light consists of ..... spectrum colours.
   a. nine
   b. six
   c. seven
   d. eight
6. ..... colour has the lowest deviation.
   a. Violet
   b. Green
   c. Red
   d. Yellow
7. The ..... colour in the spectrum colours has the highest frequency.
   a. violet
   b. green
   c. red
   d. yellow
8. If the frequency of red colour is 4×10^{12} Hz, the frequency of violet colour is ..... $\times 10^{12}$ Hz.
   a. 1.5
   b. 3.5
   c. 4
   d. 7.5
9. 📖 Photon energy = Planck's constant × .....
   a. photon frequency.
   b. photon wavelength.
   c. amplitude.
   d. photon velocity.
10. The quanta of ..... colour has the lowest energy.
    a. blue
    b. violet
    c. green
    d. red
11. Which of the following graphs represents the relation between the frequency of light (F) and its energy (E) ? .....



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12. The quantum of energy of green light is ..... the quantum of energy of yellow light.
a. greater than b. equal to c. less than d. half

13. Which of the following arrangements is correct concerning the increase in photon energy ? .....
a. Violet → blue → yellow → red.
b. Red → blue → violet → yellow.
c. Violet → red → blue → yellow.
d. Red → yellow → blue → violet.

14. All of the following are among the characteristics of violet colour, except .....
a. it has the highest frequency of the spectrum colours.
b. it has the longest wavelength of the spectrum colours.
c. its photon has the largest energy.
d. it is the nearest colour to the base of the prism.

15. The media which permit most light to pass through are called ..... media.
a. only transparent b. only translucent
c. transparent and opaque d. transparent and translucent

16. Media that we can see objects less clearly through are called .....
a. opaque media. b. transparent media. c. translucent media. d. spectrum colours.

17. ..... media don't allow light to pass through.
a. Only transparent b. Only opaque
c. Translucent and opaque d. Transparent and opaque

18. All of the following are examples of transparent media, except .....
a. air. b. tissue paper. c. glass. d. clear water.

19. Which one from the following doesn't permit the passage of light through it ? .....
a. Air. b. Clear water. c. Flint glass. d. Milk.

20. Light can transmit through ..... media.
a. only transparent b. only translucent
c. transparent and opaque d. transparent and translucent

21. The human skin is considered as a /an ..... medium.
a. transparent b. opaque c. translucent d. semi-transparent

22. By increasing the thickness of the transparent medium, the quantity of light that passes through it .....
a. decreases. b. increases.
c. remains constant. d. equals zero.

23. Light travels in ..... lines.
a. curved b. circular c. straight d. zigzag

24. Light .....
a. travels in curved lines. b. consists of compressions and rarefactions.
c. can be analysed. d. can't travel through space.

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25. The light intensity of a surface is inversely proportional to the ..... between the surface and the source of light.
a. distance
b. square of the distance
c. cube of the distance
d. double of the distance

26. When the distance between the source of light and the surface of a wall decreases, the light intensity on the surface .....
a. decreases.
b. increases.
c. is doubled.
d. remains constant.

27. If the distance between a surface and light source decreases to its half, the light intensity of the surface .....
a. decreases to its one fourth.
b. decreases to its half.
c. increases twice.
d. increases four times.

2. Rewrite the following statements after correcting the mistakes :

1. Light is a mechanical transverse waves.
2. The velocity of light through space is 30000 km/sec.
3. White light is a mixture of five colours known as bright colours.
4. The glass prism is used to analyse the white light into nine spectrum colours.
5. The frequency of the green light is lower than that of yellow light.
6. Violet colour has the longest wavelength.
7. Yellow colour is the first colour in spectrum colours, but violet colour is the last one.
8. Al-Hassan Ibn Al-Haitham proved that the energy of light waves is composed of photons.
9. Energy of the photon = Planck's constant + Frequency of the photon.
10. The energy of the quanta of light is directly proportional to the wavelength of the light wave.
11. The media can be classified according to their ability to transmit light into transparent and opaque media only.
12. Transparent media allow a part of light to pass through them.
13. Air and pure water are examples of translucent media, but tissue paper and flint glass are examples of opaque media.
14. Milk, wood and carton are examples of transparent media.
15. The objects can be seen clearly through translucent media.
16. By increasing the thickness of the transparent medium, the quantity of light that passes through it increases.
17. Light travels in transparent media in the form of zigzag lines.
18. The intensity of light on a surface increases as the distance between the source of light and the surface increases.
19. The intensity of light on a surface is directly proportional to the distance between the light source and the surface.
20. As the distance between light source and a surface decreases to its one third, the intensity of light increases 3 times.

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3. Write the scientific term of each of the following :

1. Electromagnetic waves stimulate the sense of vision when they reach the eye.
2. The distance covered by light in one second.
3. One of the components of the electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.
4. The main source of light energy on the Earth's surface.
5. The splitting of white light into seven spectrum colours.
6. A mixture of seven spectrum colours.
7. A structure used in the analysis of light.
8. Seven colours are produced as a result of splitting of the white light.
9. The scientist who proved that the energy of the photon depends on its frequency.
10. • The colour which has the lowest frequency, longest wavelength and lowest energy.
    • The colour which has the lowest deviation and it is the closest to the prism apex.
11. • The colour which has the highest frequency, shortest wavelength and highest energy.
    • The colour which has the highest deviation and it is the closest to the prism base.
12. A physical quantity equals Planck's constant is multiplied by frequency.
13. 🕮 A medium doesn't allow light rays to penetrate through.
14. The media allow the passage of most light through them.
15. The media allow the passage of a part of light through them and absorb the remaining part.
16. The amount of light falling perpendicular to a unit area of a surface in one second.
17. The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

4. Complete the following statements :

1. Light is ..... waves that travel through free space (vacuum).
2. Visible light is one of the components of electromagnetic spectrum of wavelength ranges between ..... to ..... nanometres.
3. The light velocity is the distance .....
4. ..... is the main source of light energy on Earth's surface.
5. Light waves consist of ..... and .....
6. White light consists of ..... colours.
7. The glass prism is used to analyse the ..... light into ..... colours.
8. ....., orange , ..., green , blue , ... and violet are the seven spectrum colours.
9. ..... is the nearest colour to the prism apex, while ..... is the nearest colour to the prism base.
10. The ..... colour has the highest frequency and the shortest wavelength, while the ..... colour has the lowest frequency and the longest wavelength.

11. The frequency of blue colour is ..... than the frequency of yellow colour, so the energy of yellow light photon is ..... than the energy of blue light photon.
12. The scientist ..... proved that the energy of light waves is composed of energy quanta known as .....
13. The energy of the photon is ..... proportional to the ..... of light wave.
14. Energy of photon = ... × .....
15. Light is used in home decorations like ..... to illuminate artifacts and ..... to concentrate light for reading.
16. Media are classified according to their ability to allow light to pass through into ..... medium , ... medium and ..... medium.
17. The medium which allows most light to pass through is called .....
18. ..... and ..... are examples of the transparent media.
19. The glass cup is an example of transparent medium , while flint glass is an example of ..... medium.
20. Carton and ..... are examples of ..... medium that don't permit light to pass through.
21. By increasing the ..... of the transparent medium , the quantity of light that passes through it .....
22. Light travels through the ..... media in ..... lines.
23. The light intensity is the amount of light .....
24. The light intensity of a surface is ..... proportional to square of the distance between the surface and the light source.
25. As the distance between the light source and the surface increases twice, the intensity of light of the surface ..... to its .....

5. Give reasons for :

1. Light can travel through free space.
2. Light waves are considered as electromagnetic waves.
3. The light of the Sun is a complex light.
4. The energy of red light photon is less than that of orange light photon.
5. The energy of violet photon has the maximum energy in spectrum colours.
6. The energy of violet photon is larger than that of blue photon.
7. Objects can be seen clearly through transparent media.
8. A clear glass is a transparent medium.
9. Although water is a transparent medium, we cannot see fish at the bottom of the River Nile.
10. Objects cannot be seen clearly through the frosted glass.
11. A tissue paper is a translucent medium.
12. Aluminium foil is an opaque medium.

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13. Wood doesn't allow the light to pass through.
14. 🕮 The inability to see the impurities present in black honey.
15. The intensity of light on a surface decreases to its quarter as the distance between the surface and light source is doubled.

6. What is meant by ... ?

1. Light.
2. The velocity of light is 3×10^8 m/sec.
3. 🕮 Visible light.
4. Analysis of white light.
5. Transparent medium.
6. Translucent medium.
7. Opaque medium.
8. 🕮 Light intensity.
9. The inverse square law of light.

7. What happens when ... ?

1. A compact disc (CD) with shiny side is put to face sunlight.
2. 🕮 Incidence of a white light ray on one face of a triangular glass prism.
3. The thickness of the transparent medium increases concerning the quantity of light that passes through it.
4. Light falls on a transparent medium.
5. Light falls on a translucent medium.
6. Light falls on an opaque medium.
7. You look at a picture through a clear glass.
8. You look at a picture through a frosted glass.
9. You look at a picture through a metallic sheet.
10. The distance between the source of light and a surface increases (concerning the light intensity).
11. The distance between the light source and a surface is doubled (concerning the light intensity).

8. Choose the unsuitable word or statement out, then express the rest of the words or statements with something proper :

1. 🕮 Yellow / Blue / White / Violet / Red.
2. Glass / Ceramic / Water / Air.
3. Wood / Concrete / Air / Metal.
4. 🕮 Light travels in straight lines / The speed of light differs in different media / White light consists of seven spectrum colours / Light travels through materialistic media only / The thickness of a light beam can be controlled.

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9. Variant questions :

(1) Arrange the spectrum colours ascendingly according to :

a. Frequency.

b. Deviation in the triangular prism.

(2) Mention the use(s) of :

a. Light.

b. Triangular glass prism.

(3) Write down the mathematical relation that joins between :

The photon frequency of a wave and its energy.

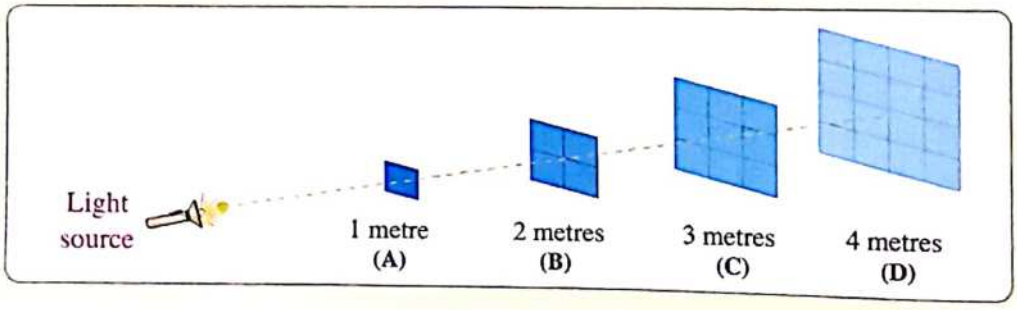
(4) Compare between : Transparent medium, translucent medium and opaque medium.

10. Study the following figures, then answer the questions :

(1) In the following figure, the light intensity of the surface at point (A) equals the unity.

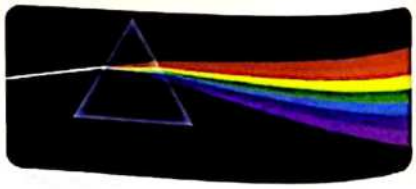
Choose from the following values : $(\frac{1}{2} - \frac{1}{3} - \frac{1}{4} - \frac{1}{6} - \frac{1}{9} - \frac{1}{12} - \frac{1}{16})$

What is suitable to be the light intensity at the points (B) , (C) and (D) ?

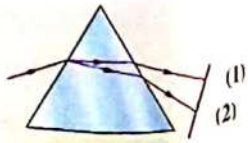


(2) Look at the opposite figure, then answer :

1. The figure shows the separation of ..... into ..... by .....
2. Mention the names of the spectrum colours in the right order.

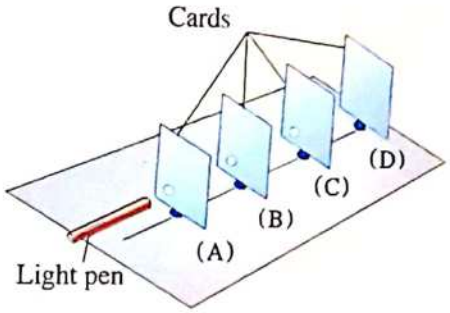


(3) In the opposite figure, which ray represents the red colour and which ray represents the violet colour ?



(4) **The opposite figure represents an experiment that you have studied :**

1. What is formed on card (D) when lighting the light pen ?
2. What do you observe when you increase the area of holes on cards ?
3. What is the effect of ... ?
   a. Replacing card (B) with a clear glass sheet that has no holes.
   b. Moving card (B) slightly to the left.
4. What do you conclude from this experiment ?



11. Creative thinking :

Glass manufacturing factories in Egypt produce different types of glass, like transparent (clear) glass, flint glass and reflecting glass. **Mention some uses of each type, stating the reason.**

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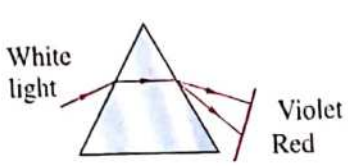
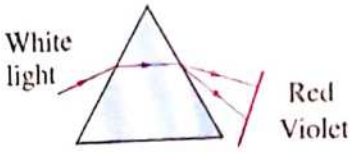
Thinking Skills Questions

1. Choose the correct answer :

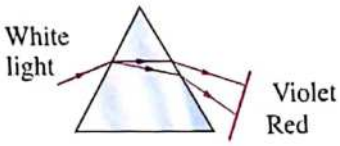
1. The figure ..... represents the analysis of white light by a triangular glass prism.



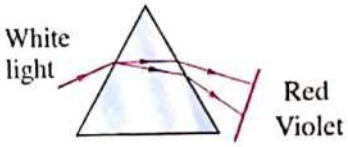
(a)



(b)



(c)



(d)

2. The ratio between the frequency of red light to the frequency of violet light is ..... one.

a. more than
b. equal to
c. less than
d. no correct answer

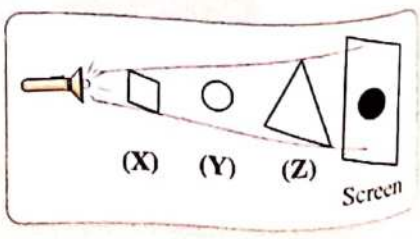
3. The periodic time of green light wave is ..... the periodic time of red light wave.

a. more than
b. equal to
c. less than
d. no correct answer

4. Wavelength of violet colour × frequency of violet colour is ..... wavelength of orange colour × frequency of orange colour.

a. more than
b. equal to
c. less than
d. no correct answer

5. In the opposite figure, the shadow formed on the screen indicates that (X) , (Y) and (Z) are made of ..... respectively.



a. iron , flint glass and transparent plastic
b. glass , rubber and carton
c. carton , plastic and glass
d. transparent glass , rubber and transparent plastic

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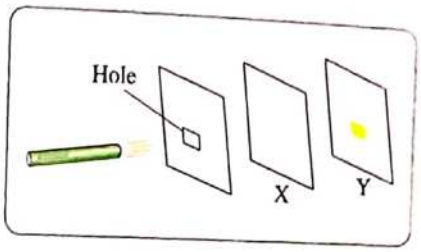
2. Mercury lamp is preferred in headlights of cars. (Give a reason).

3. If the distance between the Earth and the Sun is 1.5×10^8 km, calculate the time taken by sunlight to reach the Earth in minutes.

4. From the opposite figure, what is the type of the medium of card (X) and card (Y) according to the ability of each of them to permit the light through ?



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LESSON 3

Reflection and Refraction of Light

Why we can see the shadow of trees on the land during a sunny day ?

From the previous lesson you knew that light travels in straight lines and it does not permits through dark objects, so the result is the formation of shadow.

In this lesson, we will talk about two basic concepts of light which are:

1. Light reflection. **2. Light refraction.**

1 Light reflection :

- Sometimes, in our daily life, we can observe the formation of inverted images of trees and buildings on the surface of water or on the road when rain falls.
- When you throw a ball against a wall, it returns back (rebounds) from the wall.
  Similarly when light meets a reflecting surface, it rebounds again and this is known as **"light reflection"**.
- The surface, at which the reflection takes place is called the **"reflecting surface"**.

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Light reflection :

It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

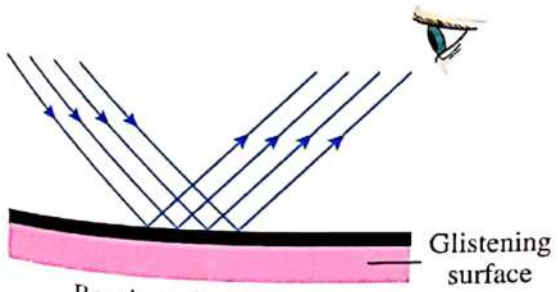
Types of light reflection :

Light reflection is classified according to the nature of the reflecting surface into :

1. **Regular (uniform) reflection**
2. **Irregular (non-uniform) reflection**

Regular (uniform) reflection :

It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.



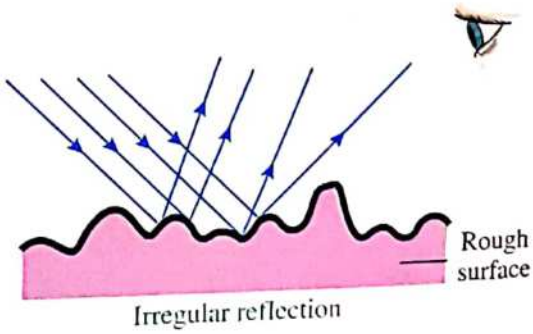
Regular reflection

Examples of smooth surfaces :

- A plane mirror.
- A thin sheet of aluminium (foil).
- A stainless steel sheet.

Irregular (non-uniform) reflection :

It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different (many) directions.



Irregular reflection

Examples of rough surfaces :

- A leaf of a tree.
- A piece of paper.
- A piece of leather.
- A piece of wool.

Exercise 1

Mention the type of reflection when light rays fall on :

1. A woolen jacket.

2. A stainless steel sheet.

Answer

1. Irregular reflection.

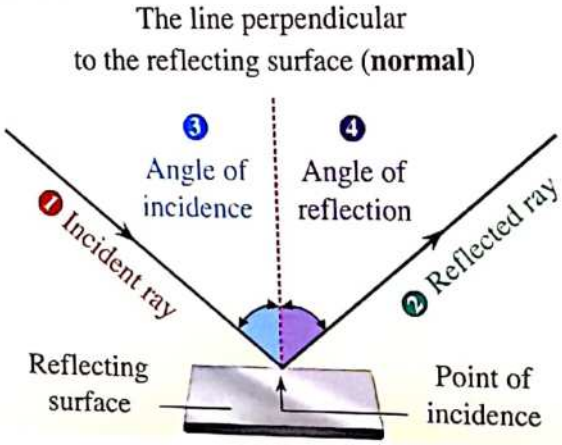
2. Regular reflection.

Enrichment information

The surface of a clean mirror causes regular reflection, while the dirty mirror surface causes irregular reflection.

Laws of light reflection :

➲ **To know the laws of light reflection, we should know some basic concepts that are used in this laws.**



1 The incident light ray :
It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.

2 The reflected light ray :
It is a narrow light beam which is represented by a straight line, it is reflected from the reflecting surface at the point of incidence.

3 Angle of incidence :
It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.

4 Angle of reflection :
It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

What is meant by ...?

The angle of reflection of a light ray = 40°

➲ This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence equals 40°.

The angle of incidence of a light ray = 30°

➲ This means that the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence equals 30°.

When light reflects on a surface, its reflection is ruled by two important laws.

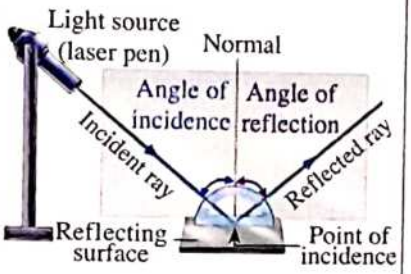
Activity 1 To conclude the two laws of light reflection :

Materials and tools :

- Plane mirror.
- Protractor.
- Laser pen.
- White paper.

Warning

Avoid exposing the eyes to direct laser.

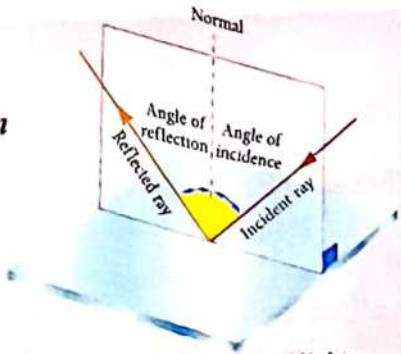
Steps	Figure	Observations
1. Fix a plane mirror horizontally and fix on its edge, a white paper and a plastic protractor perpendicular to it. 2. Direct a light ray on the plane mirror surface tangent to the paper (as shown in the figure). 3. Measure the angle of incidence and the angle of reflection. 4. Change the angle of incidence several times and measure the angle of reflection in each time.	 Light reflection	1. The angle of incidence = the angle of reflection. 2. The angle of reflection changes according to the change of the angle of incidence, since they are equal.

Conclusion:

The reflection of light is governed by two laws :

First law : ***Angle of incidence = Angle of reflection***

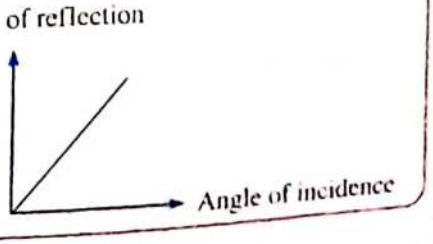
Second law : ***The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.***



Laws of reflection of light

NB

The opposite graph represents the relation between the angle of incidence and the angle of reflection.



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What happens when ...?

light ray falls perpendicular on a reflecting surface. Give a reason.

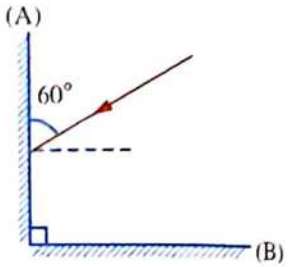
➲ It will reflect on itself, that because the angle of incidence and the angle of reflection are equal zero.

Exercise 2

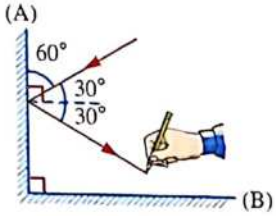
In the opposite figure, a light ray falls on mirror (A), complete the path of the ray till it reflects from mirror (B), then calculate the value of :

(1) The angle of reflection from mirror (A).

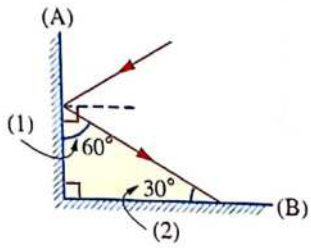
(2) The angle of incidence on mirror (B).



Idea of Solution



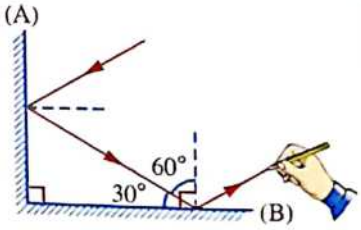
Angle of reflection from mirror (A) = angle incidence
$= 90° - 60° = 30°$



The angle (1) between the reflecting ray and mirror (A)
$= 90° - 30° = 60°$

∵ The sum of angles of triangle $= 180°$

∴ The angle (2) between the incident ray and mirror (B)
$= 180° - (60° + 90°) = 30°$

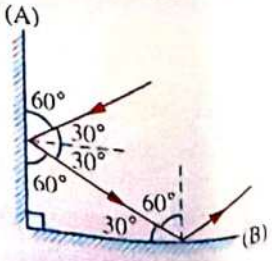


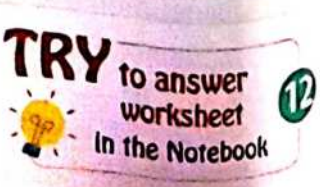
∴ The angle of incidence on mirror (B)
$= 90° - 30° = 60°$

Answer

(1) The angle of reflection from mirror (A) = 30°

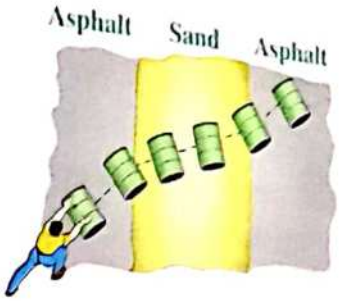
(2) The angle of incidence on mirror (B) = 60°





2 Light refraction :

When you push a barrel from asphalt to sand then to asphalt again, the barrel changes its path (as shown in the figure). This is due to the change of barrel velocity on asphalt from that on sand.



Similarly, as light travels from :

a transparent medium (like air) → To → another transparent medium (like glass)

Its path changes due to the difference of the velocity of light through different transparent media and this phenomenon is known as "Light refraction".

Refraction of light

Light refraction :

It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

The ability of the transparent medium to refract the light is called the "optical density of the medium".

Optical density of the medium :

It is the ability of the transparent medium to refract light.

Each medium has its own optical density,

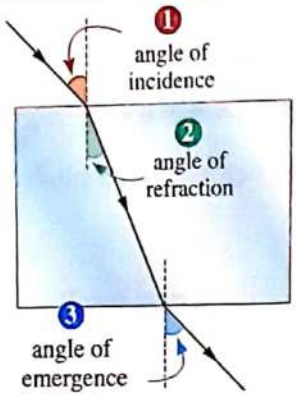
So the optical density of a medium differs from one medium to another , **which leads to** the change in the light velocity through such medium.

i.e. As optical density of the medium increases, the speed of light through it decreases and vice versa.

G.R. | ***The velocity of light changes from one medium to another.***

Because the optical density of a medium differs from one medium to another.

Concepts related to light refraction :



1 Angle of incidence :
It is the angle between the incident light ray and the normal at the point of incidence on the interface.

2 Angle of refraction :
It is the angle between the refracted light ray and the normal at the point of incidence on the interface.

3 Angle of emergence :
It is the angle between the emergent light ray and the normal at the point of emergence on the interface.

What is meant by ...?

The angle of emergence in a prism is 50°

➲ This means that the angle between the emergent light ray and the line perpendicular to the interface at the point of emergence is 50°

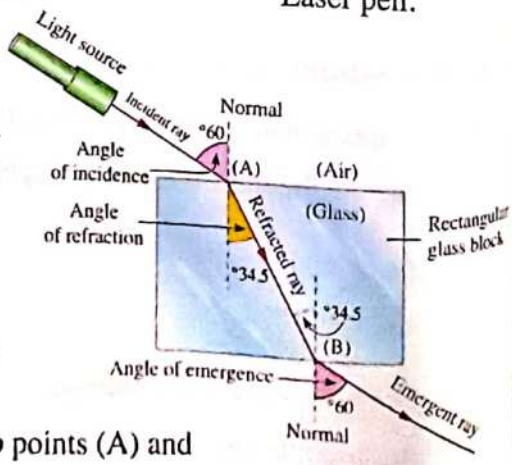
Activity 2 To demonstrate the light refraction :

Materials and tools :

- Thick rectangular glass block.
- Ruler.
- White paper sheet.
- Protractor.
- Pencil.
- Laser pen.

Steps :

1. Put a rectangular glass block on a white paper sheet and mark around the block using a pencil.
2. Direct a ray from the laser pen to the point of incidence (A) on the side of the rectangular glass and draw its path (using the pencil and the ruler) to represent the incident ray.
3. Draw the path of the emergent ray from point (B) on the opposite side of the glass.



4. Remove the rectangular glass and join the two points (A) and (B) with a straight line which represents the refracted ray.
5. Draw at (A) and (B) dotted vertical lines, where each line represents the normal at the point of incidence and at the point of emergence on the interface.

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Observations :

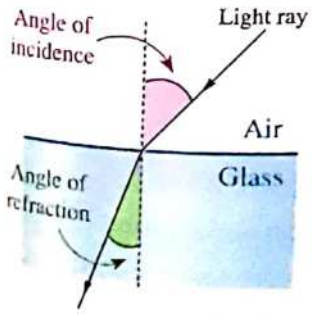
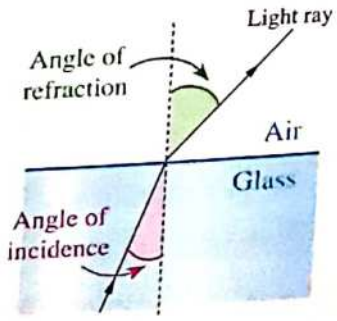
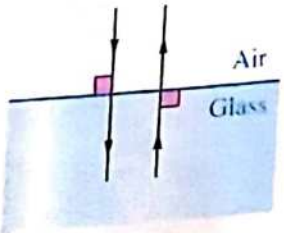
- When the light ray travels from air into glass or vice versa, it refracts.
- The angle of incidence (60°) is not equal to the angle of refraction (34.5°).
- The angle of incidence (60°) is equal to the angle of emergence (60°).
- The incident light ray is parallel to the emergent light ray.

Conclusion:

The light refraction phenomenon occurs when the light ray travels from a transparent medium to another transparent medium of different optical density.

Laws of light refraction :

The path of a light ray falls on the interface between two transparent media differ in their optical densities :

• When a light ray travels from a transparent medium of **lower** optical density (like air or water) to another of **higher** optical density (like glass).	• When a light ray travels from a transparent medium of **higher** optical density (like glass) to another of **lower** optical density (like air or water).	• When a light ray falls **perpendicular to** the interface between two different transparent media.
So, the light ray		
refracts near the normal.	refracts far from the normal.	passes without refraction.
		
The angle of incidence **is greater than** the angle of refraction.	The angle of incidence **is smaller than** the angle of refraction.	The angle of incidence **is equal to** the angle of refraction **equals zero.**

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From the previous facts, we conclude that, the two factors necessary for occurrence of light refraction are :

1. The presence of an interface between two different transparent media which differ in their optical densities.
2. The incident light ray falls inclined to the interface (angle of incidence ≠ zero) so, we can observe that the amount of refraction due to the transfer of a light ray from a medium to another depends on the optical density of each medium.

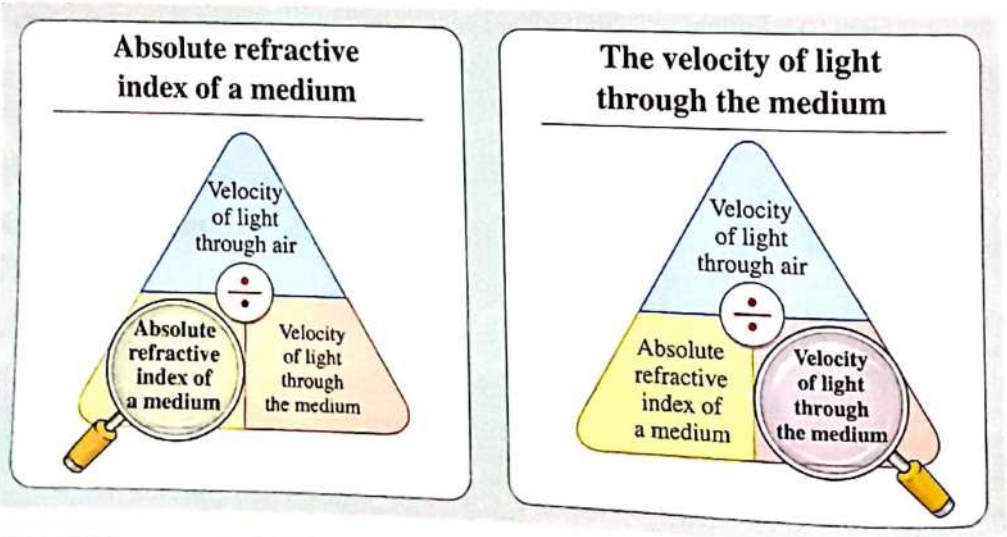
There is a relation between the velocity of light through air and any other transparent medium, which is known as "Absolute refractive index".

Absolute refractive index of a medium :

It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.

$$\text{Absolute refractive index of a medium} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$$

To calculate :



If the refractive index of a medium is **high** → Its optical density is **high** → The speed of light through it **decreases** → Its ability to refract light **increases** (where the refracted light ray is near the normal)

G.R. ***The absolute refractive index of any transparent medium is always greater than one.***
Because the velocity of light through air is always greater than that through any other transparent medium.

What is meant by ...?

The absolute refractive index of glass is 1.5

- This means that the ratio between the velocity of light through air to that through glass is 1.5

Enrichment information

The ratio between the absolute refractive index of a medium to the absolute refractive index of another medium is known as the ***relative refractive index.***

Problems

1 ***Calculate the velocity of light through glass given that the velocity of light through air equals 3×10^8 m/s and the absolute refractive index of glass is 1.5***

Solution

$$\text{The absolute refractive index of glass} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$$

$$\text{The velocity of light through glass} = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s.}$$

2 ***If the velocity of light through water is 2.25×10^8 m/s, calculate the absolute refractive index of water. Knowing that the velocity of light through air is 3×10^8 m/s.***

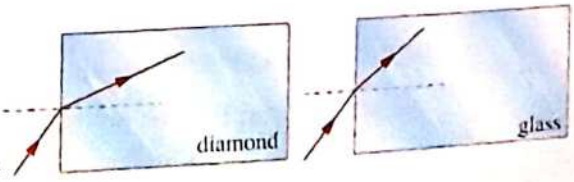
Solution

$$\text{The absolute refractive index of water} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$$

$$= \frac{3 \times 10^8}{2.25 \times 10^8} = \frac{3}{2.25} = 1.33$$

Notes

- Glass, water and air are examples of transparent media, which are different in optical density and they are arranged according to the optical density as follows :
  Glass > Water > Air
- The medium, which has large optical density, has large absolute refractive index and then the velocity of light passes through it, will be small.



G.R. ***The ability of diamond to refract the light is greater than that of glass .***
Because the absolute refractive index of the diamond is greater than the absolute refractive index of the glass.

Natural phenomena related to reflection and refraction of light :

1 Apparent shapes of objects :

A pencil, which is partially immersed in water appears as being broken (as shown in the figure). **G.R.**

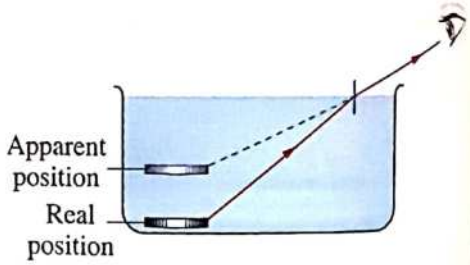
Due to the refraction of light rays coming from the immersed part in water.

Pencil image due to light refraction

2 Apparent positions of objects :

The submerged object in water is seen in an apparent position slightly above its real position (as the coin shown in the figure). **G.R.**

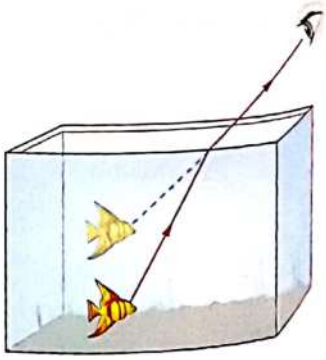
Due to the refraction of light rays coming from the submerged object (far from the normal) where, the eye sees this object in an apparent position on the extensions of these refracted rays.



G.R.

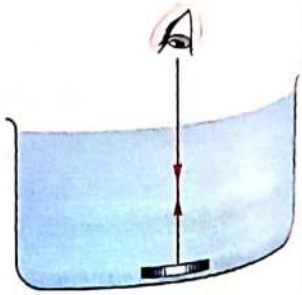
- ***The fish that is put in a glass basin seems at a position higher than its real position.***

  Due to the refraction of light rays coming from the object where the eye sees the fish in an apparent position on the extensions of these refracted rays.



- ***To pick up a coin which has fallen in water, we must look at it vertically.***

  Because the incident light ray perpendicular to the interface between air and water, passes without refraction , so the apparent position is the real position.



3 Mirage :

Mirage :

It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.

Mirage phenomenon

Mirage phenomenon occurs due to reflection and refraction of light in air layers which differ in the degree of temperature.

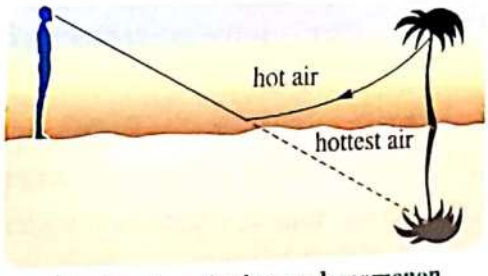


Illustration of mirage phenomenon

TRY to answer worksheet 13
- General Exercise of the School Book on Unit 2
- Model exams on Unit 2

in the Notebook

Remember Lesson Three

Light reflection :

It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.

Types of light reflection according to the nature of reflecting surface

1. **Regular (uniform) reflection**
2. **Irregular (non-uniform) reflection**

Regular (uniform) reflection :

It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.

Irregular (non-uniform) reflection :

It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

The incident light ray :

It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.

The reflected light ray :

It is a narrow light beam which is represented by a straight line that is reflected from the reflecting surface at the point of incidence.

Angle of incidence :

It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.

Angle of reflection :

It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

Laws of light reflection :

First law : Angle of incidence = Angle of reflection

Second law : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.

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Light refraction :

It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

Optical density of the medium :

It is the ability of the transparent medium to refract light.

Angle of incidence :

It is the angle between the incident light ray and the normal to the surface at the point of incidence on the interface.

Angle of refraction :

It is the angle between the refracted light ray and the normal to the surface at the point of incidence on the interface.

Angle of emergence :

It is the angle between the emergent light ray and the normal to the surface at the point of emergence on the interface.

Absolute refractive index of a medium :

It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.

$$\text{Absolute refractive index of a medium} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$$

Natural phenomena related to reflection and refraction of light :

1. Apparent shapes of objects.
2. Apparent positions of objects.
3. Mirage.

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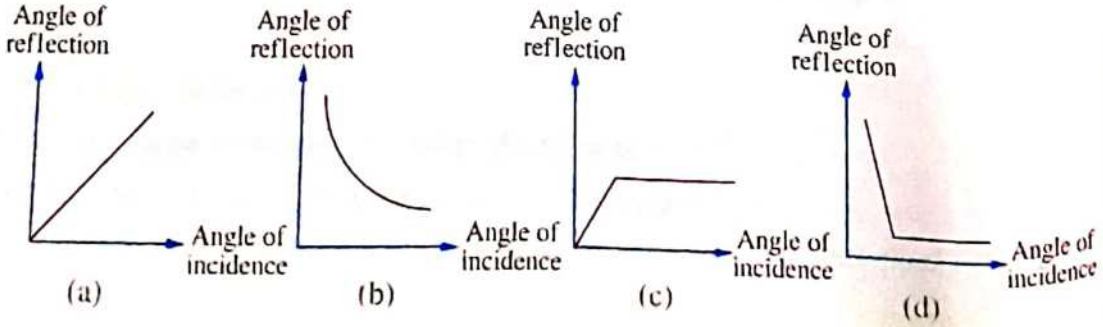
Questions ? on lesson Three

Interactive Exercises

● Remember ● Understand ● Apply ⁂ Higher skills [SB] School book questions.

1. Choose the correct answer :

1. Light ..... plays an important role in the formation of inverted images of the objects on the road when rain falls.
   a. velocity b. refraction c. reflection d. frequency
2. In ..... reflection, the reflected rays are reflected in many directions.
   a. irregular b. uniform c. regular d. total internal
3. A regular reflection happens when light rays fall on .....
   a. a woolen jacket. b. a stainless steel sheet.
   c. a leaf of a tree. d. a piece of leather.
4. Light is reflected ..... when it falls on a smooth bright surface.
   a. regularly b. irregularly c. and refracted d. and scattered
5. Light is reflected ..... when it falls on a rough surface.
   a. regularly b. irregularly c. and refracted d. in one direction
6. The angle between the reflected ray and the line perpendicular to the reflecting surface at the point of incidence is called the angle of .....
   a. emergence. b. incidence. c. refraction. d. reflection.
7. If the angle between the incident light ray and the reflected light ray is 90°, so the angle of incidence equals .....
   a. 0° b. 30° c. 45° d. 90°
8. If the angle between a reflected light ray and a reflecting surface is 30°, so the angle of reflection will be equal to .....
   a. 15° b. 30° c. 60° d. 90°
9. If you know that the incident ray which falls perpendicular on a reflecting surface reflects on itself, so the angle of reflection is equal to .....
   a. 0° b. 90° c. 120° d. 180°
10. The angle of incidence of light is ..... its angle of reflection.
    a. larger than b. smaller than c. equal to d. double to
11. ⁂ Which of the following graphs represents the relation between the angle of incidence and the angle of reflection ?



12. The ability of the transparent medium to refract the light is called the ..... of the medium.
a. refractive index b. density c. optical density d. viscousty

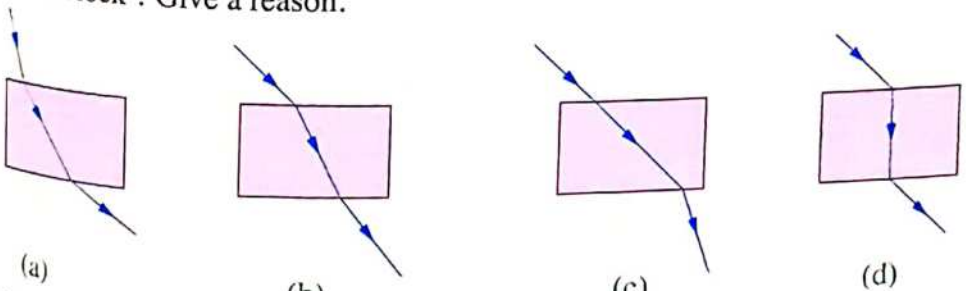
13. The ..... is the change in the direction of light rays when light passes from a transparent medium to another transparent medium of different optical density.
a. light reflection b. light refraction
c. light absorption d. light separation

14. The angle between the refracted light ray and the normal at the point of incidence on the separating surface is .....
a. the angle of reflection. b. the angle of refraction.
c. the angle of incidence. d. the angle of emergence.

15. The angle between the emergent light ray and the normal at the point of emergence on the interface is called the angle of .....
a. incidence. b. reflection. c. refraction. d. emergence.

16. Light refraction is due to the difference in ..... through different media.
a. sound intensity b. nature of the surface
c. light velocity d. sound velocity

17. Which of the following figures represents the refraction of light in a rectangular glass block ? Give a reason.

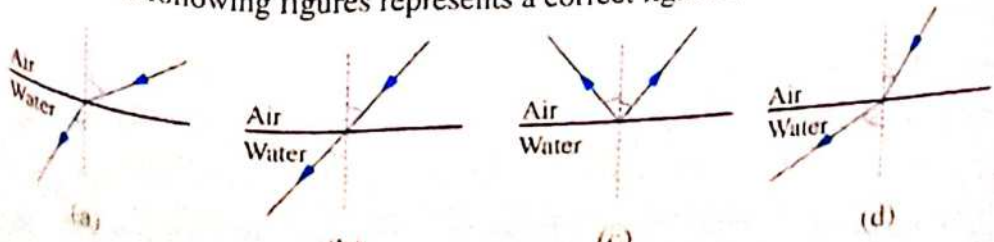


(a) (b) (c) (d)

18. The angle of incidence is smaller than the angle of refraction when a light ray travels from .....
a. air to water. b. air to glass.
c. water to air. d. water to glass.

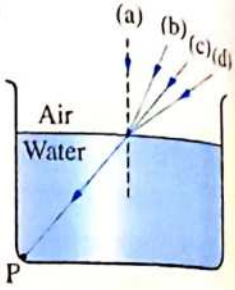
19. When light ray travels from air to water, it .....
a. refracts near the normal. b. refracts far from the normal.
c. passes without refraction. d. reflects.

20. Which of the following figures represents a correct light refraction ?



(a) (b) (c) (d)

∴ 21. In which direction should a spotlight be directed to the water surface to be inspected at point (p) ? .....



a. (a)
b. (b)
c. (c)
d. (d)

• 22. The absolute refractive index of any material is always .....

a. more than one.
b. less than one.
c. equal to one.
d. equal zero.

• 23. We have got the refractive index of four materials. Which result of the four is incorrect ? (Give a reason)

a. 0.8
b. 1.3
c. 1.5
d. 1.8

• 24. The absolute refractive index is the ratio between the speed of light through air and .....

a. the speed of light through another medium.
b. the speed of light through the same medium.
c. the speed of sound through the same medium.
d. the speed of sound through another medium.

• 25. A pencil seems broken when it is placed in a glass cup of water due to the ..... of light.

a. reflection
b. refraction
c. total internal reflection
d. rebounding

• 26. When a boy looked at a fish under water, it seemed to be in the shown position. Which position is the real one ?

a. A , B
b. D
c. E
d. C , E

• 27. From the natural phenomena that is resulted from the refraction and reflection of light on the desert roads is .....

a. echo.
b. mirage.
c. seeing objects higher than its normal position.
d. seeing objects bigger than its normal size.

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2. Choose from column (B) what suits it in column (A) :

1.

(A)	(B)
1. Angle of incidence is	a. the change of the path of light ray when it moves between two media with different optical densities.
2. Angle of reflection is	b. the angle between the extensions of both, the incident ray and the emergent ray.
3. Angle of refraction is	c. the angle between the incident light ray and the normal to the surface.
4. Light reflection is	d. the change in the direction of light ray in the same medium, when it falls on a reflecting surface.
5. Light refraction is	e. the angle between the reflected light ray and the normal to the surface.
	f. the angle between the refracted light ray and the normal to the surface.

2.

(A)	(B)
1. The incident light ray that is perpendicular to the separating surface between two different transparent media	a. higher than their real positions.
2. The incident light ray falls perpendicular on a surface of plane mirror	b. it reflects on itself.
3. Fish that swim in water are seen	c. it refracts.
4. A light ray passes inclined from a transparent medium to another transparent medium	d. does not refract (passes in a straight line).

3. Put (✓) or (×) , then correct what is wrong :

1. Light refraction is the rebounding of light rays in the same medium on meeting a reflecting surface. ( )
2. Light reflection plays an important role in the formation of inverted images of trees on the road when rain falls. ( )
3. In uniform reflection, the light rays are reflected directly in one direction. ( )
4. Reflection of light from rough surfaces is called regular reflection. ( )
5. The reflection of light on a piece of white paper is a regular reflection, while the reflection of light on a plane mirror is an irregular reflection. ( )
6. The angle of reflection of a light ray falls perpendicular on a reflecting surface equals 90° ( )

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7. Light reflects when it travels from a transparent medium to another one of different optical density. ( )
8. The ability of the transparent medium to refract light is called the refractive index of the medium. ( )
9. The optical density of a medium differs from one medium to another due to the change in the light intensity through such medium. ( )
10. The light ray refracts near to the normal when it travels from air to glass. ( )
11. When light ray travels from air to water, the angle of incidence is greater than the angle of refraction. ( )
12. The optical density of the medium is the ratio between the velocity of light through air to the velocity of light through the medium. ( )
13. The reason for light refraction is that its velocity is equal in the different transparent media. ( )
14. The absolute refractive index of any transparent medium is always greater than one. ( )
15. The velocity of light through any transparent medium is less than that through air. ( )
16. The fish is seen higher than its real position in the fish tank. ( )
17. Objects on the desert road sides seem as if they had inverted images on a wet area due to the mirage phenomenon. ( )

4. Write the scientific term of each of the following statements :

1. The rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.
2. A smooth or rough surface, at which the reflection of light takes place.
3. The reflection in which the light rays recoil (return back) in one direction, when falling on a glistening surface.
4. The reflection in which the light rays recoil (return back) in many directions, when falling on a rough surface.
5. A narrow light beam, which is represented by a straight line that is reflected from the reflecting surface at the point of incidence.
6. The angle between the incident light ray and the normal at the point of incidence on the separating surface.
7. The angle between the reflected light ray and the normal at the point of incidence on the reflecting surface.
8. Angle of incidence = angle of reflection.
9. The incident light ray, the reflected light ray and the normal on the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.

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10. The ability of the medium to refract light rays.
11. Changing the path of light when it travels from a transparent medium to another transparent medium of different optical density.
12. The angle between the refracted light ray and the normal at the point of incidence on the separating surface.
13. The angle between the emergent light ray and the normal at the point of emergence on the interface.
14. The ratio between the velocity of light through air to the velocity of light through another transparent medium.
15. The position, at which the submerged object in water is seen slightly above its real position.
16. The phenomenon that appears in the desert as a result of refraction and reflection of light on the desert roads.

5. Complete the following statements :

1. The light reflection is classified into two types which are ..... and .....
2. In ..... reflection, the reflected rays are in one direction, while in ..... reflection, the reflected rays are in different directions.
3. When parallel light rays meet a rough surface, they reflect in ..... directions and this is called ..... reflection.
4. The ..... and the thin aluminium sheet are examples of smooth surfaces which cause ..... reflection.
5. A woolen jacket causes ..... reflection of light rays, while a stainless steel sheet causes ..... reflection of light rays.
6. The angle of ..... is the angle between the incident ray and the line perpendicular to the reflecting surface at the point of .....
7. The first law of light reflection states that .....
8. The incident light ray, the ..... light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane ..... to the ..... surface.
9. When a light ray falls on a reflecting surface, the angle between the incident ray and the reflecting surface is 35°, therefore the angle of reflection equals .....and the angle between the incident ray and the reflected ray equals .....
10. When a light ray falls perpendicular on a reflecting surface, it reflects ....., because the angle of incidence and the angle of reflection equal .....
11. The optical density of a medium differs from one medium to another due to the change in the ..... through such medium.
12. Light ..... is the change of light path when it travels from a transparent medium to another transparent medium of different .....
13. Angle of ..... is the angle between the refracted light ray and ..... at the point of incidence on the separating surface.

14. When light ray travels from a medium of ..... optical density to another of ..... optical density, it refracts far from the normal on the separating surface.
15. If the angle of incidence is more than the angle of refraction, this means that the light ray travels from a medium of ..... optical density to another of ..... optical density.
16. When light ray travels from water (or glass) to air, the angle of ..... is greater than the angle of .....
17. When light ray travels from air to water, it refracts ..... the normal and the angle of refraction is ..... than the angle of incidence.
18. When light ray falls perpendicular to the interface between two transparent media different in optical densities, it ..... to the other medium without .....
19. The absolute refractive index of the medium is the ratio between ..... to .....
20. As the optical density of a medium is high, so the refractive index of such medium is .....
21. From the natural phenomena that are related to the reflection and refraction of light are ..... , ... and .....
22. A pencil which is partially immersed in water appears as being ..... due to the ..... of light rays coming from the immersed part in water.
23. When we look at a fish in a trough filled with water, its ..... position will be higher than its ..... position. This is due to light .....
24. When you look at a coin in a glass of water, its ..... position appears to be lower than the ..... position.
25. ..... is a natural phenomenon that takes place on desert roads at noon in summer days due to light refraction and reflection.

6. Give reasons for :

1. The formation of inverted images of the trees and buildings on the road when rain falls.
2. A leather jacket produces irregular light reflection, while a stainless steel plate produces regular light reflection.
3. The light ray that falls perpendicular on a glistening surface reflects on itself.
4. The velocity of light changes from one medium to another.
5. The light refracts when it travels from a medium to another.
6. When a light ray travels from air to water, it refracts near the normal.
7. When a light ray travels from glass to air, the angle of refraction is larger than that of incidence.
8. When a light ray passes through a glass prism, it refracts.
9. The absolute refractive index of any transparent medium is always greater than one.
10. The ray falling perpendicular on the separating surface between two media different in the optical density doesn't refract.

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11. The pencil, which is partially immersed in water appears as being broken.
12. The submerged object in water is seen in an apparent position above its real position.
13. The floor of the swimming pool appears higher than its real position.
14. To see a coin which has fallen in a beaker filled with water in its real position, we must look at it vertically.
15. ☐ Occurrence of mirage phenomenon in desert regions at noon.

7. Define :

1. Light reflection.
2. Regular reflection of light.
3. Irregular reflection of light.
4. Angle of incidence.
5. Angle of reflection.
6. Light refraction.
7. Optical density of a medium.
8. Angle of refraction.
9. Angle of emergence.
10. The absolute refractive index of a medium.
11. The refractive index of a medium is high.
12. Mirage phenomenon.

8. What is meant by ... ?

1. The angle of reflection of light ray = 40°
2. The angle of refraction of light ray = 20°
3. The angle of emergence of light ray = 30°
4. ☐ Absolute refractive index of water is 1.33

9. What happens when ... ?

1. ☐ Incidence of light rays on a rough surface.
2. Incidence of light rays on a smooth glistening surface.
3. Light ray is incident on a plane mirror by an angle of incidence equals 30°
4. Light ray falls perpendicular on a reflecting surface.
5. Light ray travels from a transparent medium to another one of different optical density.
6. Light ray travels from glass to air.
7. Light ray travels from air to glass.
8. Light ray falls perpendicular to the interface between two transparent media of different optical densities.
9. You look at a pencil partially immersed in water.
10. You look from one side at a coin in a glass full of water.

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10. Show by drawing :

1. The path of light ray that falls on a reflecting surface with an angle of incidence equals 30°
2. The path of light ray falling perpendicular on a reflecting surface.
3. The path of light ray that is incident on one face of a rectangular glass block.
4. The path of light ray which travels from water to air.
5. The path of light ray which travels from a transparent medium of lower optical density (air) to another of high optical density (glass).
6. The path of light ray falling perpendicular to the interface between two transparent media of different optical densities.
7. The path of rays by which Ahmed sees the image of the coin, which is put in a basin containing water (from one side).

11. Write the physical relation between each of the following :

1. The light velocity in a medium and the refractive index of its material.
2. The angle of incidence and the angle of reflection of light.

12. Compare between :

Regular reflection and irregular reflection.

13. Explain with drawing an activity to :

1. Conclude the two laws of light reflection.
2. Demonstrate the light refraction.

14. Problems :

1. If the angle between the incident and reflected rays is 140°, find the angle of incidence and the angle of reflection.
2. Calculate the velocity of light through glass if you know that the velocity of light through air is 3×10^8 m/sec. and the absolute refractive index of glass is 1.5
3. Calculate the absolute refractive index of diamond given that the speed of light through it is 1.25×10^8 m/s. (Knowing that the velocity of light through air is 3×10^8 m/s.
4. If the absolute refractive index of water is $\frac{4}{3}$ and the velocity of light through water is 2.25×10^8 m/s, calculate the velocity of light through air.

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15. Study the following figures, then answer the questions :

(1) Look at the following figures, then complete :

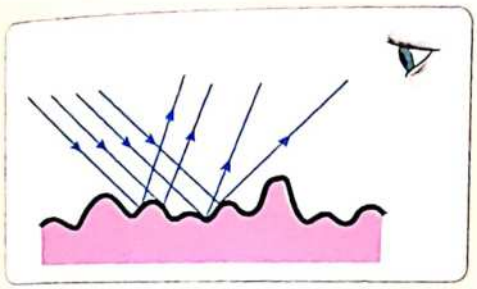


Fig. (a)

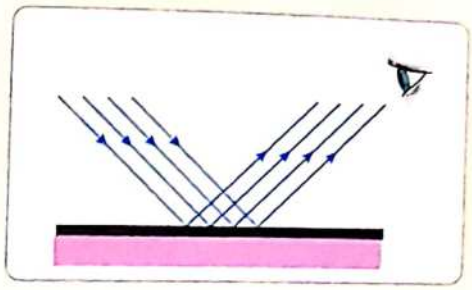
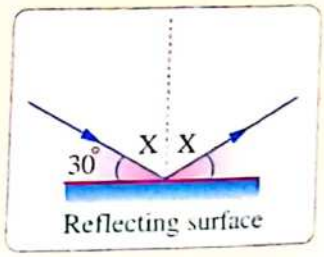


Fig. (b)

1. The two figures represent .....
2. Figure (a) represents ..... , so the reflecting surface may be .....
3. Figure (b) represents ..... , so the reflecting surface may be .....

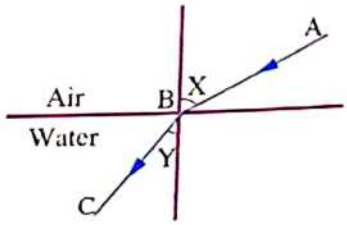
(2) From the opposite figure :

1. Calculate the angle of reflection.
2. Re-draw this figure in your answer sheet and show the angle of incidence and the angle of reflection.
3. What can you conclude from this figure ?



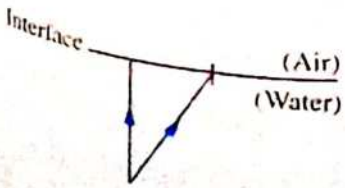
(3) From the opposite figure, complete the following statements :

1. The ray (AB) represents .....
2. The ray (BC) represents .....
3. Angle (X) is .....
4. Angle (Y) is .....

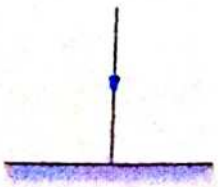


(4) Complete the following figures after redrawing them in your answer sheet then write the name of each ray :

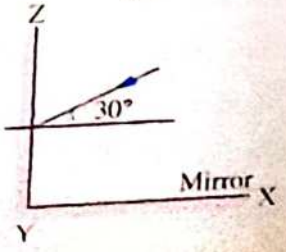
(1)



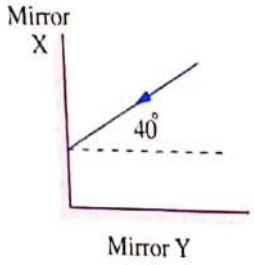
(2)



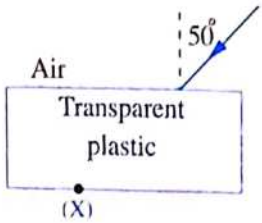
(3)



⁂ (5) 📖 **Complete the path of rays in each of the following figures according to what is written below each :**



a. Determination of the angle of reflection of the ray in mirror (Y).



b. Calculating the angle of emergence from point (X) given that the optical density of air is less than plastic.

• **(6) Look at the opposite figure, then answer :**

1. The opposite figure indicates the ..... property.
2. The speed of light through air is ..... its speed through water.
3. Why does the pencil seem broken ?

Thinking Skills Questions

1. Choose the correct answer :

1. A person inside a dark room can see another person from the window.

The outside person can't see the person in the room, this is because .....

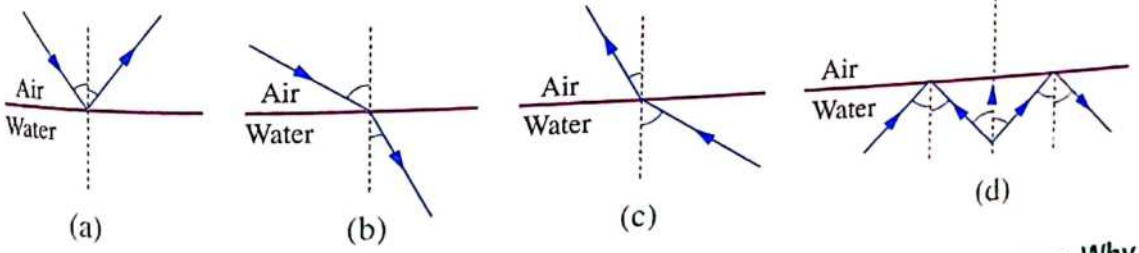
a. there is no enough light reflected from the person inside the room.

b. the light rays can't penetrate the window.

c. light doesn't penetrate windows.

d. sunlight isn't intense enough as other light sources.

2. Which of the following figures represents light refraction ?



(a) (b) (c) (d)

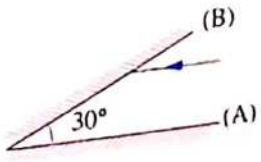
2. Books and reference books aren't preferred to be printed on bright papers. Why ?

3. Draw the following figure, then :

a. Complete the pathway of light ray, which is incident parallel to the mirror (A) where it reflects from it.

b Find the angle of reflection from mirror (B).

c. Find the angle of incidence on mirror (A).



4. From the following figures :

Which of the two medium (A) or (B) has more optical density ? Why ?

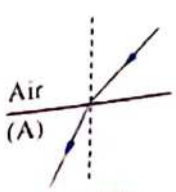


Fig. (1)

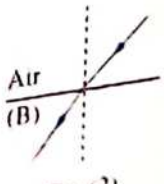
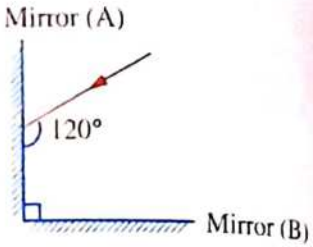


Fig. (2)

5. From the opposite figure, complete :

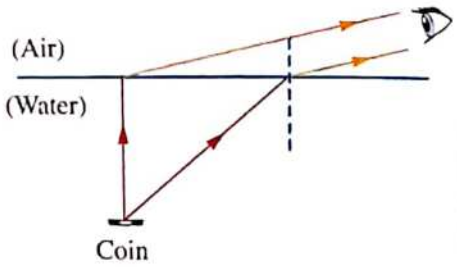
The path of the light ray which is incident on the mirror (A), where it reflects from the mirror (B), then find the angle of reflection from mirror (B).



6. Adel discovered an error in the opposite figure, which represents the path of two light rays that travel from water to air :

a. Re-draw the figure after correcting the error.

b. Add to the figure what shows the apparent position of the coin as the eye sees it.



Project On UNIT TWO

A project to develop the creative thinking "Problem solving"

Suggest a suitable way to solve each of the following problems :

1. Suggest a way to produce different musical sounds by using empty soft drink bottles.

.....

.....

2. Suggest an activity to explain the reaction of colours of clothes with the weather temperature.

.....

.....

3. Suggest an activity to hear the unheared buzzing sound of an insect.

.....

.....

4. Suggest an explanation for changing the shapes of shadows of an object throughout the whole day.

.....

.....

5. Suggest a method to see objects that are located outside the field of view.

.....

.....

6. Suggest an explanation for the role of light in making the sky looks in a blue colour.

.....

.....

7. Suggest an activity to prove that white light is composed of seven colours.

.....

.....

8. Suggest a solution for the problem of landmines in El-Alamein city during the Second World War.

.....

.....

9. Suggest a way to increase the sound pitch of a stretched rubber string.

.....

.....

10. Suggest a solution to the noise produced from a train during traveling.

.....

.....

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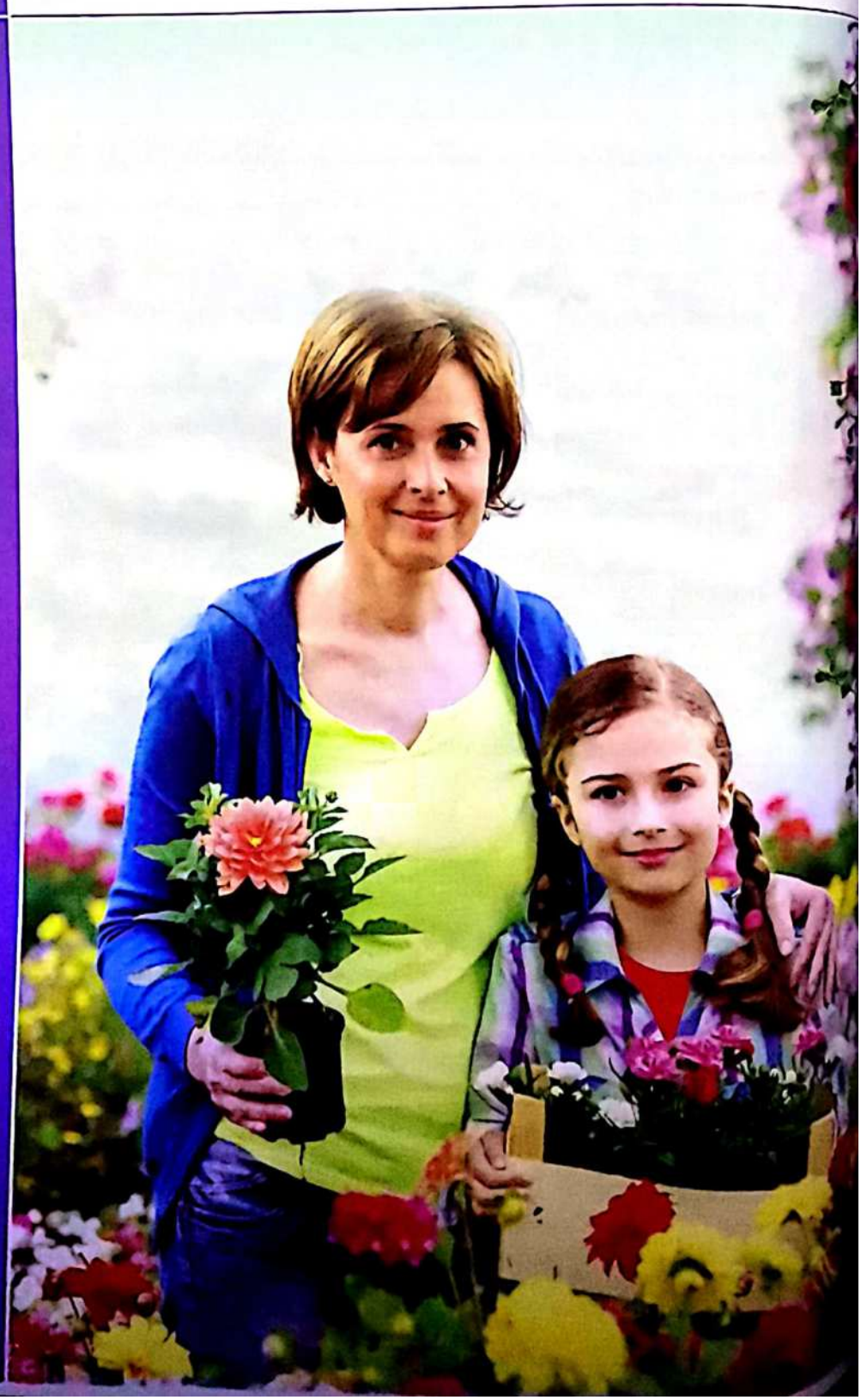
UNIT 3

Reproduction and Continuity of Species



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Lesson 1 | Reproduction in Plants.

Lesson 2 | Reproduction in Humans.

Unit Objectives :

By the end of this unit, students will be able to :

- Recognize the structure of a flower (bisexual, male and female).
- Deduce the functions of the bisexual flower's organs.
- Determine the sex of the flower.
- Deduce the types and methods of reproduction in plants.
- Use the materials and tools needed to study the germination of a pollen grain.
- Determine the concept of fertilization in plants.
- Deduce the methods of asexual reproduction in plants.
- Appreciate the importance of asexual reproduction in plants in preserving species.
- Appreciate the importance of plants in our life.
- Appreciate the importance of science and technology to human life & society.
- Recognize the structure of male and female genital systems in man.
- Deduce the functions of male and female organs of the genital system in man.
- Compare between the functions of the human male and female genital systems.
- Draw an illustration of the sperm and ovum.
- Identify some of the human genital system diseases in male & female human beings.
- Preserve his health by preventing infection by the diseases of the genital system.
- Commit to the healthy and right sexual attitudes.
- Commit to the right religious and social ethics connected with the human nature.
- Bear responsibility for preserving man's own health and man's genital system
- Positive participate for social decision making regarding health issues concerned with preservation of man's health and birth control.

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LESSON 1

Reproduction in Plants

How do plants reproduce to secure their existence ?

- Living organisms perform seven vital processes which are :
- Nutrition. • Growth. • Sensation. • Motion.
- Respiration. • Excretion. • Reproduction.
- All these vital processes aim to continuity the life of the living organism except **"Reproduction process"** which aims to continuity its species and protects it from extinction and the life of the individual doesn't depend on it.

Reproduction process :

It is a vital process that aims to secure the existence and continuity of living organisms species by producing new individuals of the same species to prevent them from extinction.

Reproduction in plants

There are two kinds of reproduction in plants

First

Sexual reproduction through male and female reproductive organs in flowers

Second

Asexual reproduction through the various vegetative parts of the plant except flowers

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FIRST Sexual reproduction in plants :

* **The flower** is the organ of sexual reproduction in flowering plants.

Flower :

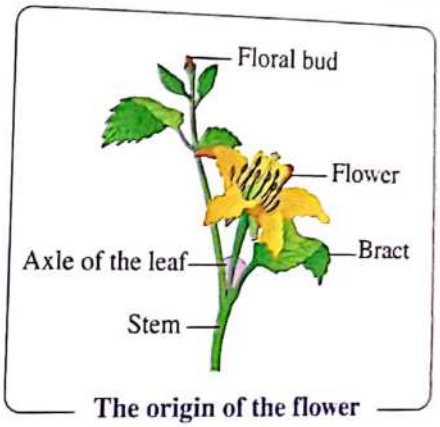
It is a short stem whose leaves are modified to form genital (reproductive) organs which in turn form seeds inside fruits.

A Origin of the flower :

* It arises from a floral bud which emerges from the axle of a leaf called bract.

Bract :

It is the green leaf, where the floral bud emerges from its axle and developed into a flower.



The origin of the flower

* The axle may carry a number of flowers which are known as inflorescence.

Inflorescence :

It is a group of flowers carried on the same axle.

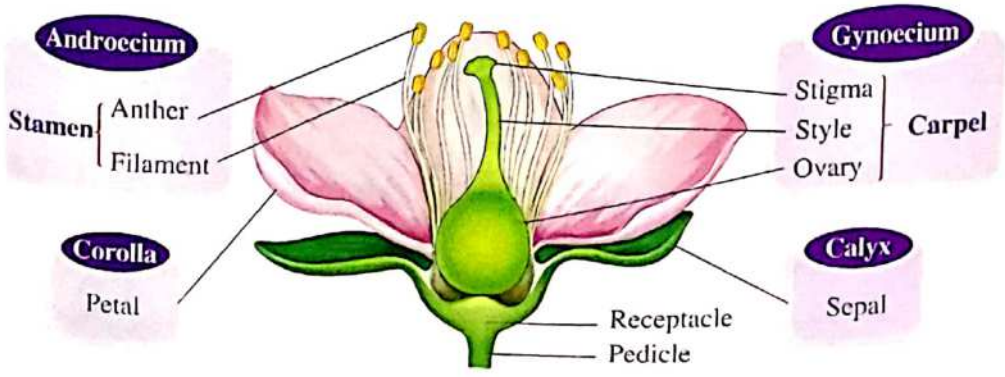
Inflorescence

B The structure of the flower :

If you examine a flower, you will notice that the flower has a thin neck ***(pedicle)*** ends in a swollen part ***(receptacle)*** which carries the floral leaves in four different floral whorls.

Receptacle :

It is the swollen part upon the flower pedicle, on which the floral leaves are existed.



The structure of a flower

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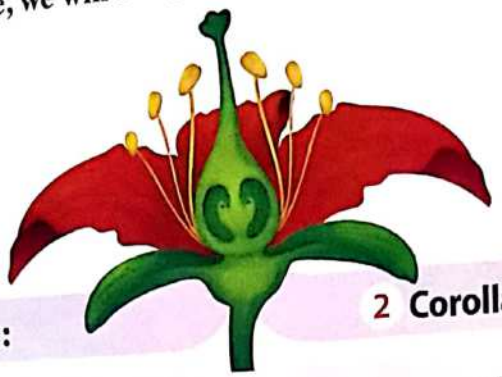
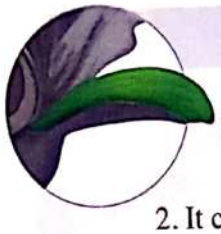
➲ **In the following figure, we will study the four different floral whorls :**





1 Calyx :

1. It is the first (outermost) whorl of the floral leaves.
2. It consists of a group of green leaves, each leaf is called a "sepal".

Its function :

It protects the inner parts of the flower specially before blooming.

2 Corolla :

1. It is the second whorl (following the calyx) of the floral leaves.
2. It consists of a group of bright coloured scented leaves, each leaf is called a "petal".

Its function :

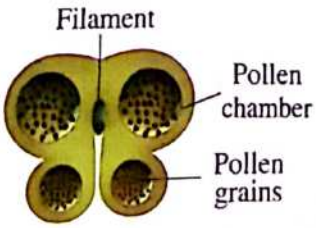
- It protects the reproductive organs.
- It attracts insects to the flower, which help in the reproduction process.

3 Androecium :

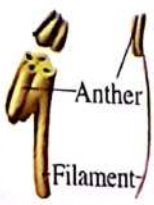
1. It is the third whorl (following the corolla) of the floral leaves.
2. It is the **male** reproductive organ of the flower.
3. Its leaves are known as "stamens".
4. Each stamen consists of a fine **filament** ends in a sac known as the **anther**, which is divided into two parts, each part has two chambers containing pollen grains.

Its function :

It produces pollen grains (inside the pollen chamber).



A cross-section in an anther



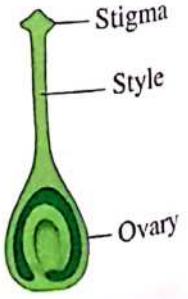
Stamen

4 Gynoecium :

1. It is the fourth (innermost) whorl of the floral leaves.
2. It is the **female** reproductive organ of the flower.
3. Its leaves are known as "carpels" which resemble the flask in shape.
4. Each carpel consists of a swollen part called the **ovary**, which is connected with a tube called the **style**, which ends in an opening called the **stigma**.

Its function :

It produces ovules (inside the ovary).



Carpel

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• **We can summarize the four whorls and their functions in the following table :**

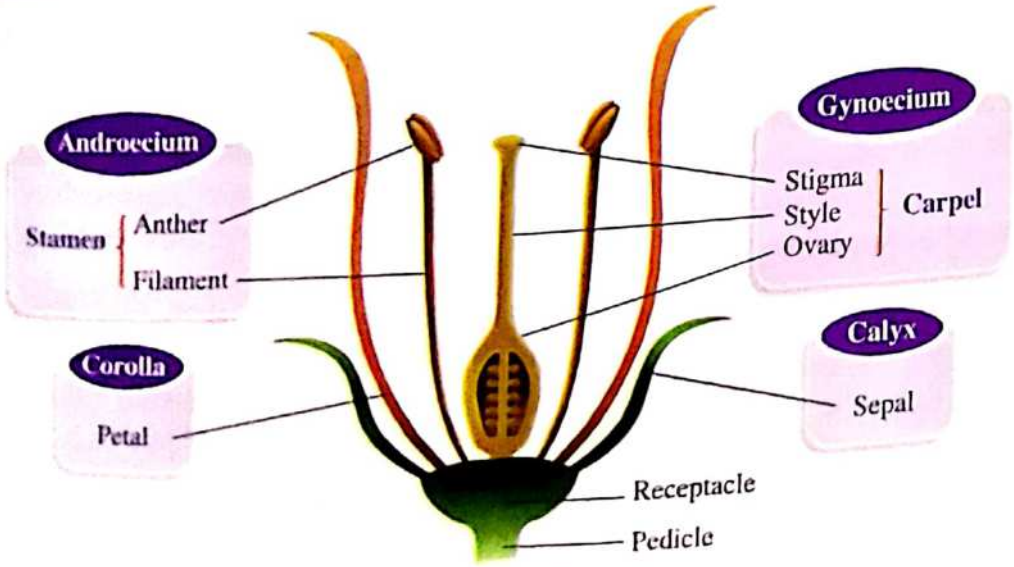
Whorl	Calyx	Corolla	Androecium	Gynoecium
Consists of :	Sepals	Petals	Stamens	Carpels
Description :	Green leaves surrounding the flower from outside.	Bright coloured scented leaves.	Fine filament ends in a sac.	A hollow tube like a flask that lies in the centre of the flower.
Function :	Protection of the inner parts of the flower.	- Attraction of insects. - Protection of reproductive organs.	Production of pollen grains.	Production of ovules.

Typical flower :

The flower is considered as a typical flower if it contains the four different floral whorls.

Typical flower :

It is the flower that contains four floral whorls.



A diagrammatic figure of a typical flower

NB Flowers are different from each other in the separation or fusion of the **sepals** and **petals**, like in the flowers of wallflowers (Manthoor) and Petunia.

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Exercise

Compare between the wallflower and the flower of petunia.

Answer

The wallflower		The flower of petunia
4 separated sepals.	sepals	5 fused sepals.
4 separated petals.	petals	5 fused petals.

Enrichment information

- *The sepals of calyx and petals of corolla might be of the same shape and colour as in onion flower, that's why we call the two whorls together the perianth.*
- *Hay-fever is a disease infecting people who have allergy to pollen grains, the symptoms of this disease are : inflammation of the mucus membrane of the nose , running nose, continuous sneezing and tear flow.*

The sex of flower :

Flowers are classified according to sex into two types

Bisexual flower

Bisexual flower (hermaphrodite)

Flower that carries both male and female reproductive organs.

Unisexual flower

Unisexual flower

Flower that carries either male or female reproductive organ only.

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Comparison between hermaphrodite flower, male flower and female flower :

	Hermaphrodite flower	Male flower	Female flower
Flower sex	Bisexual	Unisexual	Unisexual
Reproductive organs	Stamen and carpel	Stamen only	Carpel only
Symbol	⚥	♂	♀
Shape			
Number of floral whorls	4	3	3
Examples	Flowers of most plants such as : • Flax. • Tulip. • Petunia. • Wallflower. • Peas. • Sunflower.	Flowers of some plants such as : • Palms. • Maize. • Pumpkins.	

G.R.

- ***The flower of the tulip plant is a bisexual flower.***
  Because it contains both stamens and carpels together.
- ***The flowers of palms are unisexual flowers.***
  Because some of them contain only male reproductive organs (stamens) and the others contain only female reproductive organs (carpels).

Real Life application : *Drying-flowers*

- Pick up a bunch of flowers and remove the lowermost leaves from the flower pedicle, and organize them in groups to be tied to the pedicle.
- Hang them in an upside down position in a dark, well ventilated room for one week.

Drying-flowers

TRY to answer worksheet

Steps of sexual reproduction in plants

- It takes place in flowering plants through female reproductive organs (gynoecium) and male reproductive organs (androecium).
- It takes place in two successive processes, which are :

1. Pollination. **2.** Fertilization.

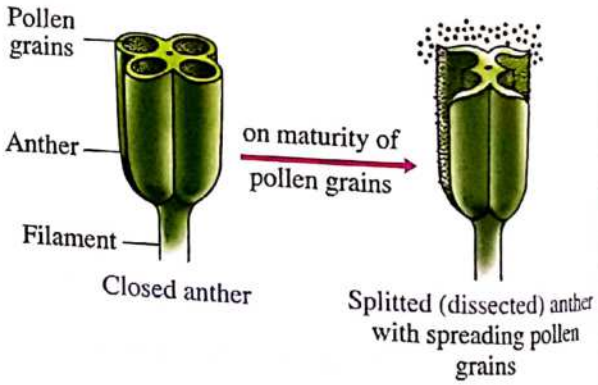
1 Pollination :

Pollination

It is the process of transfer of pollen grains from the anthers of a flower to the stigmas.

Notes

- Pollen grains are small cells formed in the anther inside the pollen chamber.
- When those grains become mature, the anther splits longitudinally and the pollen grains spread in air like dust.



Question

Put (✓) or (✗) :

1. Corolla is the outermost whorl of the floral leaves. ( )
2. The flower is the organ of asexual reproduction in flowering plants. ( )
3. Gynoecium consists of a group of carpels. ( )
4. Tulip and petunia are hermaphrodite flowers. ( )
5. The female flower consists of four whorls. ( )
6. Sexual reproduction in plants takes place in two processes, which are pollination and fertilization. ( )

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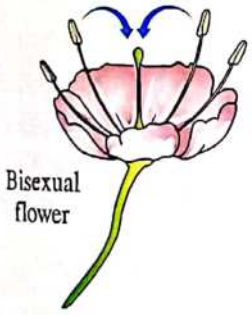
Types of pollination :

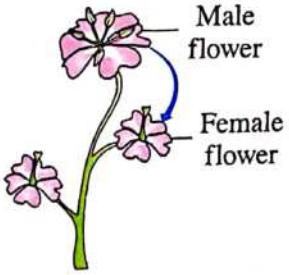
Self (auto) pollination

Self (auto) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to the stigmas of another flower in the same plant.

Illustrating figures





Reasons of occurrence

- Flowers must be bisexual (hermaphrodite) and characterized by one of the following :
  - Anthers and stigmas are maturated in the same time, such as flax plant.
  - Non-blooming flowers until completion of fertilization process, such as barley plant.

Give a reason

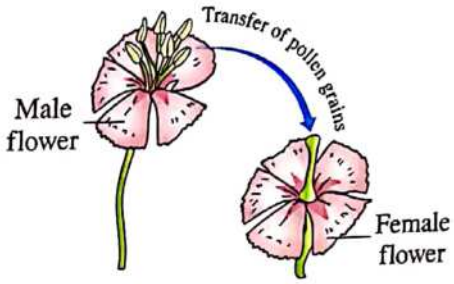
- **The pollination in barley plant is self pollination.**
  Because its flowers never bloom until the completion of fertilization process.

Mixed (cross) pollination

Mixed (cross) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

Illustrating figures



Reasons of occurrence

- The flower is bisexual and its anthers and stigmas are not maturated at the same time, such as sunflower plant.
- The flower is unisexual, such as maize plant.

Give a reason

- **Auto pollination can't happen in sunflower plant.**
  Because the anthers and the stigmas are not maturated at the same time.

Methods of mixed (cross) pollination

Pollen grains are transferred from one flower to another by different ways, which are :

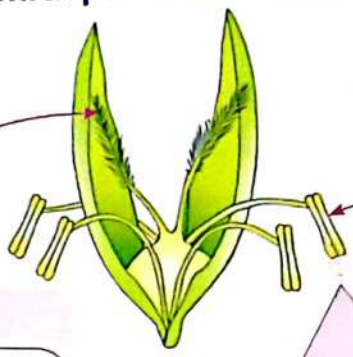
- A — Pollination by air (wind)
- B — Pollination by insects
- C — Artificial pollination

A Pollination by air (wind) :

Some characteristics of flowers in which pollination occurs by air :

Stigmas

They are feathery like and sticky. **G.R.**
To catch pollen grains from air.

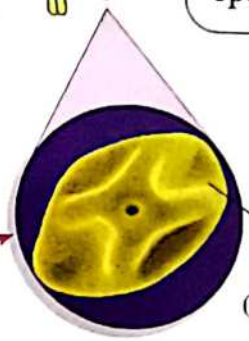


Anthers

They are hanged. **G.R.**
To be easily opened by air.

Pollen grains

- They are produced by huge numbers. **G.R.**
  To compensate what are lost in air.
- They are light in weight and dry. **G.R.**
  To be easily carried for long distances by air.



A light and dry pollen grain (highly magnified)

▸ Enrichment information

Maize plant produces about 50 millions pollen grains.

B Pollination by insects :

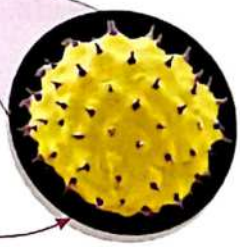
Some characteristics of flowers in which pollination occurs by insects :

Petal

It is coloured and scented. **G.R.**
To attract insects (like bees) to feed on its nectar.

Pollen grain

It is sticky or having coarse surfaces. **G.R.**
To stick (adhere) on the insect body.



A coarse pollen grain (highly magnified)

C Artificial pollination :

This method of pollination is carried out by man.

Example

The gardener in pollination process of **palm trees** spread pollen grains over their female flowers.

Pollination of palm trees

Pollen grains

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2 Fertilization :

After pollen grains transfer to the stigmas of flowers, the pollen grains must be germinated first, then the fertilization process will occur, so to know the germination process of pollen grains, we should do the following activity :

Activity 1 To study a pollen grain germination :

Materials and tools :

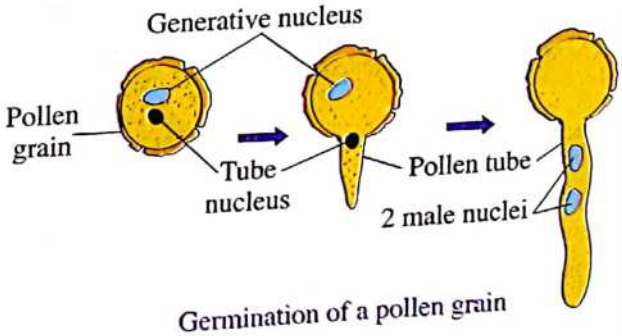
- A group of flowers contains ripe pollen grains.
- Diluted sugary solution.
- Water.
- Glass slides and covers.
- Microscope.

Steps :

1. Place a drop of the diluted sugary solution on a glass slide and put some pollen grains, then cover them with a glass cover.
2. Repeat the previous step with replacing diluted sugary solution by water.
3. Keep both slides in a dark warm place for half an hour.
4. Examine the two slides under the microscope.

Observation :

Each pollen grain in the sugary solution germinates by the formation of a pollen tube containing 2 male nuclei and one tube nucleus, but that placed in a drop of water doesn't germinate.



Germination of a pollen grain

Conclusion :

Pollen grains germinate forming pollen tubes when a suitable nutritive medium is available such as a diluted sugary solution.

*** The previous activity explains :**

What happens to the pollen grains when fall on the stigmas of the flowers to complete fertilization process.

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Stages of fertilization process in plants :

Stage 1

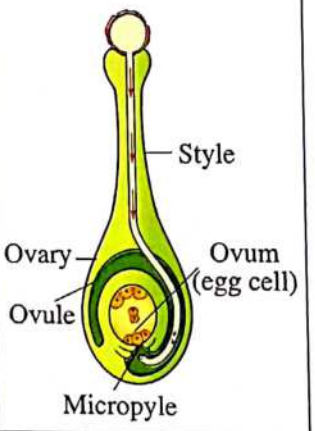
After pollination, the pollen grain sticks on the stigma, which secretes sugary solution.

Stage 2

The pollen grain germinates forming a pollen tube (containing ***2 male nuclei***).

Stage 3

The pollen tube extends through the style till it reaches the ovule inside the ovary through the **micropyle.**

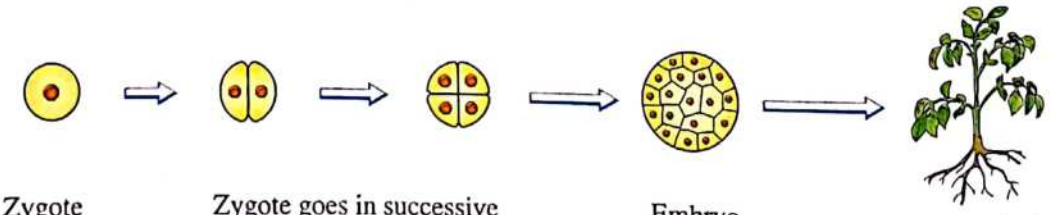


Stage 4

The end of the pollen tube degenerates and one of the 2 male nuclei fuses (combines) with the ovum (egg cell) forming a fertilized ovum which is known as "zygote".

Stage 5

The zygote undergoes successive divisions to form the embryo which grows forming a new plant.



From the previous explanation, we can define fertilization in plants and zygote as follows :

Fertilization in plants :

It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

Zygote

The cell resulting from the fusion of a pollen grain and an ovum nuclei.

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Formation of seeds and fruits :

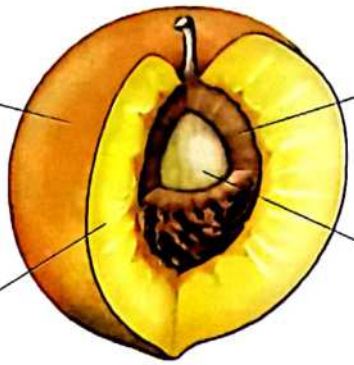
After completion of fertilization process

The wall of the ovary

It develops to become the outer coat of the fruit which is called "pericarp".

The ovary

It develops to become a fruit.



The wall of the ovule

It develops to become the seed coat.

The ovule

It develops to become a seed.

Note

Fruits differ from each other according to the nature of the ovary. G.R.

Because the ovary that contains :

One ovule gives a fruit with a **single seed**.

Many ovules gives a fruit with **many seeds**.

Examples

- Olives.
- Peaches.

Peaches

- Beans.
- Peas.

Peas

TRY to answer worksheet in the Notebook 15

SECOND Asexual reproduction in plants :

- There are plants that can reproduce without flowers through parts of root, stem, leaves or buds and this type of reproduction is called "Vegetative reproduction" and the resulting individuals are completely identical to the original plant.

Vegetative reproduction :

It is a process of producing new individuals from different parts of the plant without the flower having a role in this process.

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Kinds of vegetative reproduction

1. Natural vegetative reproduction
2. Artificial vegetative reproduction

1 Natural vegetative reproduction :

- It takes place by many ways, such as reproduction by :
  - Rhizomes.
  - Corms.
  - Tubers.
  - Bulbs.
  - Offshoots.

➲ **We will study only one of them.**

Reproduction by tubers :

Tuber :

It is a swollen part from a horizontal root or a terrestrial stem, which contains growing buds and it is used for vegetative reproduction.

The tuber is :

A horizontal root as sweet potatoes.

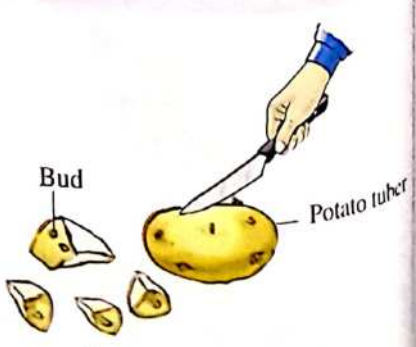
or

A terrestrial stem as potatoes.

Activity 2 To identify the reproduction by tubers.

Steps :

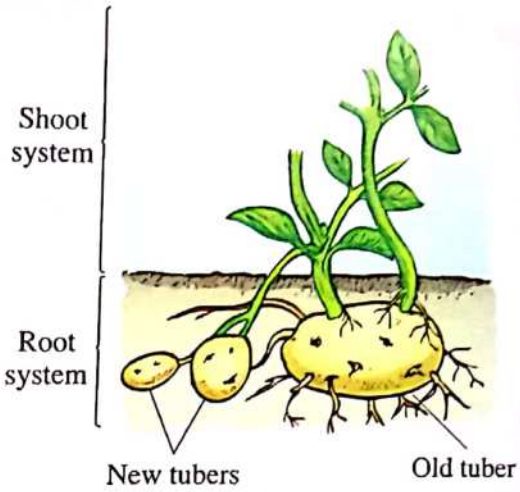
1. Cut a tuber of potato into multiple slices, where each slice should contain a bud or more.
2. Cultivate these parts and water (irrigate) them regularly for a week.



Cutting of potato tubers

Observations & Conclusions :

- Some buds grow forming a **root system** which grows down.
- Other buds grow forming a **shoot system** which grows up.
- After some days, the old tuber changes into a plant that carries many new tubers.



Reproduction by tubers

2 Artificial vegetative reproduction :

It takes place by four ways, which are :

1. Cutting. **2.** Grafting. **3.** Tissue culture. **4.** Layering.

We will study the first three ways only :

1 Reproduction by cutting :

-Reproduction by cutting :

It is a kind of artificial vegetative reproduction in which a part of a plant that contains growing buds known as the cut is planted.

-The cut :

It is a part of root, stem or leaf that contains growing buds taken from a plant for reproduction.

* It is common for the cut to be a branch carrying many buds.

The cut containing growing buds

Examples :

Grapes

Roses

Sugar cane

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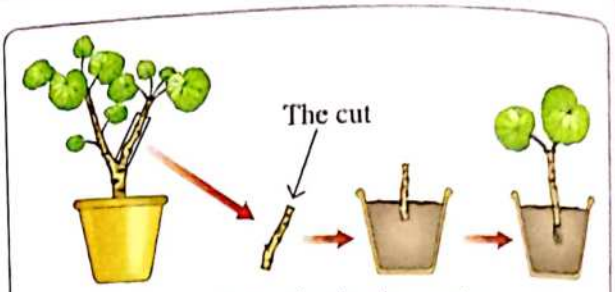
Activity 3 To identify reproduction by cutting.

Steps :

1. Cultivate one cut of a plant in a pot (this cut must contain more than one bud).
2. Irrigate the cut regularly for two weeks.



Reproduction by cutting

Observations & Conclusions :

- The buds buried inside the soil grow to form the root system of the plant.
- The buds above the soil surface grow to form the shoot system of the plant.

NB The shrubs obtained from cuttings are transferred to gardens and fields for planting in the soil to obtain new plant individuals.

2 Reproduction by grafting :

Reproduction by grafting :
It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock.

Reproduction by grafting

Methods of grafting :

1 Grafting by attachment :

1. The scion and the stock are cut with two integrated angles.
2. The scion is attached to the stock.

2 Grafting by wedge :

1. The scion is prepared in the form of a wedge (pencil shaped).
2. The scion is inserted into a cleft in the stock.

The two methods can be occurred by the following steps :

3. The scion and the stock are tightly tied together. **G.R.**
To make the scion feed on the juice of the stock.

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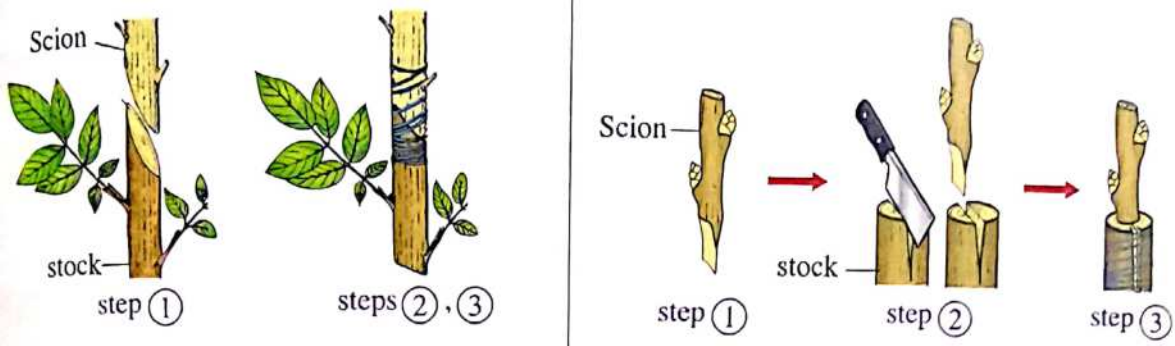
The following figures show the previous steps :



Example

The grafting by attachment is occurred in :
Mango trees.

The grafting by wedge is occurred in :
Large trees.

NB The produced fruits by grafting belong to the type of the scion.

This kind of reproduction is used only between highly similar plant species such as :

1 Oranges and naring (bitter orange)	2 Apples and pears	3 Peaches and apricots

G.R. ***The reproduction by grafting cannot be used between oranges and peaches.***
Because this kind of reproduction is used only between highly similar plant species.

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Enrichment information

Gluing stem is a disease, which infects bitter orange trees and doesn't infect naring. That's why reproduction by grafting is useful when the disease spreads in orange fields. In this case orange is the scion while bitter orange is the stock.

What happens when ...?

Tie a part of the orange plant on a branch of naring plant.

➲ The orange plant (scion) feeds on the juice of the naring plant (stock) and grows forming orange fruits.

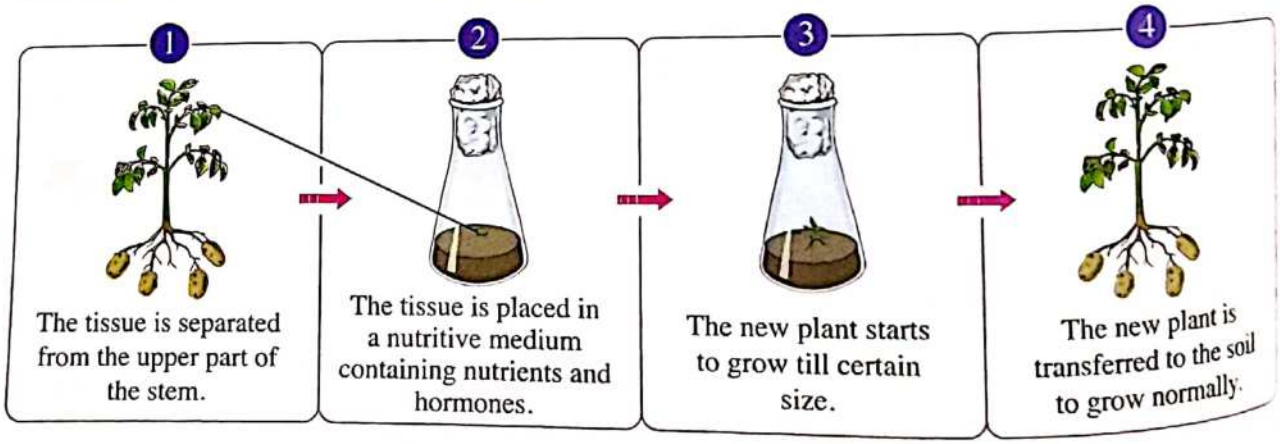
3 Tissue culture :

Tissue culture :

It is a process of multiplying a small part of a plant to get many identical parts.

G.R. ***Tissue culture is considered from the important modern ways to increase crops.***
Because it is a process of multiplying a small part of a plant to get many identical parts.

Steps to grow a tissue from the stem of a potato plant



What happens when ...?

Separating a tissue from the upper part of a potato stem and putting it in a nutritive medium and hormones.

➲ The tissue grows forming a new plant of the same kind.

TRY to answer worksheet 16 in the Notebook

Remember

Lesson One

Reproduction process :

It is a vital process that aims to secure the existence and continuity of living organisms species by producing new individuals of the same species to prevent them from extinction.

Flower :

It is a short stem whose leaves are modified to form genital (reproductive) organs which in turn form seeds inside fruits.

Bract :

It is the green leaf, where the floral bud emerges from its axle and developed into a flower.

Inflorescence :

It is a group of flowers carried on the same axle.

Receptacle :

It is the swollen part upon the flower pedicle, on which the floral leaves are existed.

Typical flower :

It is the flower that contains four floral whorls.

Floral whorls of the flower :

1. Calyx. 2. Corolla. 3. Androecium. 4. Gynoecium.

The sex of flower :

1. Male flower. 2. Female flower. 3. Bisexual (hermaphrodite) flower.

Reproduction in plants :

1. Sexual reproduction. 2. Asexual reproduction.

Self (auto) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.

Mixed (cross) pollination :

It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

Methods of mixed (cross) pollination :

Pollen grains are transferred from one flower to another by different ways, which are :

a. Pollination by air (wind). b. Pollination by insects.

c. Artificial pollination.

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Fertilization :
It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

Zygote :
The cell resulting from the fusion of a pollen grain and an ovum nuclei.

Vegetative reproduction :
It is a process of producing new individuals from different parts of the plant without the flower having a role in this process.

Natural vegetative reproduction :
It takes place by many ways such as reproduction by :

- Rhizomes.
- Corms.
- Tubers.
- Bulbs.
- Offshoots.

Tuber :
It is a swollen part from a horizontal root or a terrestrial stem which contains growing buds and it is used for vegetative reproduction.

Artificial vegetative reproduction :
It takes place by four ways, which are :

1. Cutting.
2. Grafting.
3. Tissue culture.
4. Layering.

Reproduction by cutting :
It is a kind of artificial vegetative reproduction in which a part of a plant that contains growing buds known as the cut is planted.

The cut :
It is a part of a root, a stem or a leaf that contains growing buds taken from a plant for reproduction.

Methods of grafting :

1. **Grafting by attachment.**
In which the scion and the stock are cut with two integrated angles, then the scion is attached to the stock.
Example : Mango trees.

2. **Grafting by wedge.**
In which the scion is prepared in the form of a wedge (pencil shaped) and it is inserted into a cleft in the stock.
Example : Large trees.
In each of the two methods, the scion and the stock are tightly tied together to make the scion feed on the juice of the stock.

Tissue culture :
It is a process of multiplying a small part of a plant to get many identical parts.

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Questions ? on lesson one

● Remember ● Understand ○ Apply ● Higher skills 📖 School book questions.

Interactive Exercises

1. Choose the correct answer :

1. Inflorescence is a group of ..... on a floral axle.
   a. fruits b. leaves c. seeds d. flowers
2. The floral leaves of a typical flower are arranged in ..... whorls.
   a. two b. three c. four d. five
3. The outer whorl of the flower is called .....
   a. petal. b. calyx. c. androecium. d. corolla.
4. The small green leaves that surround the flower from outside are known as .....
   a. petals. b. stamens. c. carpels. d. sepals.
5. All of the following statements show the importance of corolla, except it .....
   a. protects the reproductive organs. b. attracts insects to the flower.
   c. helps in reproduction process. d. produces pollen grains.
6. The filament and anther are structures of the .....
   a. carpel. b. stamen. c. stigma. d. sepal.
7. ..... produces pollen grains.
   a. Carpel b. Style c. Stamen d. Petal
8. The female reproductive organ of the flower is the .....
   a. stamen. b. carpel. c. corolla. d. androecium.
9. The organ responsible for formation of the ova in the flower is the .....
   a. ovary. b. anther. c. corolla. d. receptacle.
10. The floral whorl which is absent in the female flower is the .....
    a. calyx. b. corolla. c. androecium. d. gynoecium.
11. The bisexual flower contains .....
    a. only androecium. b. only gynoecium.
    c. androecium and gynoecium. d. androecium and calyx.
12. All of the following are unisexual flowers, except .....
    a. tulip. b. palm. c. maize. d. pumpkins.
13. Which of the following flowers is a typical flower? .....
    a. Palm. b. Maize. c. Petunia. d. Pumpkins.
14. The flower which contains both male and female reproductive organs is called ..... flower.
    a. male b. female c. unisexual d. hermaphrodite
15. The innermost floral whorl of the male flower is the .....
    a. gynoecium. b. androecium. c. corolla. d. calyx.

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16. Sexual reproduction in plants takes place via .....
a. seeds. b. vegetative parts. c. flowers. d. fruits.

17. The process of transferring of pollen grains from the flower anthers to the stigmas of another flower in the same plant is called .....
a. fertilization. b. self-pollination.
c. cross pollination. d. artificial pollination.

18. Flowers pollinated by air are characterized by all of the following, except .....
a. hanged anthers. b. feathery like stigmas.
c. scented petals. d. light pollen grains.

19. The pollen grains of flowers pollinated by wind are characterized by all the following features except they are .....
a. produced in huge number. b. light in weight.
c. dry. d. sticky.

20. In the flowers which have feather like stigmas, pollination is achieved through .....
a. water. b. air. c. man. d. insects.

21. The pollen grains of the insect pollinated flowers are .....
a. large. b. smooth. c. sticky. d. dry.

22. Mixed pollination in palm trees is carried out by .....
a. man. b. insects. c. air. d. water.

23. The zygote undergoes successive divisions to form the ..... that grows forming a new plant.
a. pollen grain b. ovum c. embryo d. flower

24. All of the following are fruits of single seed, except .....
a. apricots. b. olives. c. peaches. d. peas.

25. All of the following are ways of natural vegetative reproduction, except .....
a. rhizomes. b. bulbs. c. fruits. d. tubers.

26. The potato tuber is a .....
a. stem. b. root. c. leaf. d. bud.

27. The sweet potato tuber is a .....
a. stem. b. root. c. leaf. d. bud.

28. All of the following are ways of artificial vegetative reproduction, except .....
a. grafting. b. tissue culture. c. corms. d. cutting.

29. The cut is a part of ..... that contains growing buds taken from a plant for reproduction.
a. root or leaf only b. stem or root only
c. leaf or stem only d. leaf, stem or root

30. It is common that a cut is a branch carrying many .....
a. buds. b. leaves. c. fruits. d. stems.

31. In reproduction by grafting, the part of plant containing more than one bud is known as .....
a. stock. b. cut. c. scion. d. bud.

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32. Grafting by attachment can be carried to the ..... trees.
a. grape b. sugar cane c. rose d. mango

33. The produced fruits by grafting belong to the type of the .....
a. scion. b. cut. c. stock. d. bud.

34. Tissue culture is a process of multiplying small parts of a plant to get many ..... parts.
a. different b. identical c. small d. large

35. In the tissue culture, the tissue is placed in a suitable medium that contains .....
a. nutrients and salts. b. nutrients and fertilizers.
c. nutrients and hormones. d. salts and hormones.

2. Choose from column (B) and (C) what suit them in column (A) :

(A)	(B)	(C)
Floral whorl	**Consists of**	**Function**
1. Calyx	a. stamens	A. male organ in a flower.
2. Corolla	b. sepals	B. female organ in a flower.
3. Androecium	c. carpels	C. protects the inner parts of a flower.
4. Gynoecium	d. petals	D. attracts insects to the coloured leaves.

3. Put (✓) or (×) and correct what is wrong :

1. The flower is the organ of asexual reproduction in flowering plants. ( )
2. The group of flowers which are grouped on the same axle is known as bract. ( )
3. The swollen part which carries the floral leaves is known as the pedicle. ( )
4. Calyx is the outer whorl of floral leaves and it consists of a group of green sepals. ( )
5. The corolla consists of bright coloured scented leaves. ( )
6. Androecium is the female reproductive organ in the flower. ( )
7. Each anther consists of two chambers containing pollen grains. ( )
8. Gynoecium consists of a group of carpels. ( )
9. Anthers produce ovules. ( )
10. Each carpel consists of ovary, filament and stigma. ( )
11. Tulip and petunia are hermaphrodite flowers. ( )
12. Palm and maize are bisexual flowers. ( )
13. The innermost whorl of female flower is the androecium. ( )
14. The male flower consists of three whorls. ( )
15. Sexual reproduction in plants takes place in two processes, which are fertilization then pollination. ( )
16. Pollination is the transfer of pollen grains from the flower's stigma to the anther. ( )
17. Auto (self) pollination occurs in barely plant. ( )
18. The anthers of air pollinated flowers are feathery like and sticky. ( )

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19. The pollen grains of air pollinated flowers are sticky or with coarse surfaces. ( )
20. Flowers of hanging anthers are pollinated by insects. ( )
21. Insects pollinated flowers are characterized by coloured and scented petals. ( )
22. Palm trees are pollinated by air. ( )
23. The pollen tube contains two female nuclei. ( )
24. The zygote is a fertilized ovum. ( )
25. The wall of the ovary after fertilization forms the outer coat of the fruit. ( )
26. The ovary of beans fruits contains one ovule. ( )
27. Vegetative reproduction is a kind of sexual reproduction. ( )
28. In reproduction by cutting, buds buried inside the soil grow to form the shoot system. ( )
29. The insertion of the scion inside the stock is known as attachment grafting. ( )
30. Mango trees can be reproduced by wedge grafting. ( )
31. When an orange scion is attached to naring stock, the produced fruit belongs to naring. ( )
32. Reproduction by tuber happens in orange and bitter orange. ( )
33. Grafting is a process of multiplying a small part of a plant to get many identical parts. ( )
34. In tissue culture, the tissue is separated from the lower part of the stem. ( )
35. In tissue culture, the tissue is placed in a soil. ( )

4. Write the scientific term of each of the following :

1. A process by which living organisms are protected from extinction.
2. 📖 Short stem where leaves developed and modified into reproductive organs.
3. An organ of sexual reproduction in the flowering plants.
4. The leaf that the floral bud (which forms the flower) emerges from its axle.
5. A group of flowers found on the same axle.
6. The swollen part upon the pedicle on which the floral leaves exist.
7. The outer whorl of the floral leaves which consists of a group of sepals.
8. A floral whorl in the flower which protects the inner parts of the flower.
9. A floral whorl in the flower, whose function is to attract insects because of it is colourful and scented.
10. A group of coloured leaves in flowers, each of them is called petal.
11. • The male reproductive organ of the flower.
    • The organ of the flower which consists of a group of stamens.
12. An organ in the flower, which consists of filament and anther.
13. • The female reproductive organ in the flower.
    • The innermost whorl of the floral leaves of a typical flower.
14. An organ in the flower, which consists of ovary, style and stigma.
15. Small minute cells are formed inside the anther of a flower.

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16. The flower which contains androecium only.
17. The flower which contains gynoecium only.
18. • The bisexual flowers.
    • The flowers which contain both androecium and gynoecium.
19. The process of transfer of pollen grains from the flower anthers to the stigmas.
20. The transfer of pollen grains from the anther of a flower to the stigma of the same flower or to another flower in the same plant.
21. The transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
22. A kind of pollination which is carried out by human.
23. The fusion of male cell nucleus (pollen grain) with the female cell nucleus (ovum) to form the zygote.
24. • 🕮 The cell resulting from the fusion of the pollen grain and the ovum nuclei.
    • The fertilized ovum.
25. The position of the entrance of the male nucleus to the ovule inside the ovary.
26. The organ which forms the fruit after fertilization.
27. 🕮 The reproduction of some plants by parts of the roots, stems or leaves.
28. A part of a root, a stem or a leaf taken from a plant for reproduction.
29. A kind of asexual reproduction, which is used only between highly similar plant species.
30. The selected individual plant, which carries more than one bud in reproduction by grafting.
31. The method of grafting in which the scion is attached to the stock.
32. The method of grafting in which the scion is inserted into a cleft in the stock.
33. • A process of multiplying a small part of a plant to get many identical parts.
    • 🕮 A new method to produce large numbers of plants from a small part of it.

5. Complete the following statements :

1. Reproduction aims to secure the existence and continuity of living organisms ..... to prevent them from .....
2. The flower is a short ..... whose leaves are ..... to form reproductive organs.
3. The ..... is the organ of ..... reproduction in flowering plants.
4. The flower arises from a floral ..... which emerges from the axle of a leaf called .....
5. A number of flowers are grouped together on the floral axle to form .....
6. The flower has a thin neck called ..... ending in a swollen part called ..... which carries the floral leaves.
7. The floral leaves of calyx have ..... colour and each one is called .....
8. ..... is a group of coloured leaves, each leaf is called a .....
9. The corolla attracts ..... to the flower, which helps in ..... process.

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10. ..... is the male reproductive organ of the flower, while ..... is the female reproductive organ.
11. Androecium is the ..... reproductive organ of the flower and it consists of a group of .....
12. Each stamen consists of a fine ..... ending in a sac known as the .....
13. The anther consists of ..... chambers, each of them contains a large number of .....
14. Gynoecium is the ..... reproductive organ of the flower and it consists of a group of .....
15. Each carpel consists of a swollen part called ..... which connects with a tube called ..... and ending in .....
16. Carpels produce ..... inside the .....
17. The bisexual flower contains ..... and ..... but the male flower contains ..... only.
18. ..... and ..... are examples of unisexual plants, while ..... and ..... are examples of bisexual plants.
19. Hermaphrodite flowers take the symbol ..... , while male flowers take the symbol .....
20. There are two kinds of reproduction in plants, which are ..... reproduction and ..... reproduction.
21. Sexual reproduction in plants takes place in two successive processes, which are ..... then .....
22. ..... is the transfer of pollen grains from the flower anthers to the .....
23. Types of pollination are ..... pollination and ..... pollination.
24. Pollination by air takes place in flowers whose anthers are ..... and their stigmas are ..... like and sticky.
25. Pollination process takes place by ..... in flowers, which produce dry and light pollen grains, while it takes place by ..... in flowers which produce sticky pollen grains.
26. ..... pollination takes place by man, such as .....
27. After pollination, the pollen grain germinates forming a ..... , which contains two ..... nuclei.
28. Fertilization is the process of fusing the male cell nucleus (pollen grain) with the ..... to form .....
29. After fertilization, the ovary grows forming the ..... , while the ovule converts into the .....
30. ..... is an example of a fruit with a single seed, while ..... is an example of a fruit with many seeds.
31. ..... reproduction is a kind of asexual reproduction, which takes place via parts of ..... , stem, leaves and .....
32. Kinds of vegetative reproduction are ..... and .....

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33. The tuber is a ..... as sweet potatoes or a ..... as potatoes.
34. On cultivating a tuber part of potato in the soil, some buds grow forming a ..... and other buds grow forming a .....
35. Artificial vegetative reproduction is carried out in four methods, which are ..... , ... , ... and layering.
36. On cultivating a cut in a soil, the buds buried inside the soil grow to form the ..... while buds above the soil surface grow to form .....
37. In reproduction by grafting, a part of a plant, which contains more than one bud known as ..... is selected to be placed on a branch of another plant known as .....
38. The two methods of reproduction by grafting are the grafting by ..... and by .....
39. In grafting by wedge, the scion is ..... into a ..... in the stock such as .....
40. In reproduction by grafting, the ..... feeds on the ..... of the stock.
41. Tissue culture is a process of ..... a small part of a plant to get many ..... parts.

6. Give reasons for :

1. The petals of corolla are colourful and scented.
2. The androecium is the male reproductive organ of the flower.
3. The gynoecium is the female reproductive organ of the flower.
4. The flower of bean plant is a typical bisexual flower.
5. Palm flowers are unisexual.
6. Auto pollination can't happen in sunflowers.
7. The pollination in barley plant is self pollination.
8. The pollination of maize plant is mixed pollination.
9. Flowers pollinated by air having hanging anthers.
10. The stigmas of air pollinated flowers are feathery like and sticky.
11. Pollen grains of air pollinated flowers are produced in a huge number.
12. Pollen grains of air pollinated flowers are light in weight and dry.
13. Flowers pollinated by insects have coloured and scented petals.
14. Flowers pollinated by insects produce coarse pollen grains.
15. Pollination in palm trees is an artificial pollination.
16. Pollen grains that are transferred by wind can be easily distinguished from those transferred by insects.
17. Bee insect is more important than the honey production process.
18. The pollen grains germinate in the sugary solutions and don't germinate in water.
19. The number of seeds in fruits depends on the nature of the flower's ovary.
20. Olive fruit contains only one seed, while bean fruit contains more than one seed.
21. Some plants can reproduce sexually and asexually.
22. In reproduction by cutting, the cut must be a branch carrying many buds.
23. The scion and the stock are tightly tied together.
24. Reproduction by grafting can't be used between apples and peaches.
25. Tissue culture is a good method for plant reproduction.

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7. What is meant by ... ?

1. Reproduction process.
2. The flower.
3. The bract.
4. Inflorescence.
5. Calyx.
6. Corolla.
7. Androecium.
8. Gynoecium.
9. Male flower.
10. Female flower.
11. Bisexual flower (hermaphrodite).
12. Pollination.
13. Self (auto) pollination.
14. Mixed (cross) pollination.
15. Fertilization in plants.
16. The zygote.
17. Vegetative reproduction.
18. Tuber.
19. Reproduction by cutting.
20. The cut.
21. Reproduction by grafting.
22. 🕮 Tissue culture of a carrot plant.

8. Mention one function of each of the following :

1. Reproduction.
2. The flower.
3. The receptacle.
4. Calyx.
5. Corolla.
6. Androecium.
7. Gynoecium.
8. Tuber.
9. Buds in potatoes.
10. Stock in reproduction by grafting.
11. Tissue culture.

9. What happens ... ?

1. When a pollen grain falls on the stigma of a flower.
2. To the anther when pollen grains become mature.
3. When the anthers of air pollinated flowers are not hanged.
4. When the stigmas of air pollinated flowers are not feathery like and not sticky.
5. When the petals of insect pollinated flowers are not coloured and with no scent.
6. When the pollen grains of insect pollinated flowers are not sticky and with a smooth surface.
7. If the stigma doesn't secrete sugary solution after its pollination.
8. When the nucleus of the pollen grain fuses with the nucleus of the ovum.
9. When completion of fertilization process for the parts of the flower.
10. 🕮 To the ovary (after fertilization).
11. 🕮 To the zygote (after fertilization).
12. When the ovary of the flower contains more than one ovule.
13. When cultivate a piece of potato tuber contains buds in the soil.
14. When a part of an orange plant is tied to a branch of a naring plant.
15. When cultivate a cut contains several buds in a pot and irrigate it with water.
16. When separating a tissue from the upper part of a potato stem and putting it in a nutritive medium and hormones.

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10. Compare between :

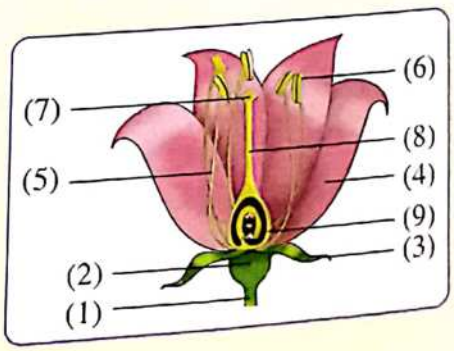
1. Calyx and corolla.
2. Androecium and gynoecium.
3. Male flower and hermaphrodite flower.
4. Self pollination and cross pollination.
5. Pollination and fertilization.
6. Air-pollinated flowers and insect-pollinated flowers.
7. Olive fruit and bean fruit.
8. Natural vegetative reproduction and artificial vegetative reproduction.
9. Grafting by attachment and grafting by wedge.
10. Reproduction by tubers and reproduction by grafting.

11. Exclude the unsuitable word, then write down the relation between the rest of words :

1. 📖 Stigma / Stamen / Style / Ovary.
2. 📖 Sepals / Petals / Tubers / Carpels.
3. Olives / Peaches / Apricots / Peas.
4. Tuber / Cutting / Grafting / Tissue culture.
5. 📖 Cutting / Pollination / Layering / Grafting.

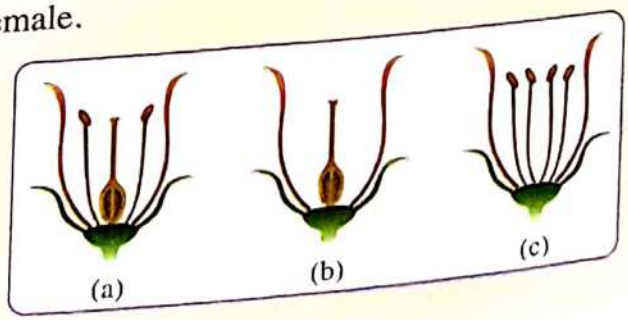
12. Study the following figures, then answer the questions :

(1) The opposite figure represents the structure of a typical flower :



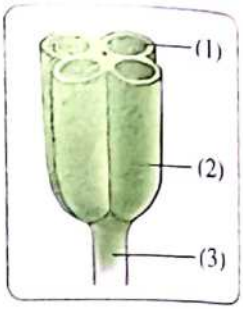
1. Label the figure.
2. What is the floral whorl, which consists of :
   a. part (3). b. part (4).
3. What is the kind of pollination that happens in this flower ?
4. Mention one function of parts (3) , (4) , (6) , and (9).
5. Mention the numbers of parts if they are removed, the flower becomes :
   a. male. b. female.

(2) There are some different types of flowers in front of you :



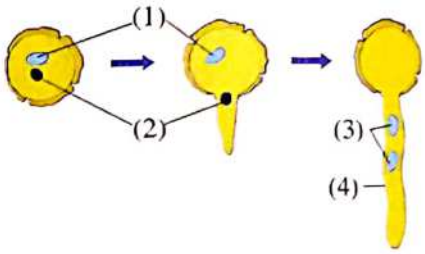
1. State the type of each flower.
2. In which one of these flowers, pollination can be mixed and in which one can be self pollination? (Give a reason).

(3) The figure shown in front of you represents one of the constituents of a flower :



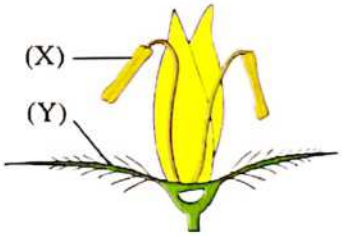
1. Mention its name.
2. Write the names which are indicated by the numbers (1),(2) and (3).
3. Mention its function.
4. What happens when part (1) becomes mature ?
5. What is the kind of pollination that happens when the structure number (1) falls on:
   a. The stigma of the same flower ?
   b. The stigma of another flower in other plant of the same kind?

(4) From the opposite figure :



1. Write the labels of the figure.
2. The figure represents .....

(5) The opposite figure shows a flower being pollinated by wind (air):



1. Write the labels for (X) and (Y).
2. Mention two characteristics that make this flower pollinated by wind (air).
3. Explain how cross pollination happens in this flower.

(6) The opposite figures represent the pollination process:

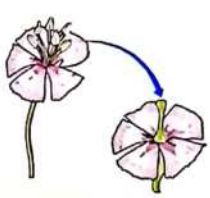


Fig. (1)

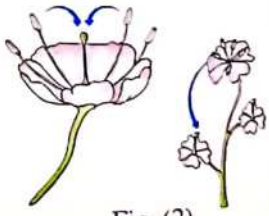


Fig. (2)

Mention the type of pollination in each figure.
(Give reasons for your answer).

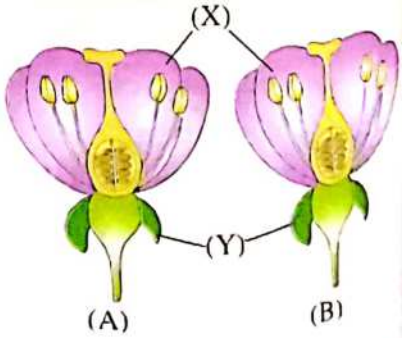
(7) The opposite two figures show two kinds of flower :

Fig. (1)

Fig. (2)

1. Mention the method of cross pollination in each figure. (Give the reason).
2. Mention the characteristics of the produced pollen grains in each figure. (Give the reason).

(8) The opposite figure shows two flowers of two plants of the same species :



1. What's the function of parts (X) and (Y) ?
2. Pollen grains from the flower (A) are transferred to the ova in flower (B) :
   a. What's the type of pollination that happened ?
   b. What's the sex of flower (A) ?

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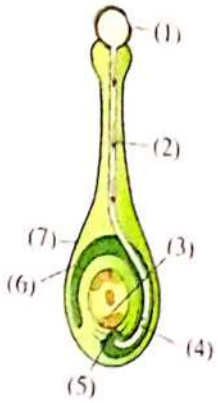
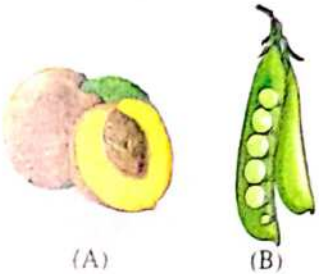
(9) From the opposite figure :

1. Write the labels of the figure.
2. What is the result of the combination of part (4) with part (3) ? and what is the name of this process ?
3. What is the number of the part which converts to :
   a. seed ?
   b. fruit ?



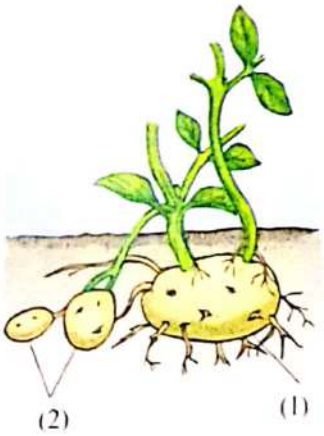
(10) From the opposite figures :

1. What is the sex of the flower of plant (B) ?
2. What is the origin of the figure (A) before the completion of fertilization process ?
3. What is the difference between the ovary in the flowers of plant (A) and (B) ?



(11) The opposite figure represents a method of natural vegetative reproduction :

1. Mention the name of this method.
2. Label the figure.
3. Mention the steps of this method.



(12) The following figures represent some ways of artificial vegetative reproduction :

1. Write the name of each method.
2. Label the figures.
3. Which method is used in mango trees ?

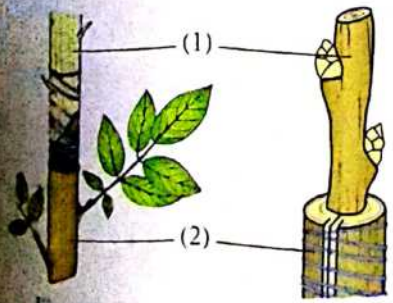


Fig. (1)

Fig. (2)

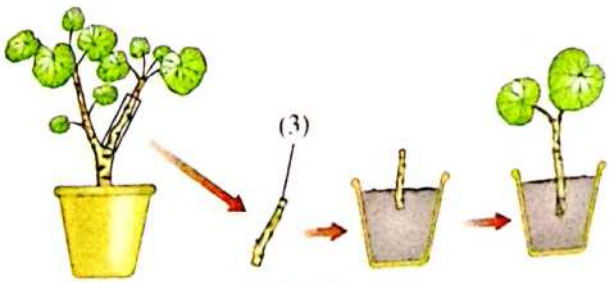
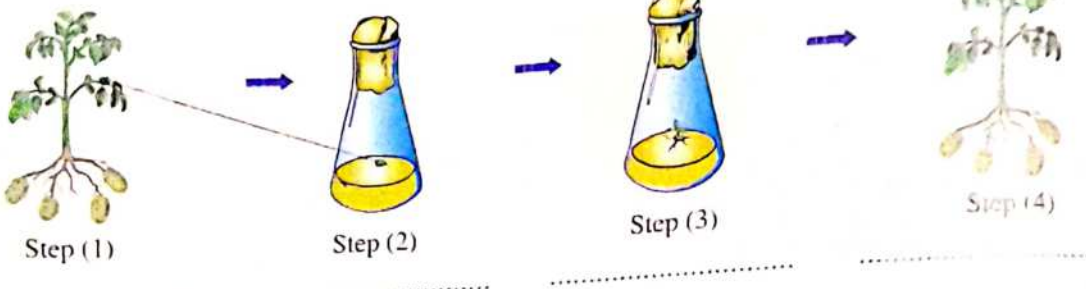


Fig. (3)

⁂ **(13) The following figures represent steps of tissue culture from a potato stem:**

1. What is meant by tissue culture ?
2. Write down the description of each step.



Step (1)

Step (2)

Step (3)

Step (4)

.....
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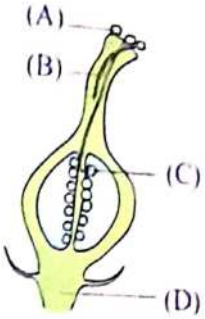
Thinking Skills Questions

1. Choose the correct answer :

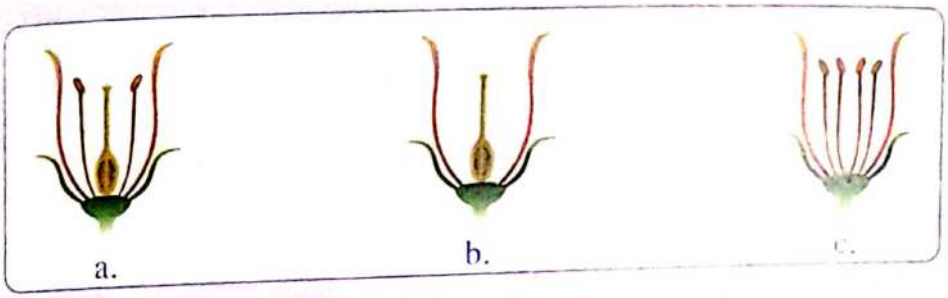
1. Which of the parts shown in the opposite figure can reproduce vegetatively to produce a similar plant ? .....



a. (A) b. (B)

c. (C) d. (D)

2. Which of the following flowers can't form fruits ? Why ?



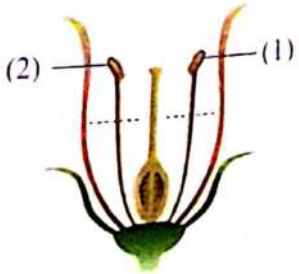
2. We can cultivate a piece of potato by cutting the tuber into multiple slices, each slice contains a bud. What is the type of this reproduction (sexual or asexual) ? (Explain your answer).

3. What happens if ... ?

1. The flower loses its calyx before blooming.
2. The stigmas of air-pollinated flowers are dry.
3. The end of the pollen tube doesn't decompose after germination.
4. The scion and the stock aren't tightly tied together.

4. The opposite figure represents a flower.

A pupil cuts the parts indicated by the numbers (1) , (2) for a purpose and after a week he noticed that the flower becomes a fruit.



a. Mention the reason for the formation of the fruit, although the parts (1) and (2) were cut.

b. What is the purpose of cutting parts (1) and (2) ?

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LESSON 2

Reproduction in Humans

Why does the reproduction process have a great importance for human beings ?

Humans reproduce sexually when two different persons mate, the male (♂) and the female (♀) using a special system called reproductive (genital) system.

* Reproduction process aims to secure the existence and continuity of living organisms **G.R.**

  To prevent them from extinction.

* Man can't reproduce asexually but he only reproduces sexually **G.R.**

  Because the individuals (offspring) coming from asexual reproduction are identical to the parent, while in human, each individual differs from others.

In this lesson, we will study :

1. The male reproductive system.
2. The female reproductive system.
3. The structure of the ovum and sperm in human.
4. Fertilization and embryo formation.
5. Genital system diseases.

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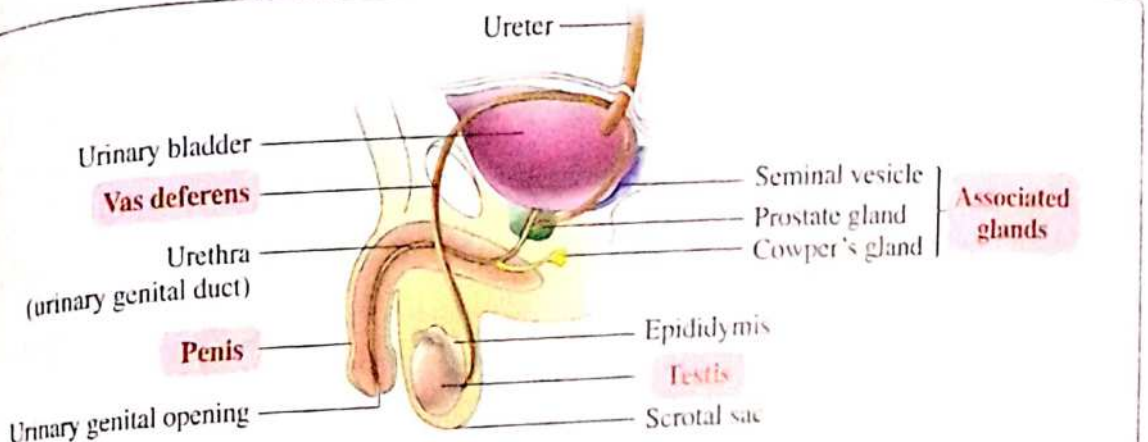
1 The male reproductive (genital) system :

The male reproductive system consists of 4 main parts which are :

1. Two testes. **2. Two vas deferens.** **3. Associated glands.** **4. Penis.**



Male reproductive system

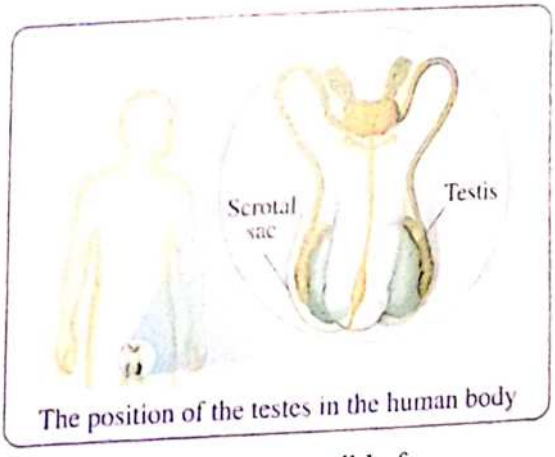
1 Two testes :

Description :

They are two glands of oval (elliptical) shape.

Position :

They locate outside the body in a sac like structure called ***scrotal sac (scrotum)*** which is hanged between male's thighs.



The position of the testes in the human body

Function of two testes :

1. Production of sperms (male gametes).
2. Production of male sex hormone known as "testosterone" which is responsible for the appearance of secondary male sex characters (signs of puberty in male).

Function of scrotal sac :

It regulates and keeps the temperature of testes ***2°C*** below the normal body temperature which is the optimum (suitable) temperature for the growth and development of sperms.

Signs of puberty in male :

1. Growth of hair in certain body areas (like beard and mustache).
2. Harshness of voice.
3. Growth and development of genital organs.
4. Growth of bones.
5. Enlargement of muscles.

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NB If the testes are present inside the body and don't come out during the development of the embryo, the testes cannot produce sperms, so the individual becomes infertile (sterile).

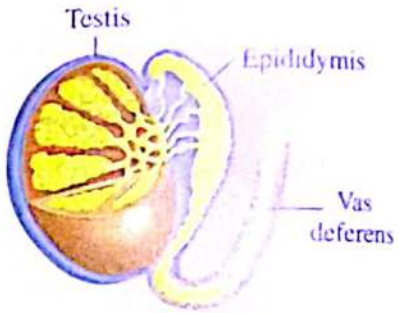
Enrichment information

The testes of the elephant are present inside the body cavity. That's why it is surrounded by a cooling system that preserves the optimum temperature for the testes to function efficiently and produce healthy sperms.

2 The vas deferens :

Description :

Each testis is connected to a group of fine convoluted (highly looped) tubes known as "Epididymis" which extends in the form of a single tube known as "Vas deferens".



The connection of the vas deferens with testis

Function of epididymis :

1. The final stages of the growth and development of sperms take place in it.
2. It stores the sperms.

Function of vas deferens :

It transfers the sperms from the testes to the urinary genital duct (urethra).

What happens if ...?

The two vas deferens were cut.

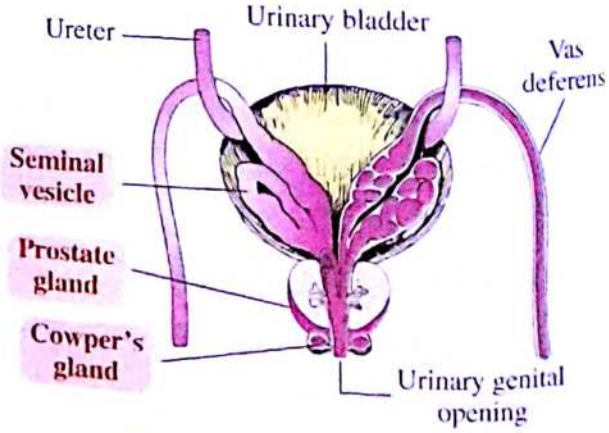
➲ The sperms can't transfer from the testes to the urinary genital duct and the individual becomes infertile.

3 Genital associated glands :

Description :

There are three kinds of genital glands connected to the male reproductive system, which are :

1. Two seminal vesicles.
2. Prostate gland.
3. Two Cowper's glands.



The associated glands of the male genital system

Function of genital associated glands :

They pour secretions on the sperms to form an alkaline fluid known as seminal fluid.

Function of seminal fluid :

1. Nourishes (feeds) the sperms (as it contains nutrients).
2. Facilitates the flow of sperms.
3. Neutralizes the acidity of urethra (so sperms don't die during passing through urethra).

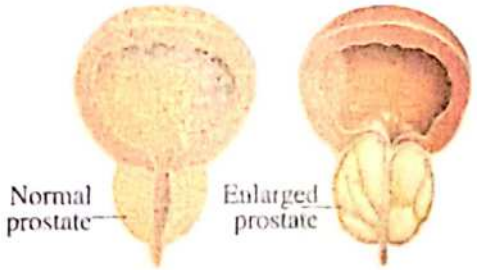
What happens if ...?

The inability of the sex glands to secrete the semen.

➲ The sperms die, so the individual becomes infertile (sterile).

Enrichment information

- *The prostate is a muscular gland surrounding the urethra at the site of connection with the urinary bladder and it might be enlarged in some men above forty years.*
- *This leads to increase pressure on the urethra which eventually causes difficulty in urination, and needs to be removed surgically.*



The enlargement of prostate

4 The penis :

Description :

It is a sponge-like tissue, the urethra passes through it and ends in a urinary genital (urinogenital) opening.

Function :

Through which the semen and urine go out of the body through the urinogenital opening but never at the same time.

• From the previous explanation, we conclude that :

The reasons that lead to the occurrence of sterility (infertility) in the male human being are :

1. The testes don't come out of the body cavity during the development of the embryo.
2. Occurrence of a cut in the two vas deferens.
3. Inability of sex glands to secrete the seminal fluid.

Exercise 1

Trace the path of the sperms from the beginning of its formation in the testes and even exit from the urinogenital opening.

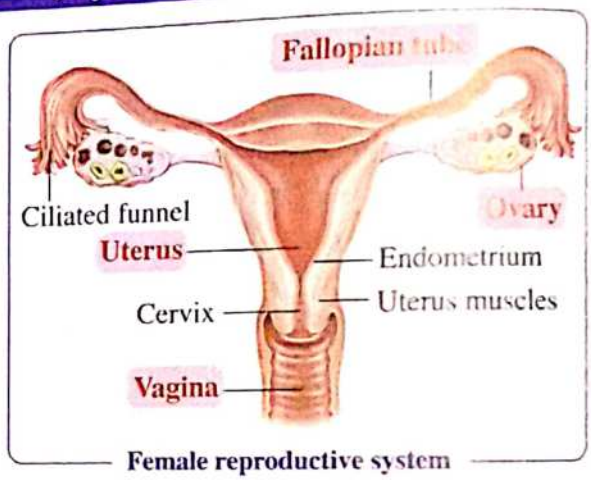
Answer

Testes → Epididymis → Vas deferens → Urethra → Urinogenital opening.

TRY to answer worksheet 17 in the Notebook

2 The female reproductive (genital) system :

- The genital system in a female differs from that in a male in several aspects, mostly in being adapted to carry the embryo during the period of pregnancy.
- The female reproductive system consists of 4 main parts, which are :
  1. **Two ovaries.**
  2. **Two fallopian tubes.**
  3. **Uterus.**
  4. **Vagina.**



Female reproductive system

1 Two ovaries :

Description :

They are two glands having the size and shape of a peeled almond.

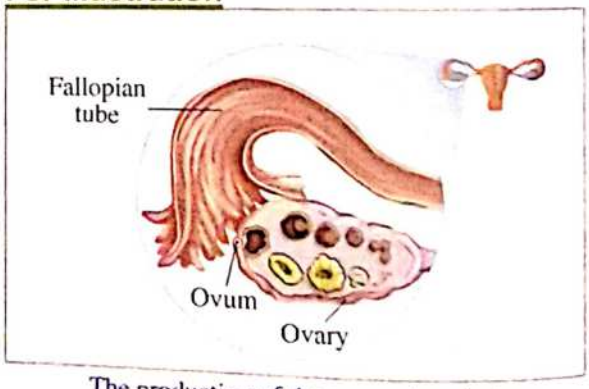
Position :

They locate inside the body in the lower part of the abdominal cavity from the back.

Function :

1. Production of ova (female gametes), in a process known as **ovulation**.
2. Production of female sex hormones, which are :
   a. Progesterone, which is responsible for the continuity of pregnancy.
   b. Estrogen, which is responsible for the appearance of secondary female sex characters (signs of puberty in female).

For illustration



The production of the ova and ovulation

Ovulation process :

It is the process of production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary.

Signs of puberty in female :

1. Growth of hair in armpit and pubic.
2. Softness of voice.
3. Growth and development of breasts.
4. Accumulation of fats in some body regions.
5. Occurrence of menstrual cycle.

Menstrual cycle :

- It is one of the signs of puberty in female.
- It repeats every 28 days, as long as no pregnancy happens.
- It starts at the age of **female puberty** (11 to 14 years) and stops at the age of **menopause** (45 to 55 years).

Female menopause :

It is the age at which the two ovaries completely stop releasing ova.

Exercise 2

Calculate the number of ripe ova that an adult woman can produce during 35 years "Assuming no pregnancy happens".

Answer

∵ The adult female produces one ripe ovum every 28 days.

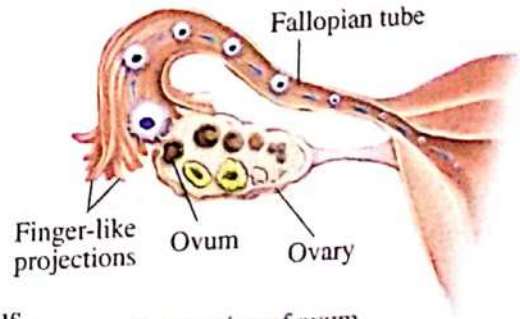
∴ The number of produced ova in one year $= \frac{365}{28} \simeq 13$ ova

∴ The number of produced ova during 35 years $= 13 \times 35 = 455$ ova

2 Two fallopian tubes :

Description :

- They are two tubes of funnel-shaped opening provided with finger-like projections.
- The inner wall of fallopian tubes lined with ***cilia***.



The motion of ovum in fallopian tube

Position :

The two fallopian tubes are located near to the ovaries and end at the upper corners of the uterus.

Function :

They receive (trap) the ripe ovum and direct it towards the uterus with the aid of :

- The contraction and relaxation of the muscles in the tube wall.
- The movement of the lining cilia.

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G.R.

- ***Fallopian tube starts with a funnel-shaped opening provided with finger-like projections.***
  To receive the ripe ovum from the ovary by the finger-like projections and push it towards the uterus through the movement of cilia.
- ***The inner wall of fallopian tubes is ciliated.***
  To direct the ripe ovum towards the uterus.

3 The uterus :

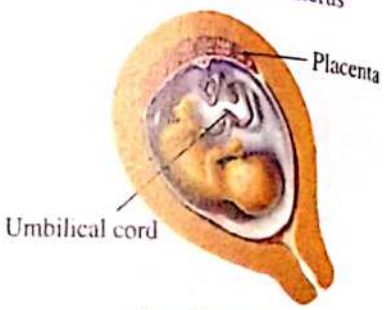
Description :

- It is a hollow pear-shaped organ.
- It has a muscular wall that can expand as the fetus grows during pregnancy.
- It is lined with mucus membrane rich in blood capillaries to form ***placenta*** during the pregnancy.

The position of the uterus

Position :

It locates in the pelvic cavity between the urinary bladder and the rectum.



Nourishing the embryo in the uterus

Function :

1. It protects the fetus until birth.
2. It nourishes the fetus during the pregnancy by the **placenta** through the **umbilical cord**.

G.R.

The uterus is lined with mucus membrane rich in blood capillaries.
To form the placenta which is responsible for the nourishment of fetus during the pregnancy through the umbilical cord.

4 The vagina :

Description :

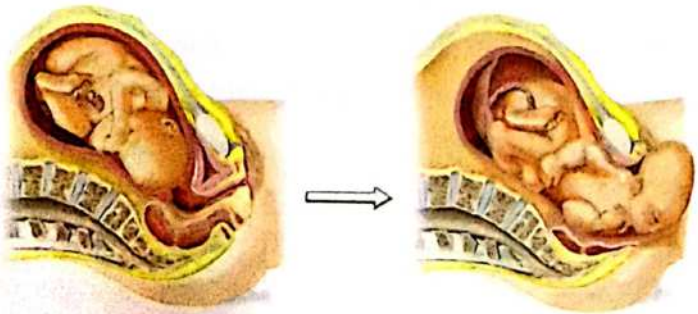
It is a muscular tube that expands during labour.

Position :

It extends from the uterus and ends in the external genital opening.

Function :

It expands during the labour to deliver (coming out) the baby.


The expansion of the vagina during the labour

3 The structure of the ovum and the sperm in human :

1. - You know that the body of a living organism consists of cells, each cell contains a nucleus that contains the complete number of chromosomes (46 chromosomes) of the species.
   - Chromosomes (genetic material) carry genes, which are responsible for the hereditary traits of the organism.
2. The ovum and the sperm differ from any other body cells in the number of chromosomes in the nucleus, where the nucleus of a sperm or an ovum contains only half number of chromosomes (23 chromosomes).

The following table shows a comparison between the ovum and the sperm :

1 The ovum (female gamete) :

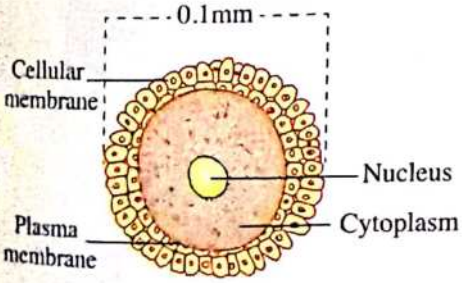
Properties

- It is relatively large in size (as sesame seed size) **G.R.**

Due to the storage of nutrient materials.

- It is not a mobile cell (it is a static cell).
- It is a spherical cell.

Illustrating figure



Consists of

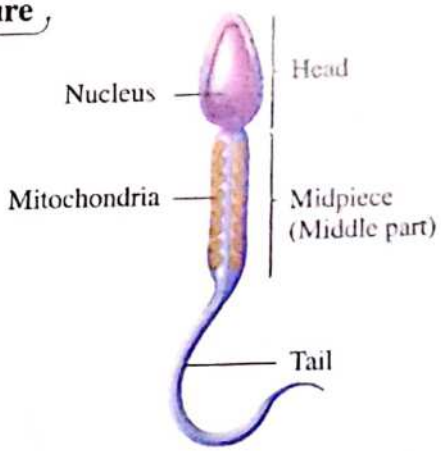
1. **The nucleus :** that contains one half of the genetic material (23 chromosomes).
2. **The cytoplasm :** that contains stored food and nutrients that are surrounded by plasma membrane.
3. **The cellular membrane :** an intact membrane that surrounds (coats) the cell from outside.

2 The sperm (male gamete) :

Properties

- It is considered very small if it is compared with the ovum.
- It is a mobile cell.

Illustrating figure



Consists of

1. **The head :** that contains one half of the genetic material (23 chromosomes).
2. **The midpiece :** that contains mitochondria which are responsible for energy production needed for the sperms movement.
3. **The tail :** thin and long and it is responsible for the movement of the sperm till reaches the ovum.

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From the previous explanation, we can summarize that :

In human :

Body cell contains **nucleus** that contains the **complete** number of chromosomes (46 chromosomes)

Gamete (a sperm or an ovum) contains **nucleus** that contains **half** the number of chromosomes (23 chromosomes)

Exercise 3

Trace the path of the un-fertilized ovum from its formation till its decomposition, then its exit in the menstrual blood.

Answer

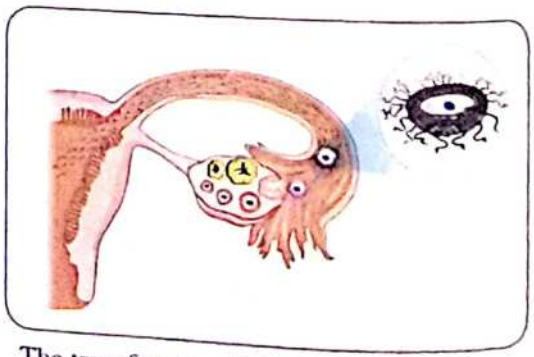
Ovary ⟶ Fallopian tubes ⟶ Uterus ⟶ Gential opening.

4 Fertilization and embryo formation in human :

TRY to answer worksheet 18 in the Notebook

* **The following stages show the fertilization process (occurrence of pregnancy) in human from mating to the formation of the embryo.**

1. The female produces only one ripe ovum on the 14th day of the beginning of menstrual cycle.
2. During mating, the male secretes billions of sperms, which move from the vagina towards the uterus then to the fallopian tube.
3. The sperms rush the ovum at the beginning of fallopian tube.



The transference of the sperms to the ovum through fallopian tube

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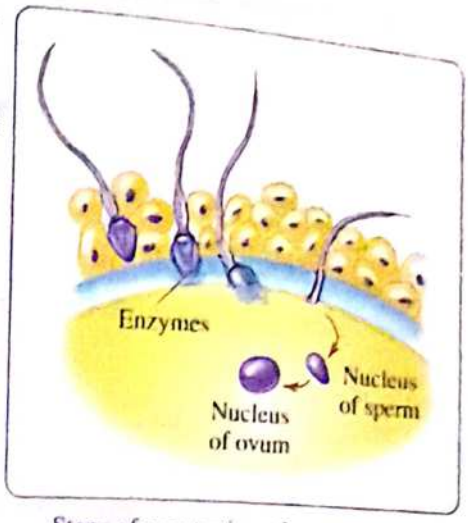
4 • The head of the sperm secretes enzymes **G.R.** **To dissolve the cellular membrane of the ovum and facilitate its penetration inside the ovum.**

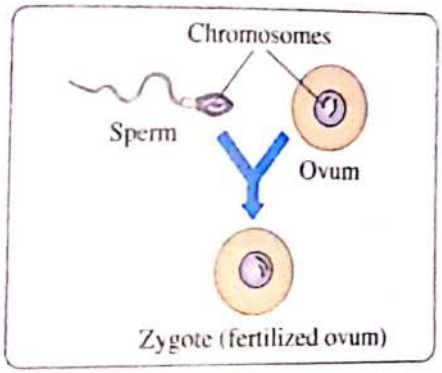
• One sperm only can penetrate the cellular membrane of the ovum.

5 After the penetration of the sperm, the ovum surrounds itself with a membrane that prevents the penetration of any other sperm.



Steps of penetration of one sperm to the ovum

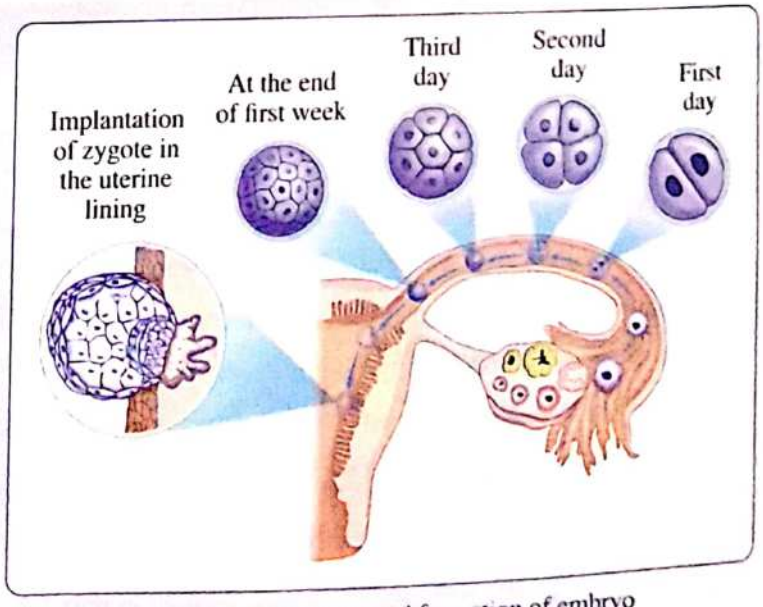
6 Fertilization occurs by the fusion of the nucleus of sperm (which contains 23 chromosomes) with the nucleus of the ovum (which contains 23 chromosomes) to form the ***zygote*** (fertilized ovum), that contains a nucleus with 46 chromosomes (23 pairs of chromosomes).



Formation of zygote

7 The zygote transfers to the uterus to be implanted in its lining.

8 The zygote divides many successive divisions into many cells that differentiate and continue to grow forming the ***embryo*** (fetus).



Divisions of zygote and formation of embryo

* **From the previous explanation, we can define :**

Fertilization in human :

It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).

The pregnancy period :

It is the period between the fertilization process and delivery which extends for about 9 months.

NB The new born baby will carry the genetic traits of his parents [as his cells contain 23 chromosomes coming from his mother (ovum) and 23 chromosomes coming from his father (sperm)].

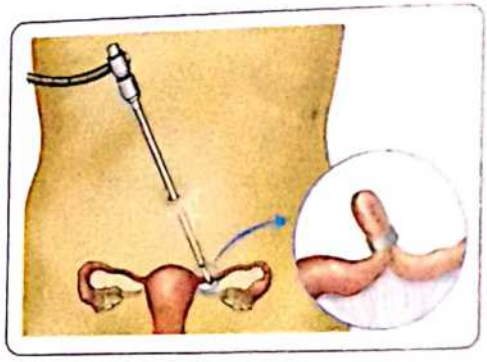
G.R. • ***The ovum surrounds itself with a coat after the penetration of a sperm inside it.***
To prevent the penetration of any other sperm.

What happens if ...?

The fallopian tubes are ligated.

➲ The sperm doesn't reach the ovum, therefore the fertilization (pregnancy) doesn't occur.

So, Fallopian tubes ligation surgically is considered as one of the means of birth control.



Fallopain tube ligation

▸ Enrichment information

* *The testes of the adult human male produce about 2 billions sperms per day.*
* *The lifetime of a single sperm inside the female vagina ranges from 2 to 6 hours, this period can extend to reach up to 3 days if the sperm managed to break through the cervix and enters the uterus where it feeds on uterine secretions.*
* *In case of failure in fertilization, the endometrium falls down and the blood capillaries detach causing blood to flow out of the vagina for 4 to 5 days in a process known as the menstruation.*

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From the previous study, we can compare between plant gametes and human gametes :

	Kind of organism	Reproductive organ	Gametes	Characteristics of gametes
Male	Animals	Testis	Sperms	• small in size. • produced in large numbers. • mobile. • each one of them contains half the number of chromosomes that are found in a male (father) body cells.
Male	Plants	Anther	Pollen grains	
Female	Animals	Ovary	Ova (egg cells)	• large in size because it stores nutrients. • produced in few numbers. • not mobile (static). • each one of them contains half the number of chromosomes that are found in a female (mother) body cells.
Female	Plants			

5 Genital system diseases :

Diseases of genital system in male and female are classified into two types, which are :

First type

Diseases don't arise from sexual contact with a sick person or a carrier of a sexually transmitted disease.

Examples :

Uterine cancer, prostate cancer and puerperal sepsis (childbed fever).

Second type

Diseases arise from sexual contact (sexually transmitted diseases "STDs") with a sick person or a carrier of a sexually transmitted disease.

Examples :

Gonorrhea, syphilis and AIDS.

Incubation period of the disease :

It is the period between the beginning of infection and the appearance of symptoms of the disease.

NB **A person who carries a disease :** a person who carries the microbe that causes the disease without showing symptoms of the disease.

Now, we will study puerperal sepsis as an example of the first type and syphilis as an example of the second type.

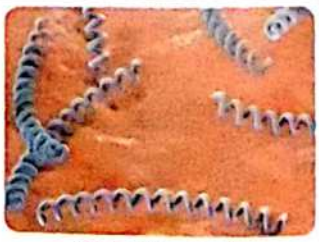
1 Puerperal sepsis (fever) :

The microbe that causes the disease :	Spherical-shaped bacteria. Spherical bacteria
Methods of infection :	1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to a vagina of recently laboured mother. 2. An infected wound during the labour.
Incubation period :	From one to four days.
Symptoms :	1. High elevation in body temperature. 2. Chills. 3. Pallor (face paling). 4. Severe acute pain in lower abdomen. 5. Bad smelling secretions from the uterus.
Means of protection (prophylaxis) :	1. Sterilizing the surgical tools during labour (delivery). 2. Wearing masks during labour (delivery). 3. Preventing visits of persons, who suffer from respiratory diseases to the mother after delivery. 4. The mother should be kept warm and avoid exposure to cold air currents G.R. . **To protect her from throat infection or tonsillitis which may cause the infection with puerperal sepsis (fever).**

▸ Enrichment information

The bacteria causing puerperal sepsis can be transferred to the patient by her own throat secretions, that is why a pregnant woman suffering any respiratory disease should be treated first before delivery especially in the last two months to avoid autoinfection.

2 Syphilis

The microbe that causes the disease :	Spiral-shaped bacteria.  Spiral bacteria
Methods of infection :	1. Sexual contact with an infected person. 2. From a pregnant woman to her fetus (through the umbilical cord or during the delivery).

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Incubation period :	From two to three weeks.
Symptoms :	1. Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female). 2. Appearance of dark brass coloured rashes on the back and hands of the patient.
Means of protection (prophylaxis) :	1. Preventing the sexual contact with an infected person (preventing the illegal contacts). 2. Induce abortion of the infected pregnant woman.

The hand of a patient of syphilis

What happens when ...?

The patient is not treated as soon as the appearance of symptoms of syphilis disease.

This leads to many complications such as :

- The appearance of tumors in different body parts like : the liver, bones and parts of genital system.
- The brain may also be damaged and the patient will die.

Note

Syphilis can be treated in all symptoms stages.

The effect of smoking and addiction on the genital syste

The studies showed that there are many bad effects of smoking on the reproductive health of males and females :

1. **In males :** Decreases the formation of male sex hormone.
2. **In females :**
   - Decreases the formation of female sex hormones.
   - Leads to the increase in deformation rate in the embryos.
   - Leads to the death of the embryos and newly born babies.

Real Life application : *Healthy toilet seat cover :*

A plastic medical cover in the form of an elliptical plastic frame sold in pharmacies is to be used in public toilets to avoid infection by some skin and genital diseases.

Healthy toilet seat cover

TRY to answer worksheet 19
- General Exercise of the School Book on Unit 3
- Model exams on Unit 3

in the Notebook

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Remember Lesson Two

The male reproductive system consists of :

- Two testes.
- Associated glands.
- Two vas deferens.
- Penis.

Function of two testes :

- Production of sperms (male gametes).
- Production of male sex hormone known as "testosterone" which is responsible for the appearance of secondary male sex characters (signs of puberty in male).

Signs of puberty in male :

1. Growth of hair in certain body areas (like beard and mustache).
2. Harshness of voice.
3. Growth and development of genital organs.
4. Growth of bones.
5. Enlargement of muscles.

There are three kinds of genital glands connected to the male reproductive system which are :

1. Two seminal vesicles.
2. Prostate gland.
3. Two Cowper's glands.

Function of genital glands :

They pour secretions on the sperms to form seminal fluid (alkaline fluid) which :

1. Nourishes (feeds) the sperms (as it contains nutrients).
2. Facilitates the flow of sperms.
3. Neutralizes the acidity of urethra (so sperms don't die during passing through urethra).

The female reproductive system consists of :

- Two ovaries.
- Uterus.
- Two fallopian tubes.
- Vagina.

Function of two ovaries :

- Production of ova (female gametes), in a process known as **ovulation**.
- Production of female sex hormones, which are :
  a. Progesterone, which is responsible for the continuity of pregnancy.
  b. Estrogen, which is responsible for the appearance of secondary female sex characters (signs of puberty in female).

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Ovulation process :

It is the process of production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary.

Signs of puberty in female :

1. Growth of hair in armpit and pubic.
2. Softness of voice.
3. Growth and development of breasts.
4. Accumulation of fats in some body regions.
5. Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens.

Female menopause :

It is the age at which the two ovaries completely stop releasing ova.

The ovum consists of :

The nucleus, cytoplasm and cellular membrane.

The sperm consists of :

The head, midpiece and tail.

Fertilization in human :

It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).

Pregnancy period :

It is the period between the fertilization and delivery which extends for about 9 months.

Incubation period of the disease :

It is the period between the beginning of infection and the appearance of symptoms of the disease.

The **puerperal sepsis disease** is caused by **spherical-shaped bacteria**, while **syphilis disease** is caused by **spiral-shaped bacteria**.

The incubation period of **puerperal sepsis disease** is from **1 to 4 days**, while that of **syphilis disease** is from **2 to 3 weeks**.

The effect of smoking and addiction on the genital system :

1. **In males :**
   Decreases the formation of male sex hormone.
2. **In females :**
   - Decreases the formation of female sex hormones.
   - Leads to the increase in deformation rate in the embryos.
   - Leads to the death of the embryos and newly born babies.

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Questions ? on lesson two

● Remember ● Understand ● Apply ● Higher skills 📖 School book questions.

Interactive Exercise

1. Choose the correct answer :

1. All of the following are organs of the male reproductive system, except .....
   a. vas deferens. b. uterus. c. testes. d. penis.
2. The temperature of the two testes must be ..... the normal body temperature.
   a. two degrees below b. two degrees above
   c. the same as d. higher than
3. Male puberty features are related to the effect of ..... hormone.
   a. estrogen b. thyroxin c. testosterone d. progesterone
4. ..... is from the signs of puberty in male.
   a. Softness of voice b. Development of breasts
   c. Harshness of voice d. Occurrence of menstrual cycle
5. Sperms transfer from the testes to the urinary genital duct through .....
   a. urethra. b. epididymis. c. vas deferens. d. penis.
6. Sperms are stored in the .....
   a. epididymis. b. vas deferens. c. urethra. d. prostate gland.
7. The seminal fluid is ..... in nature.
   a. an acidic b. a neutral c. an alkaline d. amphoteric
8. All of the following are functions of seminal fluid, except .....
   a. it facilitates the mobility of sperms. b. it feeds sperms.
   c. it keeps the temperature of testes. d. it neutralizes the acidity of urethra.
9. The ..... has the size and shape of a peeled almond.
   a. testis b. uterus c. ovary d. sperm
10. 📖 The right ovary in the female human produces a mature (ripe) ovum every ..... days.
    a. 24 b. 28 c. 34 d. 56
11. ..... hormone is responsible for the continuity of pregnancy.
    a. Estrogen b. Testosterone c. Progesterone d. Thyroxin
12. The fallopian tubes are characterized with many features, except they are .....
    a. of funnel-shaped opening. b. lined with cilia.
    c. opened in the upper corners of uterus. d. having the size of a peeled almond.
13. The ..... nourishes the embryo during the pregnancy period.
    a. ovary b. placenta c. spinal cord d. fallopian tube
14. The ..... is a muscular tube that expands during the labour.
    a. fallopian tube b. vagina c. ovary d. uterus

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15. The ovum stores food and nutrients in the .....
a. nucleus. b. cytoplasm.
c. cellular membrane. d. plasma membrane.

16. The ..... of a sperm contains mitochondria.
a. head b. midpiece c. tail d. nucleus

17. The female produces only one ripe ovum in the ..... of the menstrual cycle.
a. 7^{th} day b. 12^{th} day c. 14^{th} day d. 16^{th} day

18. In human, fertilization process takes place in the .....
a. vagina. b. fallopian tube. c. uterus. d. cervix.

19. Fertilization occurs when ..... is formed.
a. embryo b. zygote c. endometrium d. ovum

20. In man, the zygote contains .....
a. 23 chromosomes. b. 32 pairs of chromosomes.
c. 32 chromosomes. d. 23 pairs of chromosomes.

21. The fertilized egg is implanted in the lining of the .....
a. uterus. b. vagina. c. cervix. d. fallopian tube.

22. In human, the period between fertilization and delivery is about ..... months.
a. 7 b. 8 c. 9 d. 10

23. All of the following are sexual transmitted diseases, except .....
a. gonorrhea. b. syphilis. c. prostate cancer. d. AIDS.

24. The incubation period of puerperal sepsis disease ranges from .....
a. 1 to 4 days. b. 2 to 6 days. c. 1 to 4 weeks. d. 2 to 3 weeks.

25. All of the following are symptoms of puerperal sepsis disease, except .....
a. high body temperature. b. headache.
c. face paling. d. chilling.

26. The microbe that causes the syphilis is .....
a. spiral virus. b. spherical bacteria.
c. spiral bacteria. d. spiral algae.

27. The incubation period of syphilis disease ranges from .....
a. 1 to 4 days. b. 1 to 4 weeks. c. 2 to 3 days. d. 2 to 3 weeks.

28. An ulcer appears at the tip of the penis in males is due to ..... infection.
a. syphilis b. gonorrhea c. puerperal sepsis d. german measles

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2. Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Testes	a. the embryo grows and develops inside it.
2. Ovary	b. fine convoluted tubes that store sperms.
3. Epididymis	c. muscular tube expands during labour.
4. Fallopian tube	d. produce sperms and male sex hormone.
5. Uterus	e. transfers sperms from testes to urethra.
	f. receives the female gamete.
	g. produces the ovum.

3. Put (✓) or (×), then correct what is wrong :

1. Man can't reproduce asexually. ( )
2. The offspring coming from asexual reproduction are different from their parents. ( )
3. Production of sperms and male sex hormone is the function of prostate gland. ( )
4. The temperature of testes is 4°C above the normal body temperature. ( )
5. Sperms transfer from testes to urethra through the epididymis. ( )
6. The sperm's nucleus contains half the number of chromosomes. ( )
7. In human female, the two ovaries locate in the lower part of the pelvic cavity from the back. ( )
8. The human female's ovum is a settled sphere shaped cell. ( )
9. The female puberty features are related to the effect of estrogen hormone. ( )
10. The left ovary releases one ripe ovum every 28 days. ( )
11. The progesterone enzyme is responsible for pregnancy to continue. ( )
12. Growth of hair in armpit, harshness of voice, growth and development of breasts are from sings of female puberty. ( )
13. The age of menopause in female ranges between 11 to 14 years. ( )
14. Fallopian tubes open in the lower corners of the uterus. ( )
15. The uterus is a hollow pear-shaped organ with a muscular wall. ( )
16. The cervix connects the ovary with the uterus. ( )
17. The vagina is a muscular tube that expands during the pregnancy. ( )
18. The ovum is a mobile cell of a relatively large size. ( )
19. Sperms move from vagina to fallopian tubes through the uterus. ( )
20. The human female ovary produces only one ripe ovum on the 28^{th} day of the beginning of the menstrual cycle. ( )
21. The sperm secretes hormones to dissolve the cellular membrane of the ovum. ( )
22. The fertilized ovum contains the complete number of chromosomes. ( )

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23. After fertilization, the zygote transfers to the vagina to be implanted in its lining. ( )
24. The period between fertilization and delivery is known as the incubation period. ( )
25. The pregnancy period in human beings takes 28 weeks. ( )
26. Uterine cancer is a genital disease which doesn't arise from sexual contact. ( )
27. Puerperal sepsis disease can infect both male and female. ( )
28. The incubation period of puerperal sepsis disease ranges from 1 to 4 weeks. ( )
29. Bad smelling secretions from the uterus is from the symptoms of syphilis disease. ( )
30. Syphilis disease is caused by spiral bacteria. ( )
31. Syphilis disease can be transmitted by inhalation. ( )
32. The incubation period of syphilis ranges between 1 to 2 weeks. ( )
33. Appearance of tumors in liver, bones and parts of genital organ are from the symptoms of syphilis disease. ( )

4. Write the scientific term of each of the following :

1. The type of reproduction in human beings.
2. An oval-shaped gland that produces male cells (gametes).
3. A sac-like structure that regulates and keeps the temperature of testes 2°C below the normal body temperature.
4. Group of glands, their function is to secrete semen.
5. The male sex hormone which is responsible for the appearance of secondary male sex characters.
6. A group of fine convoluted tubes connected to the testes.
7. It transfers the sperms from the testes to the urethra.
8. A fluid secreted by male genital associated glands.
9. A male reproductive organ through which urine and seminal fluid pass outside the body.
10. Two glands that produce the female gametes in human females.
11. The female reproductive organ, which secretes the female sex hormones.
12. The female sex hormone, which is responsible for the appearance of secondary female sex characters.
13. The female sex hormone, which is responsible for the continuity of pregnancy.
14. The process of producing ova from the ovaries mutually every 28 days.
15. A phenomenon happens in female every 28 days at the age of puberty.
16. A tube with a funnel-shaped opening transport the ovum to the uterus.
17. • A hollow pear-shaped female sex organ with a muscular wall.
    • A female sex organ, which locates in the abdominal cavity between the urinary bladder and the rectum.
    • A female reproductive organ in which the fetus is protected and fed till birth.

18. The female gamete.
19. The male gamete.
20. A part of the ovum which contains the genetic material.
21. A part of the ovum stores food and nutrients.
22. A part of the sperm which contains the genetic material.
23. A part of the sperm which contains mitochondria.
24. A part of the sperm which is responsible for its movement.
25. The genetic material in the cell.
26. The fusion of the nucleus of male gamete with the nucleus of female gamete to form the zygote.
27. The period between fertilization and delivery.
28. A structure which is formed as a result of successive divisions of zygote.
29. • A genital disease which is caused by spherical-shaped bacteria.
    • A genital disease which infects a recently laboured mother.
    • A genital disease among its symptoms : high elevation in body temperature, face paling and bad smelling secretions from the uterus.
30. The period between the beginning of infection and the appearance of disease symptoms.
31. • A genital disease caused by spiral bacteria.
    • A disease, whose symptoms appear as a rash on the reproductive organ.

5. Complete the following statements :

1. ..... aims to secure the existence and continuity of living organisms species to prevent them from .....
2. The human male reproductive system consists of ....., two vas deferens, ... and penis.
3. The two testes locate ..... the body in a structure called .....
4. The function of the testis is to produce ..... and secrete the ..... hormone.
5. ..... is the male sex hormone, which is responsible for the appearance of .....
6. Growth of hair in certain body areas, ... of voice and development of ..... are from the signs of ..... in male.
7. The scrotal sac keeps the temperature of testes ..... degrees below the normal body temperature, which is the optimum temperature for the growth and development of .....
8. In the reproductive system of the human male, each testis is attached to highly looped tubes known as .....
9. The final stages of the growth and development of sperms take place in .....
10. Vas deferens transports ..... from ..... to ..... duct.
11. ..... glands and ..... gland are from glands associated with the male genital system.
12. The seminal fluid ..... the acidity of the .....
13. The female reproductive system consists of ..... , ... , ... and vagina.

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14. The ..... is a female reproductive organ, that has the shape and size of a peeled .....
15. The two ovaries locate inside the body in the lower part of the ..... cavity from the .....
16. Each ovary releases one ripe ..... every ..... days in exchange with the other ovary in a process called .....
17. ..... and ..... are female sex hormones.
18. The ..... hormone in males and ..... hormone in females are responsible for the appearance of secondary sexual characters.
19. From the signs of puberty in female is the occurrence of ..... every ..... days.
20. Fallopian tubes are tubes of ..... -shaped opening provided with finger-like projections to receive the ripe .....
21. The inner wall of fallopian tubes is lined with ..... to direct the ovum towards the .....
22. The two fallopian tubes are open in the ..... corners of the .....
23. The ..... is a hollow pear-shaped female sex organ that has a ..... wall.
24. The ..... extends from the uterus and ends in external genital opening.
25. The vagina is a ..... tube that expands during the .....
26. The ovum consists of ..... , cytoplasm and .....
27. The sperm consists of ..... , middle part and .....
28. The midpiece of the sperm contains ..... which are responsible for energy production needed for the sperm .....
29. Chromosomes carry ....., which are responsible for the ..... of the species.
30. ..... is the fusion of a sperm nucleus with an ovum nucleus to from the .....
31. During fertilization process, the sperm secretes ....., which dissolve the ..... of the ovum to facilitate its penetration inside the ovum.
32. The zygote cell of human carries ..... chromosome.
33. The fertilized ovum is called .....
34. ..... and ..... are examples of genital diseases which don't arise from sexual contact.
35. The infection with syphilis and ..... is caused by .....
36. The puerperal sepsis disease is caused by ..... bacteria, while syphilis disease is caused by ..... bacteria.
37. The incubation period of puerperal sepsis disease is ..... , while that of syphilis disease is .....
38. Syphilis disease can be transmitted from pregnant woman to her fetus through the ..... or during the .....
39. From the complications of syphilis disease is the appearance of ..... in different body parts like ..... and bones.

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6. Give reasons for :

1. Man can't reproduce asexually.
2. The presence of testes outside the body in a sac-like structure called the scrotal sac.
3. The man, whose testicles are still present inside the abdominal cavity is infertile (sterile).
4. The seminal fluid is alkaline.
5. The seminal fluid contains nutrients.
6. When occurrence a cut in the two vas deferens, the person becomes infertile.
7. The sperms don't die during their passage through urethra.
8. Fallopian tubes are of a funnel-shaped opening provided with finger-like projections.
9. The inner wall of fallopian tubes is lined with cilia.
10. The uterus has a muscular wall.
11. The uterus is lined with mucus membrane rich in blood capillaries.
12. The midpiece of the sperm contains mitochondria.
13. The sperm has a long and thin tail.
14. The ovum is relatively large in size.
15. During fertilization, the head of sperm secretes enzymes on the ovum.
16. Fallopian tubes ligation is considered one of the means of birth control.
17. The ovum surrounds itself with a coat after the penetration of a sperm inside it.
18. Zygote carries the complete number of chromosomes.
19. Surgical tools must be sterilized during labour.
20. A new laboured mother should avoid air currents after delivery.
21. • It is necessary to wear masks during labour process.
    • Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.
22. Smoking is harmful to reproductive health.

7. What is meant by ... ?

1. The age of menopause of females.
2. Ovulation process.
3. Fertilization process in human.
4. The sperm carries half of the genetic material of the species.
5. The pregnancy period.
6. Incubation period.

8. Mention the function or importance of each of the following :

1. Reproduction in human.
2. The two testes.
3. Testosterone hormone.
4. The scrotal sac.
5. The vas deferens.
6. The epididymis.

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7. Genital associated glands in male.
8. Seminal fluid.
9. The two ovaries.
10. Estrogen and progesterone hormones.
11. Fallopian tubes.
12. The placenta.
13. The uterus.
14. The cellular membrane of the ovum.
15. The midpiece of a sperm.
16. The tail of a sperm.
17. Chromosomes.
18. Enzymes secreted from the sperms.

9. Extract the unsuitable word or statement, then write the relation between the rest :

1. Testes / Fallopian tubes / Vas deferens / Scrotum.
2. Thyroid gland / Prostate gland / Cowper's gland / Seminal vesicles.
3. Ovary / Epididymis / Uterus / Vagina / Cervix.
4. Head / Tail / Midpiece / Cytoplasm.
5. Development of breasts / Harshness of voice / Menstrual cycle / Growth of hair in armpit and pubic.
6. AIDS / Gonorrhea / Syphilis / Measles.
7. Vomiting / High body temperature / Chilling / Face paling.

10. What happens when ... ?

1. The two testes present inside the body and don't come out during the embryo development.
2. The two vas deferens were cut.
3. The inability of the sex glands to secrete the semen.
4. The seminal fluid is not alkaline.
5. The testes are unable to secrete testosterone hormone.
6. The ovary is unable to secrete estrogen hormone.
7. The ovary is unable to secrete progesterone hormone.
8. The fallopian tubes are not ciliated and have no muscular wall.
9. Contraction and relaxation of the muscles of the wall of the fallopian tube.
10. The fallopian tubes are ligated.
11. The mucus membrane lining the uterus has no blood capillaries.
12. The umbilical cord is cut during pregnancy.
13. The woman reaches menopause.
14. The midpiece of a sperm does not contain mitochondria.
15. The sperm lost its tail.
16. The sperm head is unable to secrete enzymes on the ovum.
17. Penetration of one sperm to the ovum.
18. • The wound of recently laboured mother is infected by spherical bacteria.
    • The recently laboured mother is subjected to air currents.
19. The syphilis infected person is not treated.

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11. Compare between :

1. Testes and ovaries (related to : the position and function).
2. 📖 The sperm and the ovum (three points only).
3. Gametes in human and gametes in plant.
4. Puerperal sepsis and syphilis (related to : the microbe causing disease - methods of infection and incubation period).

12. Various questions :

(1) Mention the signs of puberty in :

1. Males.
2. Females.

(2) Write briefly the effect of smoking and addiction on the genital system.

(3) Mention the symptoms of the following diseases and the preventive methods :

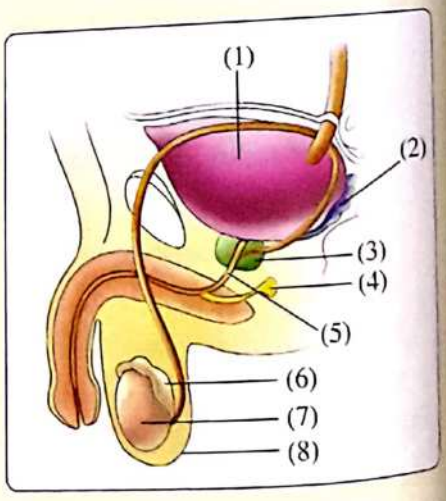
1. Puerperal sepsis.
2. 📖 Syphilis.

(4) Draw an illustration showing the structure of :

1. 📖 The female human ovum.
2. The male human sperm.

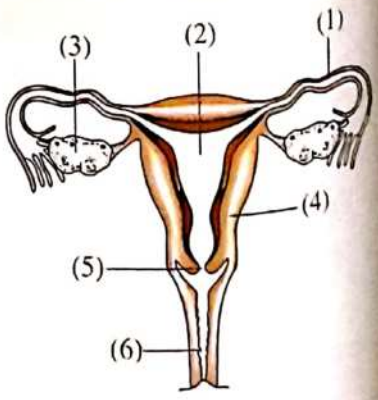
13. Study the following figures, then answer the questions :

(1) Study the opposite figure, then answer the following questions :



1. What is the name of this system ?
2. What does each number in the figure refer to ?
3. What is the function of parts (2), (3) and (4) ?
4. Name the part (vessel) that carries sperms to part number (5).
5. The organ (7) has two functions, mention them.
6. What happens if part (7) exists inside the body ?
7. What are the glands that open in part (5) ?

(2) 📖 Study the opposite figure which represents the female genital system, then answer the following questions :



1. Replace the numbers present in the figure with suitable labels.
2. What is the organ in which :
   a. Ova are produced ?
   b. The ovum is fertilized ?
   c. The embryo is delivered to life ?

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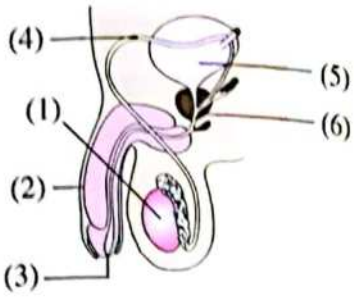
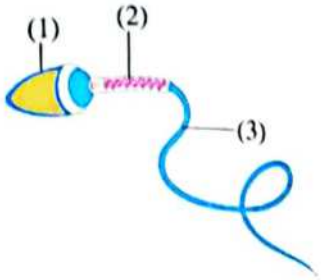
(3) Study the opposite figure which represents the male genital system, then answer the following questions :



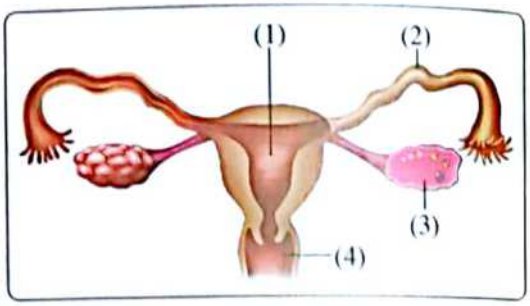
1. Replace the numbers with the suitable labels.
2. Write the number of the part, in which :
   a. Sperms are produced. b. Secretion of semen.
   c. Transfer of sperms from the testes to the penis.

(4) Study the opposite figure, then answer the following :



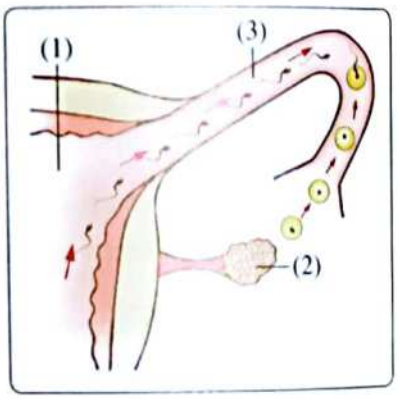
1. What does the figure represent ?
2. Label the figure.
3. Mention the importance of the part (2).
4. How does part (1) penetrate the ovum ?

(5) The opposite figure represents one system in the human body, mention its name, then answer the following :



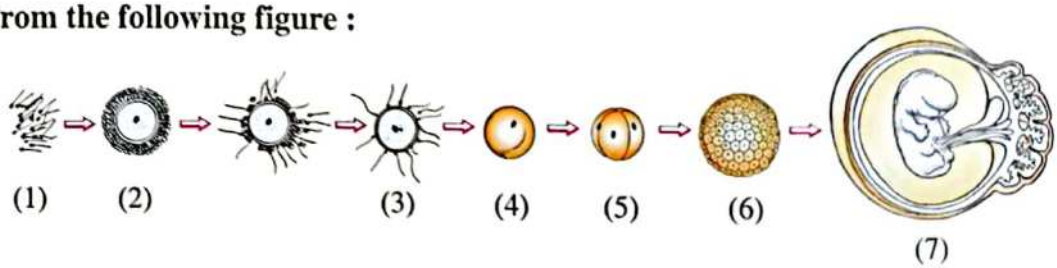
1. Label it from (1) to (4).
2. What is the character of part (2) to help a fertilized ovum to pass into part (1) ?
3. Part (3) has a secretion activity. Mention the products and explain their benefits.
4. What happens on ligation of part (2) ?

(6) The opposite figure is the left part of the human female reproductive system :



1. Write what does each number indicate?
2. What is the function of the organ number (1) ?
3. Mention the process, which takes place in part (3).
4. The organ number (2) usually releases one ripe ovum every ..... days.
   a. 14 b. 28 c. 42 d. 56

(7) From the following figure :



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1. What is the process which is referred by the structure (3) ? And what is the place of its occurrence ?
2. What is the number of chromosomes present in the cells (1) , (2) and (7) ?
3. **Complete :**

Structure (4) refers to ..... which is formed in the ..... but structure (7) refers to ..... which is formed in the .....

(8) The opposite two figures show two kinds of bacteria, which cause two different diseases related to human reproductive system :

1. Detect the shape of bacteria in each figure.
2. Mention the kind of disease, which is caused by each of them.
3. Mention the incubation period of the disease caused by the bacteria in fig. (A).
4. Mention the complications of the disease caused by the bacteria in fig. (B).

Fig. (A)

Fig. (B)

14. Creative thinking :

Write down as far as you know about the methods of prevention against diseases of the genital tract.

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Thinking Skills Questions

1. Choose the correct answer :

1. The adult female produces about ..... ova during 3 years "assuming no pregnancy happens".

a. 12 b. 13 c. 36 d. 39

2. The small-sized sperm joins the large-sized ovum to form genetic material and genetic traits at a ratio .....

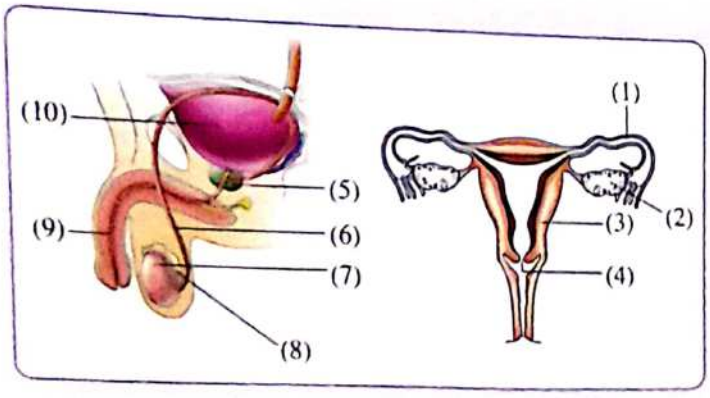
a. 1 : 2 b. 1 : 1 c. 2 : 1 d. 1 : 4

3. **From the two following figures :**

(A) Part number ..... and part number ..... have the same two functions in the sexual reproduction process.

a. (1) , (6) b. (2) , (9)

c. (3) , (5) d. (4) , (7)



(B) Part number (2) has the same function of part number ..... in the reproduction process.

a. (5) b. (7)

c. (8) d. (10)

2. Put (✓) or (×) , then correct what is wrong :

1. Sperms are completely matured when they are released from testes. ( )

2. Fertilized ovum contains the same number of chromosomes as ripe ovum. ( )

3. Sperm contains 23 chromosomes. Give a reason.

4. What happens if an ovary produces testosterone hormone instead of estrogen hormone ?

Project
On UNIT THREE

A project to develop the critical thinking
"Distinguish between facts and non-facts"

*** Some of the following statements represent facts and others doesn't. Put (✓) in front of sentences that represent facts and (✗) in front of those that represent non-facts, with your scientific evidence :**

1. The colour of sepals of calyx differ according to the difference of the type of flower. ( )
.....

2. The flower which makes mixed pollination also can make self pollination. ( )
.....

3. The nature of pollen grains differ according to the difference in the way through which they are transmitted. ( )
.....

4. Banana plant can reproduce through offshoots. ( )
.....

5. The scion that is used in reproduction by grafting contains only one bud. ( )
.....

6. Cultivation through tissue culture produces a harvest much more than that is produced by the ordinary ways of cultivation. ( )
.....

7. The two testes are located outside the male body and inside the female body. ( )
.....

8. The way of reproduction of both potato and sweet potato is similar because both of them grow under the surface of the soil. ( )
.....

9. Mixed pollination can occur in malt plant. ( )
.....

10. Number of sperms secreted from a male testis is equal to the number of ova secreted from a female ovary. ( )
.....

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Glossary

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Unit 1

Lesson 1

periodic motion	حركة دورية
oscillatory (vibrational) motion	حركة اهتزازية
transitional motion	حركة انتقالية
regularly repeated	تتكرر بانتظام
wave motion	حركة موجية
simple pendulum	بندول بسيط
original position	مكان أصلى
time intervals	فترات زمنية
velocity (speed)	سرعة
displacements	إزاحات
maximum value	أعلى قيمة
oscillating body	جسم مهتز
kinetic energy	طاقة الوضع
vanishes	تنعدم
tuning fork	شوكة رنانة
spring	زنبرك
stretched string	وتر مشدود
motion of swing	حركة الأرجوحة
rotary bee	النحلة الدوارة
graphical representation	تمثيل بيانى
smooth paper tape	شريط ورق أملس
two rolls	بكرتين
simple harmonic motion	حركة توافقية بسيطة
amplitude	سعة الاهتزازة
complete oscillation	اهتزازة كاملة
periodic time	زمن دورى
frequency	تردد
maximum displacement	أعلى إزاحة
measuring unit	وحدة قياس
two successive times	مرتين متتاليتين
inverse relation	علاقة عكسية

Lesson 2

wave	موجة
concentric circles	دوائر متحدة المركز
transfer	ينقل
disturbance	اضطراب
propagate	تنتشر
direction of waves propagation	اتجاه انتشار الأمواج
incense stick	عود بخور
horizontally	أفقيًا
sound waves	موجات صوتية
medium particles	جزيئات الوسط
certain moment	لحظة معينة
definite direction	اتجاه ثابت (موحد)
line of wave propagation	خط انتشار الموجة
transverse waves	أمواج مستعرضة
longitudinal waves	أمواج طولية
mechanical waves	أمواج ميكانيكية
electromagnetic waves	أمواج كهرومغناطيسية
solar explosions	الانفجارات الشمسية
thunder	رعد
lightning	برق
vacuum (free space)	فراغ
medium (pl. media)	وسط (أوساط)
perpendicular	عمودى
crests	قمم
troughs	قيعان
highest point	أعلى نقطة
lowest point	أقل نقطة
compressions	تضاغطات
rarefactions	تخلخلات
highest density	أعلى كثافة
lowest density	أقل كثافة
equivalent to	مُكافئ لـ
sprians and cramps	التواءات وتشنجات
nervous tension	توتر عصبي
wavelength	طول موجى
wave velocity	سرعة الموجة
wave frequency	تردد الموجة
distance	مسافة
sound velocity	سرعة الصوت
directly proportional	تتناسب طرديًا
waves propagation law	قانون انتشار الأمواج

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Unit 2

Lesson 1

properties	خصائص
external factor	عامل خارجى
ear	أذن
sense of hearing	حاسة السمع
vibration of bodies	أهتزاز الأجسام
nature of sound waves	طبيعة الموجات الصوتية
different media	أوساط مختلفة
musical tone	نغمة موسيقية
noise	ضوضاء
uniform frequency	تردد منتظم
non-uniform frequency	تردد غير منتظم
drill	حفار
loudspeakers	مكبرات صوت
comfortable	مُريح
sound pitch	درجة الصوت
sound intensity	شدة الصوت
sound quality	نوع الصوت
rough (harsh)	غليظ
sharp (soft)	رفيع
segment	جزء
length	طول
air column	عمود هواء
Savart's wheel	عجلة ساڤار
gear's teeth	أسنان الترس
strong	قوى
weak	ضعيف
noise intensity	شدة الضوضاء
vibrating surface	سطح مهتز
density of medium	كثافة الوسط
direction of wind	اتجاه الرياح
faint	يضعف
inverse square law of sound	قانون التربيع العكسى فى الصوت
resonance box	صندوق رنان
vacuum pump	مخلخلة هواء
glass jar	ناقوس زجاجى
ear plugs	سدادات الأذن
fundamental tone	نغمة أساسية
harmonic tone	نغمة توافقية
accompany	مصاحبة
audible sounds	أصوات مسموعة
non-audible sounds	أصوات غير مسموعة
sonic waves	موجات سمعية
ultrasonic waves	موجات فوق سمعية
infrasonic waves	موجات تحت السمعية
transmit	تنقل
translate	تُترجم
medical fields	مجالات طبية
industrial fields	مجالات صناعية
military fields	مجالات حربية
breaking	تفتيت
kidney and ureter stones	حصوات الكلى والحالب
surgical	جراحى
operations	عمليات
malignant tumors	أورام سرطانية
sterilize	تعقيم
landmines	الألغام الأرضية

Lesson 2

sense of vision	حاسة الإبصار
nature of light waves	طبيعة الموجات الضوئية
visible light	ضوء مرئى
electromagnetic spectrum	الطيف الكهرومغناطيسى
light analysis	تحليل الضوء
light behaviour	سلوك الضوء
straight lines	خطوط مستقيمة
spectrum colours	ألوان الطيف
glistening surface	سطح لامع
indigo	نيلى
violet	بنفسجى
triangular glass prism	منشور ثلاثى زجاجى
prism base	قاعدة المنشور
prism apex	رأس المنشور
quanta	كمات
photons	فوتونات
home decorations	ديكورات منزلية

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spot lights	كشافات ضوئية
artifacts	لوحات فنية
ornamented lamps	مصابيح الزينة
stand lamps	الأباجورات
transparent medium	وسط شفاف
translucent medium	وسط شبه شفاف
opaque medium	وسط معتم
permit	سَمَحَ
thickness	سُمك
frosted (flint) glass	زجاج مصنفر
molasses	عسل أسود
light intensity (brightness)	شدة الاستضاءة
inverse square law of light	قانون التربيع العكسى فى الضوء

Lesson 3

light reflection	انعكاس الضوء
light refraction	انكسار الضوء
shadow	الظل
refract	ينكسر
inverted images	صور مقلوبة
regular (uniform) reflection	انعكاس منتظم
irregular (non-uniform) reflection	انعكاس غير منتظم
recoil (return back)	ترتد
leather	جلد
light beam	حزمة ضوئية
normal	عمود مقام
barrel	برميل
optical density	كثافة ضوئية
rectangular block	متوازى مستطيلات
angle of refraction	زاوية الإنكسار
angle of emergence	زاوية الخروج
facts	حقائق
absolute refractive index of the medium	معامل الإنكسار المطلق لمادة الوسط
apparent position	موضع ظاهرى
real position	موضع حقيقى
extensions	امتدادات
mirage	السراب

Unit 3

Lesson 1

reproduction	تكاثر
sexual reproduction	تكاثر جنسى
flowering plants	نباتات زهرية
modified to	تحورت إلى
floral bud	برعم زهرى
axle	محور
floral whorls	محيطات زهرية
calyx	الكأس
sepal	سبلة
blooming	تفتح
corolla	التويج
petal	بتلة
androecium	طلع
stamen	سداة
filament	خيط
anther	متك
pollen grain	حبة لقاح
gynoecium	متاع
carpel	كربلة
stigma	مبسم
style	القلم
ovary	مسقى
ovum (pl. ova)	بويضة/بويضات
receptacle	تخت
pedicle	عنق
typical flower	زهرة نموذجية
Hay-fever	حمى القش
bisexual (hermaphrodite) flower	زهرة خنثى
male flower	زهرة مذكرة
female flower	زهرة مؤنثة
palm trees	أشجار النخيل
pollination	تلقيح
fertilization	إخصاب
self pollination	تلقيح ذاتى
mixed pollination	تلقيح خلطى
hanged	مدلاة
feathery-like	ريشية
sticky	لزجة
scented	ذات رائحة ذكية
artificial pollination	تلقيح صناعى
generative	مولدة
germination	إنبات
micropyle	نقير
zygote	زيجوت
embryo	جنين
degenerate	يتحلل
asexual reproduction	تكاثر لاجنسى
vegetative reproduction	تكاثر خضرى
cut	عُقله
reproduction by cutting	التكاثر بالتعقيل

reproduction by grafting	التكاثر بالتطعيم
tissue culture	زراعة الأنسجة

Lesson 2

secure	ضمان
extinction	الإنقراض
mate	يتزاوجا
male reproductive system	الجهاز التناسلى الذكرى
testis (pl. testes)	خصية / خصيتين
scrotal sac (scrotum)	كيس الصفن
thighs	الفخذين
puberty	البلوغ
sperms	حيوانات منوية
optimum	مناسبة
infertile (sterile)	عقيم
vas deferens	الوعاء الناقل
convoluted tubes	أنابيب ملتفة
urinogenital duct (urethra)	قناة بولية تناسلية
seminal fluid	سائل منوى
neutralize	يُعادل
penis	القضيب
female reproductive system	الجهاز التناسلى الأنثوى
ovary	مبيض
peeled almond	اللوزة المقشورة
abdominal cavity	التجويف البطنى
cervix	عنق الرحم
vagina	المهبل
fallopian tubes	قناتا فالوب
ripe = mature	ناضجة
ovulation	تبويض
pregnancy	حمل
armpit	الإبط
pubic	العانة
breasts	الثديين
menstrual cycle	الدورة الشهرية
menopause	سن اليأس
projections	زوائد
cilia	أهداب
uterus	الرحم
pear-shaped	كمثرى الشكل
hollow	أجوف
fetus	الجنين
blood capillaries	شعيرات دموية
placenta	المشيمة
umbilical cord	الحبل السرى
pelvic cavity	تجويف الحوض
urinary bladder	المثانة البولية
labor = labour	وقت الطلق (الولادة)
chromosomes	الكروموسومات
genetic material	مادة وراثية
hereditary traits	صفات وراثية
fusion	اندماج
secrete	يفرز
secretions	إفرازات
facilitate	يُسهّل
penetrate	يخترق
surround	يحيط بـ
implanted	تنغرس فـ
successive divisions	انقسامات متتالية
differentiate	يُفرق
delivery	الولادة
genital system diseases	أمراض الجهاز التناسلى
sexual contact	الاتصال الجنسى
uterine cancer	سرطان الرحم
prostate cancer	سرطان البروستاتا
puerperal sepsis	حمى النفاس
gonorrhea	السلان
syphilis	الزهرى
droplets	رذاذ
infected	مُصاب
throat	الزور
tonsillitis	اللوزتين
high elevation	ارتفاع شديد
chilling	قشعريرة
face paling	شحوب فى الوجه
sterilizing	تعقيم
incubation period	فترة الحضانة
hard ulcer	قرحة صلبة
rash	طفح
dark brass coloured	لون نحاسى غامق
tumors	أورام
addiction	إدمان

CamScanner

SCIENCE

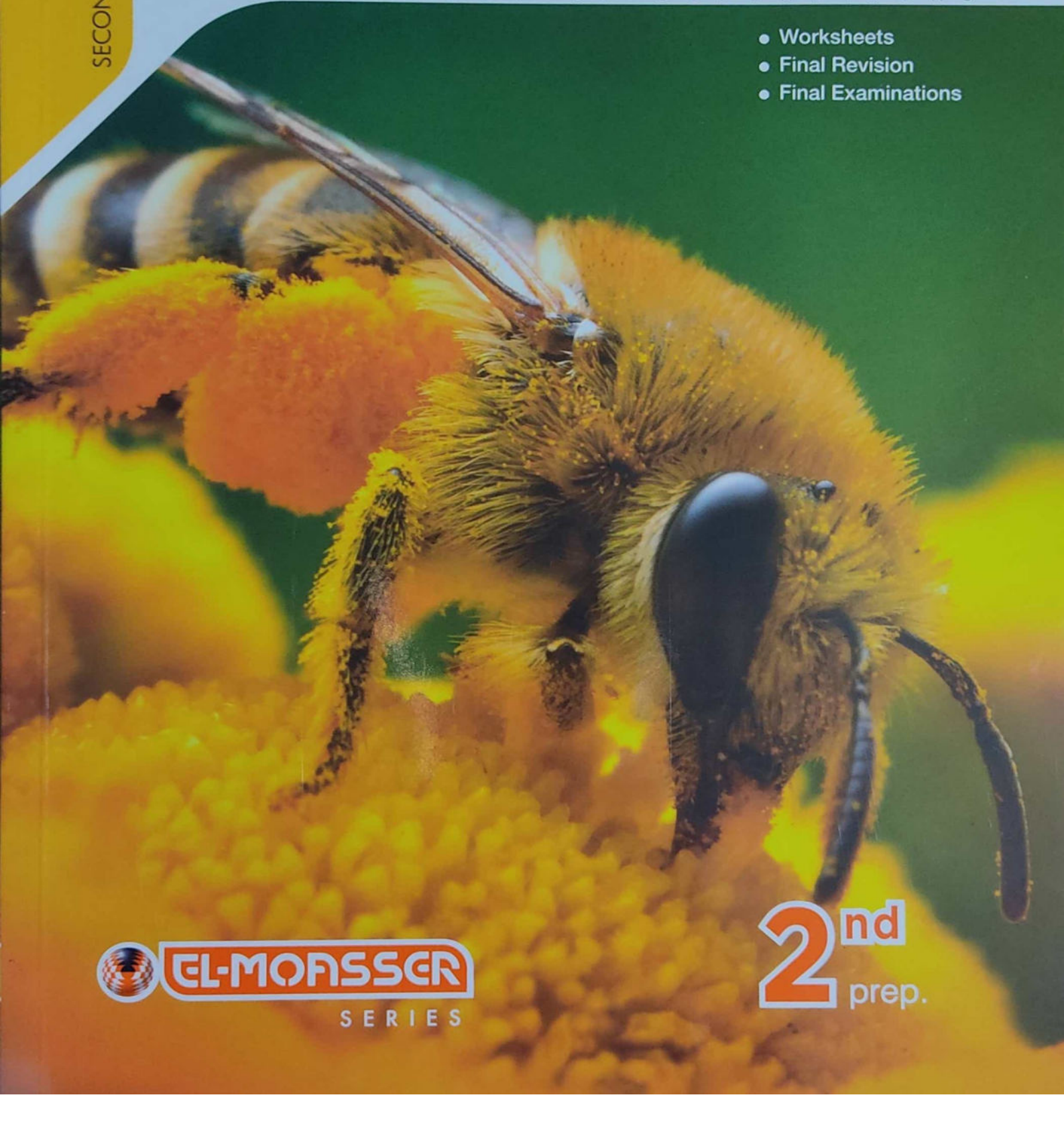
NOTEBOOK

2023

SECOND TERM

BY A GROUP OF SUPERVISORS

- Worksheets
- Final Revision
- Final Examinations



EL-MOASSER SERIES

2nd prep.

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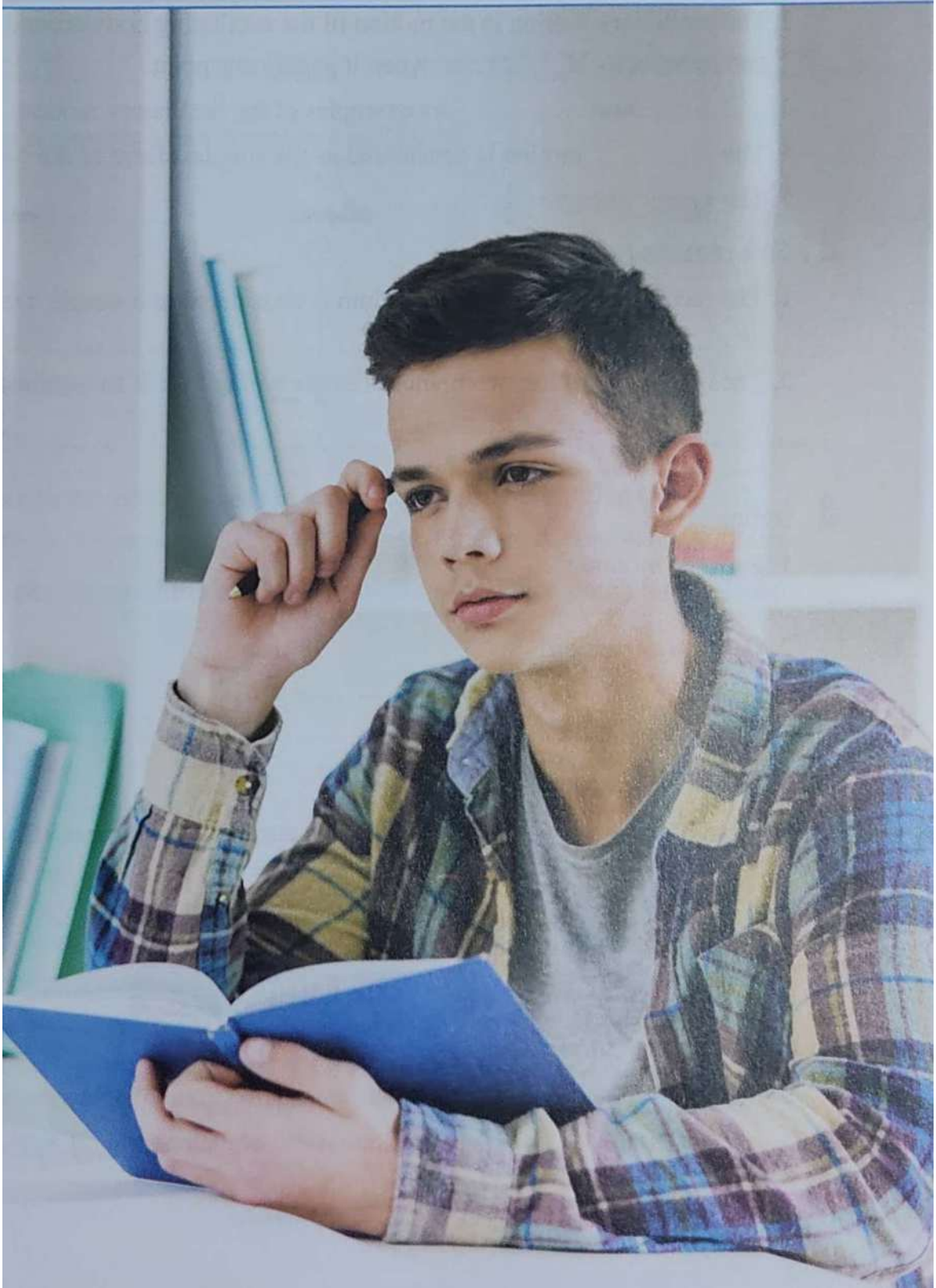


UNIT 1

Lesson One

Oscillatory Motion

Worksheet 1

1. Complete the following statements :

1. ..... and ..... are examples of periodic motion.
2. The oscillatory motion is the motion of the oscillating body around its ..... point and its velocity is ..... when it passes this point.
3. ..... and ..... are examples of the oscillatory motion.
4. The ..... motion is considered as the simplest form of the oscillatory motion.
5. The kinetic energy = $\frac{1}{2}$ ..... × .....

2. Give reasons for :

1. The motion of a wall clock pendulum is considered as a simple harmonic motion.

.....

2. The oscillation of the two branches of the tuning fork is an oscillatory periodic motion.

.....

.....

3. Define :

1. Periodic motion. *(Al-Mostakbal Modern Sch. / Giza 2019)*

.....

2. Oscillatory motion. *(El-Agamy Zone / Alex. 2019)*

.....

.....

4. What happens when ... ?

The oscillating body passes its rest position during its movement. (Concerning its velocity)

(El-Sayeda Khadija Official Lang. Sch. / Cairo 2022)

.....

Worksheet 2

1. A. Choose the correct answer :

1. The ..... includes four successive maximum displacements.

a. amplitude b. complete oscillation c. wavelength d. half complete oscillation

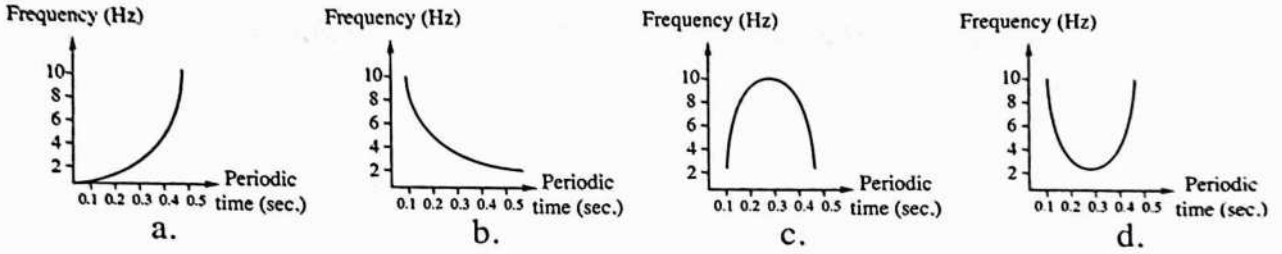
2. If the frequency of an oscillating body is 100 Hz, so the periodic time is ..... seconds.

(Belkas zone / Dakahlia 2019)

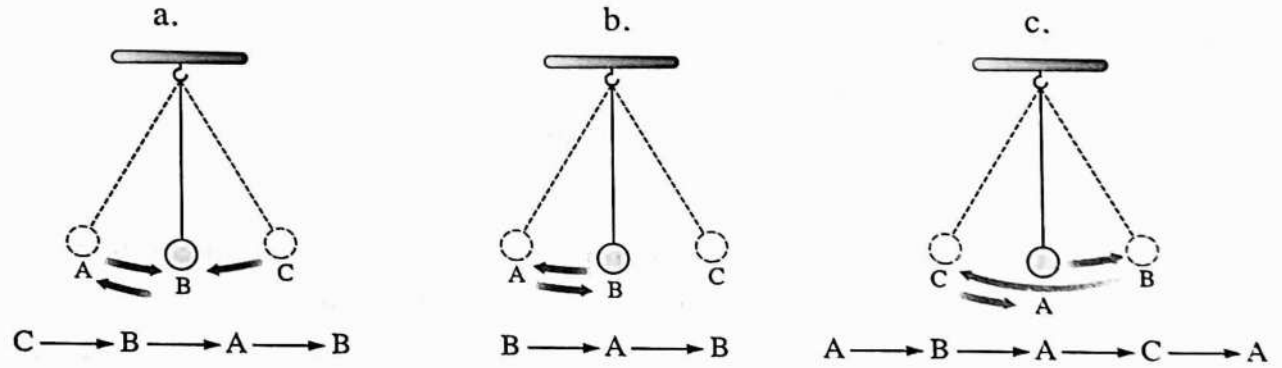
a. 100 b. 0.01 c. 0.1 d. 1×10^2

3. Which figure represents the relation between the periodic time and the frequency ? .....

(El-Behaira 2022)



4. Which figure represents a half complete oscillation ? .....



5. The time taken by the vibrating body to make one complete oscillation is .....

a. amplitude. b. frequency. c. periodic time. d. complete oscillation.

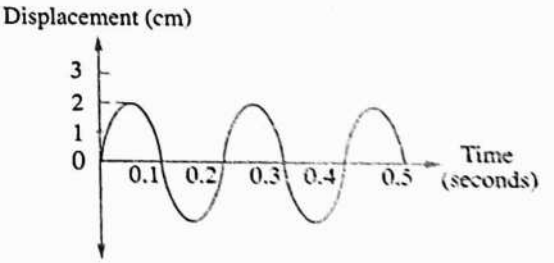
B. From the opposite figure of the oscillatory motion of a simple pendulum, calculate :

1. Amplitude.
2. Periodic time.
3. Frequency.

.....

.....

.....



2. A. Put (✓) or (✗) :

1. Complete oscillation is the maximum displacement done by the oscillating body away from its rest position. ( )
2. The periodic time is the time taken by an oscillating body to make 4 successive maximum displacements away from its rest position. ( )
3. The oscillating body which its frequency is 50 Hz, it takes 50 sec. to make one complete oscillation. ( )

B. What's meant by ...?

1. The amplitude of an oscillating body is 0.2 metre. *(El-Gomrok zone / Alex. 2019)*

.....

.....

2. The frequency of a tuning fork is 652 Hz.

.....

3. The time taken by the oscillating body to make 30 complete oscillations is 10 seconds. *(Minia Ksawmia sch. / El-Minia 2019)*

.....

4. The oscillating body makes 540 oscillations in one and a half minute. *(Patriarchal College / Cairo 2019)*

.....

3. A. Write the scientific term :

1. The reciprocal of the frequency. (.....)
2. The simplest form of the oscillatory motion. (.....)

B. Give reasons for :

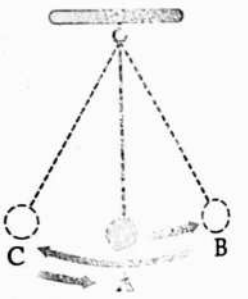
1. When the periodic time of a tuning fork increases, the number of complete oscillations which made by it in one second will decrease.

.....

2. The periodic motion of the clock hands is not considered an oscillatory motion.

.....

4. A. Study the opposite figure, then answer the following questions :



1. Point (A) represents .....
2. The distance $\overrightarrow{AB}$ represents ..... and it equals the distance .....
3. The vibrating body has its maximum kinetic energy at point(s) .....
4. When the pendulum makes 600 complete oscillations in two minutes, its frequency = ... and its periodic time = ...

B. What happens when ... ?

The ball of the pendulum reaches its maximum displacement away from its rest position (Concerning its velocity).

.....

Worksheet 3

1. A. Complete the following statements :

1. Wave motion is a kind of ..... motion.
2. Waves are classified according to ..... into mechanical waves and electromagnetic waves.

B. Give reasons for :

1. Water waves are mechanical waves, while light waves are electromagnetic waves.

.....

.....

2. We see lightning before hearing thunder. *(El-Sahel Edu. Zone / Cairo 2022)*

.....

.....

2. A. Put (✓) or (✗), then correct what is wrong :

1. The movement of the clock pendulum is considered as a wave motion. ( )

(Al-Montazah Edu. Zone / Alex. 2022)

.....

2. Visible light waves and radio waves are examples of electromagnetic waves. ( )

.....

3. Waves are classified according to the medium at which they propagate into transverse and longitudinal waves. ( )

.....

B. Compare between : *(Heliopolis Modern Lang. Sch. / Cairo 2022)*

Mechanical waves and electromagnetic waves.

Mechanical waves	Electromagnetic waves
.....	.....
.....	.....
.....	.....
.....	.....

3. A. Mention the importance of the wave. *(Shebeen El-Koum Edu. Zone / Monofia 2022)*

.....

.....

B. From the opposite figure :

1. What is the type of this wave ?

.....

2. What are the scientific terms that indicated by the numbers (1), (2) ?

- No. (1) indicates : .....
- No. (2) indicates : .....

4. What happens when ... ?

1. You close a vibrating tuning fork to a burning candle.

.....

2. The vibration of the medium particles along the direction of wave propagation. *(Ismailia 2019)*

.....

Worksheet 4

1. Complete the following :

1. Transverse waves are formed of ..... and ..... *(Gharbia 2022)*
2. The crest in the transverse wave corresponds to ..... in the longitudinal wave, while the trough corresponds to ..... *(Baverly Hills sch. / Giza 2019)*
3. The ..... is the lowest point of medium particles in the transverse wave.
4. In the transverse waves, the particles of the medium vibrate ..... the wave propagation direction, while in the longitudinal waves, the particles of the medium vibrate ..... the direction of wave propagation. *(Patriarcal college / Cairo 2019)*

2. A. What is meant by ...?

1. Wavelength of a transverse wave is 30 cm.

.....

2. Rarefaction. *(Deir Mwas Official Sch. for Lang. / El-Menia 2022)*

.....

3. Crest.

.....

4. The distance between the centres of successive compression and rarefaction equals 1 metre.

.....

B. Give reasons for :

1. The waves due to vibration of strings are mechanical transverse waves.

(El-Ma'aref Private sch. / Cairo 2019)

.....

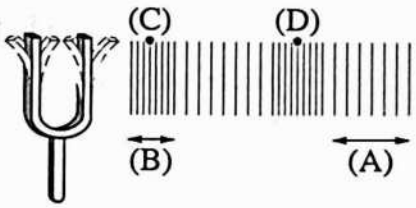
.....

2. Jacuzzi is used in some hospitals and sport clubs.

.....

.....

3. A. Study the opposite figure, then answer the following :



1. Label points (A) and (B).

.....

2. What is the kind of the produced waves ?

.....

3. What's the name of the distance between (C) and (D) ?

.....

B. What are the results of ...?

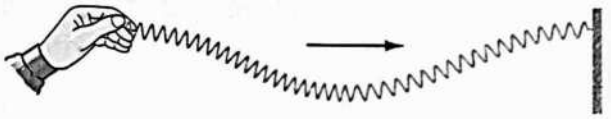
1. The distance between two successive crests of a transverse wave is doubled.

.....

2. Propagation of a wave in a medium as pulses of crests and troughs (Concerning the particles of the medium).

.....

4. A. Choose the correct answer :



1. In the opposite figure, the particles of the medium (the coil) vibrate .....

(Fayoum 2019)

a. to the right only. b. upwards only.

c. upwards and downwards. d. to the right and left.

2. ..... wave is an example of the longitudinal waves. *(El-Agamy zone / Alex. 2019)*

a. Water b. Sound c. Light d. Radio

3. If the distance between the centre of the third rarefaction and the centre of the fifth rarefaction on the wave propagation is 10 cm, then the wavelength of this wave is .....

(Dokki zone / Giza 2019)

a. 40 cm. b. 20 cm. c. 10 cm. d. 5 cm.

B. Write the scientific term :

1. The measuring unit of the wavelength. (.....)

2. A design consists of a tub, where water moves in the form of circular waves for treating sprains and cramps. (.....)

Worksheet 5

1. A. What does each of the following relationship indicate ?

1. $\frac{\text{Distance covered by the wave}}{\text{Time}}$ = ...
2. $\frac{1}{\text{Frequency}}$ = ...
3. $\frac{\text{Wave velocity}}{\text{Wave frequency}}$ = ... *(Patriarchal college / Cairo 2019)*

B. Write the scientific term :

1. The maximum displacement of medium particles away from their rest positions. *(Cairo 2019)* (.....)
2. The relationship between the wave frequency and the wavelength in the wave motion. (.....)
3. It is the time taken to make one wave. (.....)

2. A. What is meant by ...?

1. The velocity of all electromagnetic waves in space equals 3×10^8 m/sec.

   .....
2. Frequency of a transverse wave is 50 waves/second.

   .....
3. The wavelength of a sound wave is 30 cm. *(Assiut 2022)*

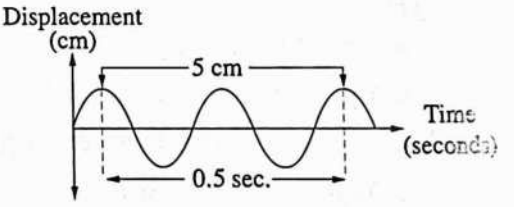
   .....

B. Sound waves have frequency 400 Hz in air and its wavelength is 85 cm. Calculate the velocity of these waves. *(Damietta 2019)*

.....

.....

3. A. Complete the following :



1. From the opposite figure :
   a) Wavelength = ... cm.
   b) Periodic time = ... second.
2. Hertz is the measuring unit of .....
3. ..... is the measuring unit of amplitude, while ..... is the measuring unit of wave velocity.
4. The velocity of sound waves through air is ..... than its velocity through liquids, while its velocity through solids is ..... than that through liquids.
5. Wavelength = $\frac{\text{Wave velocity}}{\text{.....}}$
6. The wave frequency is ..... in one second.

B. What happens when ... ?

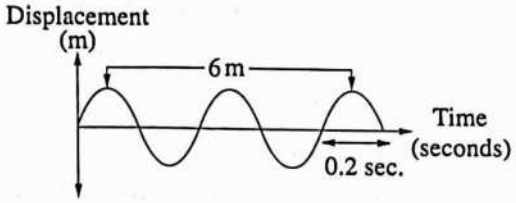
1. The frequency of a wave and its velocity of propagation decrease to quarter (Concerning its wavelength).

.....

2. The frequency of a wave and its wavelength increase to double (Concerning the velocity of wave propagation).

.....

4. A. From the opposite figure, find :



1. Wavelength.
2. The time of one wave (periodic time).
3. Frequency.
4. Wave velocity.

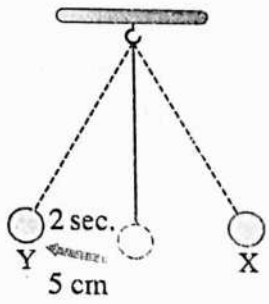
.....

.....

.....

.....

B. From the opposite figure, choose the correct answer :



1. The periodic time = ...
   a. 2 sec. b. 8 sec.
   c. 6 sec. d. 3 sec.
2. The frequency = ...
   a. 0.2 sec. b. 0.4 Hz.
   c. $\frac{1}{8}$ cycle/sec. d. 0.4 m.
3. Amplitude = ...
   a. 0.2 sec. b. 0.4 Hz. c. 3 cm. d. 5 cm.
4. The distance covered in a complete oscillation = ...
   a. 0.2 sec. b. 0.4 Hz. c. 20 cm. d. 5 cm.

General Exercise of the School Book on Unit One

1. Choose the right answer :

1. If the distance between the centre of the third compression and the centre of the fifth compression on the wave propagation is 20 cm, then the wavelength of this wave is .....

   a. 40 cm. b. 20 cm. c. 10 cm. d. 5 cm.

2. In the opposite figure, the particles of the medium (the coil) vibrate .....

   a. to the right only. b. upwards only.

   c. to right and left. d. upwards and downwards.

3. If the frequency of an oscillating body was 6 Hz, then the periodic time is ..... seconds.

   a. 6 b. 3 c. $\frac{1}{3}$ d. $\frac{1}{6}$

2. Cross the odd word out. Then, state the relation among the remaining words :

1. Sound wave - Light wave - Radio wave - Infrared wave.

   .....

2. Pendulum motion - Spring motion - Rotary bee motion - Stretched string motion.

   .....

3. Give reasons for each of the following :

1. Oscillatory motion is considered as a periodic motion.

   .....

2. The waves due to vibration of strings are mechanical transverse waves.

   .....

3. We see lightning before hearing thunder.

   .....

4. What are the results of ...?

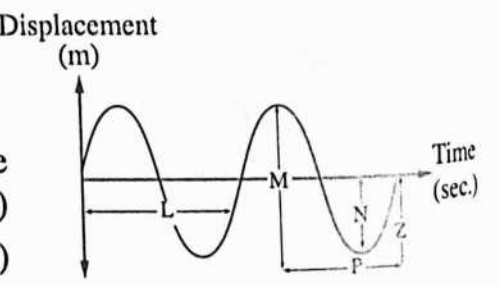
1. The vibration of the particles of a medium in a direction normal (perpendicular to) the direction of wave propagation.

   .....

2. The increase in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant.

   .....

5. The opposite figure represents an oscillatory motion for a simple pendulum. Choose the letter that denotes :



1. The oscillation of the pendulum forming $\frac{3}{4}$ complete oscillation. (.....)

2. The amplitude. (.....)

Model Exams on Unit 1

Model Exam 1

56

Answer the following questions :

Question 1 *14 marks*

A Choose the correct answer :

1. If the periodic time of a tuning fork is 4 sec., so the frequency is .....
   a. 4 Hz. b. 6 Hz. c. $\frac{1}{4}$ Hz. d. $\frac{1}{6}$ Hz.
2. The sound waves are ..... waves. *(Giza 2022)*
   a. mechanical longitudinal b. mechanical transverse
   c. electromagnetic longitudinal d. electromagnetic transverse
3. The wave transfers ..... in the direction of propagation. *(Giza 2022)*
   a. molecules b. energy c. matter d. force
4. The double of the horizontal distance between a crest and a trough of a transverse wave is known as the .....
   a. frequency. b. wavelength. c. amplitude. d. wave velocity.

B Put (✓) or (✗) :

1. The simple pendulum is an example of the oscillatory motion. ( )
2. The periodic time is the time taken by the oscillating body to make one complete oscillation. ( )
3. The wavelength for a longitudinal wave is the distance between the first crest and the second crest. ( )
4. The transverse wave is a disturbance that causes the movement of medium particles from their positions. ( )

C Give a reason for :

The motion of a swing is an example of the oscillatory motion.

.....

Question 2 *14 marks*

A Write the scientific term :

1. The measuring unit of wave velocity. (.....)
2. Physiotherapy tubs which are used to treat sprains, cramps and nervous tension. (.....)
3. Maximum displacement made by the oscillating body away from its rest position. *(El-Seddeek Sch. / Cairo 2019)* (.....)

4. It is the motion produced as a result of the vibration of the particles of the medium in a certain moment and in a definite direction. (.....)

(El-Ma'aref private sch. / Cairo 2019)

B Study the following figures, then answer the following questions :

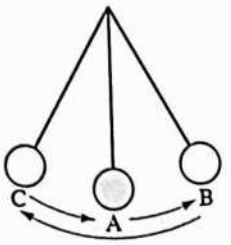


Fig. (1)

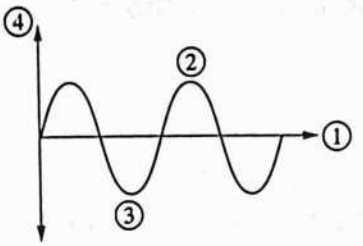


Fig. (2)

1. What are these figures represent ?

.....

2. Label the figure (2).

① ..... ② ..... ③ ..... ④ .....

3. What is the number of displacements in fig. (1) ?

.....

C Compare between :

Transverse wave and longitudinal wave (definition only).

.....

.....

.....

(Manor House Internationl sch. / Cairo 2019)

Question 3 14 marks

A Complete the following statements :

1. Light is ..... waves but sound is ..... waves. *(El Seddeek sch. / Cairo 2019)*
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave. *(El-Behaira 2022)*
3. The complete oscillation includes ..... displacements, each is called ..... *(Abou El-Nomros Edu. Zone / Giza 2022)*
4. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves. *(Heliopolis Modern Lang. Sch. / Cairo 2022)*

B Correct the underlined words :

1. The movement of the clock pendulum is an example of <u>wave motion</u>. (.....)

(Al-Montazah Edu. Zone / Alex. 2022)

2. The kinetic energy of the pendulum decreases by increasing its velocity. (.....)

3. The simple harmonic motion is considered as the simplest form of transition motion.

(Educational Directorate / Ismailia 2019) (.....)

4. The relation between frequency and wavelength is constant relation.

(Middle zone science Inspectorate / Alex. 2019) (.....)

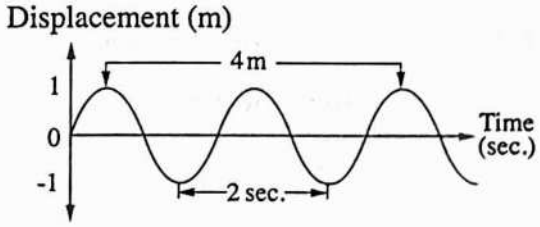
C What is meant by ... ?

The distance covered by a water wave in one minute is 9×10^4 m.

.....

Question 4 *14 marks*

A From the opposite figure, find :



1. Amplitude.
2. Periodic time.
3. Frequency.
4. Wavelength.

.....

.....

.....

(Middle zone / Alex. 2019)

B Cross out the odd word. Then, state the relation among the remaining words :

1. Sound waves / Light waves / Infrared waves / Radio waves.

.....

(Heliopolis Modern Lang. Sch. / Cairo 2022)

2. Water waves / Sound waves / Light waves / Pendulum motion.

.....

3. Pendulum motion / Spring motion / Rotary bee motion / Stretched string motion.

(Heliopolis Modern Lang. Sch. / Cairo 2022)

.....

4. Water waves / Sound waves / Micro waves / Infrared waves.

.....

C What happens when ... ?

The frequency of a wave is doubled (concerning the wavelength) when the wave velocity its constant.

(Al-Resala Language sch. / Qaliubya 2019)

.....

Model Exam 2

56

Answer the following questions :

Question 1 14 marks

A Complete the following statements :

1. If the wavelength of a sound wave is 2 metres, so the distance between the centre of the first compression and the fifth one in this wave = ...
2. 20 megahertz = ... gigahertz.
3. Kinetic energy = $\frac{1}{2}$ ..... × .....
4. Tuning fork is considered as one of the examples of ..... motion.

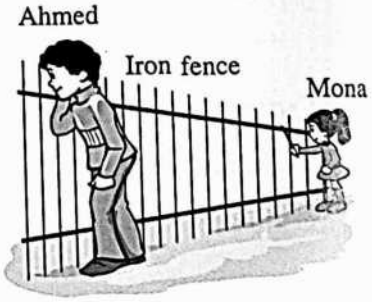
B Choose the correct answer :

1. From the following table, the wave ..... is considered as an electromagnetic wave.

Wave	A	B	C	D
Velocity (m/sec.)	330	330	3×10^8	3×10^8
Type	Longitudinal wave	Transverse wave	Longitudinal wave	Transverse wave

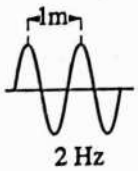
a. A b. B c. C d. D

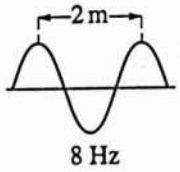
2. In the opposite figure :
Mona knocks on the iron fence. Then Ahmed hears the sound which transfers through air after 0.1 sec. and the sound which transfers through the iron fence after ..... sec.

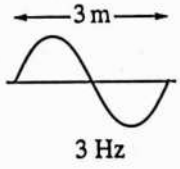


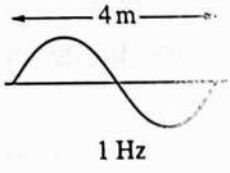
a. zero b. less than 0.1
c. 0.1 d. more than 0.1

3. The velocity of wave ..... is considered as the largest one.

a. 

b. 

c. 

d. 

4. Sound velocity is the greatest through ..... *(Orouba Language sch. / Giza 2019)*

a. vacuum. b. solids. c. liquids. d. gases.

C What is meant by the velocity of a certain wave = 340 m/sec.

.....

.....

Question 2 14 marks

A Put (✓) or (✗) and correct what is wrong :

1. The rarefaction is the area in the longitudinal wave at which the particles of the medium are of the highest density and pressure.

( ) .....

2. Wave velocity is constant in the different media.

( ) .....

3. The motion of pendulum which includes 3 complete oscillations, includes 12 amplitudes.

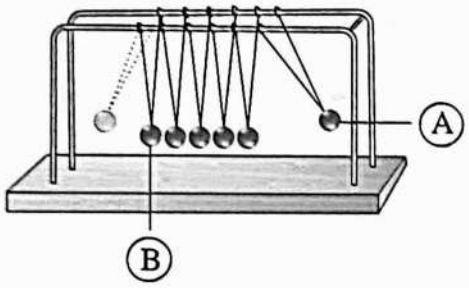
( ) .....

4. The transverse wave is a disturbance that causes the movement of medium particles from their positions.

( ) .....

B Study the two following figures, then answer the questions followed by these figures :

Fig. (1)

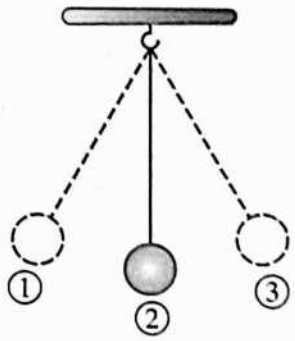


What is your explanation about the motion of ball (B) when ball (A) collides the other balls although ball (A) doesn't touch the ball (B) ?

.....

.....

Fig. (2)



Choose :

The velocity of the pendulum ball is very small at the position (s) .....

a. (1)

b. (2)

c. (3)

d. (1) and (3)

C If the distance between the centre of the rarefaction and the centre of the successive compression in the longitudinal wave = 0.02 m. Calculate :

1. The wavelength of the longitudinal wave.

.....

2. The wave velocity, if the frequency of this wave = 60 Hz.

.....

3. The periodic time, if the frequency of this wave = 40 Hz.

.....

Question 3 *14 marks*

A Write the scientific term of each of the following :

1. The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time. (.....)
2. It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation. *(Patriarchal College / Cairo 2019)* (.....)
3. The time taken by the oscillating body to make one complete oscillation. (.....)

(Manor House / Cairo 2019)

4. The point of the lowest density and pressure in the longitudinal wave. (.....)

(Middle zone / Alex. 2019)

B Correct the following statements without changing the underlined parts :

1. In wave motion, medium particles move from their places.

.....

2. The motion of spring is considered as a circular periodic motion.

.....

3. Wavelength $= \frac{\text{Wave velocity}}{\text{Periodic time}}$

.....

4. The amplitude equals double the complete oscillation.

C Give a reason for :

The frequency of the vibrating body decreases by increasing the periodic time.

.....

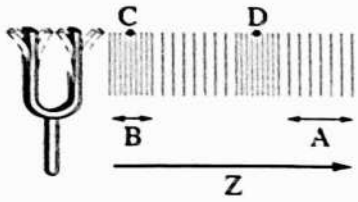
Question 4 *14 marks*

A Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Periodic time.	a. Hertz.
2. Amplitude.	b. sec.
3. Frequency.	c. m/sec.
4. Wave velocity.	d. cm.

1. ..... 2. ..... 3. ..... 4. .....

B From the opposite figure, answer :



1. What is the kind of the produced wave ?

.....

2. Label pionts (A) and (B).

.....

3. What's the name of the distance between (C) and (D) ?

.....

4. The arrow (Z) refers to the .....

(Damietta Educational Directorate / Damietta 2019)

C What is the importance of ... ?

Physiotherapy tubs (jacuzzi). *(Borg Al-Arab Edu. Zone / Alex. 2022)*

.....

UNIT 2

Lesson One

Properties of Sound Waves

Worksheet 6

1. Complete the following statements :

1. The human ear can differentiate between the sounds through different factors which are sound ..... , sound ..... and sound .....
2. Sound is produced due to ..... *(Al-Shrouk Zone / Cairo 2022)*
3. Sound waves are ..... waves which travel through air as pulses of ..... and .....
4. The voice of lion is ..... pitch than that of sparrow.
5. The frequency of the vibrating string is ..... proportional to its length.
6. Musical tone is a sound of ..... frequency and it is produced from ..... and .....

2. 1. If the frequency of sound produced from Savart's wheel is 1000 Hertz, when the metallic plate touches the teeth of a certain gear. **Find the number of teeth of such gear if the wheel makes 250 rotations in one and a half minute.**

.....

.....

2. A tuning fork produces a sound wave of frequency 512 Hz, if its wavelength is 65 cm , **calculate the velocity of sound through air in metre/sec.**

.....

.....

3. What is meant by ...?

1. Sound pitch. *(Menofia 2019)*

.....

.....

2. The wavelength of a sound wave equals 3 cm. *(Omar Al-farouk sch. / Sharkia 2019)*

.....

.....

3. Sound velocity.

.....

.....

4. A. Give reasons for :

1. We hear sound from all directions that surround the sound source.

(Al-Montazah Zone / Alex. 2022)

.....

.....

2. The violin's player changes the length of strings during his play.

.....

B. You have three gears in Savart's wheel shown in the table. Answer the following : By rotating them and touching each with a metallic plate.

The gear no.	A	B	C
No. of teeth	20	40	60

1. The sharp sound is produced from touching the plate to the gear .....

2. Adham has run the wheel to 540 cycles/min. and the half of the frequency equals 180 Hz. Which gear has Adham touched with the plate ?

.....

Worksheet 7

1. Write the scientific term :

1. The measuring unit of sound intensity. *(Gharbia 2022)* (.....)
2. The intensity of sound at a point varies inversely with the square of the distance between that point and the sound source. *(Menofia 2019)* (.....)
3. The characteristic by which the ear can distinguish strong or weak sounds. (.....)
4. The measuring unit of noise intensity. (.....)

2. A. Choose the correct answer :

1. All of the following are factors affecting sound intensity, except the .....

a. amplitude of vibration. b. medium density.

c. frequency. d. wind direction.

(Dokki Zone / Giza 2019)

2. The intensity of sound in the presence of carbon dioxide as a medium for sound travels is ..... that in the presence of air.

a. equal to b. higher than c. lower than d. half of

3. The intensity of sound ..... when the direction of sound waves propagation is in the opposite direction of wind.

a. decreases b. increases c. doesn't change d. double

B. Give reasons for :

1. The intensity of sound increases when the sound source touches a resonance box.

.....

2. The intensity of sound decreases as the distance between the ear and sound source increases.

.....

.....

3. Mention the relationship between each of the following :

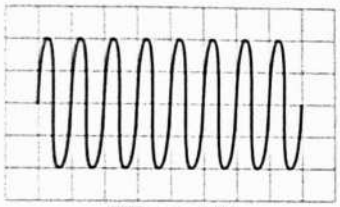
1. The sound intensity and the amplitude of vibration of the sound source.

.....

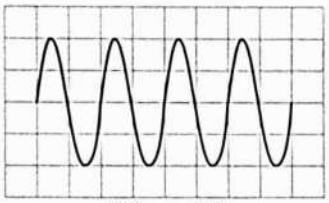
2. The intensity of sound and the density of the medium through which the sound passes.

.....

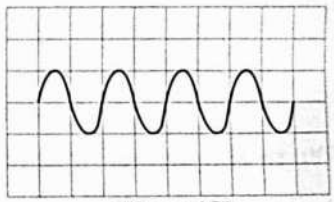
4. Using the following figures, compare from the point of view of sound intensity and pitch between :



Wave (A)



Wave (B)



Wave (C)

1. Sound wave (A) and sound wave (B).

.....

.....

2. Sound wave (B) and sound wave (C).

.....

.....

Worksheet 8

1. A. Put (✓) or (✗) :

1. Ultrasonic waves have frequencies less than 20 Hz. ( )
2. Sound of frequency 25000 Hz is audible sound. ( )
3. Bats, dogs and dolphins can hear ultrasonic waves. *(Heliopolis Zone / Cairo 2022)* ( )

B. What is meant by ...?

1. Sonic waves. *(Dakahlia 2019)*

.....

2. Sound quality.

.....

2. You have several resonating sources with different frequencies :

These sources are arranged ascendingly according to their frequencies in the following table :

Resonating source :	1	2	3	4
Its frequency (vibrations/sec.) :	10	50	10000	30000

1. You can hear sound waves produced from vibration of sources : .....

   [(1 , 2) , (2 , 4) , (1 , 4) , (2 , 3)] **(Choose one answer)**

2. The waves used in food sterilization is produced from source(s) : .....

   [(1 , 2) , (2 , 3) , (4 only) , (3 , 4)] **(Choose one answer)**

3. Does any of these waves travel through free space ? Why ? **(Answer)**

   .....

4. The waves that are produced from the vibration of the vibrating sources are called :

   a. Sonic in case of ..... **(Complete)**

   b. Ultrasonic in case of .....

   c. Infrasonic in case of .....

3. Give reasons for :

1. Dogs can hear all sounds produced by man.

   .....

   .....

2. The piano sound differs from that of violin sound even if they have the same intensity and pitch. *(El-Minia 2019)*

   .....

   .....

3. The importance of ultrasonic waves.

   .....

4. A person stands near an apparatus producing different sounds of different frequencies as follows :

(12 Hz , 15 Hz , 35 Hz , 50 Hz , 1000 Hz , 15000 Hz , 20000 Hz , 25000 Hz).

Which of these sounds will be heard by such person ? Why?

.....

.....

UNIT 2

Lesson Two

Wave Nature of Light

Worksheet 9

1. What is meant by ...?

1. Speed of light. *(Al-Agamy zone / Alex. 2019)*

.....

2. Light.

.....

3. Visible light. *(Dokki zone / Giza 2019)*

.....

2. A. Give reasons for :

1. The energy of red light photon is less than that of orange light photon. *(Menofia 2019)*

.....

.....

2. Light can travel through free space. *(Damietta 2019)*

.....

.....

B. Mention the uses of light ?

.....

.....

3. Choose the correct answer :

1. Light waves are ..... waves. *(Qaliubya 2019)*

a. mechanical transverse
b. electromagnetic transverse
c. electromagnetic longitudinal
d. mechanical longitudinal

2. The quantum of energy of green light is ..... the quantum of energy of yellow light.

a. greater than
b. equal to
c. less than
d. half

(Ismailia 2022)

3. All of the following are from the characteristics of the red colour in spectrum colours, except .....

a. it has the lowest frequency.
b. its photon energy is the smallest one.
c. its photon has the highest deviation.
d. it has the longest wavelength.

4. Energy of the photon equals .....
   a. Planck's constant + Frequency.
   b. Planck's constant ÷ Frequency.
   c. Planck's constant × Frequency.
   d. Planck's constant – Frequency.
5. ..... scientist proved that the energy of light waves is composed of photons.
   a. Isaac Newton
   b. Kepler
   c. Al-Hassan Ibn El-Haitham
   d. Max Planck

Worksheet 10

1. Compare between : transparent medium and translucent medium : *(Ismailia 2019)*

Points of comparison	Transparent medium	Translucent medium
• **Definition :**	.....	.....
• **Examples :**	.....	.....

2. Write the scientific term :

1. A medium doesn't allow light rays to penetrate through. *(Omar Al-Farouk / Sharkia 2019)*
   (.....)
2. The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light. *(6th of october / Giza 2019)*
   (.....)
3. The quantity of light falling perpendicular to a unit area of a surface in one second.
   (Qalyoub Zone / Qalyoubia 2022) (.....)

3. Put (✓) or (✗) :

1. The light travels in curved lines through transparent medium. ( )
2. By increasing the thickness of the transparent medium, the quantity of light that passes through it increases. ( )
3. Carton and human skin are examples of opaque medium. ( )

4. Give reasons for :

1. The inability to see the impurities present in black honey.

.....

.....

2. The intensity of light on a surface decreases to its quarter when the distance between the light source and this surface is doubled.

.....

.....

3. The clothes pins can be seen clearly before and after placing them in a transparent plastic bag.

.....

.....

4. Carton is an opaque medium.

.....

.....

Worksheet 11 on Lessons 1 & 2 Unit Two

1. Complete the following :

1. The energy of the photon is ..... proportional to the ..... of light wave.
2. ..... waves are audible sounds.
3. White light consists of a mixture of seven colours which are known as .....
4. High pitch sounds have relatively large ..... and small ..... *(Qena 2019)*
5. By increasing the speed of rotation in Savart's wheel the frequency ..... , and the sound becomes .....

2. A. Calculate the number of the gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz and the wheel rotates 30 cycles/min.

(6^{th} of october directorate / Giza 2019)

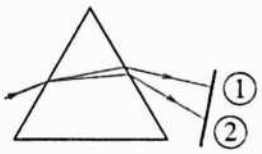
.....

.....

.....

B. In the opposite figure : *(Al-Shrouk Zone / Cairo 2022)*

Which ray represents the red colour and which ray represents the violet colour ?



.....

.....

3. A. Choose the unsuitable word, then express the rest of the words with something proper.

1. Yellow / Blue / White / Violet. *(Deirmwas Official Sch. / El-Menia 2022)*

.....

2. Violin / Drill / Piano / Reed pipe.

.....

B. Put (✓) or (✗), then correct what is wrong :

1. The sound velocity through liquids is less than that through gases. ( )

.....

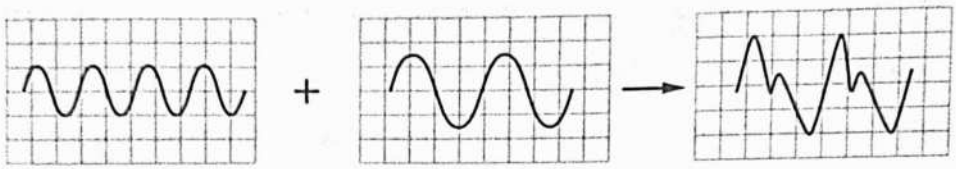
2. Light travels through transparent media in the form of straight lines. ( )

.....

3. Sound wave of frequency 15000 Hz is audible sound. ( )

.....

4. The following figures shows the formation of complex tones. Which of the two figures (1) , (2) represents the fundamental tone and which one represents the harmonic tone. (give a reason).



(1) (2) complex tones

.....

.....

.....

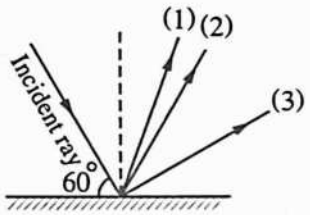
.....

Worksheet 12

1. A. Write the scientific term :

1. A smooth or rough surface at which the reflection of light takes place. (.....)
2. The angle between the incident ray and the line perpendicular to the reflecting surface at the point of incidence. (.....)

B. From the opposite figure, answer the following :



1. The reflected ray is number .....
2. The angle of reflection = ...

2. A. What is meant by ...?

1. Light reflection.

.....

2. Angle of reflection. *(Cairo 2019)*

.....

B. Study the following figures, then answer the questions :

1. Find the value of the angle of incidence and the angle of reflection in each of the following cases : *(Ismailia 2022)*

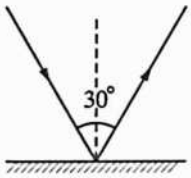


Fig. (1)

.....
.....

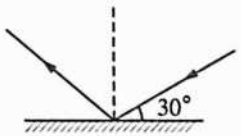


Fig. (2)

.....
.....

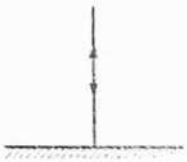
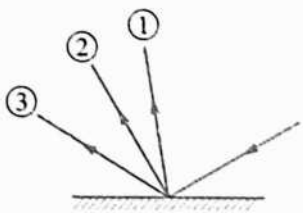


Fig. (3)

.....
.....

2. Which of the following reflected rays represents the reflected ray in the right direction and why ?



.....
.....

3. **A. State the two laws of light reflection :** *(Borg Al-Arab Zone / Alex. 2022)*

* **First law :** .....
* **Second law :** .....

.....

.....

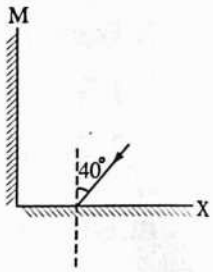
B. Choose the correct answer :

1. If the angle between the incident ray and the reflecting surface is 60°, then the angle between the incident and the reflected rays will be .....

   a. 30° b. 60° c. 15° d. 120°

2. In the opposite figure, when a ray of light falls on the mirror (X) by an angle 40°, the reflected ray will fall on the surface of the mirror (M) by angle of incidence equals .....

   a. 30° b. 60° c. 40° d. 50°



4. **What happens when ... ?**

1. A light ray falls perpendicular on a reflecting surface. Why ? *(New Cairo zone / Giza 2019)*

.....

.....

2. Incidence of light rays on a rough surface. *(Ismail-El-Habrouk sch. / Behira 2019)*

.....

.....

Worksheet 13

1. **A. Give reasons for :**

1. The light refracts when it travels from a transparent medium to another of different optical density.

.....

.....

2. The absolute refractive index of any transparent medium is larger than one.

(Al-Mostakbal Modern sch. / Giza 2019)

.....

.....

3. A coin in a glass of water appears in a position higher than its true position.

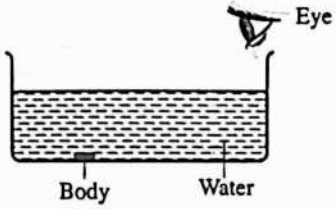
.....

.....

B. Complete the following :

1. When a light ray travels from a transparent medium of higher optical density to another of lower optical density, the angle of ..... is more than the angle of .....
2. Light ..... is the change of light path when it travels from a transparent medium to another one of different ..... *(Qena 2019)*

2. A. Show by drawing the path of the ray by which the eye can see the body.



B. Choose the correct answer :

A hunter standing on the shore of the sea, he wants to catch fish under water surface, so he should direct the arrow .....

a. to the body of the fish.
b. above the body of the fish.
c. below the body of the fish.
d. beside the body of the fish.

3. What happens when ...?

1. A light ray falls perpendicular to the interface between two transparent media of different optical densities. *(El-Agamy zone / Alex. 2019)*

.....

.....

2. You look at a pencil partially immersed in a cup of water. Why ? *(Dokki zone / Giza 2019)*

.....

.....

4. A. Write the scientific term :

1. A natural phenomenon that takes place on desert roads at noon in summer times. *(Al-Mostakbal sch. / Giza 2019)* (.....)
2. The ability of the transparent medium to refract the light. (.....)

(Helwan Zone / Cairo 2022)

3. The angle between the emergent light ray and the normal at the point of emergence on the interface. *(El Sahel Zone / Cairo 2022)* (.....)

B. What is meant by ...?

1. The absolute refractive index of water is 1.3 *(East Zagazig zone / Sharkia 2019)*

.....

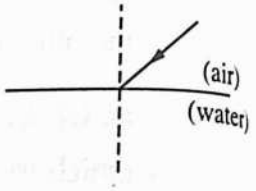
.....

2. The angle of refraction. *(Dakahlia 2019)*

.....

.....

C. Complete the opposite figure, then answer the following :



1. The light ray refracts ..... the normal.

2. The angle of ..... is greater than the angle of .....

General Exercise of the School Book on Unit Two

1. Write the scientific term :

1. Sound waves of frequencies less than 20 Hz. (.....)
2. A medium does not allow light rays to penetrate throw. (.....)
3. Changing the path of light when travel from a transparent medium to another transparent medium of different optical density. (.....)

2. Choose the correct answer, with the scientific explanation :

1. Sound of frequency 200 Hz is ..... than sound of frequency 100 Hz.

   a. sharper b. stronger c. harsher d. weaker

   .....

   .....

2. When the distance between the source of light and the surface as a wall decreases, the light intensity on the surface .....

   a. decrease. b. increases. c. doubled. d. remains constant.

   .....

   .....

3. Write down the mathematical relation that joins between each of the following :

1. The photon frequency and its energy.

   .....

2. The sound frequency (F), the number of teeth of the gear in Savart's wheal (n).

   .....

4. What are the results due to each of the following ... ?

1. Incidence of light rays on a rough surface.

   .....

   .....

2. Incidence of a white light ray on one face of a triangular glass prism.

   .....

   .....

5. What is the scientific basis on which the following depends ?

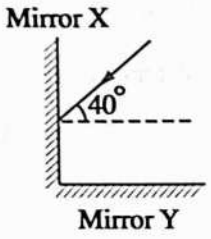
The strings of a musical lute are fixed on a hallow wooden box.

.....

.....

6. Complete the path of rays in each of the following figures according to what is written below each :

A.

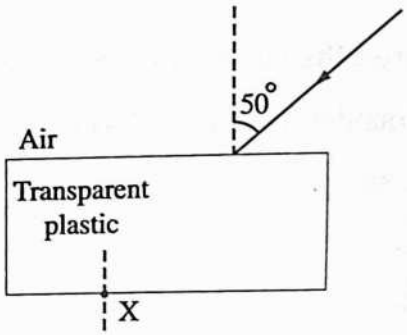


Determination of the angle of reflection of the ray on mirror (Y).

.....

.....

B.



Calculating the angle of emergence from point (X) given that the optical density of air is less.

.....

.....

Model Exams on Unit 2

Model Exam 1

56

Answer the following questions :

Question 1 *14 marks*

A Choose the correct answer :

1. The substance that a sound wave travel through is called the .....

   a. medium. b. vacuum. c. rarefaction. d. mediary.

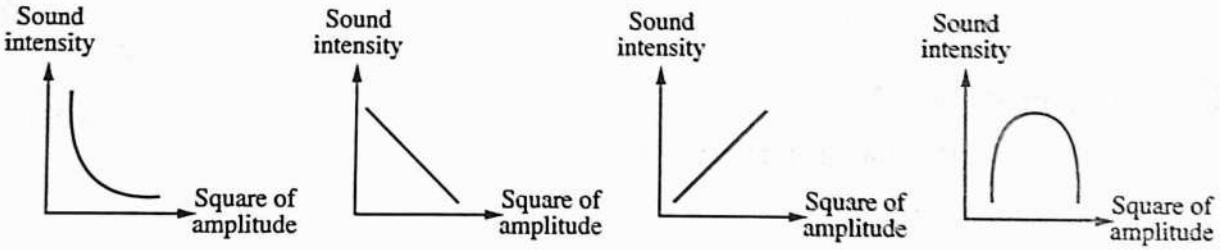
2. The angle of incidence of light is ..... its angle of reflection.

   a. larger than b. smaller than c. equal to d. double to

3. The human skin is considered as a/an ..... medium.

   a. transparent b. semi-transparent c. opaque d. translucent

4. The figure ..... represents the relation between the intensity of sound and the square of amplitude of vibration of a vibrating body.



a. b. c. d.

B Put (✓) or (✗) :

1. When light ray travels from air to water it reflects. ( )

2. The fish is seen higher than its real position in the fish tank. ( )

(Qeft Educational Adminstration / Qena 2019)

3. Bats, dogs and dolphins can hear ultrasonic waves. ( )

(Port Said Educational zone 2019)

4. Wood doesn't allow the passage of light through it. ( )

(Belkas Administration / Dakahlia 2019)

C **Give a reason for :**

The pencil which is partially immersed in water, appears as being broken.

.....

.....

Question 2 14 marks

A **Write the scientific term :**

1. A tone of regular frequency that is produced from reed pipe. (.....)
2. The ability of the medium to refract light rays. (.....)

(El-Gomrok zone / Alex. 2019)

3. Seven colours are produced as a result of splitting of the white light. (.....)
4. A property by which the human ear can distinguish between strong and weak sounds.

(6^{th} of October directorate / Giza 2019) (.....)

B **From the opposite figure :**

1. What is the type of slide that placed over the image ?

.....

2. Explain why, we can't see the part present below (X) clearly ?

.....

C **What is meant by ...?**

The angle of reflection of light ray = 30°

.....

Question 3 14 marks

A **Correct the underlined words in the following statements :**

1. The produced tone from a tuning fork is called complicated tone. (.....)

(Patriarchal college / Cairo 2019)

2. Sonic waves are used in sterilization of milk. (.....)

(6^{th} of October / Giza 2019)

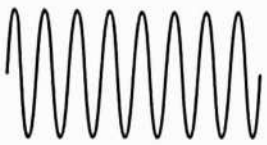
3. White light travels in curved lines. (.....)

(6^{th} of October directorate / Giza 2019)

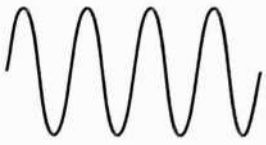
4. The absolute refractive index is equal to one. (.....)

(El-Gomrok zone / Alex. 2019)

B Compare between the two waves (A) , (B) in terms of pitch (Give a reason).



Wave (A)



Wave (B)

The sound pitch of wave ..... is higher than the sound pitch of wave .....

Because : .....

C What is the importance of Savart's wheel ? *(El-Agamy zone / Alex. 2019)*

.....

Question 4 *14 marks*

A Cross the odd word out, then write the scientific term of the rest words :

1. Yellow / Blue / White / Violet / Red. (.....) (.....)
2. Glass / Ceramic / Air / Water. (.....) (.....)
3. Milk / Cotton / Air / Human skin. (.....) (.....)
4. Sound wave its (F) = 100 Hz / Sound wave its (F) = 1KHz / Sound wave its (F) = 40 Hz / Sound wave its (F) = 10 Hz. (.....) (.....)

(Ismail El-Habrouk formal sch. / El-Behira 2019)

B What does these relations indicate ?

1. $\frac{\text{Velocity of wave propagation}}{\text{Wave frequency}}$ *(Patriarchal college / Cairo 2019)* (.....)

2. Planck's constant × Photon frequency. *(Patriarchal college / Cairo 2019)* (.....)

3. Sound intensity (I) α $\frac{1}{\text{Square of the distance between the ear and the sound source } (d^2)}$

(.....)

4. $\frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$ (.....)

C Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear, calculate the number of teeth of the gear. *(Al-Shaheed Sheriff Talat Sch. / El-Sharkia 2022)*

.....

Model Exam 2

56

Answer the following questions :

Question 1 *14 marks*

A Complete the following statements :

1. The light reflection is classified into two types which are ..... and .....
2. Sounds of different musical instruments can differentiated from each other by .....
3. When you look at a coin in a glass of water, its ..... position appears to be lower than the ..... position.
4. The light intensity is the amount of light .....

B Mention an example for :

1. Mechanical longitudinal wave. (.....)
2. Regular reflection. *(El-Gomrok zone / Alex 2019)* (.....)
3. Transparent medium. *(El-Agamy zone / Alex 2019)* (.....)
4. An opaque medium. (.....)

C Mention two factors only affecting the sound intensity. *(Cairo 2019)*

.....

.....

.....

.....

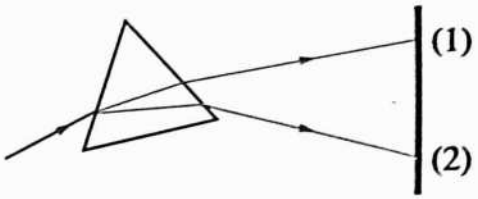
Question 2 *14 marks*

A Choose from column (B) what suits it in column (A) : *(Borg Al-Arab Zone / Alex 2022)*

(A)	(B)
1. The sound pitch	a. is the characteristic, by which the ear can differentiate between the sounds as strong or weak.
2. The quality of sound	b. is the property, by which the ear can distinguish between sharp and rough sounds.
3. The sound intensity	c. is the number of the complete vibrations in one second.
	d. is the characteristic, by which the ear can distinguish between sounds from different sources even if they are equal in intensity and pitch.

1. ..... 2. ..... 3. .....

B In the opposite figure :



1. Which ray represents the red colour and which ray represents the violet colour ?

(Al-Shrouk Zone / Cairo 2022)

.....

2. Which one has a greater energy, the photon of red light or the photon of violet light ?

.....

C Compare between regular reflection and irregular reflection. (definition only)

(El Sayeda Khadija Sch. / Cairo 2022)

.....

.....

.....

.....

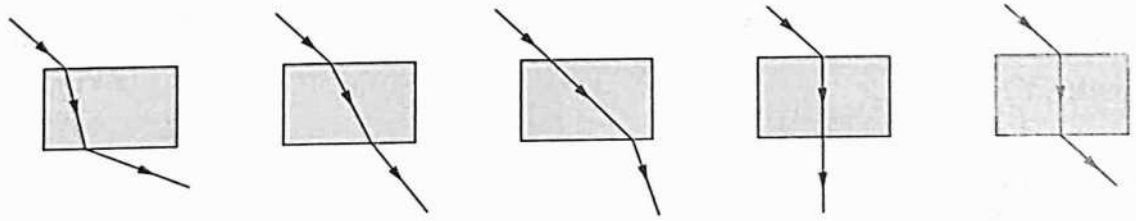
Question 3 *14 marks*

A Put (✓) or (✗) :

1. As the length of the vibrating string decreases, the frequency of the produced sound increases. ( )
2. Sound wave of frequency 25000 Hz is audible sound. ( )
3. Light intensity of a surface decreases as the distance between the surface and the light source increases. ( )
4. The light ray refracts near to the normal when it travels from air to glass. ( )

B Choose from the following figures the one that expresses correctly the refraction of light in a rectangular glass block and mention the reason.

.....



(A) *(B)* *(C)* *(D)* *(E)*

C Calculate the absolute refractive index of water, knowing that the velocity of light through water is 2.25×10^8 m/s and the velocity of light through air is 3×10^8 m/s.

.....

.....

Question 4 14 marks

A Study the given table and answer the following questions :

Area	Waves
3	Ultrasonic waves
y	
2	Sonic waves
x	
1	Infrasonic waves

1. Complete the following :

(1) The frequency of point (x) is ..... Hz.

(2) The frequency of point (y) is ..... Hz.

2. Choose :

(1) Frequency is ..... in area (1).

a. 15 Hz b. 22 Hz c. 2000 Hz d. 25000 Hz

(2) Frequency is ..... in area (2).

a. 15 Hz b. 22 Hz c. 25000 Hz d. 30000 Hz

(3) Frequency is ..... in area (3).

a. 15 Hz b. 22 Hz c. 2000 Hz d. 25000 Hz

(4) Dogs and dolphins can hear ..... waves.

a. infrasonic b. sonic c. ultrasonic d. (b) and (c)

(5) Bats can hear ..... waves.

a. infrasonic b. sonic c. ultrasonic d. (b) and (c)

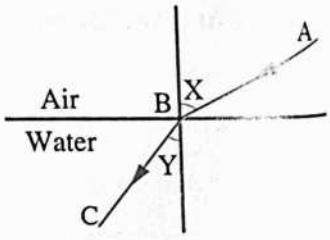
(6) Medical diagnosis instruments are made by using waves in ..... area.

a. first b. second c. third d. (a) and (b)

B From the opposite figure, complete the following statements :

(Gharbia 2022)

1. The ray (AB) represents .....
2. The ray (BC) represents .....
3. Angle (X) is .....
4. Angle (Y) is .....



C Give a reason for :

Occurrence of mirage phenomenon in desert regions at noon. *(Ismailia 2019)*

.....

UNIT 3

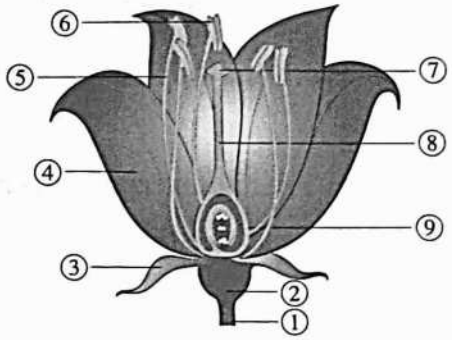
Lesson One

Reproduction in Plants

Worksheet 14

1. Study the opposite figure, then answer the following :

1. The figure represents a ..... flower.
2. Label the figure.



① ..... ② .....

③ ..... ④ .....

⑤ ..... ⑥ .....

⑦ ..... ⑧ .....

⑨ .....

3. The organ which consists of parts (7) , (8) and (9) is called ..... , while the organ which consists of parts (5) and (6) is called .....

2. A. Give reasons for :

1. Palm flowers are unisexual. *(Heliopolis Edu. Zone / Cairo 2022)*

.....

.....

2. Petals of corolla are colourful and scented. *(Heliopolis Modern Lang. Sch. / Cairo 2022)*

.....

B. Mention the function of :

1. Sepals of calyx : .....

(Al-Shrouk Edu. Zone / Cairo 2022)

2. Carpel : .....

(Ismail El-Habrouk sch. / Behira 2019)

3. A. Write the scientific term :

1. The female reproductive organ of the flower. (.....)
2. The innermost whorl of a male flower. (.....)
3. Minute cells formed inside the flower's anther. (.....)

B. What is meant by hermaphrodite flower ?

.....

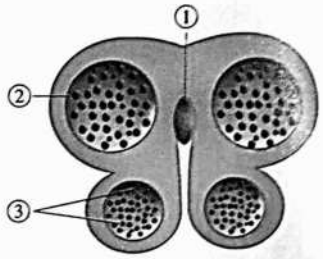
4. A. Choose the correct answer :

1. The male flower consists of ..... whorls.
   a. 2 b. 3 c. 4 d. 5
2. The symbol of female flower is .....
   a. ♀ b. ♂ c. ⚥ d. ⊕
3. The ovary of a flower contains .....
   a. pollen grains. b. anthers. c. stigmas. d. ovules.

B. From the opposite figure, answer the following questions :

(Patriarchal college / Cairo 2019)

1. The figure represents a cross section in an .....
2. Label the figure.
   ① .....
   ② .....
   ③ .....



Worksheet 15

1. A. Complete the following :

1. ..... in plants takes place in two successive processes which are pollination then .....
2. ..... fruit has a single seed, while ..... fruit has many seeds.
3. Artificial pollination is carried out by ..... such as in .....

B. Choose the correct answer :

1. Flowers which produce light and dry pollen grains are pollinated by .....
   a. man. b. wind. c. water. d. insects.
2. After fertilization, the ovary develops and becomes the .....
   a. fruit. b. seed. c. flower. d. embryo.

(Helwan Edu. Zone / Cairo 2022)

2. A. What is meant by ...?

1. Fertilization in plants. *(Fayoum 2019)*

.....

.....

2. Reproduction process.

.....

.....

B. What happens when ...?

1. A pollen grain falls on a flower's stigma. *(Qalyoub Edu. Zone / Qalyoubia 2022)*

.....

2. Sepals of insect pollinated flowers are not coloured and have no scent.

.....

.....

3. Pollen grains become mature (related to the anther). *(East Zagazig zone / Sharkia 2019)*

.....

3. A. Give reasons for :

1. Pollen grains of wind pollinated flowers are produced in a huge number.

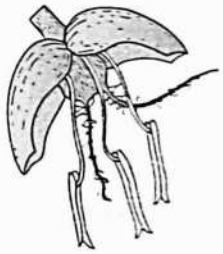
.....

2. Pollen grains of insects pollinated flowers are sticky or with coarse surfaces.

.....

B. From the opposite figure :

Mention the way by which the pollination process takes place.
Giving a reason.



.....

.....

.....

4. A. Compare between :

Auto pollination and mixed pollination. *(Baverly Hills sch. / Giza 2019)*

Auto pollination	Mixed pollination
.....	.....
.....	.....
.....	.....

B. Examine the opposite figure, then answer the following :

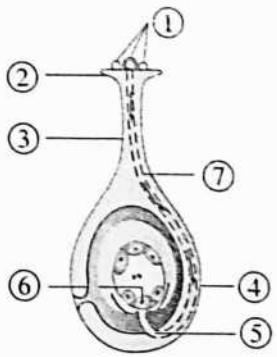
Write the names of the parts numbered from ① to ⑦.

① ..... ② .....

③ ..... ④ .....

⑤ ..... ⑥ .....

⑦ .....



Worksheet 16

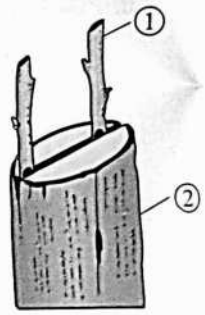
1. A. Complete the following :

1. ..... reproduction is a kind of asexual reproduction which may be ..... or .....
2. ..... may be a root as sweet potatoes or a stem as .....
3. Tissue culture is .....

B. Choose the correct answer :

1. ..... is a way from the ways of the natural vegetative reproduction.
   a. Cutting b. Tubers c. Grafting d. Tissue culture
2. Reproduction by grafting can be used between all of the following plants except .....
   a. orange and naring. b. apples and pears.
   c. mango and apples. d. peaches and apricots.

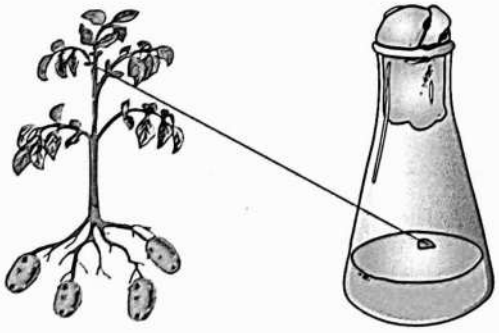
2. The opposite figure represents a kind of reproduction :



1. Label the figure.
   ① ..... ② .....
2. Mention its kind.
   .....
3. Complete :
   a. The part no. ① must be containing more than .....
   b. The part no. ① is ..... into a ..... in the part no. ②.

3. The following figures represent steps of tissue culture of a potato stem.

Complete the missing parts under each figure.



The tissue is separated from the ..... part of the .....

(a)

The tissue is placed in a ..... medium containing ..... and .....

(b)

The new plant starts to grow till certain size

(c)

The plant is then ..... to the ..... to grow normally

(d)

4. A. What happens when ... ?

Tie a part of a peach (as scion) with a part of an apricot (as stock).

(Helwan Edu. Zone / Cairo 2022)

.....

.....

B. Mention four ways of natural vegetative reproduction :

- .....
- .....
- .....
- .....

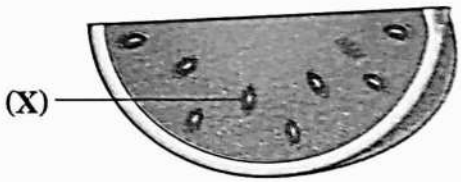
C. The opposite figure shows a section of the fruit of the watermelon plant :

1. What does the letter (X) indicate and what is its origin ?

   .....

2. What is the importance of the parts indicated by the letter (X) ?

   .....



UNIT 3

Lesson Two

Reproduction in Humans

Worksheet 17

1. A. Study the opposite figure, then answer the following questions :

1. What is its name ?

.....

2. Mention what the numbers indicate.

① ..... ② .....

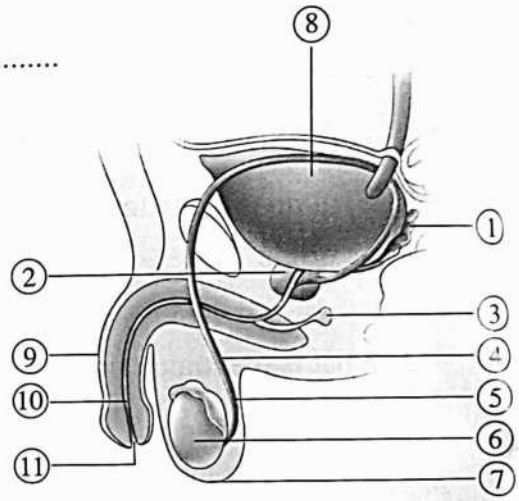
③ ..... ④ .....

⑤ ..... ⑥ .....

⑦ ..... ⑧ .....

⑨ ..... ⑩ .....

⑪ .....



3. Mention the function of part ⑤.

.....

.....

B. Mention the aim of reproduction process in humans.

.....

.....

2. A. Complete the following :

1. Each testis is connected to a group of fine convoluted tubes called ..... which extends in the form of a single tube known as .....
2. Testes produce ..... hormone which is responsible for the appearance of ..... in male.
3. The two testes locate ..... the body in a structure called .....

(Al-Montazah Edu. Zone / Alex. 2022)

B. Mention the signs of puberty in male.

.....

.....

.....

3. A. Mention the function of : *(Ismailia 2019)*

1. Scrotum : .....
.....
2. The fluid which is secreted by the genital glands : .....
.....

B. Give a reason for :

The type of reproduction in human is sexual and not asexual.
.....
.....

4. A. What happens when ... ?

1. The testes are not found inside the scrotal sac but they are found inside the abdominal cavity of man body.
.....
.....
2. The seminal fluid is a neutral fluid.
.....
3. The seminal vesicles, prostate gland and Cowper's gland were removed.
.....

B. Write the scientific term :

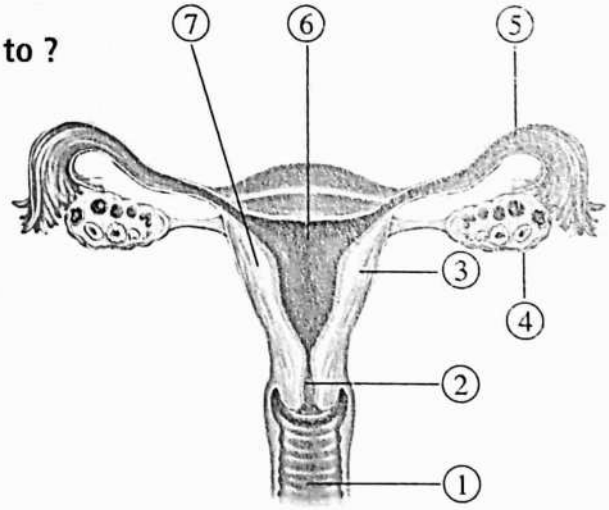
1. An oval-shaped gland that produces male cells. (.....) *(Dokki zone / Giza 2019)*
2. A part of male reproductive system that transfers the sperms from testes to urinogenital duct. *(Dakahlia 2019)* (.....)
3. A hormone produced by the testis. (.....)

Worksheet 18

1. Study the following figure which represents the human female reproductive system , then answer the following questions :

A. What does each number of the figure refer to ?

① ..... ② .....
③ ..... ④ .....
⑤ ..... ⑥ .....
⑦ .....



B. What is the organ which ... ?

1. Produces female sex hormone. (.....)
2. Receives the ripe ovum and directs it towards the uterus. (.....)
3. Locates between the urinary bladder and the rectum. (.....)

2. A. Mention the function of :

1. The placenta : .....
   .....
2. The midpiece of a sperm : .....
   .....

B. Write the scientific term :

1. The female sex hormone which is responsible for the continuity of pregnancy. (.....)
2. Structures carry genes which are responsible for the hereditary traits of the species. (.....)

3. A. Mention the signs of puberty in female. (3 only)

.....
.....
.....

B. Choose the correct answer :

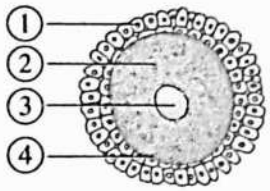
1. The nucleus of the male or female reproductive cell in human contains ..... chromosomes.
   a. 23 b. 32 c. 46 d. 64
2. The ovum ..... like the sperm.
   a. is static b. is mobile c. has large size d. contains 23 chromosomes
3. The ..... is a gland that has the size and shape of a peeled almond.
   a. uterus b. ovary c. ovum d. vagina

4. A. Correct the underlined words :

1. **The testosterone** hormone is responsible for the appearance of secondary sex characters in female. (.....)
2. **The ovum** consists of head, middle part and tail. (.....)

(El-Sayeda Khadija Official Lang. Sch. / Cairo 2022)

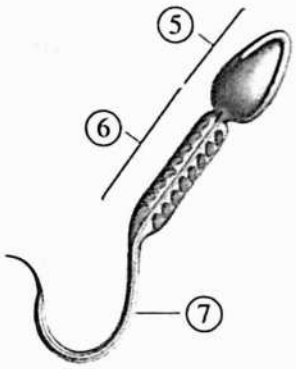
B. From the two opposite figures :



(A)

A) Complete :

1. Fig. (A) represents .....
2. Fig. (B) represents .....
3. No. (1) represents .....
4. No. (2) represents .....
5. No. (3) represents .....
6. No. (4) represents .....
7. No. (5) represents .....
8. No. (6) represents .....
9. No. (7) represents .....



(B)

B) What is the organ which produces (A) and (B) ?

– (A) produced from .....

– (B) produced from .....

Worksheet 19

1. A. Write the scientific term :

1. The period between the beginning of infection and the appearance of symptoms of the disease. (.....)
2. The period between the fertilization process and delivery. (.....)

(Gharbia 2022)

B. Complete the following :

1. The human female produces ..... in the 14^{th} day of the beginning of the menstrual cycle.
2. The head of the sperm secretes ..... which dissolve the ..... of the ovum to facilitate its penetration inside the ovum.
3. The place at which the sperms rush the ovum is .....
4. ..... disease is transmitted from the pregnant woman to her fetus through the umbilical cord or during the delivery.

C. Explain :

The zygote contains the complete number of chromosomes.

.....

.....

2. A. Choose the correct answer :

1. In human, the ..... contain(s) 23 pairs of chromosomes.

a. sperm b. ovum c. zygote d. sperm and ovum

2. All of the following are sexually transmitted diseases except .....
   a. Gonorrhea. b. AIDS. c. Prostate cancer. d. Syphilis.
3. The incubation period of ..... disease ranges from 1 to 4 days.
   a. puerperal sepsis b. prostate cancer c. syphilis d. gonorrhea
4. Which of the following genital diseases can be transmitted by means of droplets ? .....
   a. Syphilis. b. AIDS. c. Gonorrhea. d. Puerperal sepsis.

B. What are the complications of syphilis disease ?

.....
.....
.....

3. Fig. (1) and (2) are two types of bacteria which cause two different venereal diseases.

1. Detect the shape of bacteria in each figure and the name of the disease caused by it.

.....
.....

Fig. (1)

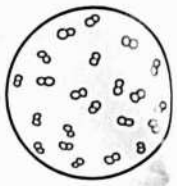


Fig. (2)

2. Mention the symptoms of each disease.

Symptoms of the disease caused by fig. (1)	Symptoms of the disease caused by fig. (2)
.....	.....
.....	.....
.....	.....
.....	.....

4. A. Mention the means of protection of puerperal sepsis disease.

.....
.....
.....

B. Mention the methods of infection of puerperal sepsis disease.

.....
.....
.....

General Exercise of the School Book on Unit Three

1. Write the scientific term for each of the following :

1. An oval shaped gland that produces male cells. (.....)
2. The process of producing ova from the ovaries mutually every 28 days. (.....)
3. The reproduction of some plants by parts of the roots, stem or leaves. (.....)

2. Correct the following sentences without changing the underlined words :

1. The **wall of the ovary** after pollination forms the wall of the fruit.

.....

2. The **progesterone** enzyme is responsible for pregnancy to continue.

.....

3. Reproduction by tuber happens in **orange** and bitter orange.

.....

4. The **ovum** is a mobile cell, of a relatively large size.

.....

3. Extract the unsuitable word, then write the relation between the rest of the words :

1. Sepals / Petals / Tubers / Carpels.

.....

2. AIDS / Gonorrhea / Syphilis / Measles.

.....

4. Give reasons for each of the following :

1. Man can't reproduce asexually.

.....

.....

2. The petals of corolla are colourful and scented.

.....

.....

5. What's meant by each of the following ...?

1. The sperm carries half of the genetic material of the species.

.....

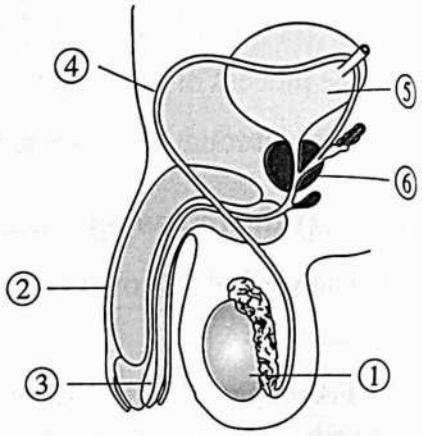
.....

2. Tissue culture of a carrot plant.

.....

.....

6. Study the opposite figure, which represents the male genital system, then answer the following :



1. Replace the numbers with the suitable labels.

① ..... ② .....

③ ..... ④ .....

⑤ ..... ⑥ .....

2. Write the number of the part, in which :

(a) Sperms are produced. (.....)

(b) Secretion of semen. (.....)

(c) Transfer sperms from the testes to the penis. (.....)

7. Draw an illustration showing the structure of the female human ovum.

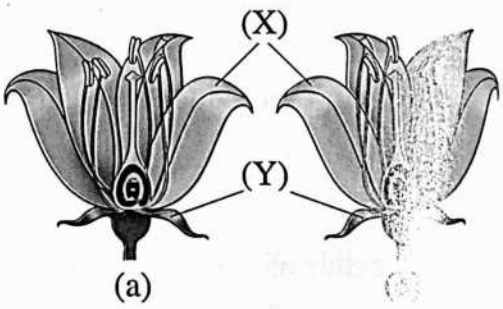
8. The opposite figure shows two flowers of two plants of the same species :

1. What's the function of the parts (X) and (Y) ?

.....

.....

.....



2. Pollen grains from the flower (a) are transferred to the ova in flower (b) :

(1) What's the type of pollination that happened ?

.....

(2) What's the sex of flower (a) ?

.....

Model Exams on Unit 3

Model Exam 1

56

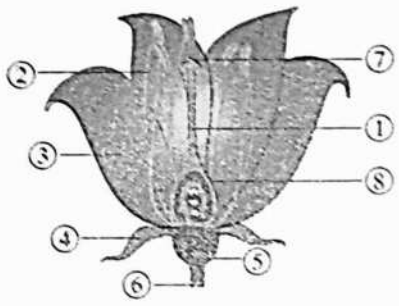
Answer the following questions :

Question 1 14 marks

A Complete the following :

1. Prostate gland and ..... glands are from glands associated with the ..... genital system.
2. The human zygote results from the fusion of ..... and ..... and it contains ..... chromosomes.
3. ..... is a short stem where leaves developed and modified into ..... organs.
4. The ovary after fertilization forms .....

B Study the opposite figure, then label it :



① ..... ② .....

③ ..... ④ .....

⑤ ..... ⑥ .....

⑦ ..... ⑧ .....

C Give a reason for :

Flowers pollinated by insects produce coarse pollen grains. *(Minia Kawmia sch. / El-Minia 2020)*

.....

Question 2 14 marks

A Put (✓) or (✗) :

1. The oval shaped gland in male reproductive system produces male gametes. ( )
2. Sepals, petals and tubers are from the parts of the flower. ( )
3. AIDS, gonorrhea and prostate cancer are from sexually transmitted diseases. ( )
4. The progesterone hormone is responsible for the continuity of pregnancy. ( )

B Mention an example of :

1. Typical flower. (.....)
2. A hormone is secreted by the ovary. (.....)

3. A disease which doesn't arise from sexual contact. (.....)

4. A plant, the type of reproduction in it is the reproduction by tubers. (.....)

C What is the importance of tissue culture ? *(El-Sayeda Khadija Official Lang. Sch. / Cairo 2022)*

.....

Question 3 *14 marks*

A Choose the correct answer :

1. All of the following plants reproduce sexually except .....

a. bean plant. b. pea plant. c. potato. d. olive plant.

(El-Seddeek sch. / Cairo 2019)

2. Artificial vegetative reproduction by cutting can be done in .....

a. peach. b. palm. c. grapes. d. olive.

(El-Seddeek sch. / Cairo 2019)

3. All of the following are parts of female reproductive system except .....

a. vas deferens. b. uterus. c. ovary. d. fallopian tube.

(Heliopolis Modern Lang. Sch. / Cairo 2022)

4. The right ovary in the female human produces a mature (ripe) ovum every ..... days.

a. 24 b. 28 c. 34 d. 56

(Giza 2022)

B What is the organ which is responsible for ...?

1. The protection of the reproductive organs in the flower. (.....)

2. The nourishment of the fetus during pregnancy. (.....)

3. The receiving of the ripe ovum and directing it towards the uterus. (.....)

4. Storing sperms. (.....)

C Mention one difference between the calyx and the corolla.

.....

.....

Question 4 *14 marks*

A Cross out the odd word, then write down the relation between the rest of words :

1. Stigma / Stamen / Style / Ovary. *(Giza 2022)*

.....

2. AIDS / Gonorrhea / Syphilis / Measles.

.....

3. Anther / Pollen grains / Ovary / Filament. *(Ismail El-Habrouk Formal sch. / El-Behira 2019)*

.....

4. Ovary / Epididymis / Uterus / Vagina / Cervix. *(Qalyoub Edu. Zone / Qalyoubia 2022)*

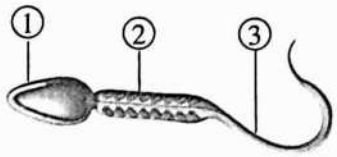
.....

B The opposite figure represents a sperm. *(Patriarchal College / Cairo 2019)*

Answer the following questions :

1. Label the numbers.

① ..... ② ..... ③ .....



2. What is the function of number ③ ?

.....

C What will happen when pollen grains mature and become well developed ?

(Al-Gharbeya Educational Directorate / Al-Gharbeya 2019)

.....

Model Exam 2

56

Answer the following questions :

Question 1 *14 marks*

A Put (✓) or (✗) :

1. Stigma is the male reproductive organ in the flower. ( )

(Port Said Educational zone / Port Said 2019)

2. Reproduction by tubers can be used in apples and pears. ( )

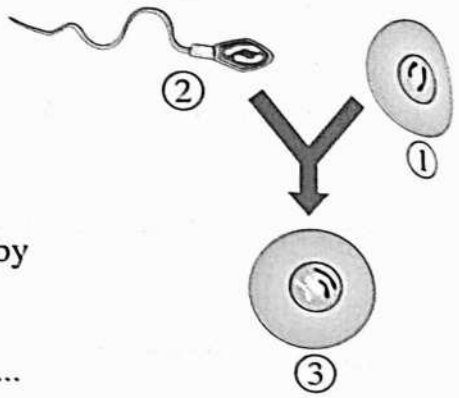
(Exp. Lang. Sch. Dir. / Giza 2022)

3. The pollen grains of the air pollinated flowers are sticky and have coarse surface. ( )

(El Obour Educational Directorate / Al-Qaliubya 2019)

4. The age of menopause in female ranges between 11 to 14 years. ( )

B **Study the opposite figure, which represents one of the processes which is very important in the reproduction in human, then answer the following questions :**



1. What is the name of the process which is represented by this figure ?

.....

2. What are the number of chromosomes in ② and ③ ?

② ..... ③ .....

C **Determine the number of ripe ova that an adult woman can produce during 35 years.**

.....

.....

Question 2 *14 marks*

A **Complete :**

1. After....., the wall of the ovary develops forming the .....
2. The appearance of an ..... at the tip of the penis in male is due to syphilis infection.
3. Types of pollination are ..... and .....

(Basateen & Dar Al-Salam Educational Administration / Cairo 2020)

4. The ovum consists of ..... , ... and .....

B **Mention the associated glands which connected to the male reproductive system and their functions :**

- The associated glands are :

1. .....
2. .....
3. .....

- Their function :

.....

.....

C What happens when the sperm lost its tail ?

.....

.....

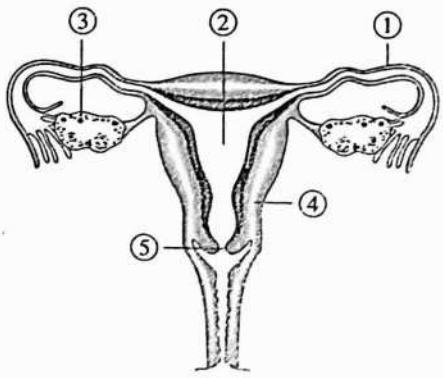
Question 3 14 marks

A Choose from column (B) and (C), what suit them in column (A).

(A)	(B)	(C)
Floral whorl	**Consists of**	**Function**
1. Calyx	a. stamens	A. male organ in a flower.
2. Corolla	b. sepals	B. female organ in a flower.
3. Androecium	c. carpels	C. protects the inner parts of a flower.
4. Gynoecium	d. petals	D. attracts insects to the coloured leaves.

1. ..... 2. ..... 3. ..... 4. .....

B The opposite figure represents the female genital system. Answer the following questions :



1. Replace the numbers presented on the figure by suitable labels.

① .....

② .....

③ .....

④ .....

⑤ .....

2. What is the function of organ number ... ?

① .....

② .....

③ .....

C Give a reason for :

The petals of corolla are colourful and scented.

.....

(Al-Montazah Edu. Zone / Cairo 2022)

Question 4 14 marks

A Write the scientific term :

1. A short stem whose leaves are modified to acheive reproduction in plant. (.....
(El-Sayeda Khadija Official Lang. Sch. / Cairo 202

2. The fusion of one of the male nuclei with the ovum. (.....
(Giza 202

3. A new method to produce large numbers of plants from small parts of it. (.....
(Giza 202

4. The fertilized ovum. (.....
(Demietta Educational Directorate / Demietta 202

B Write what is the thing which is represented by each of the following figures, and label each of them :

Figure (1)

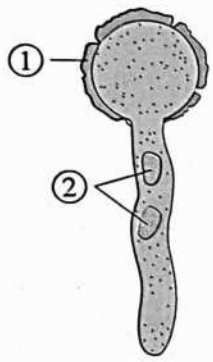


Figure (2)

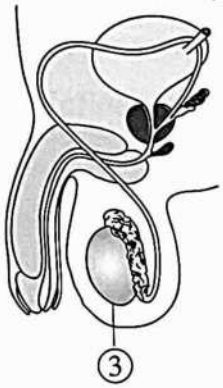


Figure (3)

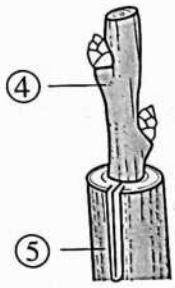


Fig. (1) represents .....

Fig. (2) represents .....

Fig. (3) represents .....

No. ① represents .....

No. ② represents .....

No. ③ represents .....

No. ④ represents .....

No. ⑤ represents .....

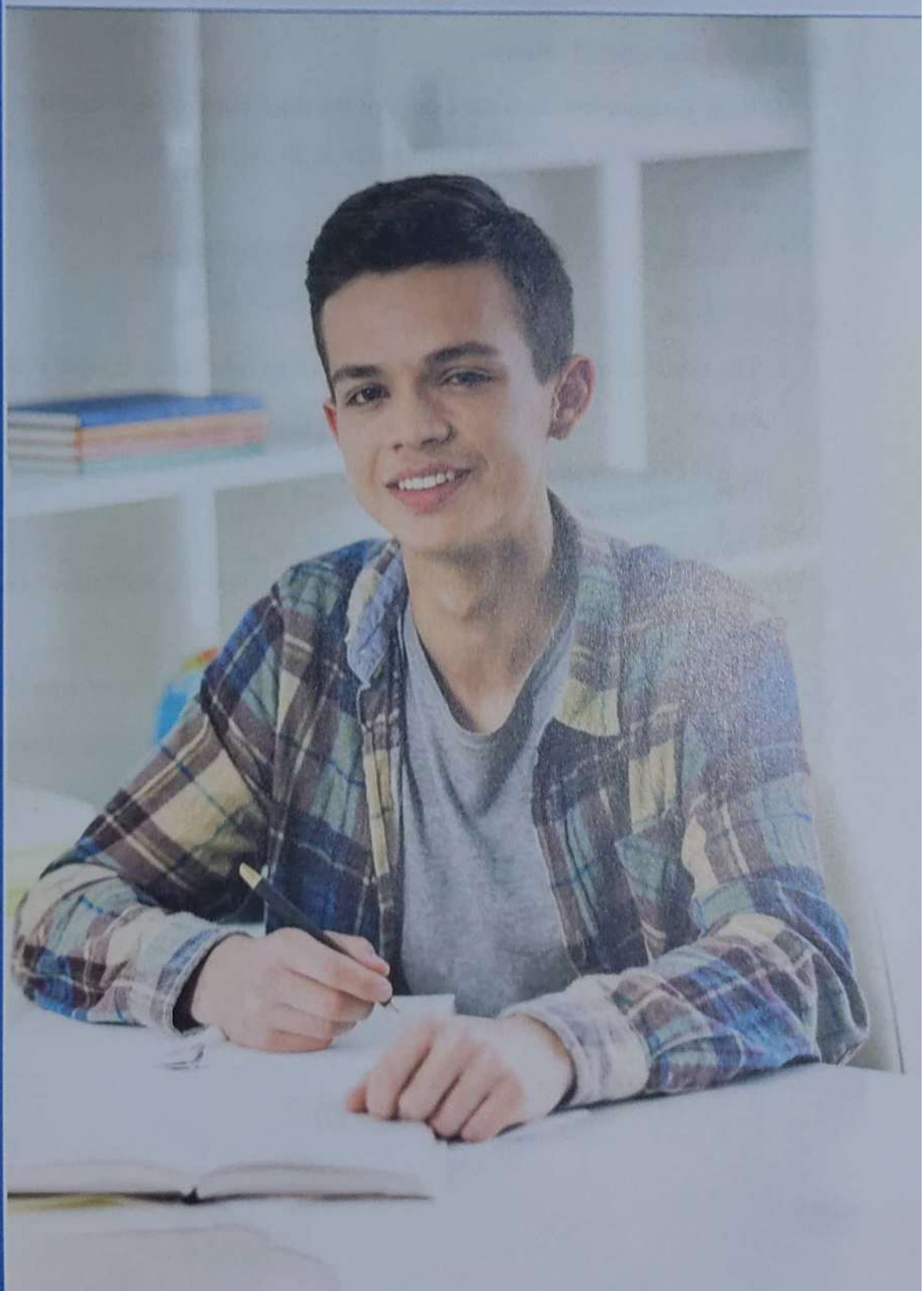
C What is meant by incubation period ?

.....

.....

Monthly Tests

- March Tests
- April Tests



March Tests

Model 1

Total mark
10

Question 1 5 marks

A Choose the correct answer :

1. If the distance between the centre of the third compression and the centre of the fifth compression on the wave propagation is 20 cm, then the wavelength of this wave is .....

   a. 40 cm. b. 20 cm.

   c. 10 cm. d. 5 cm.

2. The result of multiplying the frequency of an oscillating body by its periodic time equals .....

   a. $\frac{1}{2}$ b. $\frac{1}{4}$

   c. $\frac{1}{3}$ d. 1

3. The scientific term that expresses the strength and the weakness of sound is .....

   a. the frequency of sound. b. the pitch of sound.

   c. the quality of sound. d. the intensity of sound.

4. The complete oscillation includes ..... displacement(s).

   a. one b. two successive

   c. three successive d. four successive

B Give a reason for :

Sound waves are longitudinal mechanical waves.

.....

.....

Question 2 5 marks

A Complete the following sentences :

1. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
3. There are two types of periodic motion which are ..... motion and ..... motion.

B What is meant by ... ?

Sonic waves.

.....

.....

Model 2

Total mark
10

Question 1 5 marks

A Write the scientific term :

1. The distance between two successive crests or troughs. (.....)
2. The number of complete oscillations produced by the oscillating body in one second. (.....)
3. A property of sound by which the ears can distinguish between sharp and rough sounds. (.....)
4. The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time. (.....)

B Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear. Calculate the number of teeth of the gear.

.....

.....

.....

Question 2 — 5 marks

A Compare between :

Transverse waves and longitudinal waves (one point only).

Transverse waves	Longitudinal waves
.....	.....
.....	.....
.....	.....
.....	.....

B What does each of the following relationship indicate ?

1. Wave frequency × Wavelength. (.....

2. $\frac{\text{Number of rotations}}{\text{Time in seconds}}$ × Number of gear teeth in Savart's wheel. (.....

3. $\frac{1}{\text{Frequency}}$ (.....

4. $\frac{\text{Wave velocity}}{\text{Frequency}}$ (.....

April Tests

Model 1

Total mark: 10

Question 1 — 5 marks

A Choose the correct answer :

1. If the distance between a surface and light source decreases to its half, the light intensity of the surface .....

a. decreases to its one fourth.
b. decreases to its half.
c. increases twice.
d. increases four times.

2. The floral whorl, which is absent (not found) in the female flower is the .....

a. calyx.
b. corolla.
c. androecium.
d. gynoecium.

3. If the frequency of red colour is 4×10^{12} Hz, the frequency of violet colour is ..... $\times 10^{12}$ Hz.

a. 1.5
b. 3.5
c. 4
d. 7.5

4. If the angle between a reflected light ray and a reflecting surface is 30°, so the angle of reflection will be equal to .....

a. 15°
b. 30°
c. 60°
d. 90°

B What is meant by ...?

The velocity of light is 3×10^{8} m/sec.

.....

.....

.....

Question 2 5 marks

A Put (✓) or (✗) :

1. Auto (Self) pollination occurs in barely plant. (
2. Reflection of light from rough surfaces is called regular reflection. (
3. Vegetative reproduction is a kind of sexual reproduction. (
4. When light ray travels from air to water, the angle of incidence is greater than the angle of refraction. (

B Give a reason for the following :

The stigmas of air pollinated flowers are feathery like and sticky.

.....

.....

.....

Total mark 10

Model 2

Question 1 5 marks

A Choose from column (B) what suits it in column (A).

(A)	(B)
1. Androecium	a. is the change of the path of light ray when it moves between two media with different optical densities.
2. Light reflection	b. is the male organ in a flower.
3. Gynoecium	c. is the change in the direction of light ray in the same medium, when it falls on a reflecting surface.
4. Light refraction	d. protects the inner parts of a flower.
	e. is the female organ in a flower.

1. ..... 2. ..... 3. ..... 4. .....

B What happens if ... ?

A compact disc (CD) with shiny side is put to face sunlight.

.....

.....

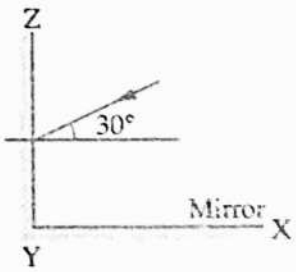
.....

Question 2 5 marks

A Write the scientific term of each of the following :

1. A physical quantity equals Plank's constant is multiplied by frequency. (.....)
2. A group of flowers found on the same axle. (.....)
3. The position, at which the submerged object in water is seen slightly above its real position. (.....)
4. The reproduction of some plants by parts of the roots, stems or leaves. (.....)

B Complete the following figure after redrawing it in your answer sheet, then write the name of each ray :



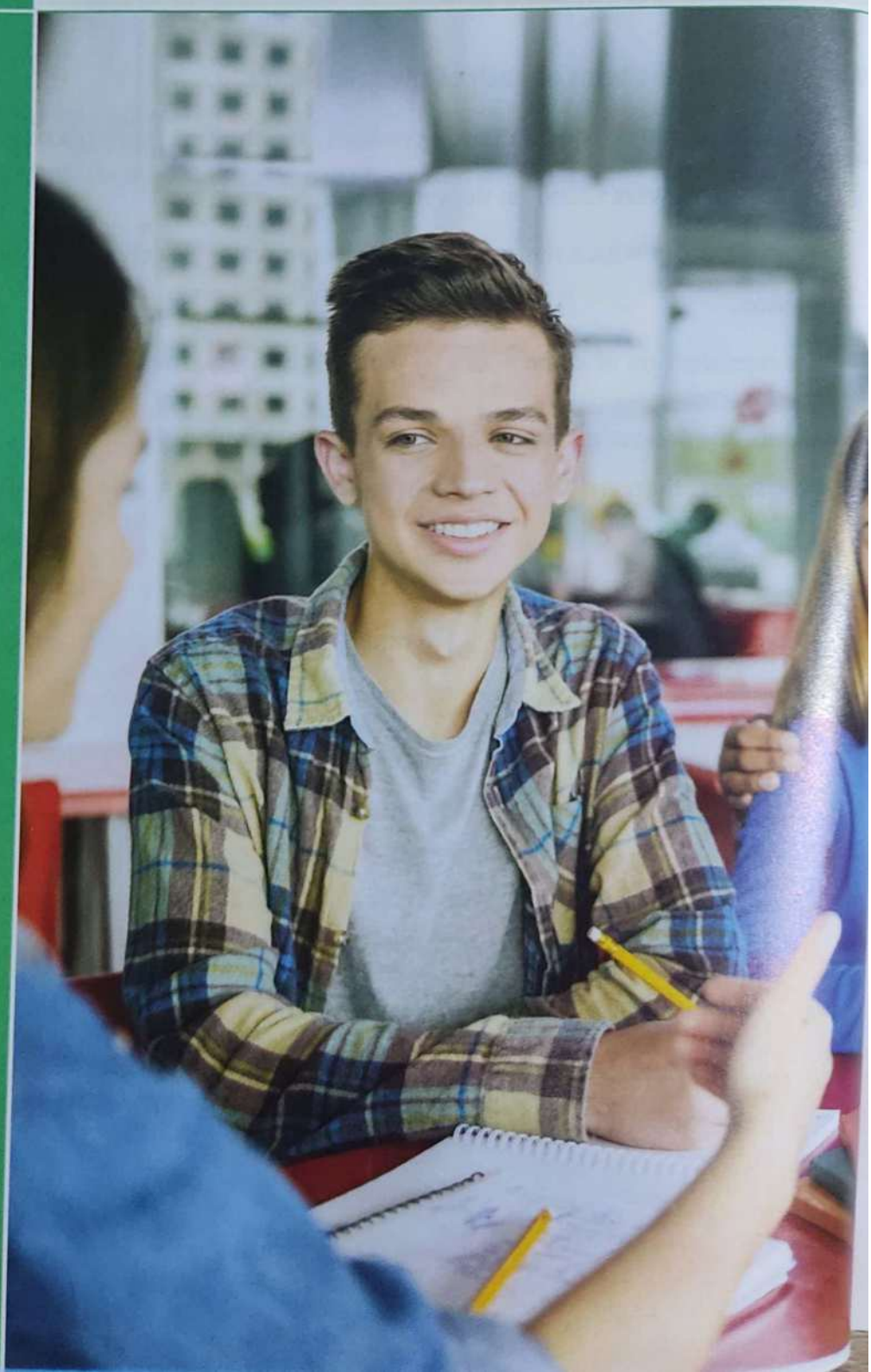
PART 2

Final Revision

Unit One : Periodic Motion.

Unit Two : Sound and Light.

Unit Three : Reproduction and Continuity of Species.



Final Revision on Unit 1

1 Definitions (or scientific terms) :

1. Periodic motion :	It is a motion which is regularly repeated in equal periods of time.
2. Oscillatory motion :	It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.
3. Amplitude :	It is the maximum displacement done by the oscillating body away from its rest position.
4. Complete oscillation (vibration) :	It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.
5. Periodic time (T) :	It is the time taken by an oscillating body to make one complete oscillation.
6. Frequency (F) :	It is the number of complete oscillations made by an oscillating body in one second.
7. The wave :	It is the disturbance that propagates and transfers energy in the direction of propagation.
8. Wave motion :	It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.
9. The line of wave propagation :	It is the direction of progression of the wave.
10. Electromagnetic waves :	They are waves which don't need a medium to propagate, where they propagate through vacuum.
11. Mechanical waves :	They are waves which need a medium to propagate, where they don't propagate through vacuum.
12. Transverse wave :	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of the wave propagation.
13. The crest :	It is the highest point of the particles of the medium in the transverse wave.
14. The trough :	It is the lowest point of the particles of the medium in the transverse wave.
15. Longitudinal wave :	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
16. The compression :	It is the area in the longitudinal wave at which the medium particles are of highest density and pressure.

17. The rarefaction :	It is the area in the longitudinal wave at which the medium particles are of lowest density and pressure.
18. The wavelength of the transverse wave :	It is the distance between two successive crests or troughs.
19. The wavelength of the longitudinal wave :	It is the distance between the centres of two successive compressions or rarefactions.
20. Wave amplitude :	It is the maximum displacement achieved by the medium particles away from their rest positions.
21. Wave velocity :	It is the distance covered by the wave in one second.
22. Wave frequency :	It is the number of complete waves produced from the source in one second.
23. The periodic time of the wave :	It is the time taken to make one wave.

2 What is meant by ... ?

1. The amplitude of an oscillating body is 6 cm :	This means that the maximum displacement done by the oscillating body away from its rest position is 6 cm (0.06 m).
2. The periodic time of an oscillating body is 0.5 sec. :	This means that the time taken by this oscillating body to make one complete oscillation is 0.5 sec.
3. The frequency of a simple pendulum is 60 Hz :	This means that the number of complete oscillations made by this simple pendulum in one second is 60 complete oscillations.
4. The time taken by a spring to make 60 complete oscillations is 1 minute :	This means that the periodic time of this spring is $(\frac{60}{60})$ which equals 1 sec.
5. The number of complete oscillations made by an oscillating body in a duration of 10 seconds is 500 complete oscillations :	This means that the frequency of the oscillating body is $(\frac{500}{10})$ which equals 50 Hz.
6. The wavelength of a transverse wave is 5 micrometre :	This means that the distance between two successive crests or two successive troughs in such wave is 5 micrometre (5×10^{-6} m).
7. The wavelength of a sound (longitudinal) wave is 30 cm :	This means that the distance between the centres of two successive compressions or two successive rarefactions in such wave is 30 cm.

8. The distance between the first crest and the third crest in a transverse wave equals 15 cm.	This means that the wavelength of such wave equals 7.5 cm (0.075 m). $\lambda = \frac{15}{2} = 7.5$ cm
9. The distance between the centre of the second compression and the centre of the fifth compression in a longitudinal wave equals 30 cm.	This means that the wavelength of such wave equals 10 cm (0.1 m). $\lambda = \frac{30}{3} = 10$ cm
10. The amplitude of a mechanical wave is 0.02 m.	This means that the maximum displacement achieved by the medium particles away from their rest positions in such wave equals 0.02 m.
11. The frequency of a longitudinal wave is 200 waves/sec. :	This means that the number of waves produced in one second is 200 waves.
12. The distance covered by a visible light wave in space in two seconds is 6×10^8 metres :	This means that the velocity of the visible light wave in space is 3×10^8 m/sec. $V = \frac{\text{distance}}{\text{time}} = \frac{6 \times 10^8}{2} = 3 \times 10^8$ m/sec.
13. Velocity of light is 300000 km/sec. :	This means that the distance that is covered by a light wave in one second is 300000 km.
14. Velocity of sound is 340 m/sec. :	This means that the distance that is covered by a sound wave in one second is 340 m.
15. The distance covered by radio waves through air in one minute is 1.8×10^{10} m :	This means that the velocity of radio waves through air is $(\frac{1.8 \times 10^{10}}{60})$ which equals 3×10^8 m/sec.
16. The distance covered by a water wave in one minute is 9×10^4 m :	This means that the velocity of water wave is $(\frac{9 \times 10^4}{60})$ which equals 1500 m/sec.

3 Measuring units

Physical quantity	Measuring unit
1. Amplitude :	Metre (m) or centimetre (cm).
2. Periodic time (T) :	Second (sec.).

3. Frequency (F) :	• Oscillation/sec. • Hertz (Hz). KHz = 1×10^3 Hz , MHz = 1×10^6 Hz , GHz = 1×10^9 Hz
4. Wavelength (λ) :	Metre (m). millimetre = 1×10^{-3} m , micrometre = 1×10^{-6} m , nanometre = 1×10^{-9} m
5. Wave velocity :	Metre per second (m/sec.).

4 Important laws (mathematical relations) and solved problems:

1 In oscillatory motion :

• **Amplitude** = Maximum displacement for the body away from its rest position.

Or

• **Amplitude** = $\frac{1}{4}$ Complete oscillation

• **Periodic time (T)** = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

Or

• **Periodic time (T)** = Time of a complete oscillation = 4 × Time of amplitude

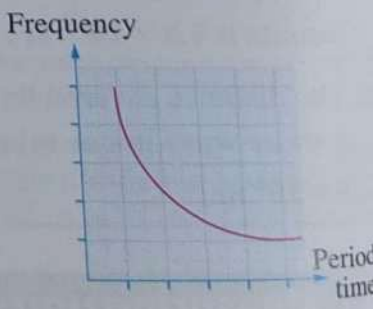
Or

• **Periodic time (T)** = $\frac{1}{\text{Frequency (F)}}$

• **Frequency (F)** = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

Or

• **Frequency (F)** = $\frac{1}{\text{Periodic time (T)}}$



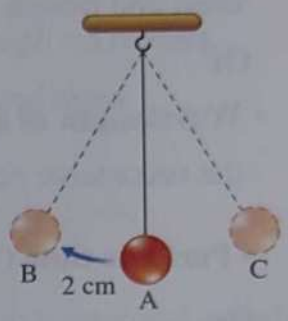
"The frequency is inversely proportio
to the periodic time and vice versa"

Problems

1 ***The opposite figure represents a simple pendulum takes 0.4 of second to make 2 complete oscillations, calculate :***

1. Amplitude. ***2. Periodic time.***

3. The time of amplitude. ***4. Frequency.***



Solution

1. Amplitude = 2 cm = 0.02 m.

2. Periodic time (T) = $\frac{\text{Time in seconds}}{\text{No. of complete oscillations}} = \frac{0.4}{2} = \frac{1}{5}$ sec.

3. The time of amplitude = $\frac{1}{4}$ periodic time

$= \frac{1}{4} \times \frac{1}{5} = 0.05$ sec.

4. Frequency (F) = $\frac{\text{No. of complete oscillations}}{\text{Time in seconds}} = \frac{2}{0.4} = 5$ Hz.

2 ***Calculate the frequency of an oscillating body in kilohertz if its periodic time is 0.2 sec.***

Solution

Frequency (F) = $\frac{1}{\text{Periodic time (T)}} = \frac{1}{0.2} = 5 \text{ Hz} = 5 \times 10^{-3}$ KHz.

2 In wave motion :

- **Wave amplitude** = The maximum displacement for the particles away from their rest positions.

Or

- **Wave amplitude** = $\frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$

- **Wavelength** (λ) = Length of a complete wave.

Or

- **Wavelength** = $\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$

Or

- **Wavelength of a transverse wave** = 2 × the horizontal distance between the successive crest and trough.

Or

- **Wavelength of a longitudinal wave** = 2 × the distance between the centre of the successive compression and rarefaction.

- **Periodic time (T)** = Time of a complete wave

Or

- **Periodic time (T)** $= \frac{\text{Time in seconds}}{\text{No. of complete waves}}$

Or

- **Periodic time (T)** $= \frac{1}{\text{Frequency (F)}}$

- **Frequency (F)** $= \frac{\text{No. of complete waves}}{\text{Time in seconds}}$

Or

- **Frequency (F)** $= \frac{1}{\text{Periodic time (T)}}$

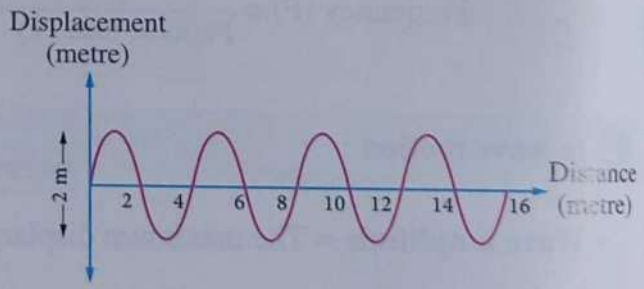
- **Wave velocity (V)** $= \frac{\text{Distance covered by the wave}}{\text{Time}}$

Problems

1 ***From the opposite figure, determine :***

1. Amplitude.

2. Wavelength.



Solution

1. Amplitude $= \frac{\text{The vertical distance between the crest and the trough of a wave}}{2}$

$= \frac{2}{2} = 1$ metre.

2. Wavelength $= \frac{\text{The distance covered by waves}}{\text{Number of waves}}$

$= \frac{16}{4} = 4$ metres.

2 ***Determine the wavelength for the following :***

1. A transverse wave, the distance between its successive crest and trough = 5 metres.

2. A longitudinal wave, the distance between its first compression and third compression = 15 metres.

Solution

1. Wavelength = 2 × the horizontal distance between the successive crest and trough

$= 2 \times 5 = 10$ metres.

2. ∵ Number of waves = 2

$$\therefore \text{ Wavelength} = \frac{\text{The distance which covered by waves}}{\text{Number of waves}} = \frac{15}{2} = 7.5 \text{ metres.}$$

3 ***From the opposite figure of a water wave, calculate :***

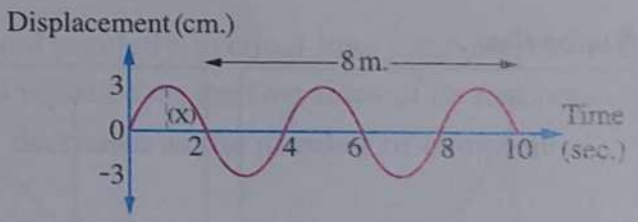
1. Amplitude of the wave.

2. Periodic time.

3. Wave frequency.

4. Wavelength.

5. Wave velocity.



Solution

1. Amplitude (X) = 3 cm.

2. Periodic time (T) (Time of one oscillation) = 4 sec.

3. Wave frequency (F) $= \frac{1}{\text{Periodic time (T)}} = \frac{1}{4} = 0.25$ Hz.

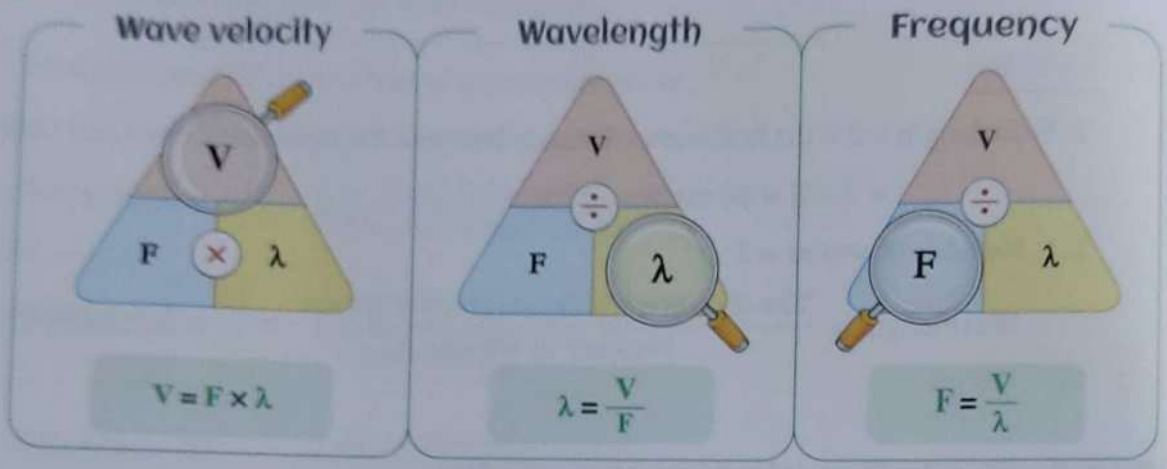
4. Wavelength $= \frac{8}{2} = 4$ m.

5. Wave velocity $= \frac{\text{Distance covered by the wave}}{\text{Time}} = \frac{8}{8} = 1$ m/sec.

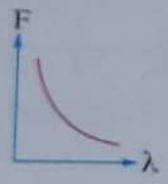
3 Law of wave propagation :

- **Wave velocity** = Wave frequency (F) × wavelength (λ)

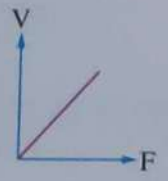
To calculate



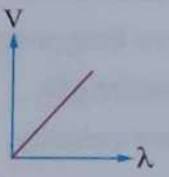
Notice that :



Frequency (F) is inversely proportional to wavelength (λ) at constant wave velocity.



Wave velocity (V) is directly proportional to frequency (F) at constant wavelength (λ).



Wave velocity (V) is directly proportional to wavelength (λ) at constant frequency (F)

Problem

Calculate the wavelength in metre for a visible light wave of frequency 5 x 10^8 megahertz and velocity 3 x 10^8 m/sec.

Solution

Frequency (F) $= 5 \times 10^8 \times 10^6 = 5 \times 10^{14}$ Hz.

Wavelength (λ) $= \dfrac{\text{Wave velocity (V)}}{\text{Wave frequency (F)}} = \dfrac{3 \times 10^8}{5 \times 10^{14}} = 0.6 \times 10^{-6} = 6 \times 10^{-7}$ metres.

5 Give reasons for :

1. • **The oscillatory motion (or wave motion) is considered as a periodic motion.**
   • **The motion of planets around the Sun is considered as a periodic motion.**
   Because it is repeated regularly in equal periods of time.
2. **The motion of spring is considered as an oscillatory periodic motion.**
   It is a periodic motion, because it is regularly repeated in equal periods of time and an oscillatory motion, because it is repeated on the two sides of its rest position.
3. **The velocity of the body is taken as a measure of its kinetic energy.**
   Because kinetic energy = $\frac{1}{2}$ mass $\times$ $(\text{velocity})^2$
4. **The kinetic energy of a pendulum is maximum when the pendulum passes its rest position.**
   Because the velocity of a pendulum is maximum when the pendulum passes its rest position and the kinetic energy is directly proportional to the square of velocity.
5. **The motion of the rotary bee is a periodic motion only, but it is not an oscillatory motion.**
   It is a periodic motion because it is repeated regularly in equal time intervals, but it is not an oscillatory motion because it is not repeated on the two sides of its rest position.
6. **The periodic time of an oscillating body decreases as the number of complete oscillations increases at the same time.**
   Because the periodic time is inversely proportional to the number of complete oscillations made by the oscillating body at constant time.
7. **Frequency $\times$ Periodic time = 1**
   Because the frequency is the reciprocal of the periodic time. $\left(\text{Frequency} = \frac{1}{\text{Periodic time}}\right)$
8. **The frequency of the vibrating body decreases by increasing the periodic time.**
   Because the frequency is inversely proportional to the periodic time.
9. **When a billiard ball strikes a similar second one at rest, the second ball moves while the first one stops.**
   Because the first ball transfers its energy to the second one through the rest of the fixed billiard balls.
10. **The flame of a candle vibrates forward and backward if we put the candle in front of a loudspeaker.**
    Because the sound waves produced from the loudspeaker propagate carrying the energy in the same direction of propagation causing the vibration of the candle flame.
11. **Sound waves are mechanical waves, while radio waves are electromagnetic waves.**
    Because sound waves need a medium to propagate through, while radio waves don't need a medium to propagate through.

12. • **Water waves are transverse mechanical waves.**
    • **The waves produced due to vibration of a string are transverse mechanical waves.**

    They are transverse waves because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs and mechanical waves because they need a medium to propagate through.

13. **Sound waves are longitudinal mechanical waves.**

    They are longitudinal waves because the medium particles vibrate along the direction of wave propagation forming compressions and rarefactions and mechanical waves because they need a medium to propagate through.

14. **We see lightning before hearing thunder.**

    Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).

15. **Jacuzzi is considered as a natural bath.**

    Because it is used to treat sprains and cramps by using hot water, and nervous tension by using cold water.

16. **We can't hear the sound of solar explosions, but we can see the light coming out of them.**

    Because the sound is mechanical waves which can't propagate through vacuum between the Sun and the Earth, while the light is electromagnetic waves which can propagate through vacuum.

17. **Astronauts use wireless devices to talk to each other on the Moon surface.**

    Because the sound is mechanical waves which can't propagate through vacuum, while wireless device works with light which can propagate through vacuum.

18. **The guard dogs sleep with one of their ears on the floor.**

    Because the velocity of sound through solids (floor) is greater than its velocity through air, this enables them to hear the sound faster.

19. **As the frequency of the wave in the same medium increases, its wavelength decreases.**

    Because the velocity of the wave is constant in the same medium, therefore the frequency of the wave is inversely proportional to its wavelength.

20. **The velocity of light waves equals the velocity of radio waves, although the difference in their frequencies.**

    Because both of them are electromagnetic waves have the same velocity in vacuum, so the product of multiplying the frequency in the wavelength of each of them equals constant value (3×10^8 m/s).

6 What happens when ... ?

1. **The oscillating body passes its rest position during its movement [concerning its velocity].**

   Its velocity increases to the maximum value.

2. **Increasing the velocity of the pendulum [concerning its kinetic energy].**

   Its kinetic energy increases.

3. **Number of oscillations produced by a vibrating body increases.**

   The frequency of the body increases.

4. **The number of complete oscillations equals to the time taken by the vibrating body to make these oscillations.**

   The value of frequency equals to that of the periodic time.

5. **You throw a stone in water.**

   Concentric circles propagate on the water surface.

6. **You move the free end of a horizontal spiral spring fixed from the other end perpendicular to its axis.**

   The rings of the spring move up and down forming crests and troughs.

7. **The vibration of the particles of a medium in a direction normal (perpendicular to) the direction of wave propagation.**

   A transverse wave is formed.

8. **Propagation of a wave in a medium as pulses of compressions and rarefactions [concerning the particles of the medium].**

   The particles of the medium propagate along the direction of propagation of the wave.

9. **The distance between two successive crests of a transverse wave is doubled.**

   The wavelength of the transverse wave is doubled.

10. **Sound wave travels from air to water [concerning its velocity].**

    Its velocity increases.

11. **The increase in the frequency of a wave to double its value with respect to the wavelength when the wave velocity is constant.**

    The wavelength decreases to its half value.

12. **The frequency and velocity of wave propagation decrease to quarter [concerning the wavelength].**

    The wavelength doesn't change.

7 Comparisons :

1 Oscillatory motion and wave motion :

Oscillatory motion	Wave motion
It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.	It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment and in a definite direction.
Complete oscillation is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.	**Wave** is the disturbance that propagates and transfers energy in the direction of propagation.
Amplitude is the maximum displacement achieved by the oscillating body away from its rest position.	**Wave amplitude** is the maximum displacement achieved by the medium particles away from their rest positions.
Frequency is the number of complete oscillations produced by an oscillating body in one second.	**Wave frequency** is the number of complete waves produced from the source in one second.
Periodic time is the time of one complete oscillation.	**Periodic time of the wave** is the time taken to make one wave.
Velocity of the oscillating body decreases when it goes far from its rest position.	**Velocity of the wave** is constant through the same medium, but it changes from one medium to another.
Examples : - Pendulum motion. - Motion of spring. - Motion of tuning fork.	**Examples :** - Motion of mechanical longitudinal sound waves. - Motion of mechanical transverse water waves. - Motion of electromagnetic transverse light waves.

2 Mechanical waves and electromagnetic waves :

Mechanical waves	Electromagnetic waves
- They need a medium to propagate. - They do not propagate through vacuum. - They are transverse or longitudinal waves. - Their velocity is relatively low.	- They do not need a medium to propagate. - They propagate through vacuum. - They are transverse waves only. - Their velocity is great (3×10^8 m/sec.).
Ex. : • Water waves (transverse waves). • Sound waves (longitudinal waves).	**Ex. :** • Visible light waves. • Infrared waves. • Radio waves (used in radars).

3 Transverse wave and longitudinal wave :

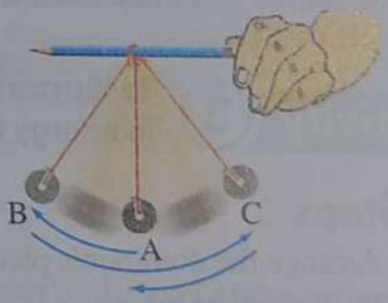
Points of comparison	Transverse wave	Longitudinal wave
• Definition :	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
• Composition :	Crests and troughs.	Compressions and rarefactions.
• Wavelength :	It is the distance between two successive crests or troughs.	It is the distance between the centres of two successive compressions or rarefactions.
• Example :	Water waves.	Sound waves.

8 Activities :

Activity 1 To illustrate the concept of oscillatory motion.

Steps :

1. Make a simple pendulum as shown in the figure.
2. Pull the metallic piece (the oscillating body) to the right side (B), then leave it.
3. Record the time taken by the metallic piece to repeat its movement several times.



Observations :

1. The oscillating body moves on both sides around its rest position (A). This motion is repeated in equal time intervals.
2. The displacements of the oscillating body around its rest position are equal.
3. The velocity of the oscillating body reaches its maximum value when it passes its rest position and decreases gradually when it goes far from it until it reaches zero at the maximum displacement on both sides of rest position.

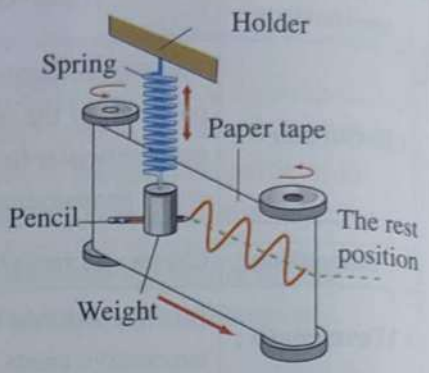
Conclusion :

The oscillating body moves around its rest position, where the motion is repeated through equal intervals of time which is known as **"oscillatory motion"**.

Activity 2 To show the graphical representation of the oscillatory motion.

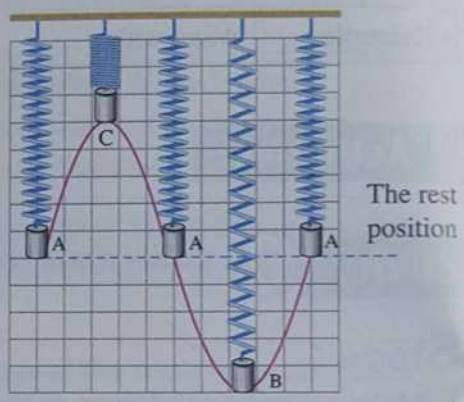
Steps :

1. Fix the pencil to the weight, then tie it at one end of the spring.
2. Tie the other end of the spring at the holder, so that the pencil's tip touches the midpoint of the paper tape (as shown in the fig.).
3. Pull the weight downwards and leave it, then roll the paper tape regularly.



Observation :

The pencil draws a curved shape on the paper tape as shown in the figure.



Graphical representation of the oscillatory motion (Simple harmonic motion)

Conclusion :

The simple harmonic motion is considered as the simplest form of oscillatory motion.

Activity 3 To illustrate the concept of wave and its role in energy transfer.

Steps :

1. Arrange the dominoe's pieces in a row at equal distances from each other.
2. Push the first piece.

Observation :

The pieces fall one after the other, as well as they don't change their positions after falling.

Explanation :

1. When the first domino piece falls, it will transfer its energy to the second piece which falls transferring its energy to the third one and so on.
2. The transfer of energy continues and the pieces don't change their positions in the row.

Conclusion :

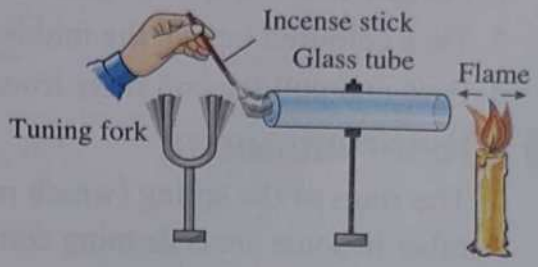
Pushing the first piece of domino creates a disturbance that propagates and transfers energy in the direction of propagation and this is known as "**the wave**".

Activity 4

- To conclude the concept of wave motion.
- To show that the particles of the medium don't move in the waves propagation direction.

Steps :

1. Fix a glass tube horizontally and put a burning candle at one end of it.
2. Tab a tuning fork and let it vibrates at the other end of the tube near a burning incense stick.



Observations :

1. The flame of the candle vibrates to the right and left.
2. The smoke of burning incense stick does not appear from the other end of the tube.

Explanation :

1. Energy is generated when the tuning fork vibrates. This energy is transferred by the medium particles (air and smoke particles) through the tube to the flame of the candle in the form of sound waves.
2. The medium particles vibrate without moving from their places during the propagation of sound waves which carry energy to the candle flame.

Conclusion :

The movement resulting from the vibration of the medium particles at a certain moment in a specific direction is known as "**wave motion**".

Activity 5

To show the nature of transverse waves.

Steps :

1. Fix one end of a spring to a wall using the nail.
2. Tie a coloured tape in the middle of the spring.
3. Move the free end of the spring up and down perpendicular to the axis of the spring.

Observations :

1. The rings of the spring (which represent the wave propagation) move up and down forming crests and troughs.
2. The coloured tape (which represents the particles of the medium) vibrates up and down without transferring from its place.

Conclusions :

1. During the wave propagation, the medium particles don't move from their rest positions, but they vibrate around their rest positions.
2. The wave in which the particles of the medium vibrate perpendicular to the direction of wave propagation is known as **"transverse wave"**.

Activity 6 To show the nature of longitudinal waves.

Steps :

1. Fix one end of a spring to a wall using the nail.
2. Tie a coloured tape in the middle of the spring.
3. Push and pull the coil rings from the left to the right.

Observations :

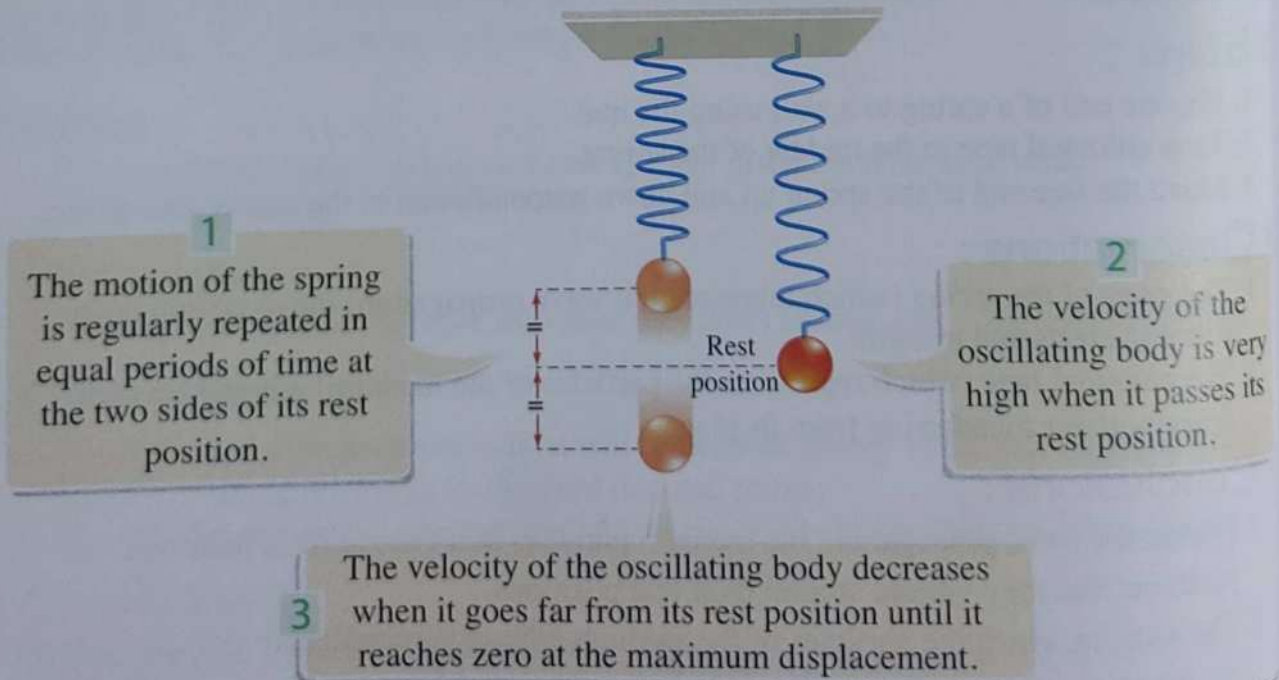
1. The rings of the spring (which represent the wave propagation) are too close to each other in some areas forming compressions and they are faraway from each other in other areas forming rarefactions.
2. The coloured tape (which represents the particles of the medium) vibrates around its rest position without transferring from its place.

Conclusions :

1. During the wave propagation, the medium particles don't move from their rest positions but they vibrate around their rest positions.
2. The wave in which the particles of the medium vibrate along the direction of wave propagation is known as **"longitudinal wave"**.

9 Important drawings :

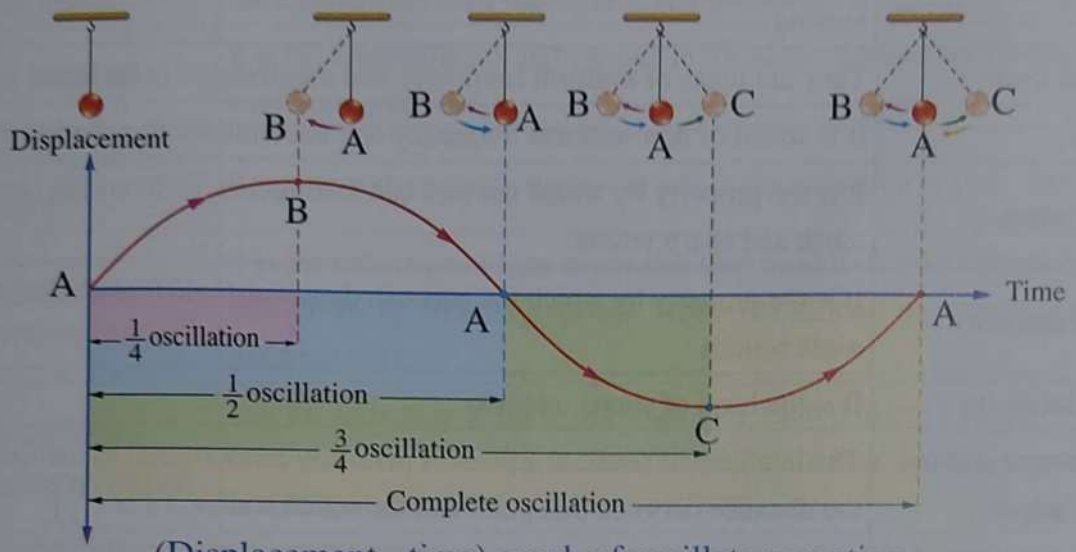
1 The oscillatory motion of the spring :



2 The relation between the displacement and the time taken for a simple harmonic motion of a simple pendulum :

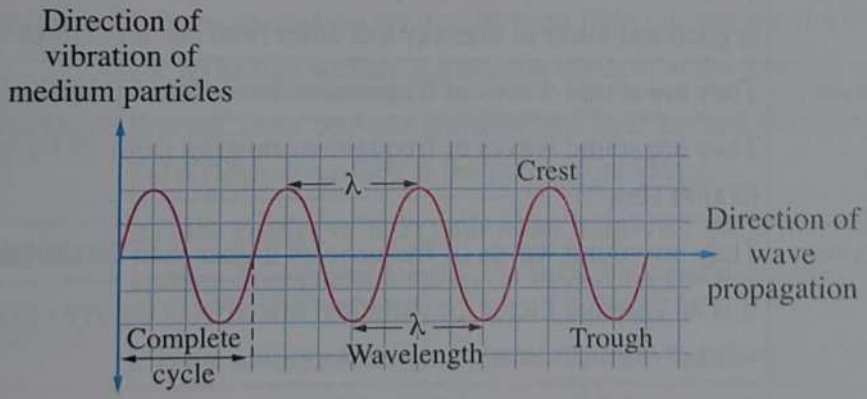
The complete oscillation includes four amplitudes (displacements)

A ⟶ B ⟶ A ⟶ C ⟶ A

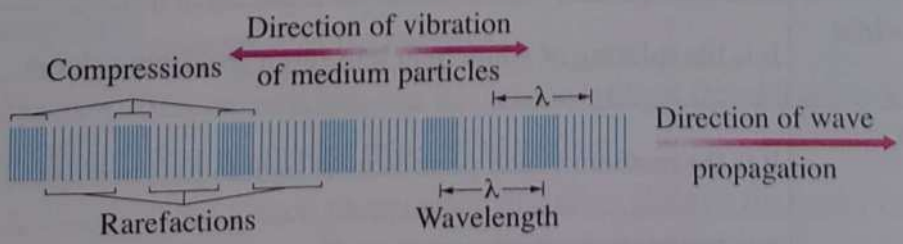


(Displacement - time) graph of oscillatory motion

3 Transverse wave :



4 Longitudinal wave :



Final Revision on Unit 2

1 Definitions (or scientific terms) :

1. Sound :	It is an external factor (or stimulus) that affects the ear causing the sense of hearing.
2. Musical tones :	They are tones of uniform frequency and comfortable to be heard.
3. Noise :	It is sound of non-uniform frequency and uncomfortable to be heard.
4. Sound pitch :	It is the property by which the ears can distinguish (differentiate) between harsh and sharp voices.
5. Sound intensity :	It is the property by which the ears can distinguish (differentiate) strong or weak sounds.
6. Noise intensity :	It is the level of sound intensity.
7. The inverse square law of sound :	The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source. [$I \propto \frac{1}{d^2}$]
8. Sound quality (type) :	It is the property by which the human ear can distinguish (differentiate) between different sounds according to the nature of the source even if they are equal in intensity and pitch.
9. Harmonic tones :	They are tones that accompany the fundamental (basic) tone but they are higher in pitch and lower in intensity and differ from one instrument to another.
10. Infrasonic waves :	They are sound waves of frequencies lower than 20 Hz.
11. Sonic waves :	They are sound waves of frequencies ranging from 20 Hz to 20 KHz (20000 Hz).
12. Ultrasonic waves :	They are sound waves of frequencies higher than 20000 Hz (20 KHz).
13. Light :	It is an external factor (or stimulus) that affects the eye causing the sense of vision.
14. The visible light :	It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.
15. Speed of light :	It is the distance covered by light in one second.
16. Analysis of white light :	It is the splitting of white light into seven spectrum colours.
17. Transparent medium :	It is the medium which permits most light to pass through.
18. Translucent medium :	It is the medium which permits only a part of light to pass through and absorbs the remaining part.

19. Opaque medium :	It is the medium that doesn't permit light to pass through.
20. Light intensity :	It is the quantity of light falling perpendicular to a unit area of a surface in one second.
21. The inverse square law of light :	The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.
22. Light reflection :	It is the rebounding of light waves in the same medium on meeting a reflecting surface.
23. Reflecting surface for light :	It is a smooth or rough surface at which the reflection of light takes place.
24. Regular (uniform) reflection :	It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.
25. Irregular (non-uniform) reflection :	It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.
26. The incident light ray :	It is a narrow light beam which is represented by a straight line, it intersects with the reflecting surface at the point of incidence.
27. The reflected light ray :	It is a narrow light beam which is represented by a straight line, it is reflected from the reflecting surface at the point of incidence.
28. Angle of incidence of light ray :	It is the angle between the incident light ray and the line perpendicular to the reflecting surface (separating surface) at the point of incidence.
29. Angle of reflection of light ray :	It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.
30. Light refraction :	It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.
31. Optical density of the medium :	It is the ability of the transparent medium to refract the light.
32. Angle of refraction :	It is the angle between the refracted light ray and the normal at the point of incidence on the interface.
33. Angle of emergence :	It is the angle between the emergent light ray and the normal at the point of emergence on the interface.
34. Absolute refractive index of a medium :	It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.
35. Mirage :	It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.

2 What is meant by ... ?

1. The wavelength of a sound wave is 1.5 m :	This means that the distance between the centres of two successive compressions or two successive rarefactions is 1.5 m.
2. Sound velocity through air is 340 m/sec. :	This means that the distance covered by sound waves in one second is 340 m.
3. The velocity of light is 3×10^8 m/sec. :	This means that the distance covered by the light in one second is 3×10^8 m.
4. Angle of incidence of a light ray is 40° :	This means that the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence is 40°
5. Angle of reflection of a light ray = 60° :	This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence = 60°
6. Angle of reflection of a light ray is zero :	• This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface equals zero. **OR** • This means that the incident light ray falls perpendicular on the reflecting surface and reflects on itself.
7. Angle of refraction of a light ray equals 30° :	This means that the angle between the refracted light ray and the normal a the point of incidence on the interface equals 30°
8. Angle of emergence in a prism is 43° :	This means that the angle between the emergent light ray and the line perpendicular to the interface at the point of emergence is 43°
9. Absolute refractive index of water is 1.33 :	This means that the ratio between the velocity of light through air to that through water is 1.33
10. The refractive index of a medium is high :	This means that the optical density of such medium is high. **OR** This means that the velocity of light through such medium is small.

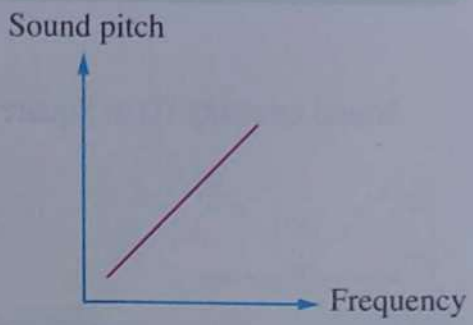
3 Measuring units :

Physical quantity	Measuring unit
1. Sound velocity :	m/sec.
2. Sound intensity :	Watt/m^2
3. Noise intensity :	Decibel

4 Important laws (mathematical relations) and solved problems :

1 Sound pitch ∝ Frequency :

Sound pitch ∝ Frequency.



2 In Savart's wheel :

$$\text{Sound frequency (F)} = \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

Problem

Calculate the number of gear teeth of Savart's wheel, given that the frequency of the sound produced is 100 Hz and the wheel rotates with a rate of 30 cycles/min.

Solution

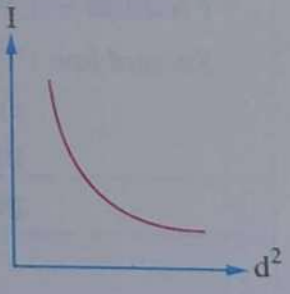
$$\text{Frequency (F)} = \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$100 = \frac{30 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{60 \times 100}{30} = 200 \text{ teeth.}$$

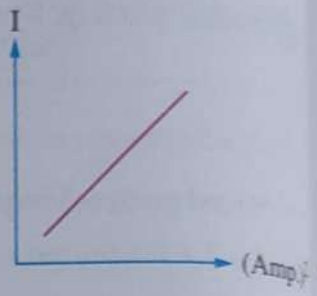
3 Inverse square law of sound :

$$\text{Sound intensity (I)} \propto \frac{1}{\text{The square of the distance between the sound source and the ear } (d^2)}$$



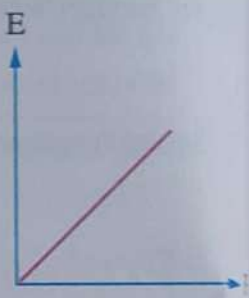
4 Sound intensity (I) ∝ the square of the amplitude (Amp^2) :

Sound intensity (I) ∝ Square of the amplitude.



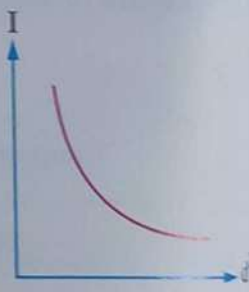
5 Photon energy = Planck's constant × Photon frequency

Photon energy ∝ Photon frequency.



6 Inverse square law of light :

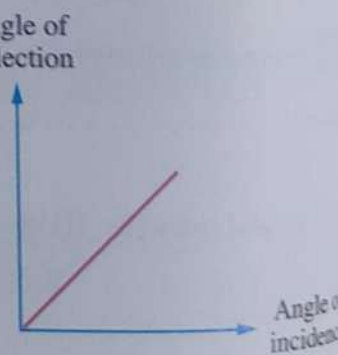
$$\text{Light intensity (I)} \propto \frac{1}{\text{The square of the distance between the surface and the source of light } (d^2)}$$



7 The two laws of light reflection :

First law : The angle of incidence = the angle of reflection.

Second law : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.

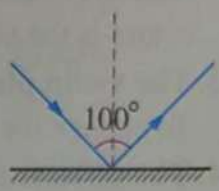


Problem

If the angle between the incident light ray and the reflected light ray is 100°, find the angle of incidence and the angle of reflection.

Solution

$$\text{Angle of incidence} = \text{Angle of reflection} = \frac{100}{2} = 50^{\circ}$$



8 Absolute refractive index of a medium $= \dfrac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$

Problem

If the velocity of light through water is 2.25×10^8 m/s, calculate the absolute refractive index of water. Knowing that the velocity of light through air is 3×10^8 m/s.

Solution

$$\text{The absolute refractive index of water} = \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$$

$$= \frac{3 \times 10^8}{2.25 \times 10^8} = \frac{3}{2.25} = 1.33$$

5 Importance or uses :

The item	Importance or uses
1. Ear plugs :	They are used to avoid the hazards of noise in loud places.
2. Savart's wheel :	It is used to determine the pitch (frequency) of an unknown tone.
3. Ultrasonic waves :	• Breaking down kidney and ureter stones without any surgical operations. • Diagnosis of male prostate gland tumors and its effect on bladder. • Discovering malignant tumors. • Sterilization of food, water and milk. • Discovering of landmines.
4. Triangular glass prism :	It analysis the white light into seven spectrum colours.
5. Light :	**Light is used in home decorations like :** - Spot lights to illuminate artifacts. - Ornamented lamps that bring happiness and joy to the place. - Stand lamps that concentrate light for reading.

6 Give reasons for :

1. **The guardian dog puts its ears on the ground when it sleeps at night.**
   Because the sound velocity through solids (the ground) is larger than that through air.
2. **Sound can be heard from all surrounding directions.**
   Because sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.
3. **The violin player changes the length of strings during his play.**
   To change the frequency of the produced tone.
4. **The difference in frequency between the tone (note) and noise.**
   Because musical note (tone) is of uniform frequency, while noise is of non-uniform frequency.
5. **The sound of drill and loudspeaker is uncomfortable to be heard.**
   Because it is sound of non-uniform frequency.
6. **Some construction workmen use ear plugs made of silicon.**
   To protect their ears from the noise.
7. **The tuning fork of frequency 251 Hz gives rougher sound than that produced by another tuning fork of 512 Hz.**
   Because the sound of the tuning fork of frequency 251 Hz is low pitch, while that of 512 Hz is high pitch.
8. • **The intensity of sound decreases four times as the distance between the ear and sound source is doubled.**
   • **It is preferred to sit in the first rows more than sit in the back rows in lecture classes.**
   Because the intensity of sound is inversely proportional to the square of the distance between the ear and the sound source.
9. • **The intensity of sound decreases as the amplitude of the vibrating source decreases.**
   • **The sound intensity which produced from a vibrating ruler will be decreased with time passes.**
   Because the sound intensity is directly proportional to the square of the amplitude of the vibrating source.
10. **The intensity of sound increases when the sound source touches a resonance box.**
    Due to the increase of the vibrating surface area.
11. **The strings of a musical lute are fixed on a hollow wooden box.**
    To increase the vibrating surface area which leads to an increase in sound intensity.
12. **Sound travelling in air has less intensity than that travelling in carbon dioxide.**
    Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.
13. **The piano sound differs from that of the violin even if they have the same intensity and pitch.**
    Due to the difference in harmonic tones that associate the fundamental tone of each of them.

14. **Dogs can hear all sounds produced by man.**
Because the range of sounds produced by man lies within the range of sounds heard by dogs.

15. **Man can't hear all sounds produced by dolphins.**
Because dolphins produce ultrasonic waves, while the human ears can't hear sounds of frequencies more than 20 kilohertz.

16. **Some sound waves cannot be heard by man.**
Because man can hear sounds of frequencies range between 20 Hz to 20 KHz.

17. **The infrasonic waves are used for weather forecast.**
Because these waves accompany the blowing of storms that preceding rainfall.

18. • **The use of ultrasonic waves in milk sterilization.**
• **Ultrasonic waves are used to sterilize food and water.**
Because they have high ability to kill some types of bacteria and stop the action of some viruses.

19. **The ultrasonic waves have medical uses.**
Because they are used for breaking down of kidney and ureter stones and also for diagnosis of male prostate tumors.

20. **Light can travel through free space.**
Because it is electromagnetic waves which don't need a medium to travel through.

21. **Light waves are considered as electromagnetic waves.**
Because light waves can propagate through vacuum.

22. **The light of the Sun is a complex light.**
Because the light of the Sun consists of seven colours which are called spectrum colours.

23. **The energy of red light photon is less than that of orange light photon.**
Because the frequency of red light photon is less than that of orange light photon.

24. **The energy of violet photon has the maximum energy in spectrum colours.**
Because it has the maximum frequency in spectrum colours.

25. **The energy of violet photon is larger than that of blue photon.**
Because the frequency of violet photon is more than that of blue photon.

26. **Objects can be seen clearly through transparent media.**
Because transparent media permit most light to pass through.

27. **A clear glass is a transparent medium.**
Because clear glass permits most light to pass through and objects can be seen clearly through it.

28. **Although water is a transparent medium, we cannot see fish at the bottom of the River Nile.**
Because the thickness of water at that point (the bottom) is large enough to prevent light to pass through.

29. **Objects cannot be seen clearly through the frosted glass.**
Because frosted glass is a translucent medium which permits only a part of light to pass through and absorbs the remaining part.

30. **A tissue paper is a translucent medium.**
Because tissue paper permits only a part of light to pass through and we can see objects through it less clearly.

31. **Aluminium foil is an opaque medium.**
Because aluminium does not permit light to pass through and objects cannot be seen through it.

32. **Wood doesn't allow the passage of light through it.**
Because it is an opaque medium.

33. **The inability to see the impurities present in black honey.**
Because black honey is an opaque medium that doesn't permit light through it.

34. **The intensity of light on a surface decreases to its quarter as the distance between the surface and light source is doubled.**
Because intensity of light is inversely proportional to the square of the distance between the surface and light source.

35. **The formation of inverted images of trees and buildings on the road when rain falls.**
Due to reflection of light.

36. **A leather jacket produces irregular light reflection, while a stainless steel plate produces regular light reflection.**
Because leather jacket is a rough surface, while stainless steel plate is a smooth surface.

37. **The light ray that falls perpendicular on a glistening surface, reflects on itself.**
Because angle of incidence = angle of reflection = zero.

38. **The velocity of light changes from one medium to another.**
Because the optical density of a medium differs from one medium to another.

39. **The light refracts when it travels from a medium to another.**
Due to the difference of light velocity through the different transparent media.

40. **When a light ray travels from air to water, it refracts near the normal.**
Because water is a transparent medium of higher optical density than air.

41. **When a light ray travels from glass to air, the angle of refraction is larger than that of incidence.**
Because the light ray refracts far from the normal.

42. **When a light ray passes through a glass prism, it refracts.**
Due to the difference of light velocity through air than that through glass.

43. **The absolute refractive index of any transparent medium is always greater than one.**
Because the velocity of light through air is always greater than that through any other transparent medium.

44. **The ray falling perpendicular on the separating surface between two media different in the optical density doesn't refract.**
Because the angle of incidence = zero.

45. **The pencil which is partially immersed in water appears as being broken.**
Due to the refraction of light rays coming from the immersed part in water, where the eye sees the immersed part of the pencil on the extensions of these refracted rays.

46. **The submerged object in water is seen in an apparent position above its real position.**
Due to the refraction of light rays coming from the submerged object (far from the normal) where the eye sees the submerged object on the extensions of the refracted rays.

47. **The floor of the swimming pool appears higher than its real position.**
Due to light refraction.

48. **To see a coin which has fallen in a beaker filled with water in its real position, we must look at it vertically.**
Because the ray which falls perpendicular to the interface passes to air without refraction, so the apparent position is the real position.

49. **Occurrence of mirage phenomenon in desert regions at noon.**
Due to reflection and refraction of light in air layers which differ in the degree of temperature.

7 What happens when ... ?

1. **Both the frequency and velocity of wave propagation decrease to quarter of their value [concerning the wavelength].**
The wavelength doesn't change.

2. • **You decrease the length of violin string during playing [concerning the sound pitch].**
• **The number of rotations per second of Savart's wheel increases.**
The pitch of the produced tone increases.

3. **The distance between the sound source and the ear increases twice.**
The intensity of sound decreases to its quarter value.

4. • **The quantity of sound energy falling perpendicularly in one second on a unit area increases.**
• **The amplitude of vibration of a sound source increases [concerning the sound intensity].**
The intensity of sound increases.

5. **You put a vibrating tuning fork on a resonance box [concerning the sound intensity].**
The intensity of the produced tone increases.

6. **Operating an electric bell under a bell jar connected to a vacuum pump, then pump the air out of the jar gradually.**
The intensity of the produced sound decreases gradually until it stops.

7. **The density of the medium decreases [concerning the sound intensity].**
   The intensity of sound decreases.
8. **The sound direction is in the direction of air flow [concerning the sound intensity].**
   The intensity of sound increases.
9. **The sound direction opposes the direction of air flow.**
   The intensity of sound decreases.
10. • **The frequency of sonic waves decreases less than 20 Hz.**
    • **The frequency of sonic waves increases more than 20000 Hz.**
    Man cannot hear these waves.
11. • **A compact disc (CD) with shiny side is put to face sunlight.**
    • **Incidence of a white light ray on one face of a triangular glass prism.**
    The white light analysis into seven colours.
12. **The thickness of the transparent medium increases concerning the quantity of light that passes through it.**
    The quantity of light that passes through it decreases.
13. **Light falls on a transparent medium.**
    It permits most light to pass through.
14. **Light falls on a translucent medium.**
    It permits only a part of light to pass through and absorbs the remaining part.
15. **Light falls on an opaque medium.**
    It doesn't permit light to pass through.
16. **You look at a picture through a clear glass.**
    I will see the picture clearly.
17. **You look at a picture through a frosted glass.**
    I will see the picture less clearly.
18. **You look at a picture through a metallic sheet.**
    I will not see the picture.
19. **The distance between the source of light and a surface increases [concerning the light intensity].**
    The light intensity decreases.
20. **The distance between the light source and a surface is doubled [concerning the light intensity].**
    The light intensity decreases to its quarter.
21. **Incidence of light rays on a rough surface.**
    The light rays are reflected in many directions.

22. **Incidence of light rays on a smooth glistening surface.**
The light rays are reflected in one direction.

23. **Light ray is incident on a plane mirror by an angle of incidence equals 30°**
It will reflect by an angle of reflection equals 30°

24. **Light ray falls perpendicular on a reflecting surface.**
It will reflect on itself.

25. **Light ray travels from a transparent medium to another one of different optical density.**
It will refract.

26. **Light ray travels from glass to air.**
It will refract far from the normal.

27. **Light ray travels from air to glass.**
It will refract near the normal.

28. **A light ray falls perpendicular to the interface between two transparent media of different optical densities.**
It will pass without refraction.

29. **You look at a pencil partially immersed in water.**
It appears as being broken.

30. **You look at a coin in a glass full of water.**
It will be seen in an apparent position higher than its real one.

8 Comparisons :

1 Musical tones and noises :

Musical tones	Noises
• Tones of uniform frequency.	• Sounds of non-uniform frequency.
• Comfortable to be heard.	• Uncomfortable to be heard.
Example : Sound of piano.	**Example :** Sound of loudspeakers.

2 Sharp and rough sounds :

Sharp sound	Rough sound
• High pitched sound.	• Low pitched sound.
• High frequency.	• Low frequency.
Example : Voice of women.	**Example :** Voice of men.

3 Sound pitch and sound intensity :

Sound pitch	Sound intensity
• It is a property by which the ear can distinguish between rough and sharp voices.	• It is a property by which the ear can distinguish between strong and weak voices.
• It depends on the frequency of the sound source.	• It depends on : - The distance between the ear and the sound source. - The amplitude of the sound source. - The area of the vibrating surface. - The density of the medium. - The direction of the wind.

4 Sonic, ultrasonic and infrasonic waves :

Points of comparison	Sonic waves	Ultrasonic waves	Infrasonic waves
• **Their frequencies :**	Between 20 Hz to 20 KHz (20000 Hz).	Higher than 20 KHz (20000 Hz).	Lower than 20 Hz.
• **Hearing by man :**	Heard.	Cannot be heard.	Cannot be heard.

5 Transparent medium, translucent medium and opaque medium :

Points of comparison	Transparent medium	Translucent medium	Opaque medium
• **Definition :**	It is the medium which permits most light to pass through.	It is the medium which permits only a part of light to pass through and absorbs the remaining part.	It is the medium that doesn't permit light to pass through.
• **Examples :**	• Air. • Pure water. • Clear glass.	• Frosted (flint) glass. • Tissue paper.	• Molasses. • Human skin. • Plant leaves. • Milk.

6 Regular reflection and irregular reflection :

Regular (uniform) reflection	Irregular (non-uniform) reflection
It is the reflection of light rays when they fall on a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.	It is the reflection of light rays when they fall on a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

7 Light reflection and light refraction :

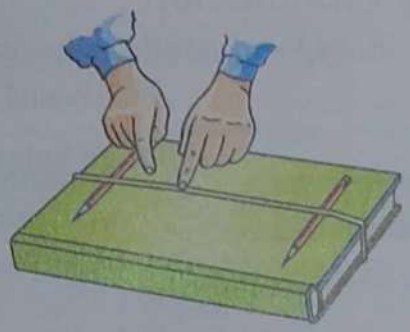
Light reflection	Light refraction
• It is the rebounding of light waves in the same medium on meeting a reflecting surface.	• It is the change of light path when it travels from a transparent medium to another one of different optical density.
• The angle of reflection equals the angle of incidence.	• The angle of refraction does not equal the angle of incidence.

9 Activities :

Activity 1 To illustrate the concept of sound pitch and its relation with sound frequency.

Steps :

1. Tie a rubber string around a book and put two pencils below it.
2. Press on the string by the forefinger of the left hand at 10 cm from one of the two pencils, then vibrate this segmented part of the string by the forefinger of the right hand.
3. Repeat the previous step by increasing the length of the vibrating segmented part of the string several times.



Observation :

The sound becomes more harsher as the length of the string increases and becomes more sharper as the length of the string decreases.

Explanation :

As the length of the string decreases, the number of vibrations produced in one second (frequency) increases.

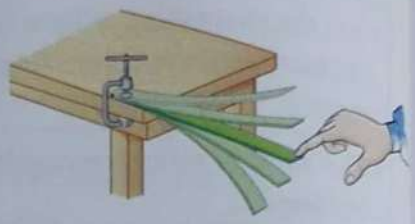
Conclusions :

- The sound pitch is a property of sound by which the ear can distinguish between harsh and sharp voices.
- The sound pitch depends on the frequency of the sound source.
- The sound pitch increases by increasing the frequency and vice versa.

(Sound pitch $\propto$ Frequency)

Activity 2 To identify the effect of the amplitude of the sound source on sound intensity.

Steps :



1. Fix one end of a ruler on the edge of a table by your right hand.
2. Pull the other end of the ruler downwards, then leave it free and notice the sound produced.

Observation :

The intensity of sound decreases as time passes.

Explanation :

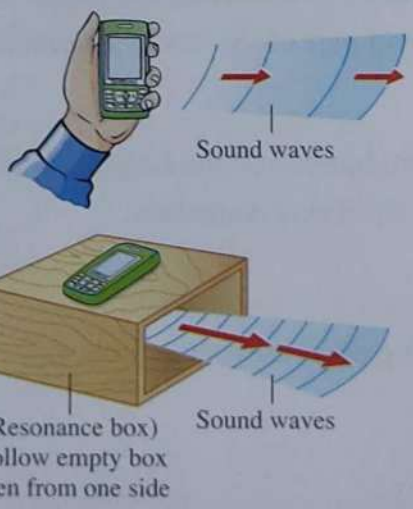
The amplitude of the ruler decreases gradually as time passes.

Conclusion :

Sound intensity decreases gradually by decreasing the amplitude of the vibration.

(Sound intensity $\propto$ Square of the amplitude)

Activity 3 To identify the effect of the area of the vibrating surface on the sound intensity.

Steps	Figures	Observation
1. Hold your mobile which is adjusted to the vibrating mode in your hand, then ring on it from another mobile. 2. Put the phone on an empty box which is opened at one of its sides to work as a resonance box. 3. Compare between the intensity of sound that is produced in each case.		The sound produced from the phone which is placed on the resonance box, is stronger than that is produced from the phone which is held.

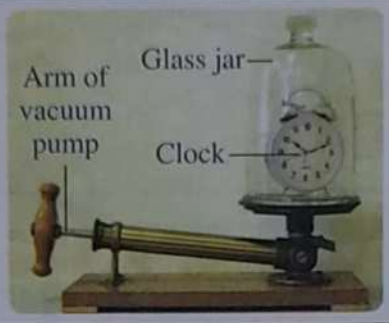
Explanation :

The resonance box increases the vibrating surface area.

Conclusion :

Sound intensity increases when the sound source touches a resonance body (box).

Activity 4 To identify the effect of the medium density on the sound intensity.

Steps	Figure	Observations
1. Ring an alarm clock, then put it on the air vacuum pump and cover it by the glass jar. 2. Evacuate (pump out) the air inside the jar gradually (by drawing the arm of the vacuum pump outwards).		1. The sound is heard clearly. 2. The sound intensity decreases gradually until it stops as the air is pumped out of the jar.

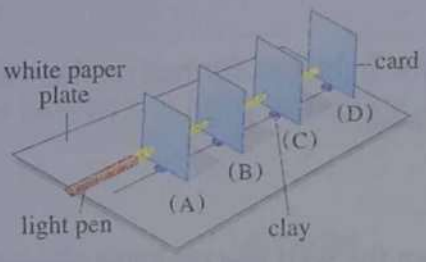
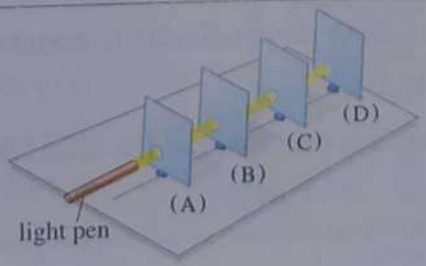
Explanation :

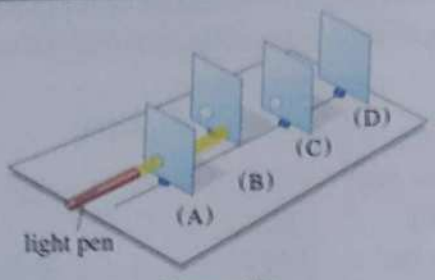
The air density decreases as you pull the air vacuum pump outwards.

Conclusion :

Sound intensity decreases by decreasing the density of the medium and vice versa.

Activity 5 To demonstrate (show) the propagation of light in straight lines :

Steps	Figures	Observations
1. Make identical holes in the three cards [A , B , C] (as shown in figure 1). 2. Fix the four cards using clay on the white paper plate, where the holes lie on straight line. 3. Allow light of the light pen to pass through the hole of card (A).	 Figure (1)	The light ray passes through the holes in straight line and a light spot is formed on the card (D).
4. Repeat the previous steps by replacing the cards with others have wider holes (as shown in figure 2).	 Figure (2)	The area of the formed light spot increases by increasing the size of the holes.

5. Move the card (B) to the left (as shown in figure 3).	 Figure (3)	The light ray cannot pass through the card (B), so a light spot disappears on the card (D).

Conclusion :

Light travels through transparent media in the form of straight lines, whose size (thickness) can be controlled.

Activity 6

- To illustrate the concept of light intensity.
- To show the light intensity of a surface changes by changing the distance between the surface and the light source.

Steps :

1. Stand at 1 meter away from a wall in a dark room and direct the light of a torch towards it.
2. Increase the distance between you and the wall to 2 metres, then 3 metres.

Observation :

The light intensity of the light spot formed on the wall decreases as the distance between you and the wall increases.

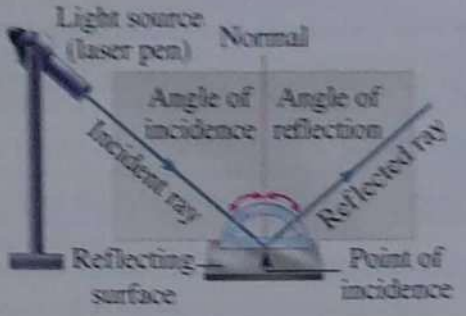
Explanation :

As the distance between the wall and the light source increases, the quantity of light incident on the unit area of the surface decreases.

Conclusions :

- The quantity of light falling perpendicular to a unit area of a surface in one second is called **"Light intensity"**.
- Light intensity of a surface decreases as the distance between the surface and the light source increases.

Activity 7 To conclude the two laws of light reflection.

Steps	Figure	Observations
1. Fix a plastic protractor perpendicular to the edge of a plane mirror. 2. Direct a light ray on the protractor with an angle of incidence 30° from the point of incidence. 3. Change the angle of incidence several times and measure the angle of reflection in each time. 4. Change the inclination of the mirror, where the angle between them not be 90°	 Light reflection	- The angle of reflection changes according to the change of the angle of incidence, since they are equal. - The reflected ray not be seen.

Conclusion :

The reflection of light is governed by two laws :

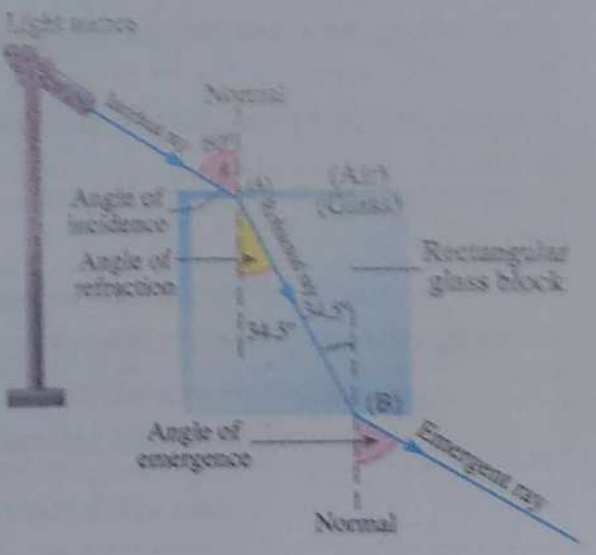
First law: Angle of incidence = Angle of reflection

Second law : The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.

Activity 8 To demonstrate (show) the light refraction :

Steps :

1. Put a rectangular glass block on a white paper sheet and mark around the block using a pencil.
2. Direct a ray from the laser pen to the point of incidence (A) on the side of the rectangular glass and draw its path (using the pencil and the ruler) to represent the incident ray.
3. Draw the path of the emergent ray from point (B) on the opposite side of the glass.
4. Remove the rectangular glass and join the two points (A) and (B) with a straight line which represents the refracted ray.



5. Draw at (A) and (B) dotted vertical lines, where it represents the normal at the point of incidence and at the point of emergence on the interface.

Observations :

- When the light ray travels from air into glass or vice versa, it refracts.
- The angle of incidence (60°) is not equal to the angle of refraction (34.5°).
- The angle of incidence (60°) is equal to the angle of emergence (60°).
- The incident light ray is parallel to the emergent light ray.

Conclusion :

The light refraction phenomenon occurs when the light ray travels from a transparent medium to another transparent medium of different optical density.

Final Revision on Unit 3

1 Definitions (or scientific terms) :

1. Reproduction process :	It is a vital process that aims to secure the existence and continuity of living organisms species by producing new individuals of the same species to prevent them from extinction.
2. The flower :	• It is a short stem whose leaves are modified to form genital (reproductive) organs which in turn form seeds inside fruits. • It is the organ of sexual reproduction of flowering plants.
3. The bract :	It is the green leaf, where the floral bud emerges from its axle and developed into a flower.
4. The inflorescence :	It is a group of flowers carried on the same axle.
5. Receptacle :	It is the swollen part upon the flower pedicle on which the floral leaves are existed.
6. Calyx :	It is the first (outermost) whorl of the floral leaves which consists of a group of green sepals.
7. Corolla :	It is the second whorl of the floral leaves which consists of a group of coloured scented petals.
8. Androecium :	It is the third whorl of the floral leaves and it is the male (♂) reproductive organ of the flower.
9. Gynoecium :	It is the fourth (innermost) whorl of the floral leaves and it is the female (♀) reproductive organ of the flower.
10. Typical flower :	It is the flower that contains four floral whorls.
11. Male flower (♂) :	It is the flower that contains only male reproductive organ (androecium).
12. Female flower (♀) :	It is the flower that contains only female reproductive organ (gynoecium).
13. Bisexual (Hermaphrodite) flower (⚥) :	It is the flower that contains both male and female reproductive organs.
14. Pollination :	It is the process of transfer of pollen grains from the flower anthers to the stigmas.
15. Self (Auto) pollination :	It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.
16. Cross (Mixed) pollination :	It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
17. Artificial pollination :	It is the pollination which is carried out by man.

18. Fertilization in plant :	It is the process of fusion of the nucleus of male cell (pollen grain) with the nucleus of female cell (ovum) to form the zygote.
19. Zygote :	The cell resulting from the fusion of a pollen grain and an ovum nuclei.
20. Vegetative reproduction :	It is a process of producing new individuals from different parts of the plant without the flower having a role in this process.
21. Tuber :	It is a swollen part from a horizontal root or a terrestrial stem which contains growing buds and it is used for vegetative reproduction.
22. Reproduction by cutting :	It is a kind of artificial vegetative reproduction in which a part of a plant that contains growing buds known as the cut is planted.
23. The cut :	It is a part of root, stem or leaf that contains growing buds taken from the plant for reproduction.
24. Reproduction by grafting :	It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock.
25. The scion :	It is a part of a plant which contains more than one bud and is placed on the stock during reproduction by grafting.
26. The stock :	It is a branch of the plant on which the scion is placed during reproduction by grafting.
27. Grafting by attachment :	It is a kind of reproduction by grafting in which the scion is attached to the stock.
28. Grafting by wedge :	It is a kind of reproduction by grafting in which the scion in the form of a wedge is inserted into a cleft in the stock.
29. Tissue culture :	It is a process of multiplying a small part of a plant to get many identical parts.
30. Ovulation process :	It is the process of production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary.
31. Female menopause :	It is the age at which the two ovaries completely stop releasing ova.
32. Fertilization in human :	It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).
33. Pregnancy period :	It is the period between the fertilization process and delivery which extends for about 9 months.
34. Incubation period :	It is the period between the beginning of the infection and the appearance of symptoms of the disease.

2 Function or importance :

The item	Function or importance
1. Reproduction process :	It aims to secure the existence and continuity of living organisms species and to prevent them from extinction.
2. Calyx (Sepals) :	Protection of the inner parts of the flower specially before blooming.
3. Corolla (Petals) :	- Protection of reproductive organs of the flower. - Attraction of insects to the flower, which help in the reproduction process.
4. Androecium (Stamens) :	Production of pollen grains.
5. Gynoecium (Carpels) :	Production of ovules.
6. Tuber :	It is used in vegetative reproduction.
7. Buds in potatoes :	Formation of root system and shoot system.
8. Stock in reproduction by grafting :	To carry and feed the scion.
9. Tissue culture :	Producing large numbers of a plant by using a small part of it.
10. Testes :	- Production of sperms. - Production of male sex hormone (testosterone hormone).
11. Testosterone hormone :	It is responsible for the appearance of secondary male sex characters.
12. Scrotal sac (Scrotum) :	Keeping the temperature of the testes 2°C below the normal body temperature which is the optimum temperature for the growth and development of sperms.
13. Epididymis :	- It stores sperms. - The final stages of the growth and development of sperms take place in it.
14. Vas deferens :	Transferring sperms from the testes to the urinary genital duct (urethra).
15. Genital associated glands in male :	They pour secretions on the sperms to form an alkaline seminal fluid.
16. Seminal fluid :	- It nourishes the sperms. - It facilitates the flow of sperms. - It neutralizes the acidity of urethra.
17. Penis :	Through which the semen and urine go out of the body through the urinogenital opening but never at the same time.
18. Ovary (in human) :	- Production of ova. - Production of female sex hormones (estrogen and progesterone hormones).
19. Estrogen :	It is responsible for the appearance of secondary female sex characters.
20. Progesterone :	It is responsible for the continuity of pregnancy.
21. Fallopian tubes :	Receiving the ripe ovum and pushing it towards the uterus with the aid of : • The contraction and relaxation of the muscles in the tube wall. • The movement of the lining cilia.

22. Uterus :	- It protects the fetus until birth. - It nourishes the fetus during the pregnancy by the placenta through the umbilical cord.
23. Placenta :	It is responsible for nourishment of the fetus during pregnancy.
24. Vagina :	It expands during the labour to deliver (coming out) the baby.
25. Midpiece of the sperm :	It contains mitochondria which are responsible for energy production needed for sperms movement.
26. The tail of the sperm :	It is responsible for the movement of the sperm till it reaches the ovum.
27. The cellular membrane of the ovum :	It surrounds the ovum from outside.
28. Enzymes secreted from the sperm :	They dissolve the cellular membrane of the ovum during fertilization and facilitate the penetration of the sperm inside the ovum.
29. Chromosomes :	They carry genes which are responsible for the hereditary traits of the organism.

3 Give reasons for :

1. **The petals of corolla are colourful and scented.**
   To attract insects to the flower which help in the sexual reproduction process.
2. **The androecium is the male reproductive organ of the flower.**
   Because it produces pollen grains.
3. **The gynoecium is the female reproductive organ of the flower.**
   Because it produces ovules.
4. **The flower of bean plant is a typical bisexual flower.**
   Because the flower contains the four whorls.
5. **Palm flowers are unisexual.**
   Because the flowers contain only male or female reproductive organ.
6. **Auto pollination can't happen in sunflowers.**
   Because their anthers and stigmas are not maturated at the same time.
7. **The pollination in barley plant is self pollination.**
   Because its flowers never bloom until the completion of fertilization process.
8. **The pollination of maize plant is mixed pollination.**
   Because the flowers of this plant are unisexual flowers.
9. **Flowers pollinated by air having hanging anthers.**
   To be easily opened by air.
10. **The stigmas of air pollinated flowers are feathery like and sticky.**
    To catch pollen grains from air.
11. **Pollen grains of air pollinated flowers are produced in a huge number.**
    To compensate what are lost in air.

12. **Pollen grains of air pollinated flowers are light in weight and dry.**
To be easily carried by air.

13. **Flowers pollinated by insects have coloured and scented petals.**
To attract insects (like bees) to feed on its nectar.

14. **Flowers pollinated by insects produce coarse pollen grains.**
To adhere on the insect's body.

15. **Pollination in palm trees is an artificial pollination.**
Because it takes place by man.

16. **Pollen grains that are transferred by wind can be easily distinguished from those transferred by insects.**
Because pollen grains that are transferred by wind are light in weight and dry, while that are transferred by insects are sticky or having coarse surfaces.

17. **Bee insect is more important than the honey production process.**
Because it transfers pollen grains from a flower to another during absorbing nectar.

18. **The pollen grains germinate in sugary solutions and don't germinate in water.**
Because in sugary solutions, the nutrients needed for germination of pollen grains are available.

19. **The number of seeds in fruits depends on the nature of the flower ovary.**
Because the ovary that contains :
- One ovule gives a fruit with a single seed.
- Many ovules gives a fruit with many seeds.

20. **Olive fruit contains only one seed, while bean fruit contains more than one seed.**
Because the ovary of olive contains only one ovule, while that of bean contains many ovules.

21. **Some plants can reproduce sexually and asexually.**
Because some plants reproduce sexually through flowers but reproduce asexually through different parts of the plant without the flower having a role in this process and the resulting individuals are completely identical to the original plant.

22. **In reproduction by cutting, the cut must be a branch carrying many buds.**
To grow the buds buried inside the soil forming the root system of the plant and to grow the buds above the soil surface forming the shoot system of the plant.

23. **The scion and the stock are tightly tied together.**
To make the scion feed on the juice of the stock.

24. **Reproduction by grafting can't be used between apples and peaches.**
Because this kind of reproduction is used only between highly similar plant species.

25. **Tissue culture is a good method for plant reproduction.**
Because through tissue culture, it is possible to produce large numbers of a plant by using a small part of it.

26. **Man can't reproduce asexually but he only reproduces sexually.**
Because the individuals coming from asexual reproduction are identical to the parent, while in human each individual differs from others.

27. **The presence of testes outside the body in a sac-like structure called the scrotal sac.**
Because it regulates and keeps the temperature of testes 2°C below the normal body temperature which is the optimum temperature for the growth and development of sperms.

28. **The man, whose testicles are still present inside the abdominal cavity is infertile (sterile).**
Due to the inability of the testes to produce sperms as a result of the rise in temperature of the body cavity by about two degrees above the optimum temperature for the production of sperms.

29. **The seminal fluid is alkaline in nature.**
To neutralize the acidity of urethra, so sperms will not die during their passage through urethra.

30. **The seminal fluid contains nutrients.**
To nourish the sperms.

31. **When occurrence a cut in the two vas deferens, the person becomes infertile.**
Due to stopping the transfer of the sperms from the testes to the urinary genital duct.

32. **The sperms don't die during their passage through urethra.**
Because the seminal fluid neutralizes the acidity of the urethra.

33. **Fallopian tubes are of funnel-shaped opening provided with finger-like projections.**
To trap the ripe ovum.

34. **The inner wall of fallopian tubes is lined with cilia.**
To direct the ovum towards the uterus.

35. **The uterus has a muscular wall.**
To expand as the fetus grows during the pregnancy period.

36. **The uterus is lined with mucus membrane rich in blood capillaries.**
To form the placenta which is responsible for the nourishment of fetus during the pregnancy period through the umbilical cord.

37. **The midpiece of the sperm contains mitochondria.**
Because mitochondria are responsible for energy production needed for the sperms movement.

38. **The sperm has a long and thin tail.**
Because it is responsible for movement of the sperm till it reaches the ovum.

39. **The ovum is relatively large in size.**
Due to the storage of nutrient materials.

40. **During fertilization, the head of sperm secretes enzymes on the ovum.**
To dissolve the cellular membrane of the ovum and facilitates its penetration inside the ovum.

41. **Fallopian tubes ligation is considered as one of the means of birth control.**
Because the sperms don't reach the ripe ovum so, fertilization process doesn't happen.

42. **The ovum surrounds itself with a coat after the penetration of a sperm inside it.**
To prevent the penetration of any other sperm.

43. **The zygote contains the complete number of chromosomes.**
Because when the nucleus of the sperm which contains 23 chromosomes fuses with the nucleus of the ovum which contains 23 chromosomes, the zygote is formed which contains the complete number of chromosomes (46 chromosomes).

44. **Surgical tools must be sterilized during labour.**
To protect the mother from the infection with some diseases such as puerperal sepsis.

45. **Smoking is harmful to reproductive health.**
Because it causes the death of the embryos and newly born babies and leads to the increase in deformation rate in embryos.

46. • **A new laboured mother should avoid air currents after delivery.**
• **It is necessary to wear masks during labour process.**
• **Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.**
To avoid the infection with puerperal sepsis disease.

4 What happens ... ?

1. **When a pollen grain falls on the stigma of a flower.**
It will germinate forming a pollen tube.

2. **To the anther when pollen grains become mature.**
It will split longitudinally and pollen grains will spread in air like dust.

3. **When the anthers of air pollinated flowers are not hanged.**
Anthers will not be opened easily by air.

4. **When the stigmas of air pollinated flowers are not feathery like and not sticky.**
Stigmas will not catch pollen grains from air.

5. **When the petals of insect pollinated flowers are not coloured and with no scent.**
Insects will not be attracted to the flower.

6. **When the pollen grains of insect pollinated flowers are not sticky and with a smooth surface.**
Pollen grains will not adhere on the insect's body.

7. **If the stigma doesn't secrete sugary solution after its pollination.**
The pollen grain will not germinate.

8. **When the nucleus of the pollen grain fuses with the nucleus of the ovum.**
The zygote is formed.

9. **When completion of fertilization process for the parts of the flower.**
The ovary changes into a fruit, the wall of the ovary changes into outer coat of the fruit, the ovule changes into a seed and the wall of the ovule changes into a seed coat.

10. **To the ovary (after fertilization).**
The ovary will grow to become a fruit.

11. **To the zygote (after fertilization).**
The zygote undergoes successive divisions to form the embryo inside the ovary.

12. **When the ovary of the flower contains more than one ovule.**
The ovary develops to become a fruit inside it many seeds after completion of fertilization process.

13. **When cultivate a piece of potato tuber contains buds in the soil.**
Some buds grow forming a root system which grows down, other buds grow forming a shoot system which grows up and after some days, the old tuber changes into a plant that carries many new tubers.

14. **When a part of an orange plant is tied to a branch of a naring plant.**
The orange plant (scion) feeds on the juice of the naring plant (stock) and grows forming orange fruits.

15. **When cultivate a cut contains several buds in a pot and irrigate it with water.**
The buds buried inside the soil grow to form the root system of the plant and the buds above the soil surface grow to form the shoot system of the plant.

16. **When separating a tissue from the upper part of a potato stem and putting it in a nutritive medium and hormones.**
The tissue grows forming a new plant of the same kind.

17. **If the two testes present inside the body and don't come out during the embryo development.**
The testes stop producing the sperms and the individual becomes infertile.

18. **When the two vas deferens were cut.**
The sperms can't transfer from the testes to the urinary genital duct and the individual becomes infertile.

19. **When the inability of the sex glands to secrete the semen.**
The sperms die, so the individual becomes infertile.

20. **If the seminal fluid is not alkaline.**
The sperms will die during their passage through the urethra and the individual becomes infertile.

21. **If the testes are unable to secrete testosterone hormone.**
Disappearance of secondary sex characters in male.

22. **If the ovary is unable to secrete estrogen hormone.**
Disappearance of secondary sex characters in female.

23. **If the ovary is unable to secrete progesterone hormone.**
No pregnancy will continue.

24. **If the fallopian tubes are not ciliated and have no muscular wall.**
It will not be able to direct the ovum towards the uterus.

25. **When contraction and relaxation the muscles of the wall of the fallopian tube.**
The ovum pushes towards the uterus.

26. **If the fallopian tubes are ligated.**
The sperms do not reach the ripe ovum and the fertilization process not occur.

27. **If the mucus membrane lining the uterus has no blood capillaries.**
Placenta will not be formed then the nourishment of fetus cannot be occurred.

28. **If the umbilical cord is cut during pregnancy.**
Food doesn't reach from the placenta to the fetus, so the fetus dies.

29. **If the woman reaches menopause.**
The two ovaries completely stop releasing ova, so the menstrual cycle stops.

30. **When the midpiece of a sperm doesn't contain the mitochondria.**
No energy will be produced and the sperm will not be able to move or penetrate the ovum.

31. **If the sperm lost its tail.**
It will not move, so no fertilization (pregnancy) occurs.

32. **If the sperm head is unable to secrete enzymes on the ovum.**
It will not be able to penetrate the ovum.

33. **When penetration of one sperm to the ovum.**
The ovum surrounds itself with a membrane that prevents the penetration of any other sperm, then fertilization occurs and the zygote is formed.

34. • **When the wound of recently laboured mother is infected by spherical bacteria.**
• **The recently laboured mother is subjected to air currents.**
She will be infected by puerperal sepsis disease.

35. **If the syphilis infected person is not treated as soon as the appearance of the symptoms.**
Tumors will appear in different body parts like the liver, bones and parts of genital system, the brain may also be damaged and the patient will die.

5 Comparisons :

1 The four whorls of a typical flower :

Points of comparison	Calyx	Corolla	Androecium	Gynoecium
• Position :	The first (outermost) whorl.	The second whorl.	The third whorl.	The fourth (innermost) whorl.
• Consists of :	Sepals.	Petals.	Stamens.	Carpels.
• Description :	Green leaves, surrounding the flower from outside.	Bright coloured scented leaves.	Fine filament ends in a sac.	A hollow tube like a flask, that lies in the centre of the flower.
• Function :	Protection of the inner parts of the flower.	- Protection of reproductive organs. - Attraction of insects.	Production of pollen grains.	Production of ovules.

2 Androecium and gynoecium :

Points of comparison	Androecium	Gynoecium
• Position :	It is the third whorl of the floral leaves.	It is the fourth (innermost) whorl of the floral leaves.
• Its sex :	Male reproductive organ.	Female reproductive organ.
• Its leaves are known as :	Stamens.	Carpels.
• Function :	It produces pollen grains.	It produces ovules.

3 Male flower, female flower and hermaphrodite flower :

Points of comparison	Male flower	Female flower	Hermaphrodite flower
• It contains :	Only male reproductive organ (androecium).	Only female reproductive organ (gynoecium).	Both male and female reproductive organs.
• Its kind :	Unisexual.	Unisexual.	Bisexual.
• Its symbol :	♂	♀	⚥
• Examples :	Palm and maize.	Palm and maize.	Tulip and petunia.
• No. of whorls :	3 whorls.	3 whorls.	4 whorls.

4 Self pollination and cross pollination :

Self pollination	Cross pollination
It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.	It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
Ex. : • Barley plant. • Flax plant.	**Ex. :** • Sunflower plant. • Maize plant.

5 Pollination and fertilization :

Pollination	Fertilization
It is the process of transfer of pollen grains from the flower's anthers to the stigmas.	It is the process of fusion of the nucleus of male cell (pollen grain) with the nucleus of female cell (ovum) to form the zygote.

6 Air-pollinated flowers and insect-pollinated flowers :

Air-pollinated flowers	Insect-pollinated flowers
• The anthers are hanged. • The stigmas are feathery like and sticky. • The pollen grains are light in weight and dry and produced in huge numbers.	• The petals are coloured and scented. • The pollen grains are sticky or having coarse surface.

7 Vegetative reproduction and flowering reproduction :

Vegetative reproduction	Flowering reproduction
• Asexual reproduction.	• Sexual reproduction.
• It takes place via parts of root, stem, leaves or buds.	• It takes place via flowers.

8 Natural vegetative reproduction and artificial vegetative reproduction :

Natural vegetative reproduction	Artificial vegetative reproduction
It takes place by many ways such as, reproduction by : Rhizomes, corms, tubers, bulbs and offshoots.	It takes place by four ways which are : Cutting, grafting, tissue culture and layering.

9 Grafting by attachment and grafting by wedge :

Grafting by attachment	Grafting by wedge
In which the scion is attached to the stock.	In which the scion in the form of a wedge is inserted into a cleft in the stock.
Ex. : Mango trees.	**Ex. :** Large trees.

⑩ Reproduction by tubers and reproduction by grafting :

Reproduction by tubers	Reproduction by grafting
Natural vegetative reproduction.	Artificial vegetative reproduction.
It takes place by planting a horizontal root (as sweet potatoes) or a terrestrial stem (as potatoes) which contains growing buds.	It takes place by putting a part of plant which contains more than one bud (scion) on a branch of another plant (stock).
The produced individual is from the same kind of the original plant.	The produced individual is from the same scion.
Ex. : - Sweet potatoes. - Potatoes.	**Ex. :** (Between highly similar plant species) - Oranges and naring. - Apples and pears. - Peaches and apricots.

⑪ Testes and ovaries :

Points of comparison	Testes	Ovaries
• **Description :**	Two glands of oval shape.	Two glands having the size and shape of a peeled almond.
• **Position :**	In male, in scrotal sac which is hanged between man's thighs.	In female, in the lower part of the abdominal cavity from the back.
• **Function :**	• Production of sperms. • Production of male sex hormone (testosterone).	• Production of ova. • Production of female sex hormones (estrogen and progesterone).

⑫ Gametes in human and gametes in plant :

Points of comparison	Gametes in human	Gametes in plant
Male gametes :	Sperms	Pollen grains
Female gametes :	Ova	Ova

⑬ Signs of puberty in male and female :

Signs of puberty in male	Signs of puberty in female
• Growth of hair in certain body areas (like face and mustache). • Harshness of voice. • Growth and development of genital organs. • Growth of bones. • Enlargement of muscles.	• Growth of hair in armpit and pubic. • Softness of voice. • Growth and development of breasts. • Accumulation of fats in some body regions. • Occurrence of menstrual cycle every 28 days, as long as no pregnancy happens.

14 Testosterone, estrogen and progesterone hormones :

Points of comparison	Testosterone hormone	Estrogen hormone	Progesterone hormone
• Kind :	Male hormone	Female hormone	
• Secreted by :	Testes	Ovaries	
• Function :	It is responsible for the appearance of secondary sex characters in male.	It is responsible for the appearance of secondary sex characters in female.	It is responsible for the continuity of pregnancy.

15 The sperm and the ovum :

Points of comparison	The sperm	The ovum
• Size :	Small.	Relatively large.
• Mobility :	Mobile.	Static (not mobile).
• Structure :	It consists of : The head, midpiece and tail.	It consists of : The nucleus, cytoplasm and cellular membrane.

16 Puerperal sepsis and syphilis diseases :

Points of comparison	Puerperal sepsis disease	Syphilis disease
• The microbe causing the disease :	Spherical-shaped bacteria.	Spiral-shaped bacteria.
• Methods of infection :	• By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to the vagina of a recently laboured mother. • An infected wound during the labour.	• Sexual contact with an infected person. • From pregnant woman to her fetus through the umbilical cord or during the delivery.
• Incubation period :	From 1 to 4 days.	From 2 to 3 weeks.
• Symptoms :	• High elevation in body temperature. • Chills. • Face paling. • Severe acute pain in lower abdomen. • Bad smelling secretions from the uterus.	• Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female). • Appearance of dark brass coloured rashes on the back and hands of the patient.

• **Methods of protection :**	• Sterilizing the surgical tools during labour. • Wearing masks during labour (delivery). • Preventing visits of persons who suffer from respiratory diseases to the mother after delivery. • The mother should be kept warm and avoid the exposure to air currents.	• Preventing the sexual contact with an infected person (preventing the illegal contacts). • Induce abortion of the infected pregnant women.

6 Activities :

Activity 1 To study pollen grain germination.

Steps :

1. Place a drop of diluted sugary solution on a glass slide and put some pollen grains, then cover them with a glass cover.
2. Repeat the previous step with replacing diluted sugary solution by water.
3. Keep both slides in a dark warm place for half an hour.
4. Examine the two slides under the microscope.

Observation :

Each pollen grain in the sugary solution germinates by formation of a pollen tube containing two male nuclei and one tube nucleus, but that placed in a drop of water doesn't germinate.

Conclusion :

Pollen grains germinate forming pollen tubes when a suitable nutritive medium is available such as a diluted sugary solution.

- **The previous activity explains :**
  What happens to the pollen grains when fall on the stigmas of the flower to complete fertilization process.

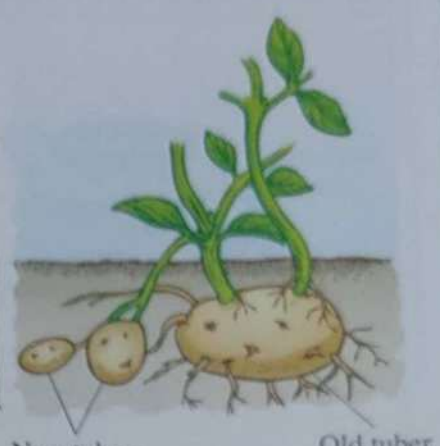
Activity 2 To identify the reproduction by tubers.

Steps :

1. Cut a tuber of potato into multiple slices, where each slice should contain a bud or more.
2. Cultivate these parts and water (irregate) them regularly for a week.

Observations & Conclusions :

- Some buds grow forming a root system.
- Other buds grow forming a shoot system.
- After days new tubers grow.

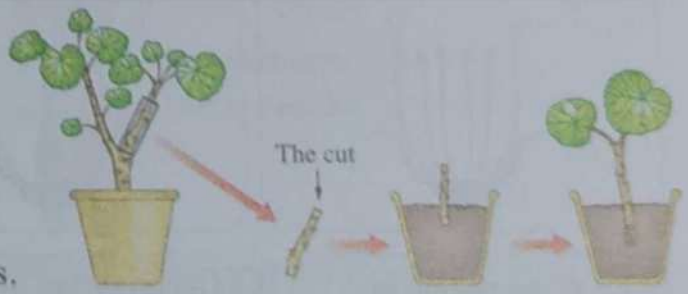


Reproduction by tubers

Activity 3 To identify the reproduction by cutting.

Steps :

1. Cultivate one cut of a plant in a pot (this cut must contain more than one bud).
2. Water the cut regularly for two weeks.



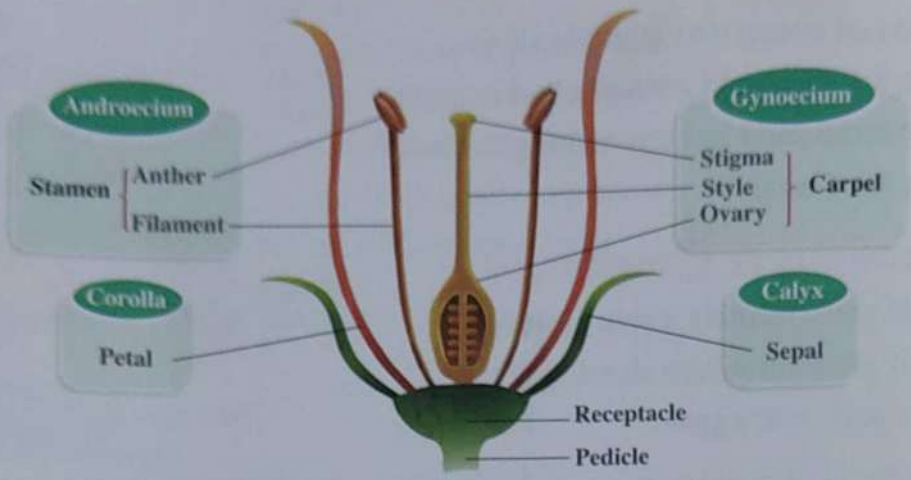
Reproduction by cutting

Observations & Conclusions :

- The buds **buried inside the soil** grow to form the **root system** of the plant.
- The buds **above the soil** surface grow to form the **shoot system** of the plant.

7 Important drawings :

1 The structure of a typical flower.

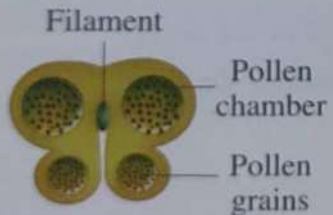


2 Male flower ♂ (Unisexual).

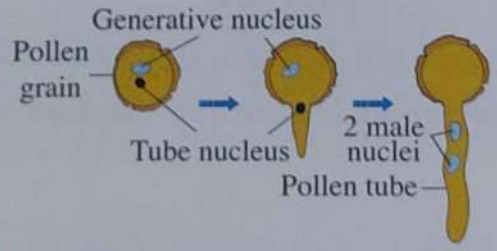
3 Female flower ♀ (Unisexual).

4 Hermaphrodite flower ⚥ (Bisexual).

5 A cross-section in an anther.

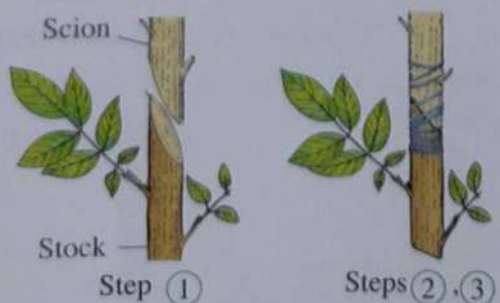


6 Germination of a pollen grain.

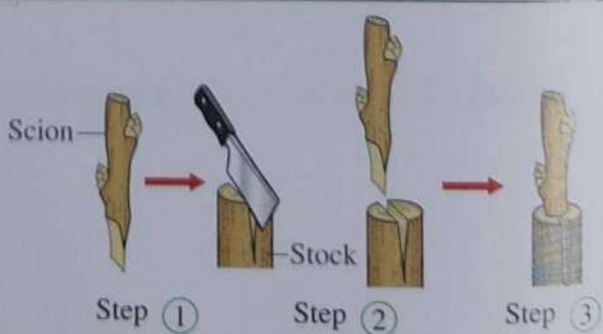


7 Fertilization process in plants.

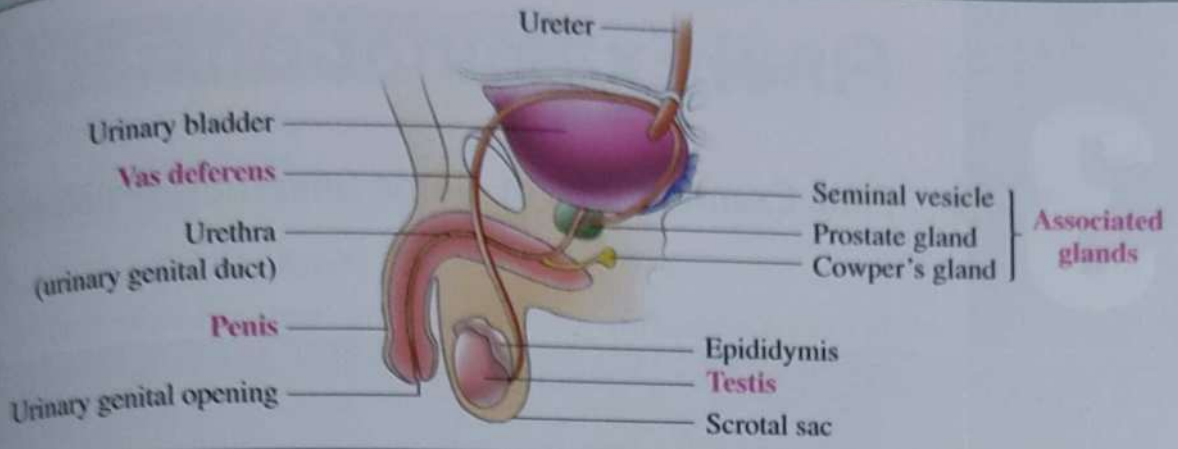
8 • Grafting by attachment.



• Grafting by wedge.

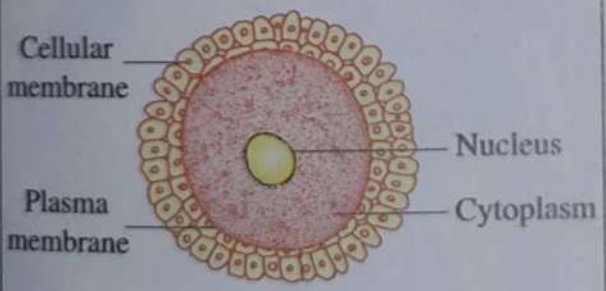


9 Male reproductive system.

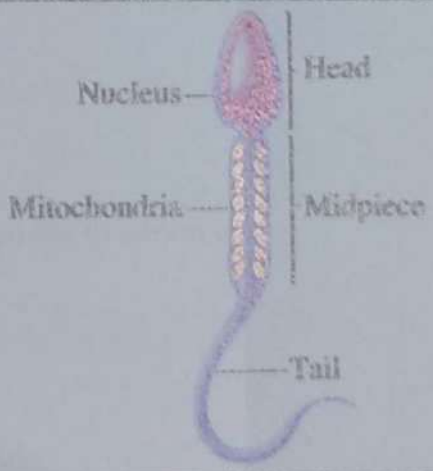


10 Female reproductive system.

11 The structure of the ovum.



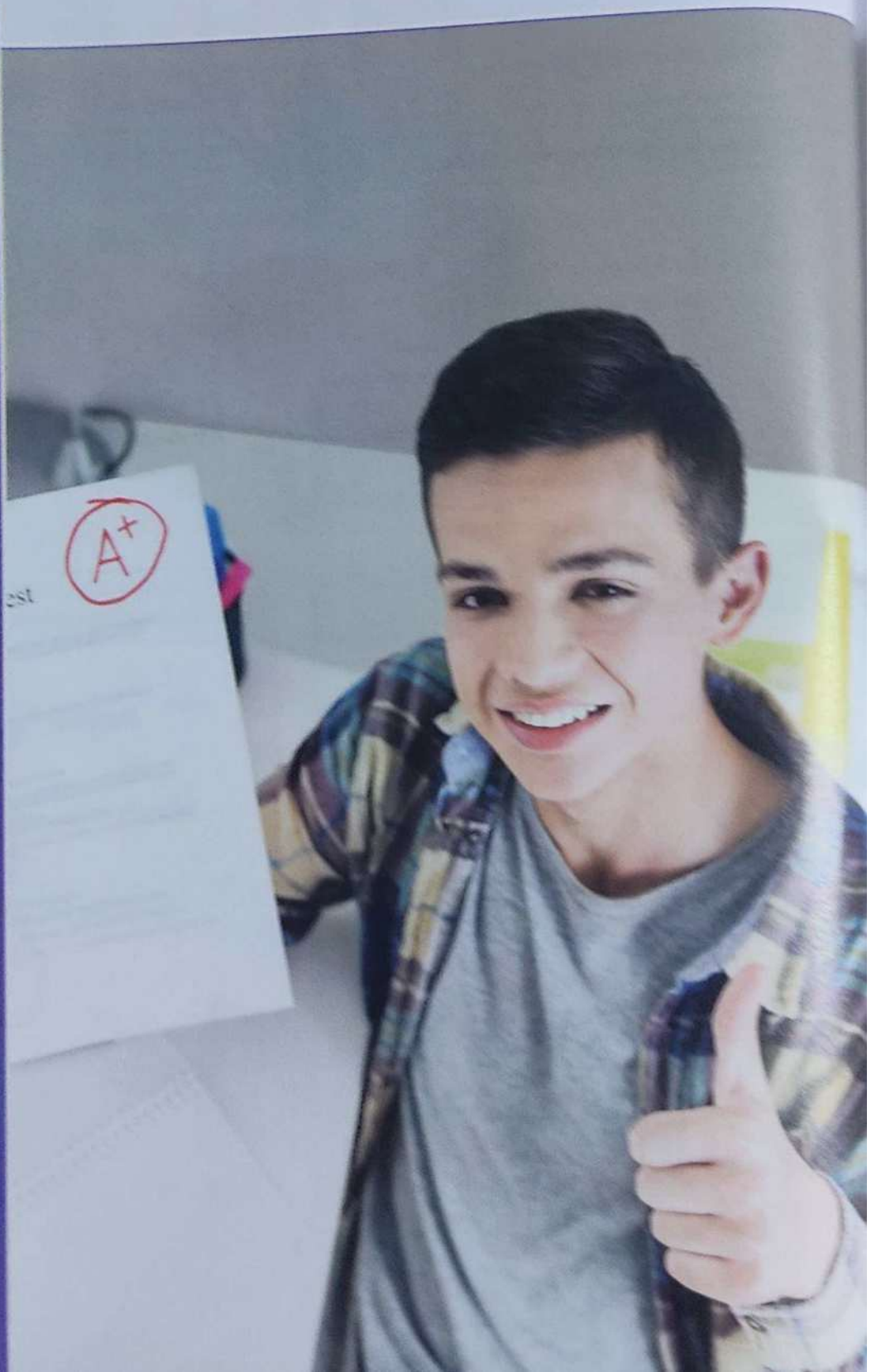
12 The structure of the sperm.



PART 3

Final Examinations

Final Examinations of Some Governorates 2022



Final Examinations of Some Governorates 2022

1 Cairo Governorate — Heliopolis Education Zone

Answer the following questions :

Question 1

A Choose the correct answer :

1. If the distance between the center of the fifth compression and the center of the ninth compression of a longitudinal wave is 4m, then the wavelength of this wave is .....
   a. 9 m. b. 1.2 m. c. 1.5 m. d. 1 m.
2. The measuring unit of noise intensity is .....
   a. Decibel. b. Hz. c. watt/m^2. d. meter.
3. All the following plants reproduce sexually except .....
   a. bean plant. b. pea plant. c. potato. d. olive plant.
4. White light analyzes into ..... spectrum colours.
   a. 3 b. 5 c. 7 d. 9

B Compare between each of the following :

1. Longitudinal wave and transverse waves, (According to the vibration of particles only).
2. Pollination by air and pollination by insects. (Two characteristics of the flower).

C Calculate the number of gear teeth if savart's wheel rotates with a velocity of 300 cycles in one minute, given that the frequency is 100 Hz.

Question 2

A Give reasons for :

1. We see lightning before hearing thunder.
2. The quantum of energy of violet light is greater than the quantum of energy of red light.
3. Palm flowers are unisexual.
4. Clear glass is a transparent medium.

B Mention the function of the following :

1. Ultrasonic waves in medical field.
2. Corolla.
3. Triangular glass prism.
4. Tissue culture.

C What happens if ... ?

1. A light ray falls perpendicular on a reflecting surface.
2. A pollen grain falls on the stigma of a flower.

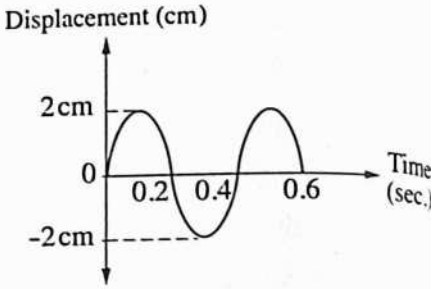
Question 3

A **Correct the underlined words :**

1. Human can distinguish sounds of frequencies between **10:20Hz**.
2. Sweet potato is considered as a **stem**.
3. **Estrogen** hormone is responsible for continuity of the pregnancy.
4. **Bract** is a group of flowers arranged on the same axle.

B **From the opposite figure, choose the correct answer :**

1. The periodic time = ...
   a. 0.2 sec b. 0.4 sec
   c. 0.6 sec d. 0.4 m
2. Frequency = ...
   a. 0.2 sec b. 0.4 Hz
   c. 2.5 cycle/sec d. 0.4 cm
3. The amplitude = ...
   a. 0.2 sec b. 0.4 sec c. 2 cm d. 0.4 cm



C **Cross the odd word out, then state the relation among the remaining words :**

1. Sound waves, Light waves, Radio waves, Infrared waves.
2. Red, Orange, While, Violet.

Question 4

A **Write the scientific term :**

1. The reproduction of some plants by parts of the root, stem or leaves.
2. Sound waves of frequencies less than 20 Hertz.
3. Fusion of the nucleus of the male cell with the nucleus of the female cell.
4. The ratio between the speed of light in air and its speed in a transparent medium.

B **Put (✓) or (✗), then correct the false one (s) :**

1. Stigma is the male reproductive organ in the flower. (
2. The light ray refracts towards the normal when it travels from air to glass. (
3. Bats, dogs and dolphins can hear ultrasonic waves. (
4. The movement of pendulum is an example for the wave motion. (

C **What is the meant by ... ?**

1. Light intensity.
2. Sonic waves.

2 Cairo Governorate — El Sahel Educational Zone

Answer the following questions :

Question 1

A Complete the following sentences :

1. Ultrasonic waves are used in ..... and .....
2. The sound pitch ..... by ..... the frequency and vice versa.
3. ..... is the measuring unit of sound intensity, while ..... is the measuring unit of noise intensity.
4. Angle of ..... is the angle between the reflected light ray and ..... at the point of incidence on the reflecting surface.

B What is meant by ... ?

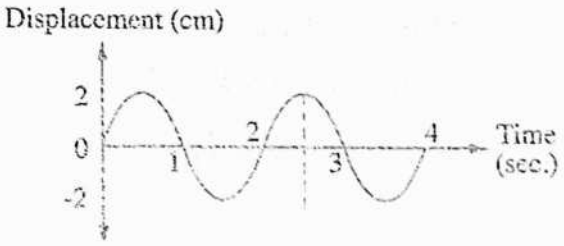
1. The frequency of tuning fork is 652 Hz.
2. Transparent medium.
3. The absolute refractive index of glass is 1.5
4. Mixed pollination.

C Mention the importance of petals.

Question 2

A The opposite figure represents oscillatory motion. Find :

1. Amplitude.
2. Periodic time.
3. Frequency.
4. Time of one amplitude.



B Give reasons for :

1. The ray falling perpendicular on the reflecting surface reflect on itself.
2. We see lightning before hearing thunder.
3. Palm flowers are unisexual.

C Calculate the number of teeth of Savart's wheel. Given that the frequency of sound produced is 100Hz and the wheel rotates with 30 cycles/mins.

Question 3

A Write the scientific term for each of the following :

1. It is the fourth whorl of the floral leaves and it produces ovules.
2. The ability of medium to refract light ray.

3. It is the angle between the emergent light ray an the normal at the point of emergence on the interface.
4. They are sound waves of frequency ranging from 20 to 20000 Hz.

B Compare between :

1. Sound pitch – Sound intensity.
2. Pollination – Fertilization.

C Correct the following sentences :

1. The human skin is considered translucent medium.
2. Light refraction is rebounding of light wave in the same medium.

Question 4

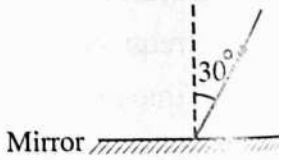
A Choose the correct answer :

1. If the frequency of an oscillating body is 6Hz, so the periodic time is ..... second.
   a. 1 b. $\frac{1}{6}$ c. 6
2. Zygote contains ..... of genetic material of plant species.
   a. half b. all c. quarter
3. In ..... reflection, the reflected light rays are reflected in many directions.
   a. irregular b. regular c. no answer
4. Flowers which produce light and dry pollen grains are pollinated by .....
   a. man. b. air. c. water.

B Give one difference between :

1. Mechanical waves and electromagnetic waves.
2. Stamen and carpel.

C Complete by drawing :



3 Cairo Governorate — Helwan Educational Zone

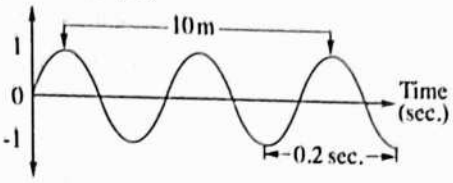
Answer the following questions :

Question 1

A Write the scientific term of each of the following :

1. The periodic motion made by the oscillating body around its rest point.
2. The ability of the transparent medium to refract light.
3. The outer whorl of floral leaves and protects the internal parts of flower before blooming
4. The disturbance which causes the particles of the medium to vibrate perpendicular to the direction of wave propagation.

D Look at the opposite figures, then answer the following questions :

1.	2.	3.	4.
			
Why the sound of this animal is harsh (rough) ?	What is the sex of this flower ?	Calculate the wave velocity.	What is the value of angle of reflection ?

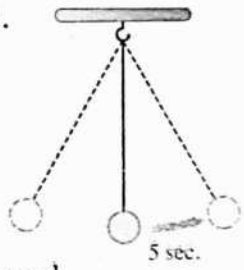
C Give reason for : we see lightning before hearing the thunder.

Question 2

A Choose the odd word out :

1. Light waves – Water waves – Radio waves – Micro waves.
2. Break down kidney stones – Discovery of land mines – Sterilize food – Analyze light.
3. Olive – Beans – Peas – Watermelon.
4. Seminal vesicles – Prostate gland – Pancreas gland – Cowper's glands.

B Complete the following sentences :



1. In the opposite figure : The periodic time = ... sec.
2. The energy of photon of violet light is ..... that of green light.
3. Potato and sweet potato vegetative reproduce by .....
4. When the distance between the sound source and the car is doubled, sound intensity .....

C Oscillating body makes 240 complete oscillations in one minute. Calculate its frequency.

Question 3

A Choose the correct answer :

1. If the distance between the centers of the third and the seventh compressions on the wave propagation is 12 cm., the wavelength of this wave is ..... cm.

   a. 5 b. 4 c. 3 d. 12

2. If the angle of incidence of light in air = 40°, its angle of refraction in water = ...°

   a. 40 b. 15 c. 50 d. 80

3. In plant, after fertilization process, the ovary grows to become .....

   a. fruit. b. seed. c. pollen grain. d. sperm.

4. The level of sound intensity is measured in .....

   a. Watt/m^2. b. Newton. c. Cm^3. d. Decibel.

B Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Energy	a. light reflects irregularly on it.
2. 50 Hertz	b. is a frequency of infrasonic wave.
3. Leaf of tree	c. secretes hormone of progesterone.
4. The ovary	d. is a frequency of sonic wave.
	e. transfers among particles of medium by wave.

C What happens when tie a part of peache (as scion) with a part of apricot (as stock) ?

Question 4

A Put (✓) or (✗) in front of each of the following statements and correct the wrong ones :

1. Complete oscillation has four amplitudes. ( )
2. Fundamental tone's intensity is lower than harmonic tone. ( )
3. Air pollinated flowers produce huge numbers of pollen grains. ( )
4. The absolute refractive index of any medium is always less than one. ( )

B Correct the underline word :

1. The trough of the transverse wave is equivalent to the center of **compression** of the longitudinal wave.
2. Light passes easily through **opaque** medium.
3. Two testes secrete male sex hormone **"Estrogen"**.
4. In regular reflection : The angle of incidence is **more than** the angle of reflection.

C The opposite figure is showing one step of reproduction in man. Explain this step briefly.

4 Cairo Governorate — Heliopolis Modern Language School

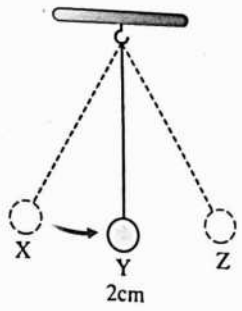
Answer the following questions :

Question 1

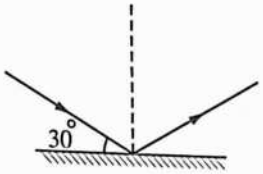
A Complete the following sentences :

1. Waves are classified according to the ability of propagation into ..... waves and ..... waves.
2. Fertilization is the process of fusion of nucleus of the male cell with nucleus of the ..... cell to form .....

3. When the opposite oscillating body covers the distance from (X) to (Y) in (0.2) sec. so, the amplitude = ... and its periodic time = ... sec.



4. If the angle between the incident light ray and the reflecting surface = 30° so the angle of incidence = ... and the angle between the incident ray and the reflected ray = ...



B Put (✓) or (✗) :

1. The velocity of sound waves in air is greater than the velocity of light wave. ( )
2. The measuring unit of noise intensity is Decibel. ( )
3. Photon energy = planck's constant × wave length. ( )
4. The typical flower contains four floral whorls. ( )

C Mention a function of each following :

1. Glass prism.
2. Ultrasonic waves in industry.

Question 2

A Choose the correct answer :

1. The result of multiplying the frequency of an oscillating body by its periodic time equals .....
   a. 0.5 b. 0.25 c. 1 d. $\frac{1}{3}$
2. Human ear can distinguish sounds of frequencies .....
   a. 100 KHz b. 30 KHz c. 200 Hz d. 10 Hz
3. All of the following are parts of female reproductive system except .....
   a. uterus. b. vas deference. c. ovary. d. fallopian tube.
4. The Absolute refractive index of any materials is always ..... one.
   a. more than b. equal to c. less than d. a part of

B Correct the underlined word :

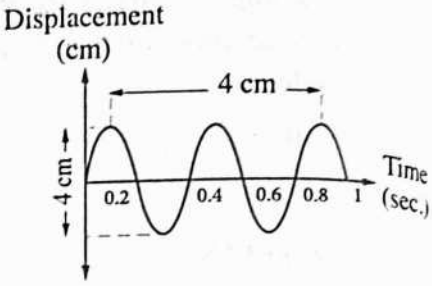
1. The distance between the first crest and the third crest of a wave is 20 cm so, the wave length of this wave is **20** cm.
2. If the distance between the sound source and ear is doubled the intensity of the sound **increases to double**.
3. **Rainbow** is phenomenon takes place on desert roads at noon especially in summer.
4. **Growing** prevents living organisms from extinction.

C 1. **Give reason for** the petals of corolla are colorful and scented.
2. **What is meant by** the absolute refractive index of water is 1.33 ?

Question 3

A Compare in a table between the mechanical waves and electromagnetic waves concerning definition, speed, type and example :

B From the opposite figure, choose the correct answer :



1. The wave length = ...
   a. 4 m b. 2 m
   c. 2 cm d. 1 m
2. The frequency = ...
   a. 0.2 sec b. 0.4 Hz c. 2.5 Hz d. 0.2 Hz
3. The amplitude = ...
   a. 4 cm b. 4 m c. 2 cm d. 0.04 m
4. Velocity of wave is .....
   a. 5 cm/sec. b. 5 m/sec. c. 10 cm/sec. d. 10 m/sec.

C What happens when ... ?

1. The oscillating body passes its rest position during its movements. (Concerns its velocity).
2. A light ray falls perpendicular on reflecting surface.

Question 4

A Cross the odd word, then write the name of the others :

1. Sound wave – Light wave – Radio wave – Infrared wave.
2. Androecium – Calyx – Corolla – Root.
3. Pendulum motion – Spring motion – Rotatory bee motion – Stretched string motion.
4. Red – Orange – White – Violet.

B Write the scientific term :

1. The colour which has maximum deviation in spectrum colour in glass prism.
2. None audible waves whose frequencies are less than 20 Hz.
3. The property by which the human ear can distinguish between sounds from different sources even they are equal in intensity and pitch.
4. The reproduction of some plants by parts of the root, stem or leaves.

C A gear of savart's wheel rotating 80 cycle in a minute, if the frequency of the sound produced is 200 Hz, calculate the number of teeth of that gear.

5 Cairo Governorate — El Sayeda Khadija Official Language School

Answer the following questions :

Question 1

A Complete the following :

1. The measuring unit of noise intensity is ....., while ..... is the measuring unit of sound intensity.
2. After fertilization, the ovary grows forming the ....., while the ovule is converted into .....
3. Light intensity is ..... proportional to ..... of the distance between the surface and the source.

B What is the importance of ... ?

1. Tissue culture.
2. Hot water in Jacuzzi.
3. Ultrasonic waves in the medical field.

C Savart's wheel rotates with a rate of 200 cycles per 2 minutes, a sound of frequency of 300 Hz is produced when an elastic plate touches the teeth of the gear, calculate the number of the teeth of the gear.

Question 2

A Write the scientific term of each of the following :

1. Short stem where leaves are developed and modified into reproductive organ.
2. The ability of the medium to refract light rays.
3. The disturbance that propagates and transfers energy in the direction of propagation.
4. The product of Planck's constant times the frequency of photon.

B What happens when ... ?

1. Increasing the density of the medium ? (related to the sound intensity).
2. Light ray travels from water to air ? (related to the angle of refraction).
3. Increasing the wavelength four times for the same velocity ? (concerning the wave frequency).
4. The oscillatory body passes its rest position during its movement ? (concerning its velocity).

C Calculate the speed of light through diamond given that the absolute refractive index of it = 2.4 and the speed of light through air = 3×10^8 m/sec.

Question 3

A Choose the correct answer :

1. The ..... colour light in the spectrum colours has the highest deviation.
   a. white b. red c. violet d. yellow
2. Human ear can't distinguish the sound of frequency equals .....
   a. 50 Hz b. 30 Hz c. 300 Hz d. 5 Hz
3. When the incident light ray reflects on itself the angle of incidence equals .....
   a. 90° b. 0° c. 120° d. 180°
4. Sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
   a. sharper b. stronger c. harsher d. weaker

B Compare between each of the following :

1. Regular and irregular reflection. (direction of reflection rays).
2. Mechanical waves and electromagnetic waves. (according to the medium of propagation).
3. Pollination by air and pollination by insects. (one characteristics of flower).
4. Transverse waves and longitudinal waves.
   (according to the direction of vibration of medium particles).

C Calculate the wavelength for a visible light wave of frequency 6×10^{14} Hertz and velocity 3×10^{8} m/s

Question 4

A Correct the underlined words :

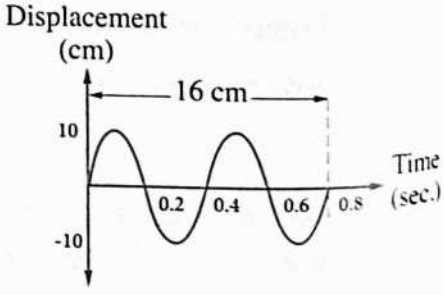
1. The **ovum** consists of head, middle part and tail.
2. The motion of rotary bee is considered as **an oscillatory motion**.
3. Angle of incident **greater than** angle of reflection.
4. **Rainbow** phenomenon takes place on desert roads at noon specially in summer.

B What is meant by ... ?

1. Harmonic tones. 2. Fertilization process in human.
3. Wave velocity.

C From the opposite figure, calculate :

1. The amplitude.
2. Wavelength.
3. The frequency.
4. Periodic time.



6 Cairo Governorate — Al-Shrouk Educational Zone

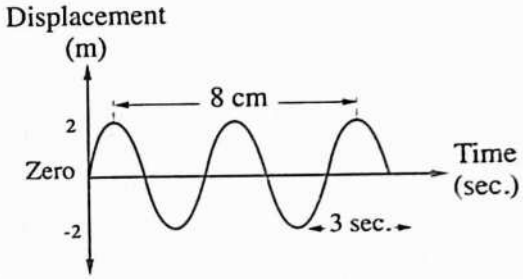
Answer the following questions :

Question 1

A Complete the following sentences :

1. From the artificial vegetative in plant ..... and .....
2. From natural phenomenon that are related to the reflection or refraction of light .....
3. The human ear can distingished sound frequencies between ..... and ..... hertz.
4. Sound produced due to ..... of bodies.
5. The distance covered by light in one second is .....
6. We use savart's wheel to determine .....
7. ..... and ..... are bisexual flowers.

B Study the opposite figure then calculate :



1. Wavelength.
2. Frequncy.
3. Amplitude.
4. Wave velocity.

Question 2

A Choose the correct answer of the following :

1. Fertilization occurs when ..... is formed.
   a. embryo b. zygote c. ovum
2. The light travels in ..... lines.
   a. straight b. oval c. circular
3. Sound of frequency 200 is ..... than sound of frequncy 100 hz.
   a. harsher b. stronger c. sharper
4. The unit of measuring sound intensity is .....
   a. m/sec b. watt/m^2 c. desible

B Mention one function for :

1. Calyx
2. Ultrasonic waves

C Give reasons for :

1. The motion of rotary bee is periodic motion not oscillatory motion.
2. Palm flowers are unisexual.

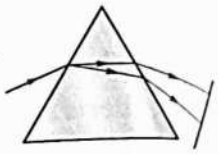
Question 3

A Write the scientific term :

1. The reproduction of some plants by root, stem, leaves.
2. A group of some colourful leaflet surrounding the flower.
3. Objects allow light to transfer through them.
4. The ability of medium to refract light rays.

B In the following figure :

1. Which represents the red colour, and which represents the violet colour.
2. Write one use for glass triangle prism.



C Mention one difference :

1. Male and female flower.
2. The mechanical and electromagnetic waves.

Question 4

A Write (✓) or (✗) :

1. The light ray refracted towards the normal when it travel from air to glass. ( )
2. The sound intensity decrease when the area of vibrating surface decrease. ( )
3. The angle of incidence of light rays = angle of reflection. ( )
4. The amplitude measured in hertz. ( )
5. The sound velocity through gases is faster than that through liquids. ( )
6. Reproduction by tuber happen in orange. ( )

B Write down the mathematical relation that join between each of the following :

1. Photon frequency and its energy.
2. The wave velocity in a medium and the refractive index for its material.

C What happens to ... ?

1. Incident light ray after falling on rough surface.
2. Ovary of flower after fertilization.

7 Giza Governorate — 6th October Educational Zone

Answer the following questions :

Question 1

A Complete the following sentences :

1. A body makes 300 complete vibrations in one minute its frequency is .....
2. If the angle of reflection = 30, so angle of incidence = ...
3. Measuring unit of wavelength is .....
4. The frequency of infrasonic waves is ..... Hz.

D Give one example for :

1. Oscillatory motion.
2. Mechanical wave.
3. Translucent material.
4. Electromagnetic wave.

E What happens when light ray fall perpendicular to a reflecting surface ?

Question 2

A Put (✓) or (✗) :

1. The jacuzzi is an application for wave motion. ( )
2. Sound pitch is a property where ear can distinguish between weak and strong sounds. ( )
3. The carpel of flower consists of filament and anther. ( )
4. The red colour has the longest wave length. ( )

B Cross out the odd word :

1. Air – Glass – Wood – Water.
2. Calyx – Corolla – Stamen – Testes.
3. Red – Orange – Black – Violet.
4. Ovary – Uterus – Vagina – Prostate gland.

C Write the function for each Savart's Wheel.

Question 3

A Write scientific term :

1. The change in light path when travel between two transparent medium differ in optical density.
2. Natural phenomenon that takes place on desert roads at summer noon times.
3. Tones are higher in pitch and lower in intensity.
4. It is the fusion of the nucleus of male cell with the female cell to form zygote in flower.

B Correct the underlined word :

1. The speed of sound is **more** than that of light.
2. The male sex hormone is **estrogen**.
3. The green leaves in flower called **corolla**.
4. The light travel in **curved** line.

C Sound wave of frequency 200 hertz wave length in air 1.7 m. Calculates the velocity of sound wave in air.

Question 4

A Choose the correct answer :

1. The unit of measuring the noise intensity is .....
   a. decibel. b. meter. c. gram. d. hertz.
2. Sound waves which are used in medical field is .....
   a. sonic. b. infrasonic. c. ultrasonic. d. intensity.
3. The complete oscillation has ..... amplitudes.
   a. 8 b. 12 c. 1 d. 4
4. The male cell in flower is .....
   a. ovum. b. pollen grain. c. sperm. d. stigma.

B Write the measuring unit for :

1. Periodic time.
2. Wave velocity.
3. Amplitude.
4. Sound intensity.

C Give reason for : the refractive index of any transparent medium is always more than one.

8 Giza Governorate — Experimental Language School Directorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The complete oscillation includes ..... displacements, each is called .....
2. The transverse wave consists of ..... and .....
3. The glass prism is used to separate the ..... light into ..... colours.
4. After fertilization in plants, ovule changes into ..... but ovary converts into .....

B Correct underlined words :

1. As the frequency decreases periodic time **decreases**.
2. Reproduction by tubers can be used in **apples and pears**.
3. **The ovum** consists of head, middle part and tail.
4. **Progestrone** hormone is responsible for male secondary sex characters.

C Problem :

Savart's wheel rotates with a rate 120 cycle per minute, a sound of frequency 100 Hz is produced when an elastic plate touches teeth of a gear, Calculate the number of teeth of this gear.

Question 2

A Write the scientific term :

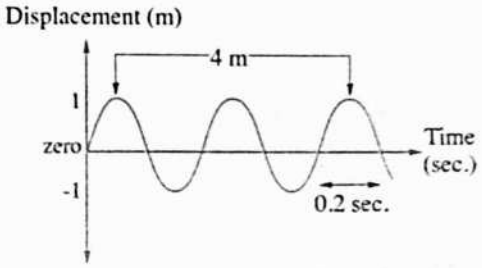
1. The motion which is regularly repeated in equal periods of time.
2. The ratio between velocity of light in air to its velocity in another transparent medium.
3. It is the returning back of light ray in the same medium on meeting a reflecting surfaces.
4. A short stem whose leaves are modified to form sexual reproductive organs in plant.

B Give an example for :

1. A mechanical transverse wave.
2. A transparent material.
3. A factor affecting sound intensity with direct relation.
4. An artificial pollinated plant.

C Look at the opposite figure then calculate :

1. Frequency.
2. Wave velocity.



Question 3

A Choose the correct answer :

1. The periodic time of a source that makes 60 oscillations/minute = ...
   a. 6 sec. b. 1 sec. c. 0.1 sec. d. 10 sec.
2. Doctors use waves of frequency ..... to break down kidney stones.
   a. 30 Hz. b. 21 KHz. c. 20 Hz. d. 20 KHz.
3. Pollination in coloured flowers takes place by .....
   a. insects. b. man. c. water. d. air.
4. All of the following are parts of female reproductive system except .....
   a. uterus. b. ovary. c. fallopian tube. d. vas deferens.

B Write one difference between :

1. Transeverse wave and longitudinal wave. (according to particles vibration direction).
2. Sound and light. (according to their velocity).
3. Fundamental and harmonic tones. (according to their frequency).
4. Male flower and female flower. (according to the symbol).

C What happens when the oscillating body passes through its rest position. (regarding to its velocity) ?

Question 4

A Put (✓) or (✗) and correct the wrong :

1. Motion of rotary bee is an example of oscillatory motion. ( )
2. Sound travels in space. ( )
3. Energy of red photon is less than that of violet photon. ( )
4. Calyx consists of green leaves called petals. ( )

B Choose the odd word out :

1. Glass – Water – Air – Wood.
2. White – Yellow – Green – Blue.
3. Violin – Drill – Piano – Reed pipe.
4. Density of the medium – Surface area – Wind direction – Frequency.

C Give a reason for : the light ray that falls perpendicular on a mirror reflects on itself.

9 Giza Governorate — Abou El Nomros Educational Zone

Answer the following questions :

Question 1

A Complete the following sentences :

1. Radio waves are from ..... waves that can travel through .....
2. There are two types of reproduction in plants which are ..... and .....
3. The frequency of sonic waves ranges between ..... Hz and ..... Hz.
4. The complete oscillation consists of ..... successive maximum displacements each of them is called .....

B Cross out the odd word :

1. Sepals – Petals – Root – Carpels.
2. Motion of swing – Tuning fork – Pendulum – Rotary bee.
3. Ovary – Testis – Fallopian tube – Vagina.
4. Androecium – Anther – Stamen – Ovary.

C Calculate the frequency of a musical tone similar to the tone produced from savart's wheel rotating with a velocity of 960 cycles in 120 seconds, knowing that the number of gear teeth is 30 teeth.

Question 2

A Choose the correct answer :

1. The angle of incidence of light is ..... the angle of reflection.
   a. larger than b. smaller than c. equals to d. double
2. The measuring unit of periodic time is .....
   a. Hz b. second c. watt/m^2 d. m/s^2
3. ..... produces pollen grains.
   a. Carpel b. Style c. Anther d. Petal
4. Male puberity features are related to the effect of ..... hormones.
   a. thyroxin b. testosterone c. estrogen d. progesterone

B Give reasons for :

1. Sound waves are mechanical waves.
2. The spirm has a long and thin tail.
3. Using ultrasonic waves in milk sterilization.
4. Aluminium foil is an opaque medium.

C What's meant by wave velocity ?

Question 3

A Put (✓) or (✗) in front of the following statements :

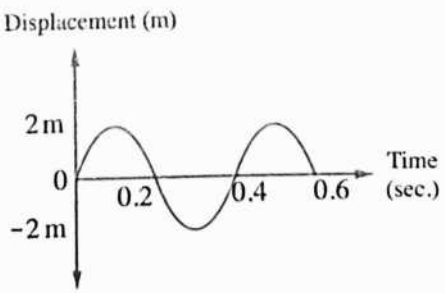
1. The simple harmonic motion is considered the simplest form of oscillatory motion. ( )
2. Palm trees are pollinated by insects. ( )
3. The pen seems broken in a cup of water due to the light refraction. ( )
4. The temperature of testes is 4°C above the normal body temperature. ( )

B Give one example for each of the following :

1. A transverse wave : .....
2. A tuber : .....
3. A high pitched sound : .....
4. A transparent medium : .....

C From the opposite figure, choose the correct answer :

1. The periodic time = ...
   (0.2 sec. – 0.4 sec. – 2 sec. – 4 sec.)
2. The amplitude = ...
   (0.2 cm. – 0.4 cm. – 2 cm. – 4 cm.)



Question 4

A Choose from column (B) what suits it in column (A) in the following tables :

(A)	(B)
1. The translucent medium	a. is the disturbance that propagates and transfers energy in the direction of propagation.
2. The zygot	b. is the property of sound by which the ear can distinguish between strong and weak sounds.
3. The sound intensity	c. is the cell resulting from the fusion of pollen grain and an ovum nuclei.
4. The wave	d. is the medium which permits some light to pass through.

B Write the scientific term of each of the following :

1. The external factor which affects the ear causing the sense of hearing.
2. The measuring unit of noise intensity.
3. The phenomenon that appears in the desert as result of reflection and refraction of light on the desert roads at noon.
4. A tool used in the analysis of light.

C What happens when a light ray falls perpendicular on a reflecting surface ?

10 Giza Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The ..... hormone in male and ..... hormone in female are responsible for the appearance of secondary sex characters.
2. The reflection is classified into two types which are ..... and .....
3. The calyx is a group of ..... leaves, each leaf is called .....
4. The frequency of 540 oscillations in aminute is ..... and periodic time is .....

B Put (✓) or (✗) :

1. Vegetative reproduction is sexual reproduction. ( )
2. The amplitude is the reciprocal of the periodic time. ( )
3. The light ray refracts towards the normal line when it travels from air to glass. ( )
4. The flint glass is considered as an opaque medium. ( )

D If the distance between first and fourth crest is 15 meter, calculate :

1. The wavelength.
2. Wave velocity when frequency = 100 Hz.

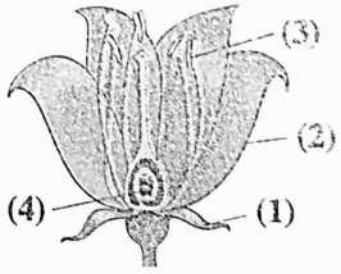
Question 2

A Choose the correct answer :

1. It is the highest point of the particles of the medium in the transverse wave is .....
   a. the crest. b. the compression. c. the rarefaction. d. the trough.
2. The right ovary in the human female produces a mature ovum every ..... days.
   a. 24 b. 28 c. 34 d. 56
3. Sound waves are ..... waves.
   a. mechanical longitudinal b. electromagnetic longitudinal
   c. longitudinal d. transverse
4. The absolute refractive index of any material is always ..... one.
   a. more than b. less than c. equal to d. (a) and (b)
5. All of the following are electromagnetic waves except ..... waves.
   a. light b. sound c. x-rays d. radio
6. The result of multiplying the frequency by periodic time equals .....
   a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{3}{4}$ d. 1
7. The wave transfers ..... in the direction of propagation.
   a. molecules b. energy c. matter d. force
8. After fertilization, the ovary develops forming the .....
   a. seed b. flower c. fruit d. leaf

B Study the opposite figure then answer :

1. Label the figure.
2. The sex of this flower is ..... and the function of number (3) is .....



C Give reasons for :

1. We see lightning before hearing thunder.
2. The ultrasonic waves have medical uses.
3. The light ray refracts when passes through glass.

Question 3

A Write the scientific term of each of the following :

1. A physical quantity equals the multiplication of plank's constant and frequency.
2. A new method of producing large numbers of plants from a small part of it.

3. A phenomenon that appears in the desert due to refraction and reflection of light.
4. Transfering pollen grains from the anther of flower to stigma of the same flower.
5. The motion which is regularly repeated in equal periods of time.
6. The number of waves produced from the source in one second.
7. The fusion of the male cell with the femal ovum.
8. Process takes place in female every 28 days.

B **Cross out the odd word :**

1. Glass – Ceramic – Water – Air.
2. Yellow – Blue – White – Violet.(lights).
3. Spring – Tuning fork – Simple pendulum – Rotary bee.
4. Stigma – Stamen – Style – Ovary.

C **What will happen if ... ?**

1. Increasing the velocity of the pendulum [concerning kinetic energy].
2. Sound wave travels from air to water [concerning its velocity].

Question 4

A **Correct the underlined words :**

1. The angle of incidence **greater than** the angle of reflection.
2. The human skin is considered as **a translucent** medium.
3. The sharp sounds have **low** frequency.
4. Light travels in **curved** lines.
5. The motion of tuning fork is **a wave** motion.
6. **Transverse** wave consists of compressions and rarefactions.
7. The male gamet contains **quarter** of the genetic material.
8. The **estrogen** hormon responsible for pregnancy continuity.

B **Mention :**

1. The measuring unit of the sound intensity.
2. The measuring unit of the noise intensity.
3. The function of ear plugs.
4. The function of triangular glass prism.

C **Calculate the absolute refractive index of diamond if light speed in it = 1.25×10^8 m/sec. and the light speed in air = 3×10^8 m/sec.**

11 Alexandria Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Cross out the odd word then mention the scientific term of the rest :

1. Pendulum motion – Spring motion – Rotary bee motion – Stretched string motion.
2. Sound waves – Light waves – Infrared waves – Radio waves.
3. Anther – Filament – Pollen grains – Style.
4. Vase deference – Ovary – Uterus – Fallopian tubes.

B Complete the following statements :

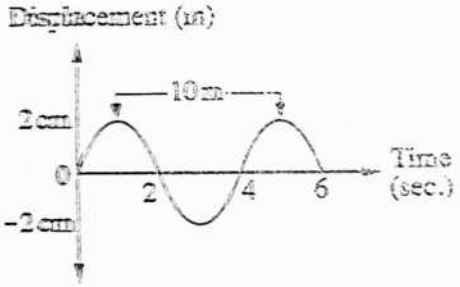
1. The measuring unit of sound intensity is .....
2. As the medium density increases, the sound intensity .....
3. Infrasonic waves are sound waves of frequencies less than ..... Hz.
4. Flowers that have feather like stigmas are pollinated by .....

C Compare between the following :

Regular reflection and irregular reflection (concerning the texture of reflecting surface and the direction of reflected rays).

Question 2

A From the opposite figure find :



1. Amplitude.
2. Periodic time.
3. Frequency.
4. Wavelength.

B Write the scientific term of each of the following :

1. The point of highest density and pressure in longitudinal wave.
2. A property by which the human ear can distinguish between harsh and sharp voice.
3. The colour with maximum deviation in spectrum colours.
4. The resulting cell of the fusion of the pollen grain nucleus with the egg nucleus.

C What is the result of the following case ... ?

The vibration of the particles of a medium perpendicular to the direction of wave propagation.

Question 3

A Choose the correct answer :

1. One amplitude equals ..... of a complete oscillation.

a. $\frac{1}{2}$ b. $\frac{1}{3}$ c. $\frac{1}{4}$ d. $\frac{1}{8}$

2. When light ray passes from air to glass it refracts ..... the normal.
   a. away from b. near to c. perpendicular to d. along
3. The sound velocity is maximum in .....
   a. vacuum. b. gases. c. liquids. d. solids.
4. A new method to produce large numbers of plants to form a small part of it is called .....
   a. tissue culture. b. grafting. c. cutting. d. bulbs.

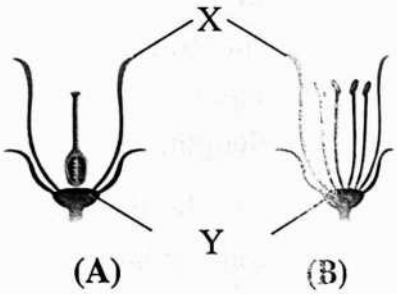
B **Choose from column (B) what suits it in column (A) :**

(A)	(B)
1. Ultrasonic waves	a. is used in the analysis of light.
2. Jacuzzi	b. produce the sperms and the testosterone hormone.
3. Triangular prism	c. treats sprains and cramps with hot water and nervous tension by cold water.
4. Testes	d. break down stones of kidney and ureter or diagnose tumors.

C **Savart's wheel rotates with a rate of 600 cycles per minute, A sound of frequency 1200 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth gear.**

Question 4

A **The opposite figure shows two flowers of two plants from the same species then complete the following statements :**



1. The name of part (X) is ..... and (Y) is .....
2. The function of part (X) is ..... and (Y) is .....
3. The sex of flower (A) ..... while in flower (B) .....
4. The ovary after fertilization in plant changes into .....

B **Correct the underlined words :**

1. The relation between frequency and wavelength is **constant** relation.
2. The light travels in **curved** lines.
3. The absolute refractive index of any material is always **smaller than** one.
4. Olive fruit is **multi seed** fruit.

C **Give a reason for : on doubling the distance between the light source and the surface the light intensity decreases.**

12 Alexandria Governorate — Al-Montazah Educational Zone

Answer the following questions :

Question 1

A Choose the correct answer :

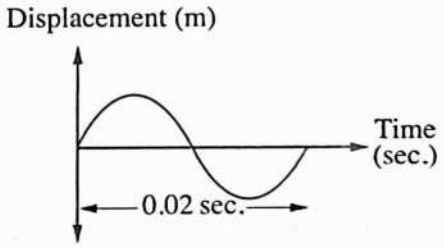
1. The periodic time of a tuning fork that makes 240 waves in one minute equal .....
   a. 1 sec. b. 4 sec. c. 0.5 sec. d. 0.25 sec.
2. All the following are electromagnetic waves except ..... waves.
   a. light b. radio c. water d. infrared
3. Pollen grains are formed inside the ..... of the flower.
   a. ovary b. calyx c. anther d. gynoecium
4. One amplitude equal ..... of a complete oscillation.
   a. $\frac{1}{4}$ b. $\frac{1}{3}$ c. $\frac{1}{2}$ d. $\frac{1}{8}$
5. Sound velocity is maximum in .....
   a. vacuum. b. gases. c. liquids. d. solids.
6. The ..... media don't allow light to pass.
   a. transparent b. translucent c. opaque d. no correct answer

B Mention one difference between :

1. Regular reflection and irregular reflection.
2. Sperm and ovum.

C From the opposite figure find :

1. The periodic time = ...
2. The frequency = ...



Question 2

A Write the scientific term :

1. The ability of the medium to refract the light.
2. The flower that contains the four whorls.
3. Changing the path of light when it travels between two transparent media.
4. Property of sound by which the ear can distinguish between the sharp and rough sound.
5. The angle lies between the incident light ray and the normal line at the point of incidence on the reflection surface.
6. The highest point of medium particles in transverse waves.

B What's meant by ... ?

1. The absolute refractive index of glass = 1.5
2. The frequency of the tuning fork = 300 HZ
3. Sound intensity.

C Mention the first law of light reflection.

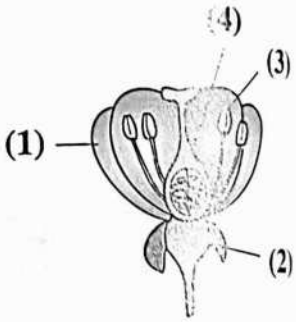
Question 3

A Complete the following :

1. Sound waves travel through the air as pulses of ..... and .....
2. The measuring unit of noise intensity is ..... while the measuring unit of sound intensity at a point is .....
3. Gynoecium is the ..... reproductive organ of the flower while the androecium is the ..... reproductive organ.
4. White light consists of a mixture of ..... colours which are known ..... colours.
5. The two testes locate ..... the body in a structure called .....

B Label the drawing :

1. .....
2. .....
3. .....
4. .....



Question 4

A Put (✓) or (✗) :

1. The movement of the clock pendulum is an example of wave motion. ( )
2. The velocity of sound in the air is greater than the light velocity. ( )
3. The wave length of transverse waves distance between two successive crests or troughs. ( )
4. When the light ray falls perpendicular to a mirror its angle of reflection = zero. ( )
5. Smoking and addiction decrease the formation of male sex hormones. ( )

B Mention one use :

1. Ultrasonic waves.
2. Triangular prism.

C Give reasons for :

1. The petal of corolla are coloured and scented.
2. Sound can be heard from all directions.

13 Alexandria Governorate — Borg Al-Arab Educational Zone

Answer the following questions :

Question 1

A Write the scientific term :

1. The distance covered by the wave in one second.
2. The flower which contains androecium and gynoecium.
3. The motion of an oscillating body when it passes by a fixed point on its two successive times in the same direction.
4. The ability of the medium to refract the light ray.

B Correct the underlined words :

1. Each **stamen** consists of stigma, style and ovary.
2. The **estrogen** hormone is responsible for pregnancy to continue.
3. The ovum of the human **male** contains half the genetic material.
4. The **oscillatory** motion is the motion that is repeated regularly in equal periods of time.

C Savarts wheel rotates with the rate 300 cycles per minute. a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear, Calculate the number of teeth of the gear.

Question 2

A Choose the correct answer :

1. The result of multiplying the frequency by its periodic time equals .....
   a. 0.5 b. 0.01 c. 1 d. 0.1
2. The energy of the green photon is ..... the energy of yellow photon.
   a. greater than b. equal to
   c. less than d. there is no correct answer
3. ..... produces pollen grain.
   a. Carpel b. Style c. Stamen d. Petal
4. The right ovary in the female human produces a mature (ripe) ovum every ..... days.
   a. 24 b. 28 c. 34 d. 56

B Cross out the odd word, then express the relation among the remaining words :

1. Sound wave – Light wave – Radio wave – Infrared wave.
2. Light travels in straight lines – The speed of light differ in different media – White light consists of seven spectrum colors – Light travels through materialistic media only.
3. Amplitude of vibration – Medium density – Frequency – Wind direction.
4. Cutting – Pollination – Tissue culture – Grafting.

C **Calculate the number of complete oscillation that are made by a body in 5 minutes if its frequency is 6 Hz.**

Question 3

A **Complete each of the following sentences :**

1. In transverse wave the particles of the medium vibrate ..... the direction of wave propagation.
2. Absolute refractive index is the ratio between ..... to .....
3. The measuring unit of the quantity of sound intensity is ..... while that of the noise intensity is .....
4. The corolla attracts ..... to the flower, which help in ..... process.

B **Choose from column (B) what suits it in column (A) :**

(A)	(B)
1. The sound pitch	a. is the characteristic, by which the ear can differentiate between sounds as strong or weak.
2. The quality of sound	b. is the property, by which the ear can distinguish between sharp and rough sounds.
3. The sound intensity	c. is the number of the complete vibrations in one second.
	d. is the characteristic, by which the ear can distinguish between sounds from different sources even if they are equal in intensity and pitch.

C **Give reasons for :**

1. Sound intensity in case of presence of carbon dioxide gas as a medium is higher than the air.
2. The light ray that falls perpendicular on a glistening surface reflects on itself.

Question 4

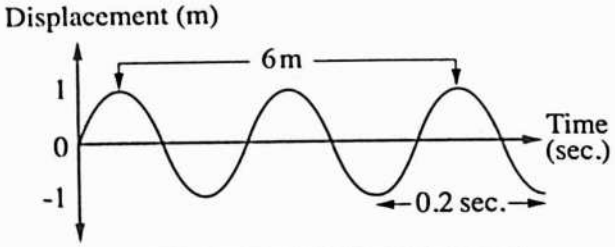
A **Put (✓) or (✗) :**

1. The complete oscillation includes four successive amplitudes. ( )
2. The fish is seen higher than its real position in the fish tank. ( )
3. Reproduction by tuber happens in orange and bitter orange. ( )
4. The sperm secrets hormone to dissolve the cellular membrane of the ovum. ( )

B **Mention one function for each of the following :**

1. Jacuzzi.
2. Ultrasonic wave.
3. Testes.
4. Glass prism.

C In the opposite figure calculate :
Wave velocity.



14 Qalyoubia Governorate — Qalyoub Educational Zone

Answer the following questions :

Question 1

A Write the scientific term :

1. The number of complete oscillations produced by the oscillating body in one second.
2. A property by which the ear can distinguish between harsh and sharp voices.
3. The quantity of light falling perpendicular to a unit area of a surface in one second.
4. A short stem whose leaves are modified to form the reproductive organs in the plants.
5. A process of multiplying a small part of a plant to get many identical parts.
6. The direction through which the wave propagates.

B What happens if ... ?

1. The frequency of a wave is doubled in its wavelength [when the wave velocity is constant]
2. A pollen grain falls on the stigma of a flower.
3. Incident light rays fall on a rough surface.

C Sound waves of frequency 200 Hz, and wavelength in air 1.7 metre.
Calculate the velocity of sound wave propagation in air.

Question 2

A Complete the following sentences :

1. The crest in ..... wave is equivalent to ..... in longitudinal wave.
2. Sound intensity at a point is ..... proportional to the ..... of the distance between this point and the source of sound.
3. Radio waves are considered as ..... waves, which propagate through free space with a velocity of .....
4. Sexual reproduction in the flowering plants takes place in two successive processes which are ..... and .....
5. If the angle of incidence is more than the angle of refraction, this means that the light ray travels from a medium of ..... optical density to another of ..... optical density.
6. The ..... hormone in males and ..... hormone in females are responsible for the appearance of secondary sex characters.

B Give reasons for :

1. The ultrasonic waves are used in milk sterilization.
2. The energy of red light photon is less than that of orange light photon.
3. The pollination of maize plant is mixed pollination.

C Calculate the absolute refractive index of diamond if the light speed through it is 1.25×10^8 m/sec. [knowing that the light velocity through air is 3×10^8 m/sec.]

Question 3

A Choose the correct answer :

1. The product of multiplying the frequency of an oscillating body by its periodic time equals .....

   a. variable value. b. negative value. c. constant value. d. one.

2. The human ear can distinguish sounds of frequency .....

   a. 50 KHz. b. 30 KHz. c. 300 Hz. d. 5 Hz.

3. Androecium is consists of group of .....

   a. pistils. b. stamens. c. stigma. d. sepals.

4. The right ovary in the human female produces a mature ovum each ..... days.

   a. 24 b. 28 c. 34 d. 56

5. Jacuzzi is a tub of physiotherapy where water moves in the form of ..... waves.

   a. oval b. circular c. transverse d. longitudinal

6. By increasing the thickness of the transparent medium, the quantity of light that passes through it .....

   a. decreases. b. increases. c. remains constant. d. doubled.

B Compare between each of the following :

1. The sound waves and light waves. (related to the propagation and the type of wave).
2. The ovum and the sperm. (related to the size and the mobility).

C Savart's wheel rotates with a rate of 300 cycles/minute. If the frequency of the sound produced is 600 Hz when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.

Question 4

A Mention the function of each of the following :

1. Progesterone hormone.
2. Calyx of the flower.
3. The midpiece in sperm.
4. The ear plugs in factories.

B Cross out the odd word, and write the relation between the rest of the words :

1. Sound wave – Light wave – Radio wave – Infrared wave.
2. Yellow – Blue – White – Violet – Red.
3. Air – Pure water – Milk – Glass.
4. Uterus – Vagina – Epididymis – Two ovaries – Two fallopian tubes.

C Mention the mathematical relation between each of the following :

1. Frequency and number of complete oscillations made by an oscillating body at a certain time.
2. The first law of light reflection.

15 El-Sharkia Governorate — Al-Shaheed Sheriff Talat School

Answer the following questions :

Question 1

A Complete the following sentences :

1. Sound pitch is a property by which the ear can distinguish between ..... and .....
2. The crest in the ..... wave is equivalent to the ..... in longitudinal wave.
3. After fertilization, the ovary grows forming the ..... , while the ovule is converted into .....
4. Oscillatery motion and ..... motion are from ..... motion.

B Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Calyx	a. Carpel.
2. Frequency	b. Sepals.
3. Androecium	c. Hertz.
4. Gynoecium	d. Stamen.
	e. m/sec.

C Savart's wheel rotates with a rate of 300 cycles per one minute, a sound of 600 Hz is produced, when an elastic plate touches the teeth of the gear. Caculate the number of the teeth of the gear.

Question 2

A Put (✓) or (✗), then correct the wrong one :

1. The typical flower contains 4 whorls. ( )
2. Drill is an example of musical tone. ( )

3. The movement of clock pendulum is an example for wave motion. ( )
4. Reproduction by tuber happens in orange. ( )

B Cross out the odd words :

1. Red – Orane – White – Violet.
2. Sound wave – Light wave – Radio wave – Infrared wave.
3. Milk – Cotton – Air – Human skin.
4. Ovary – Epididymis – Uterus – Vagina.

C Give a reason for the following :

We see lightning before hearing thunder.

Question 3

A Write the scientific term :

1. The transfer of pollen grain from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
2. A natural phenomenon that appears in the desert in summer at noon as a result of light reflection and refraction.
3. The group of flowers that carried on the same axle.
4. An area in the longitudinal wave at which the medium particles are of the lowest density.

B Give one example for :

1. Translucent medium.
2. Factors affecting the sound intensity.
3. Oscillatory motion.
4. Artificial vegetative reproduction.

C What's happens if ... ?

The frequency of an oscillating body increases (concerning the periodic time).

Question 4

A Choose the correct answer :

1. The human ear can distinguish sound of frequency .....
   a. 5 KHz. b. 30 KHz. c. 300 KHz. d. 50 KHz.
2. Pollen grains are formed inside the ..... of the flower.
   a. carpel b. anther c. ovary d. calyx
3. The measuring unit of noise intensity is .....
   a. watt/m2. b. Hz. c. decibel. d. m/sec.
4. The periodic time of a tuning fork which makes 240 waves in one minute = ... sec.
   a. 1 b. 4 c. 0.5 d. 0.25

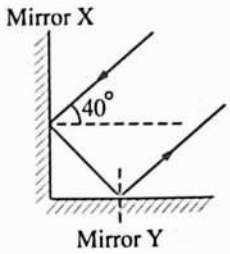
B Correct the underlined words :

1. The produced tone from a tuning fork is called **complicated** tone.
2. White light travels in **curved** line.
3. **Sonic** waves are used in sterilization of milk.
4. The absolute refractive index of any material is always **equal** one.

C Accordiong to the opposite figure :

The angle of the reflection of rays on mirror

Y = ...



16 Monofia Governorate — Shebeen El-Koum Educational Zone

Answer the following questions :

Question 1

A Complete the following sentences :

1. A simple pendulum makes 120 complete oscillations in 2 seconds, so its frequency is ..... Hz and its periodic time is ..... sec.
2. Wave frequency is ..... proportional to periodic time, while wavelength is ..... proportional to wave velocity.
3. The urine is ..... liquid, while seminal fluid is ..... liquid to keep the sperms alive.
4. The energy of a photon is ..... proportional to the ..... of the photon.

B Write the scientific term of each of the following :

1. Glands that secret the seminal fluid.
2. The swollen part upon the flower pedicle on which the floral leaves are existed.
3. The organ that responsible for the formation of the fetus.
4. The distance between two points, the velocity of the oscillating body at one point reaches its maximum value and at the other point is zero.

C If the number of teeth of a gear in a Savart's wheel is (40) teeth that rotates by (360) cycles per minute to produce a sound tone its wave length 1.4 meters calculate the speed of the produced wave.

Question 2

A Give reasons for :

1. The fish in water seems at a position higher than its real position.
2. The motion of swing is considered a simple harmonic motion.
3. A peach fruit contains a single seed, while a pea fruit contains many seeds.
4. Sperms secrete enzymes during the penetration of the ovum.

B Cross out the odd word :

1. Sepals – Petals – Tubers – Carpals.
2. Pendulum motion – Spring motion – Rotary bee motion – Stretched string motion.
3. Penis – Ovary – Uterus – Fallopian tubes.
4. Sound intensity – Sound velocity – Sound pitch – Sound quality (type).

C Two waves of the same type and spread in one medium, if their frequencies are (512), (256) Hz. respectively. Find the ratio between their wavelengths.

Question 3

A Put (✓) or (✗) :

1. Nanometer is the measuring unit of the wavelength that equals 1×10^6 meters. ( )
2. Transparent medium is that permits only a part of light to pass through it, as flint glass. ( )
3. Sperms are stored in Cowper's gland. ( )
4. Flowers pollinated by air have feather like stigmas. ( )

B Mention the importance of each of the following :

1. A glass traingular prism.
2. Testosterone hormone.
3. Savart's wheel.
4. The wave.

C What is meant by the time taken by the oscillating body to make 30 complete oscillations is 10 seconds ?

Question 4

A Choose the correct answer :

1. When a light ray travels from air to water with an angle of incidence = 40°, then the angle of refraction in water is .....
   a. 30° b. 40° c. Zero° d. 50°
2. ..... waves are used in several medical fields.
   a. Sonic b. Infrasonic
   c. Ultrasonic d. Sonic and ultrasonic
3. The ratio between the time of amplitude to the periodic time equals .....
   a. (1 : 1). b. (2 : 1). c. (1 : 4). d. (3 : 1).
4. The small-sized sperm participate with the large-sized ovum to form the genetic material in a ratio of .....
   a. (1 : 2). b. (1 : 1). c. (2 : 1). d. (1 : 4).

B What happens when ... ?

1. Increase thickness of transparent medium.
2. You look vertically at a coin in a glass of water.
3. The area of a hole through which the light passes over a barrier increases.
4. Viruses are exposed to ultrasonic waves.

C Calculate the absolute refractive index of diamond given that the speed of light through it is 1.25×10^8 m/s. (Knowing that the velocity of light through air is 3×10^8 m/s.)

17 Gharbia Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. When an oscillating body makes 600 complete cycles per minute, its frequency equals .....
2. ..... sound waves accompany the blowing of storms that preceding rainfall.
3. Transverse wave consists of ..... and .....
4. Types of pollination are ..... pollination and ..... pollination.

B Correct the underlined words :

1. 1 Gigahertz = $\underline{10^9}$ kilohertz.
2. The ovary of **beans** fruits contains one ovule.
3. The left ovary release one ripe ovum every $\underline{28}$ days.
4. The fertilized ovum contains the **half** number of chromosome.

C Calculate the velocity of light through glass if you know that the absolute refractive index of glass is 1.5

Question 2

A Write the scientific term of each of the following :

1. A process of multiplying a small part of a plant to get many identical parts.
2. The measuring unit of sound intensity.
3. Half of the vertical distance between the crest and the trough of the wave.
4. The period between fertilization and delivery.

B **Cross out the odd word, then write the scientific term of others :**

1. Stigma – Filament – Ovary – Style.
2. Reed pipe – Violin – Piano – Drill.
3. Tunning fork – Pendulum – Spring – Rotary bee.
4. 10 Hz – 20 Hz – 20 KHz – 50 Hz.

C **Compare between electromagnetic waves – mechanical waves.**

Question 3

A **Put (✓) and (✗) then correct the wrong one :**

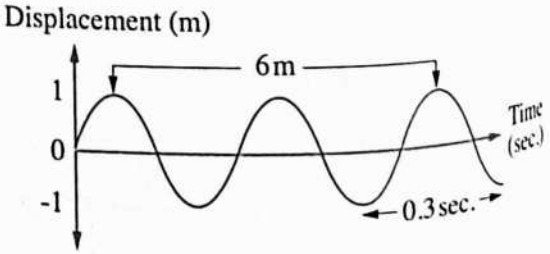
1. The anthers of air pollinated flowers are feathery like and sticky. ( )
2. The light ray refracts near the normal when it travels from glass to air. ( )
3. Syphilis disease is caused by spiral bacteria. ( )
4. If the periodic time of an oscillating body is 0.2 seconds, so the time taken to do 5 complete oscillations is 1 sec. ( )

B **Choose the correct answer :**

1. When the distance between the light source and a certain surface is doubled, the light intensity on the surface .....
   a. decrease to quarter b. increase four times
   c. is doubled d. remains constant
2. The temperature of the two testes must be ..... the normal body temperature.
   a. two degrees above b. two degrees below
   c. the same d. higher than
3. Sounds of the different musical instruments can be differentiated from each other by .....
   a. frequency. b. harmonic tones. c. fundamental tone. d. sound intensity.
4. The difference between the result of multiplying of frequency of an oscillating body by its periodic time and the whole the number one .....
   a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. 1 d. Zero

C **From the opposite figure find :**

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave Velocity.



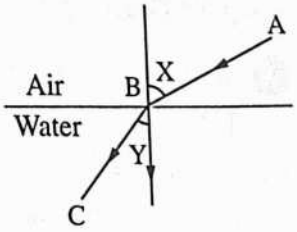
Question 4

A Mention one use or function of :

1. Jacuzzi.
2. Savart's wheel.
3. Triangular glass prism.
4. Testes.

B From the opposite fiugre, complete the following sentences :

1. The ray (AB) represents .....
2. The ray (BC) represents .....
3. Angle (X) is .....
4. Angle (Y) is .....



C What happens when ... ?

1. You put a vibrating tuning fork on a resonance box. (concerning the sound intensity).
2. You look at a pencil partially immersed in water.

18 Dakahlia Governorate — East Mansoura Educational Zone

Answer the following questions :

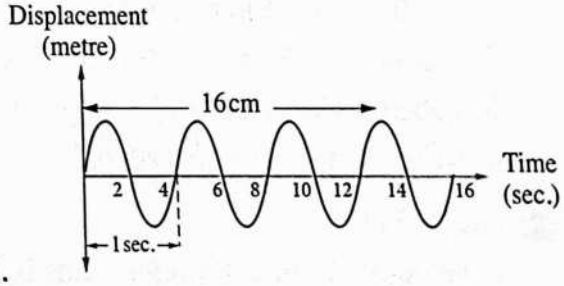
Question 1

A Complete the following sentences :

1. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
2. If time of one complete oscillation is 2 sec. so time of amplitude equal ..... and frequency equal ..... megahertz.
3. ..... is the ability of the transparent medium to refract light and it differs from one medium to another according to ..... in it.
4. The ..... hormone in male and ..... hormone in females are responsible for the appearance of secondary sexual characters.

B Choose the correct answer :

1. From the opposite figure velocity equals .....



   a. 1 m/sec. b. 3 m/sec.
   c. 4 m/sec. d. 10 m/sec.
2. Fertilization occurs when ..... is formed.
   a. embryo b. zygote c. endometrium d. ovum
3. In the flowers which have hanged anthers, pollination occurs by .....
   a. man. b. water. c. air. d. insects.
4. An organ in the flower, which consists of ovary, style and stigma is .....
   a. androecium. b. corolla. c. carpel. d. stamen.

C

Gear	The first	The second	The third
Number of teeth	50	90	150

1. The sharpest sound is produced when the metal plate touches the ..... gear.
2. Which gear produces sound its frequency 300 Hz when the metal plate touch it and rotates by a rate of 200 cycles/min show by mathematical calculation ?

Question 2

A Write the scientific term of each of the following :

1. Disturbance in which the particles of the medium vibrate along the direction of wave propagation.
2. The swollen part upon the flower pedicle on which the floral leaves are existed.
3. The tone produced from a violin or a piano.
4. A new method to produce large number of plants from a small part of it.

B Correct the underlined words :

1. If the distance between the second crest and sixth crest is **20 cm** , so the wave length of this wave 10 cm.
2. The absolute refractive index of a glass **equal to** one.
3. When a beam of light falls inclined from air to water, the angle of incidence equal to angle of refraction.
4. **The tail** contains mitochondria which are responsible for energy production needed for the sperm movement.

C From the opposite figure :

Calculate the number of compete oscillation in 100 sec.

Question 3

A Cross out the odd word, then write the scientific term of the rest :

1. Tuning fork – Stretched string – Rotary bee – Pendulum.
2. Frequency – Wavelength – Velocity – Displacement.
3. Tubers – Grafting – Bulbs – Rhizomes.
4. Softness of voice – Growth of bones – Growth hair in mustache – Enlargement of muscles.

B Put (✓) or (✗) :

1. Velocity of sound through solids is more than that in liquid and velocity of sound in liquids is more than that in air. ( )
2. The voice of woman is low pitched while the voice of man is high pitched. ( )
3. As optical density of the medium increases, the speed of light through it increases. ( )
4. The reproduction by grafting is used between orange and peaches. ( )

C What is meant by the amplitude ?

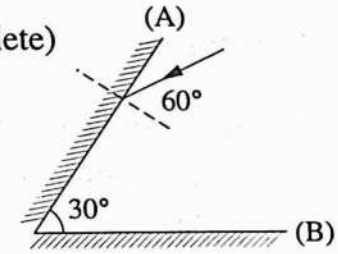
Question 4

A Find the mistakes in the following sentences. Then correct them by copying the whole correct sentence in your answer sheet :

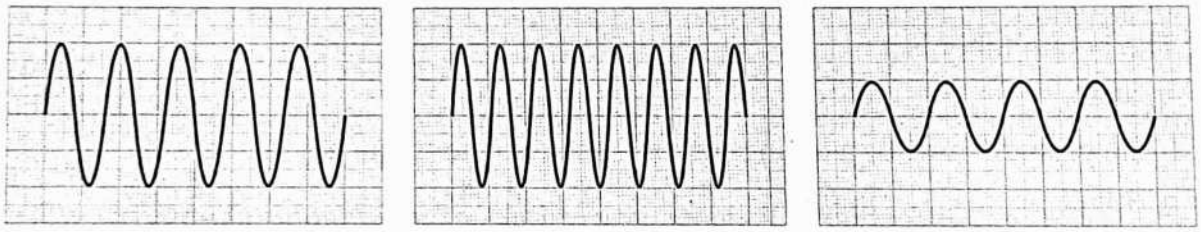
1. If the frequency of an oscillating body is 100 Hz the periodic time is 10 sec.
2. By increasing the length of the string the sound becomes sharp.
3. Sonic waves are used in discovery of landmines.
4. The wall of the ovule develops to become pericarp and the ovary develops to become a seed.

B Answer according to that in the bracts :

1. Red – Violet – Yellow – Green – Blue. (Arrange in descending order according to their energy).
2. The energy of light waves is composed of energy quanta known as photons. (Who the scientist).
3. Angle of reflection of the ray on mirror B equal ..... (complete)



4. Using the following figures (arrange the waves in ascending order according to their pitch).



(A) (B) (C)

C What is the scientific basis which the following depends on ... ?

The strings of musical instruments are fixed on a hollow wooden box.

19 Ismailia Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
2. The measuring unit of the sound intensity is ..... , while that of noise intensity is .....

3. In plant after fertilization, the ovule converts into the ..... , while the ovary grows forming the .....
4. The complete oscillation includes ..... successive displacements each one is called .....

B Cross out the odd word, then mention the common property between the rest :

1. Stigma – Stamen – Style – Ovary.
2. Sound wave – Light wave – Infrared wave – Radio wave.
3. Fallopian tube – The uterus – Vas deferens – The vagina.
4. Cutting – Grafting – Pollination – Tissue culture.

C Find the value of the angle of reflection in each of the opposite figure :

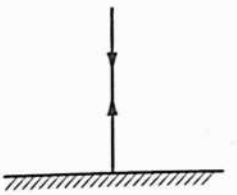


Fig. 1

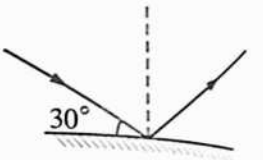


Fig. 2

Question 2

A Choose the correct answer :

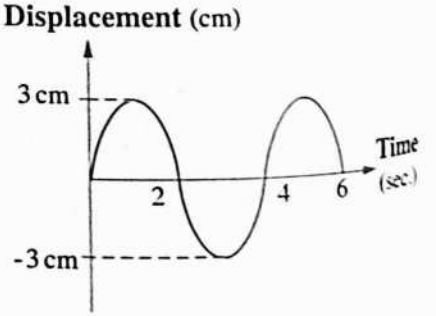
1. The quantum of energy of green light is ..... the quantum of energy of yellow light.
   a. greater than b. equal c. less than d. half
2. The potato tuber is a .....
   a. stem. b. root. c. leaf. d. bud.
3. If the periodic time of a tuning fork is 4 sec., So the frequency is .....
   a. 4 Hz. b. 6 Hz. c. $\frac{1}{4}$ Hz. d. $\frac{1}{6}$ Hz.
4. The right ovary in the human female, produces a mature ovum every ..... days.
   a. 24 b. 28 c. 34 d. 56

B Mention one function of each of the following :

1. Calyx in flower.
2. Jacuzzi.
3. Ultrasonic waves in military field.
4. Triangular glass prism.

C From the opposite figure find :

1. Periodic time.
2. Wave velocity.



Question 3

A Write the scientific term of each of the following :

1. It is the process of transfer of pollen grains from the anther of a flower to the stigma in the same flower.
2. The motion produced as a result of the vibration of the particles of the medium in a certain point in a certain direction.
3. A medium doesn't allow light rays to penetrate through.
4. Two glands of oval shape that produce the male gametes in human.

B Mention only one example for the following :

1. Unisexual flower.
2. The phenomenon that result from refraction and reflection of light on the desert roads.
3. Mechanical transverse wave.
4. An animal can produce ultrasonic waves.

C Give reasons for :

1. The oscillatory motion is considered as a periodic motion.
2. We see lightning before hearing thunder.

Question 4

A Correct the underlined words :

1. The tone produced from a tuning fork is pure and simple tone known as the **complex** tones.
2. The **estrogen** hormones is responsible for pregnancy to continue.
3. The simple harmonic motion is considered the simplest form of **transitional** motion.
4. White light is a mixture of **nine** colours known as spectrum colours.

B What happens when ... ?

1. Light ray travels from air to glass.
2. The density of the medium increase (according to the sound intensity).
3. Incidence of light rays on a rough surface.
4. The distance between the source of the light and a surface decrease (according the light intensity).

C Calculate the frequency of a musical tone similar to the frequency of an emitted tone using Savart's wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.

20 Suez Governorate

Science Inspectorate

Answer the following questions :

Question 1

A Write the scientific term of each of the following :

1. They are sound waves of frequencies ranging from 20 Hz to 20 KHz.
2. It is the angle between the emergent light ray and the normal at the point of emergence on the interface.
3. It is the highest point of the particles of the medium in the transverse wave.

B Put (✓) or (✗) :

1. The speed of the wave is fixed in the same medium and differs from one medium to another. ( )
2. The corolla is the male reproductive organ in the flower. ( )

C Calculate the wave length of a sound wave propagating through sea water with velocity 1500 m/sec. knowing that its frequency is 10 kilohertz.

Question 2

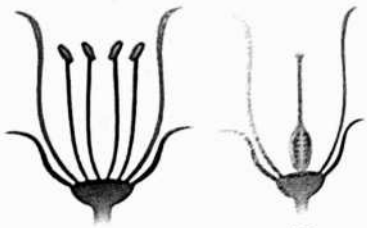
A Give reasons for :

1. Man can't hear sounds produced by dolphins.
2. When light ray travels from air to water it refracts near the normal.
3. Flowers pollinated by insects produce coarse pollen grains.
4. The product of frequency and periodic time equals unity.

B Compare between :

1. Regular and Irregular reflection.
2. Oscillatory motion and wave motion.

C Mention the sex in each flower from the following :



(1) (2)

Question 3

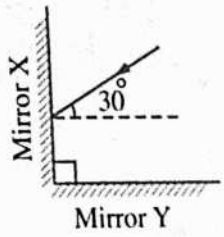
A Complete the following sentences :

1. The human zygote results from the combination of ..... and ..... and it contains ..... chromosomes.
2. The partial immersed pencil in water looks broken because of .....
3. The string are fixed above an empty wooden box in guitar to .....
4. The frequency of the vibrating body is measured in units .....
5. Sperm consists of ..... , central piece and .....

B Mention used for :

1. Triangular prism.
2. Savart's wheel.

C Complete the path of the rays in the figure, And find the angle of reflection on the mirror Y.



Question 4

A Choose the correct answer :

1. Sexual reproduction in plants take place in .....
   a. flowers. b. corolle. c. calyx. d. sepals.
2. The sound waves are ..... waves.
   a. longitudinal b. transverse c. electromagnetic d. no right answer
3. Fertilization occurs when ..... is formed.
   a. embryo b. zygote c. ovum d. endometrium
4. ..... light has a higher frequency than yellow light.
   a. Red b. Orange c. Green d. White

B What's meant by ... ?

1. Wave length of sound wave is 3 cm
2. The absolute refractive index of glass = 1.5

C Find the number of rotations in 2 minutes made by savart's wheel producing sound of frequency 300 Hz, if a metallic plate touches one gear of 100 teeth.

21 Port Said Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. Radio waves are considered as ..... waves, whereas sound waves are ..... waves.
2. The complete oscillation comprises ..... consecutive displacements, each of them is known as .....
3. Musical tones have a ..... frequency, whereas noise has ..... frequency.
4. A flower arises from a ..... bud, usually emerging from the axle of a leaf known as the .....

B Correct the underlined words :

1. The **transitional** motion is the motion repeated through equal intervals of time.
2. The calyx of the flower consists of green leaves called the **petals**.

3. During pregnancy, the vagina is responsible for the nourishment of the embryo through the umbilical cord.
4. After fertilization, the ovary of the flower grows to become the seed.

C **Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.**

Question 2

A **Cross out the odd word, then explain how other words are related to each other :**

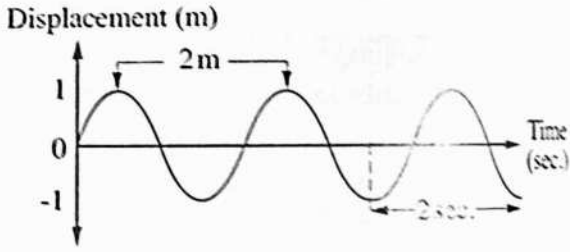
1. Tuning fork motion – Rotary bee motion – Stretched string motion – Spring motion.
2. Stigma – Stamen – Style – Ovary.
3. Wind direction – Frequency – Amplitude – Medium density.
4. Cutting – Pollination – Tissue culture – Grafting.

B **Put (✓) or (✗) :**

1. The speed of sound waves through air is faster than their speed through wood. ( )
2. In wind pollinated insects, stigmas are feathery-like and sticky. ( )
3. The absolute refractive index of any transparent medium is always less than one. ( )
4. The mirage is a natural phenomenon due to light reflection and refraction. ( )

C **From the opposite figure :**

Calculate the propagation speed of this wave.

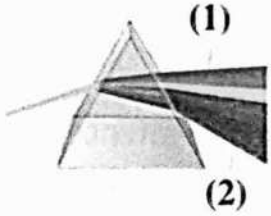
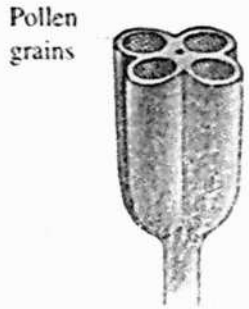


Question 3

A **Choose the correct answer :**

1. The product of the frequency × periodic time equals .....
   a. a variable value. b. a negative value. c. a fraction of ten. d. one.
2. Sound intensity is measured by .....
   a. Hertz. b. watt/sec. c. m/sec. d. watt/m^2.
3. The fruit of ..... contains many seeds.
   a. peach b. beans c. olive d. mango
4. The number of chromosomes in the zygote fertilized ovum equals ..... the number in the ovum.
   a. double b. half c. quarter d. the same

B Answer the question below each of the following figures :

1.	2.	3.	4.
			
(1) Find the periodic time.	(2) Find the angle of reflection.	(3) Name the colours (1) and (2).	(4) Name the figure.

C What are the results of vibration of the medium particles perpendicular to the wave propagation direction and what are the components of this wave ?

Question 4

A Write the scientific term of each of the following :

1. The number of complete oscillations made by a vibrating body in one second.
2. The tones which associate the fundamental tone which are higher in pitch but lower in intensity
3. The amount of light incident perpendicular onto a unit area of a surface in one second.
4. The nuclei of the sperm and ovum fuse together to form the fertilized ovum known as the zygote.

B Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Regular reflection	a. light changes its direction when it travels from a transparent medium to another one of different optical density.
2. Irregular reflection	b. light waves return back to the same medium of incidence when they meet a reflecting surface.
3. Light refraction	c. light rays return in different directions when they fall on a rough surface.
4. Light reflection	d. light rays return in one direction when they fall on a glistening surface.
	e. the ability of the transparent medium to refract light.

C Compare between :

High-pitched sound and low-pitched sound in terms of (frequency – an example for each).

22 El-Bhaira Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
2. The measuring unit of frequency is ..... while the measuring unit of periodic time is .....
3. ..... has the lowest frequency of spectrum colours, while ..... has the shortest wavelength of them.
4. After fertilization the ovule becomes ..... while the ovary becomes .....

B Cross out the odd word :

1. Motion of string – Motion of tuning fork – Motion of rotary bee – Motion of pendulum.
2. Cowper's gland – Seminal vesicles – Prostate gland – Ovary.
3. Anther – Stigma – Ovary – Style
4. Cutting – Grafting – Tuber – Tissue culture.

C Calculate the speed of light in diamond that has absolute refractive index = 2.4 and the speed of light in air = 3×10^8 m/s.

Question 2

A Choose the correct answer :

1. When the distance between the sound source and the ear increase two times, the sound intensity .....

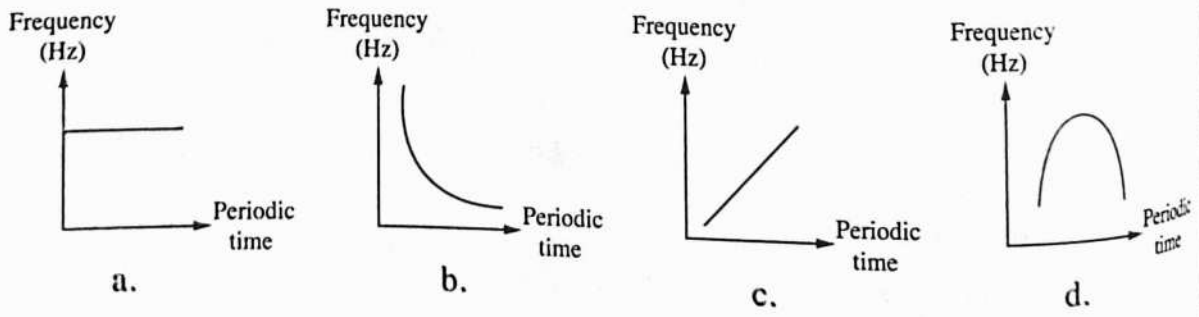
   a. decrease to half. b. increase to double.

   c. decrease to quarter. d. increase four time.

2. The ovulation process in human female happens every ..... day.

   a. 14 b. 28 c. 23 d. 46

3. Which graph represented the relation between frequency and periodic time ? .....



4. Which of the following flowers can't form fruit ?

a. b. c.

B Correct the underlined words :

1. The complete oscillation includes 8 amplitudes.
2. The deviation of indigo light colour is less than that of **green** light colour.
3. **Ultrasonic** waves have frequencies ranging from 20 to 20000 Hz.
4. **Gynoecium** is the male reproductive organ of the flower.

C Compare between : Mechanical waves and electromagnetic waves (definition & example).

Question 3

A Write the scientific term of each of the following :

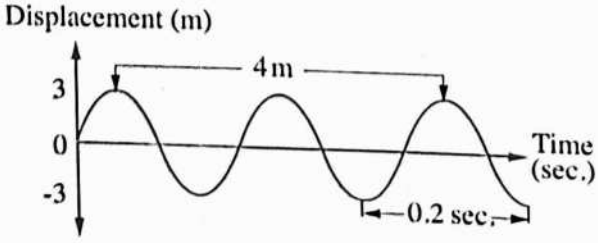
1. The motion which is regularly repeated in equal periods of time.
2. It is a natural phenomenon that takes place on desert roads at noon.
3. It is a genital system disease that causes by spiral-shaped bacteria.
4. The process of producing large numbers of plants from small part of it.

B Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Calyx	a. it is the area in the wave at which the medium particles are of lowest density and pressure.
2. Noise intensity	b. it's leaf is called "petal".
3. Rarefaction	c. is measured in "Decibel".
4. The sound pitch	d. a property by which the ear can distinguish between harsh and sharp sound.
	e. it's leaf is called "sepal".

C From the opposite figure find :

1. Amplitude.
2. Wavelength.
3. Frequency.
4. The wave velocity.

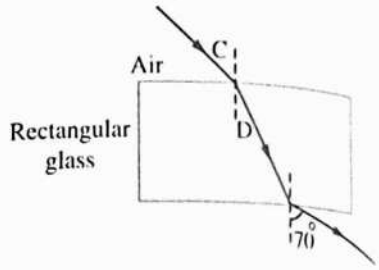


Question 4

A Rearrange this words according to which between brackets :

1. Red – Green – Blue – Yellow. (ascending according to energy of light waves).
2. Water – Wood – Air – Carbon dioxide. (descending according to sound velocity).
3. Corolla – Stamen – Calyx – Carpel. (from outer to inner in flower).
4. Water – Diamond – Air – Glass. (ascending according to the optical density).

B From the following figures answer, Find :



1. The measurement of angle (C).
2. Mention the name of angles (D).

C Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with velocity of 480 cycles in one minute, given that the number of teeth of the gear is 30 teeth.

23 El-Menia Governorate — Deirmwas Official School For Language

Answer the following questions :

Question 1

A Choose the correct answer :

1. The result of multiplying the frequency of an oscillating body by its periodic time equals .....
   a. 0.5 b. 0.25 c. 0.3 d. 1
2. The human ear can distinguish sounds of frequency .....
   a. 50 KHz b. 30 KHz c. 300 Hz d. 5 Hz
3. The right ovary in the female human produces a ripe (mature) ovum every ..... days.
   a. 24 b. 28 c. 34 d. 56
4. The human skin is considered as ..... medium.
   a. transparent b. opaque c. translucent d. semi-transparent

B Correct the underlined words :

1. **Androecium** is the first whorl of the floral leaves.
2. **Compression** is the highest point of the particles of the medium in the transverse wave.
3. Light **refraction** is the rebounding of light waves in the same medium on meeting a reflecting surface.
4. The midpiece of sperm contains **chloroplasts** which are responsible for energy production needed for the sperms movement.

C Give reasons for :

1. The waves produced due to vibration of a string are transverse mechanical waves.
2. The use of ultrasonic waves in milk sterilization.

Question 2

A Write the scientific term :

1. The transfer of pollen grains from the anther of one flower to the stigma of the same flower.
2. It is the quantity of light falling perpendicular to a unit area of a surface in one second.
3. The maximum displacement achieved by the oscillating body away from its rest position.
4. The ability of the transparent medium to refract light.

B Put (✓) or (✗) :

1. Man cannot reproduce asexually. ( )
2. The measuring unit of noise intensity is meter. ( )
3. Light travels in curved lines. ( )
4. Sound velocity through liquids is more than that through gases. ( )

C What is meant by the following ... ?

1. Fertilization in human.
2. Rarefaction.

Question 3

A Complete the following sentences :

1. Waves are classified according to the ability to propagate and transfer energy into ..... and .....
2. A complete oscillation consists of ..... successive displacement and each of them is called .....
3. The ..... hormone in males and ..... hormone in females are responsible for the appearance of secondary sexual characters.
4. Angle of ..... is the angle between the refracted light ray and ..... at the point of incidence on the interface.

B Cross out the odd word :

1. Yellow – Blue – White – Violet.
2. Pendulum motion – Spring motion – Rotary bee motion – Stretched string motion.
3. Cutting – Pollination – Layering – Grafting.
4. AIDS – Gonorrhea – Syphilis – Measles.

C Write one function for each of the following :

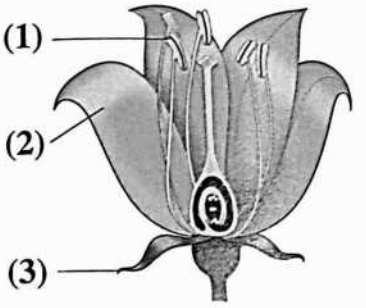
1. The glass prism.
2. The epididymis.

Question 4

A Choose from column (B) what suits it in column (A) :

(A)	(B)
1. Wave velocity	a. from the factors affecting sound intensity.
2. Frequency	b. always greater than one.
3. The wind direction	c. the distance covered by the wave in one second.
4. Absolute refractive index	d. is measured by Hertz.

B Look at the figure and answer :



1. .....
2. .....
3. .....
4. The sex of this flower is .....

C Problem :

Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.

24 Assiut Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
2. Angle of ..... is the angle between the refracted light ray and ..... at the point of incidence on the separating surface.
3. The ..... hormone in males and the ..... hormone in females are responsible for the appearance of secondary sexual characters.
4. The crest in ..... wave is equivalent to ..... in longitudinal wave.

B Cross out the odd word then state the relation among the remaining :

1. Red – Yellow – White – Blue.
2. Cuttings – Pollination – Layering – Grafting.
3. Sound wave – Light wave – Radio wave – Infrared wave.
4. Stigma – Stamen – Style – Ovary.

C Give reasons for :

1. We see lightening before hearing thunder.
2. Occurrence of mirage phenomenon in desert regions at noon.

Question 2

A Correct the underlined words :

1. Light travels in **curved** lines.
2. Reproduction by tuber happens in **orange**.
3. Speed of the sound in water slower than in **air**.
4. We see the submerged objects in water in a **lower** position than its real position.

B Choose the correct answer :

1. Light waves are .....
   a. mechanical transverse. b. electromagnetic longitudinal.
   c. electromagnetic transverse. d. no answer.
2. If the distance between the center of the third compression and the center of the fifth compression on the wave propagation is 20 cm., then the wavelength of this wave is .....
   a. 40 cm. b. 20 cm. c. 10 cm. d. 5 cm.
3. Fertilization occurs when ..... is formed.
   a. embryo b. zygote c. endometrium d. ovum
4. All of the following are factors affecting sound intensity except .....
   a. amplitude of vibration. b. frequency.
   c. medium density. d. wind direction.

C Savart's wheel rotates with a rate of 300 cycles per minute a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of teeth of the gear.

Question 3

A Write the scientific term of each of the following :

1. Changing the path of light when travel from a transparent medium to antoher transparent medium of different optical density.
2. A new method to produce large numbers of plants from a small part of it.
3. The number of complete oscillations produced by the oscillating body in one second.
4. Short stem where the leaves developed and modified into reproductive organs.

B Put (✓) or (✗) :

1. The energy of red light photon is less than that of orange light photon. ( )
2. The movement of the clock pendulum is an example for wave motion. ( )

3. The corolla is the male reproductive organ in the flower. ( )
4. Palm flowers are unisexual. ( )

C What is meant by ... ?

1. Absolute refractive index of water is 1.33
2. The wavelength of sound wave is 30 cm.

Question 4

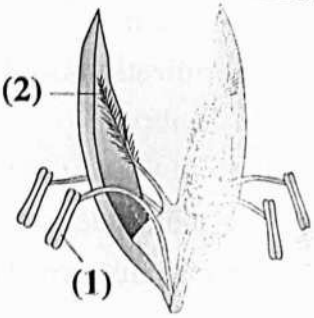
A Choose from column (B) what suits it in column (A) :

(A)	(B)
1. The sound pitch	a. it is distance covered by the wave in one second.
2. The sound intensity	b. is the property by which the ears can distinguish between sound levels either sharp or harsh.
3. Light intensity	c. is the property by which the ears can distinguish between sounds either strong or weak.
4. Wave velocity	d. it is the quantity of light falling perpendicular to a unit area of a surface in one second.

B The opposite fiugre shows a flower being pollinated by wind (air) :

Write the labels for each of :

1. .....
2. .....
3. Mention two characteristics that make this flower pollinated by wind (air).



C Compare between longitudinal waves and transverse waves (related to the definition).

25 Qena Governorate — Science Inspectorate

Answer the following questions :

Question 1

A Complete the following sentences :

1. In the ..... waves, the particles of medium oscillate perpendicular to the wave propagation direction.
2. In spectrum colours, the ..... colour has the highest frequency and shortest wavelength.
3. After fertilization, the ovary grows forming the .....
4. The measuring unit of sound intensity is .....

B Cross out the odd word :

1. Pendulum motion – Spring motion – Rotary bee motion – Stretched string motion.
2. Stigma – Filament – Ovary – Style.
3. Thyroid gland – Prostate gland – Cowper's gland – Seminal vesicles.
4. Glass – Water – Air – Wood.

C Give reason for : the use of ultrasonic waves in milk sterilization.

Question 2

A Write the scientific term :

1. The maximum displacement done by oscillating body away from its rest position.
2. Changing the path of light when it travels from a transparent medium to another transparent medium of different optical density.
3. The cell resulting from the fusion of male gamete and female gamete nuclei.
4. The female sex hormone which is responsible for the appearance of secondary female characters.

B Correct the underlined words :

1. The absolute refractive index is **equal to** 1.
2. Human can distinguish sounds of frequencies between **10 : 20** Hz.
3. Reproduction by tubers can be used in **apples**.
4. The oscillating body of frequency **360** Hz makes 180 complete oscillations in half a minute.

C What's meant by periodic time ?

Question 3

A Choose the correct answer :

1. When the distance between the sound source and the ear doubled, the sound intensity .....

   a. decreases to half. b. increases twice. c. decreases to quarter. d. increases 4 times.

2. Artificial vegetative reproduction by cutting can be done in .....

   a. peach. b. palm. c. grapes. d. olive.

3. If the angle between the incident light ray and the reflecting surface is 50°, so the angle of reflection equals .....

   a. 40° b. 50° c. 60° d. 90°

4. The floral whorl which is absent in the female flower is .....

   a. calyx. b. corolla. c. androecium. d. gynoecium.

B Complete the following table :

Points of comparison	Mechanical waves	Electromagnetic waves
Definition :	.....	.....
Example :	.....	.....

C Savart's wheel rotates with rate 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear. Calculate the number of the teeth.

Question 4

A Put (✓) or (✗) :

1. Sound velocity through liquids is more than that through gases. ( )
2. The submerged object in water is seen in an apparent position above its real position. ( )
3. Sound intensity decreases when the source of sound touches an empty box. ( )
4. The corolla consists of bright coloured scented leaves. ( )

B Give one example for the following :

1. Unisexual flower.
2. Fruit has one ovule.
3. Natural phenomenon related to reflecion and refraction of light.
4. Disease arises from sexual contact.

C What happens when a light ray falls perpendicular on a reflecting surface ?

SCIENCE

GUIDE ANSWERS

2023

SECOND TERM

BY A GROUP OF SUPERVISORS

EL-MOASSER SERIES

2nd prep.

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Unit One

Lesson 1

1 1. b 2. a 3. b 4. c 5. b
6. a / because the amplitude is the maximum displacement done by the oscillating body away from its rest position.
7. b 8. a 9. d 10. d 11. b 12. c
13. a
14. d / because frequency = $\frac{1}{\text{periodic time}}$
15. c / because the periodic time of the pendulum $= 2 \times 0.02 = 0.04$ sec.
Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.04} = 25$ Hz
16. d 17. d 18. b 19. c 20. b 21. c
22. a 23. **1.** d – **2.** c

2 1. (✓) 2. (✗) ..... is an oscillatory motion.
3. (✓) 4. (✓)
5. (✗) ..... increases by .....
6. (✓) 7. (✓)
8. (✗) ..... from C to A to B to A then back to C .....
9. (✓) 10. (✓) 11. (✓)
12. (✗) ..... 6 Hz .....
13. (✗) ..... is 16 Hz.

3
1. Periodic motion.
2. Oscillatory motion.
3. Amplitude.
4. Complete oscillation.
5. Periodic time.
6. Second.
7. Frequency.
8. Hertz.

4
1. Periodic – repeated
2. oscillatory – wave
3. rest position.
4. maximum
5. oscillatory – equal
6. tuning fork – stretched string – spring
7. oscillatory– periodic
8. oscillatory motion.
9. the maximum displacement done by the oscillating body away from its rest position – metre.
10. four – amplitude.
11. 1
12. Hertz – Hz.
13. $1 \times 10^6 - 1 \times 10^9$
14. one complete oscillation – second.
15. inversely
16. 0.2 cm – 2 seconds.
17. 10 Hz.
18. one second.
19. a. 5 cm. b. 2 seconds. c. B – E
20. Zero.

5
1. Because it is repeated regularly in equal periods of time.
2. It is a periodic motion, because it is regularly repeated in equal time intervals and an oscillatory motion, because it is repeated on the two sides of its rest position.
3. Because kinetic energy $= \frac{1}{2}$ mass $\times$ (velocity)^2.
4. Because the velocity of a pendulum is maximum when the pendulum passes its rest position and the kinetic energy is directly proportional to the square of velocity.
5. It is a periodic motion, because it is repeated regularly in equal time intervals, but it is not an oscillatory motion, because it is not repeated on the two sides of its rest position.
6. Because the periodic time is inversely proportional to the number of complete oscillations made by the oscillating body at constant time.
$\left(\text{Periodic time} = \frac{\text{Time in sec.}}{\text{Number of complete oscillations}}\right)$
7. Because the frequency is the reciprocal of the periodic time. $\left(\text{Frequency} = \frac{1}{\text{Periodic time}}\right)$
8. Because the frequency is inversely proportional to the periodic time.

6
1. It is a motion which is regularly repeated in equal periods of time.
2. It is the periodic motion of the oscillating body around its rest point, where the motion is repeated through equal intervals of time.
3. It is the maximum displacement done by the oscillating body away from its rest position.
4. It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.
5. It is the time taken by an oscillating body to make one complete oscillation.
6. It is the number of complete oscillations made by an oscillating body in one second.

7 1. This means that the amplitude of an oscillating body is 6 cm (0.06 m).

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2. This means that the maximum displacement done by the oscillating body away from its rest position is 4 cm (0.04 m).
3. This means that the time taken by the tuning fork to make one complete oscillation is 0.5 sec.
4. This means that the periodic time of this spring is $(\frac{60}{60})$ which equals 1 sec.
5. This means that the number of complete oscillations made by the simple pendulum in one second is 50 complete oscillations.
6. This means that the frequency of the oscillating body is $(\frac{500}{10})$ which equals 50 Hz.
7. This means that the frequency of this oscillating body is 30 Hz.
8. This means that the frequency of this oscillating body is 8 Hz.

8
1. Its velocity increases to the maximum value.
2. Its kinetic energy increases.
3. The frequency of the vibrating body increases.
4. The value of frequency equals to that of the periodic time.

9 1. Second. 2. Metre. 3. Hertz.

10
1. Amplitude = $\frac{1}{4}$ complete oscillation.
2. Periodic time = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$
3. Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$
4. Frequency = $\frac{1}{\text{Periodic time}}$
5. Number of complete oscillations = Frequency × Time in seconds.
6. Time of complete oscillation = 4 × Time of amplitude.

11
1. Time in seconds = 1 × 60 = 60 sec.
Periodic time (T) = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}} = \frac{60}{600} = 0.1$ sec.
2. Time of amplitude = $\frac{1}{4}$ periodic time
Periodic time = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$
$= \frac{60}{600} = 0.1$ sec.
Time of amplitude = $\frac{1}{4} \times 0.1 = 0.025$ sec.
3. Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$
$= \frac{720}{90} = 8$ Hz
4. Number of complete oscillations
= Frequency × Time in seconds = 6 × 2 × 60
= 720 complete oscillations.
5. a. Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}} = \frac{480}{1 \times 60}$
$= 8$ Hz
b. Periodic time = $\frac{1}{\text{Frequency}} = \frac{1}{8}$ sec.
6. Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.2} = 5$ Hz
$= 5 \times 10^{-6}$ megahertz
7. a. Periodic time = $\frac{1}{\text{Frequency}} = \frac{1}{10} = 0.1$ sec.
b. Time taken to make 300 complete oscillations = No. of complete oscillations × periodic time = 300 × 0.1 = 30 sec.
c. Number of complete oscillations in a minute = Frequency × Time in seconds
= 10 × 1 × 60 = 600 complete oscillations.

12
(1) Fig. (b) (2) c
(3) a. 0.4 sec. b. 2.5 cycle / sec. c. 2 cm
(4) a. rest position. b. amplitude.
c. complete oscillation – periodic time.
(5) a. A b. (B) and (C) c. 0.8 second
(6) a. P b. N
(7) a. B b. A
(8) b. because frequency is inversely proportional to periodic time.
(9) a. 3 cm b. 0.04 sec.
c. Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.04} = 25$ Hz
(10) a. No. of complete oscillations in one second = Frequency = $\frac{1}{T}$
A = $\frac{1}{0.002} = 500$ complete oscillations.
B = $\frac{1}{0.005} = 200$ complete oscillations.
C = $\frac{1}{0.01} = 100$ complete oscillations.

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b. Periodic time of (B) = 0.005 sec.

c. The relation is inversely proportional.

⑪ a. 400 b. 2 sec.

c. Frequency = $\frac{\text{No. of complete oscillations}}{\text{Time in seconds}}$

$= \frac{400}{4} = 100$ Hz

d. Periodic time = $\frac{1}{\text{Frequency}} = \frac{1}{100} = 0.01$ sec.

⑫ a. The body (C).

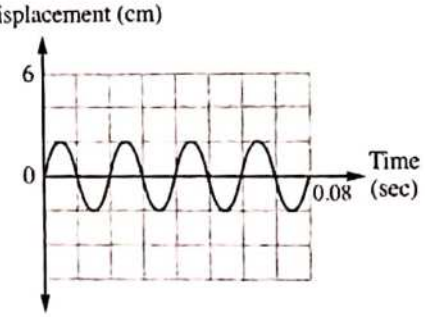
b. Periodic time = $\frac{\text{Time (sec.)}}{\text{No. of complete oscillations}}$

$= \frac{10}{200} = 0.05$ sec.

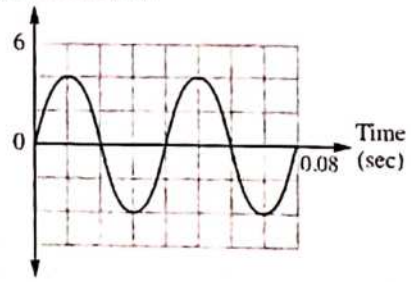
⑬ a. The periodic time is the time of one complete oscillation =

$\frac{\text{Time (sec.)}}{\text{No. of complete oscillations}} = \frac{0.08}{2} = 0.04$ sec.

b.



c.



13

1. When its motion is repeated regularly in equal periods of time.
2. When it is repeated on the two sides of the rest position through equal intervals of time.
3. When it passes its rest position.
4. When the pendulum reaches its maximum displacement furaway its rest position.
5. When the number of complete oscillations made by the oscillating body is equal to the time taken by second.

14

- (X) The motion of a string.
- (Y) The motion of the spring.
- (Z) The motion of the pendulum.

Thinking Skills Questions

1 1. d 2. c 3. a 4. b
5. a 6. d 7. c

2 a. Amplitude = $\frac{20}{4} = 5$ cm $= 0.05$ m

b. F = $\frac{1200}{60} = 20$ Hz

c. Periodic time (T) = $\frac{1}{20} = 0.05$ sec.

d. Number of complete oscillations

$= \frac{\text{Number of displacements}}{4}$

$= \frac{16}{4} = 4$ complete oscillations

Time in sec. = periodic time × number of complete oscillations

$= 0.05 \times 4 = 0.2$ sec.

3 a. Frequency / because the number of complete oscillations in fig. (1) (3 complete oscillations) equals to the number of complete oscillations in fig. (2) (3 complete oscillations) at the same period of time.

b. Amplitude / because the maximum displacement away from the rest position in fig. (1) is larger than that in fig. (2).

4 Fig. (1) / because the velocity of the oscillating body reaches the maximum value at the rest position (A).

Lesson 2

1

1. a	2. c	3. d	4. c	5. d	6. c
7. b	8. b	9. d	10. a	11. d	12. a
13. c	14. a	15. b	16. c	17. a	18. c
19. a	20. a	21. a	22. b	23. c	24. d
25. c	26. b	27. d	28. b	29. a	30. d
31. a	32. b	33. c	34. c	35. 1. a – 2. a	
36. 1. b – 2. c	37. a				

2

1. (✗)	2. (✗)	3. (✗)	4. (✗)	5. (✗)
6. (✓)	7. (✓)	8. (✓)	9. (✗)	10. (✓)
11. (✗)	12. (✓)	13. (✗)	14. (✗)	15. (✓)
16. (✗)	17. (✗)	18. (✓)	19. (✓)	20. (✗)
21. (✗)	22. (✓)			

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3

1. The movement of water waves is .....
2. In wave motion, medium particles vibrate in their places.
3. ..... into longitudinal and transverse waves.
4. Mechanical waves are those waves that need a medium to propagate such as water waves.
5. Light waves and radio waves are examples of .....
6. Rarefaction is .....
7. The transverse wave ..... vibrate perpendicular to the direction of wave propagation.
8. Wave frequency is the number of complete waves that are done by the source in a second.
9. The velocity of sound waves through water = 1500 m/s.
10. Wavelength = $\frac{\text{Wave velocity}}{\text{Wave frequency}}$
11. ..... makes 200 complete oscillations in one second.

4

1. The wave. 2. The wave motion.
3. Line of wave propagation.
4. Mechanical waves.
5. Electromagnetic waves.
6. Transverse waves. 7. Crest. 8. Trough.
9. Longitudinal waves. 10. Compression.
11. Rarefaction. 12. Jacuzzi.
13. Wavelength of the transverse wave.
14. Wavelength of the longitudinal wave.
15. Metre. 16. Wave amplitude.
17. Wave velocity. 18. Metre/second.
19. Wave frequency.
20. Periodic time of the wave.
21. Law of wave propagation.
22. Hertz.

5

1. energy – particles 2. energy
3. vibrate – transferring
4. mechanical – electromagnetic
5. transverse – longitudinal
6. transverse – longitudinal
7. Electromagnetic – light
8. Mechanical – sound – water
9. electromagnetic – 3×10^8 m/sec.
10. crests – troughs.
11. transverse – longitudinal
12. lowest – transverse 13. crest – amplitude.
14. compressions – rarefactions.
15. Compression
16. transverse – centre of compression
17. sprains – nervous tension
18. two successive crests or troughs.
19. the centres of two successive compressions or rarefactions.
20. maximum – rest positions.
21. less – greater
22. Metre – metre/second 23. waves – second.
24. Number of complete waves
25. a. 50 Hz. b. 10 m/s. c. 0.02 sec.
26. a. 1 b. 0.1
27. Frequency – Wavelength
28. 1 – Wavelength
29. a. longitudinal – AC – BD. b. 200

6

1. Because it is repeated regularly in equal periods of time.
2. Because the first ball transfers its energy to the second one through the rest of the fixed billiard balls.
3. Because the sound waves produced from the loudspeaker propagate carrying the energy in the same direction of propagation causing the vibration of the candle flame.
4. Because sound waves need a medium to propagate through, while radio waves do not need a medium to propagate through.
5. They are transverse waves because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs and mechanical waves because they need a medium to propagate through.
6. They are transverse waves because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs and mechanical waves because they need a medium to propagate through.
7. They are longitudinal waves because the medium particles vibrate along the direction of wave propagation forming compressions and rarefactions and mechanical waves because they need a medium to propagate through.
8. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
9. Because it is used to treat sprains and cramps by using hot water, and nervous tension by using cold water.
10. Because the sound is mechanical waves which can't propagate through vacuum between the Sun and the Earth, while the light is electromagnetic waves which can propagate through vacuum.

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11. Because the sound is mechanical waves which can't propagate through vacuum, while wireless device works with light that can propagate through vacuum.

12. Because the velocity of sound through solids (floor) is greater than its velocity through air, this enables them to hear the sound faster.

13. Because the velocity of the wave is constant in the same medium, therefore the frequency of the wave is inversely proportional to its wavelength.

14. Because both of them are electromagnetic waves that have the same velocity in vacuum, so the product of multiplying the frequency in the wavelength of each of them equals constant value (3×10^8 m/s).

7

1. It is the disturbance that propagates and transfers energy in the direction of propagation.
2. It is the periodic motion produced as a result of the vibration of the medium particles at a certain moment in a definite direction.
3. It is the direction of progression of the wave.
4. It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.
5. It is the highest point of the particles of the medium in the transverse wave.
6. It is the lowest point of the particles of the medium in the transverse wave.
7. It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
8. It is the area in the longitudinal wave at which the particles of the medium are of the highest density and pressure.
9. It is the area in the longitudinal wave at which the particles of the medium are of the lowest density and pressure.
10. They are waves which do not need a medium to propagate, where they propagate through vacuum.
11. They are waves which need a medium to propagate, where they do not propagate through vacuum.
12. It is the distance between two successive crests or troughs.
13. It is the distance between the centres of two successive compressions or rarefactions.
14. It is the maximum displacement achieved by the medium particles away from their rest positions.
15. It is the distance covered by the wave in one second.
16. It is the number of complete waves produced from the source in one second.

8

1. This means that the distance between the centres of two successive compressions or rarefactions in such wave is 30 cm (0.3 m).
2. This means that the wavelength of such wave is 10 cm (0.1 m).
3. This means that the maximum displacement achieved by the medium particles away from their rest positions in such wave is 5 cm (0.05 m).
4. This means that the velocity of the visible light wave in space is 3×10^8 m/s.

$$V = \frac{\text{distance}}{\text{time}} = \frac{6 \times 10^8}{2} = 3 \times 10^8 \text{ m/sec.}$$

5. This means that the distance that is covered by a light wave in one second is 300000 km.
6. This means that the distance that is covered by a sound wave through air in one second is 340 metres.
7. This means that the number of complete waves produced in one second is 600 waves.

9

1. Wave frequency $= \frac{\text{Number of complete waves}}{\text{Time in seconds}}$
2. Wave frequency $= \frac{\text{Wave velocity}}{\text{Wavelength}}$
3. Wave velocity = Frequency × Wavelength
4. Wave velocity $= \frac{\text{Distance covered by the wave in metres}}{\text{Time in seconds}}$

10

1. Wave velocity.
2. Wave frequency.
3. Periodic time.
4. Wave velocity.
5. Wavelength.
6. Wave velocity.

11

1. Concentric circles propagate on the water surface.
2. The rings of the spring move up and down forming crests and troughs.
3. A transverse wave is formed.
4. The particles of the medium propagate along the direction of propagation of the wave.

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5. The wavelength of the transverse wave is doubled.
6. Its velocity increases.
7. The wavelength decreases to its half value.
8. The wavelength does not change.

12

1. *Look at the main book on pages* **(40 , 41)**.
2. *Look at the main book on page* **(42)**.
3. • **The measuring unit of wave velocity** is metre/second.
   • **The measuring unit of wavelength** is metre.
4. • **Frequency of the wave** is the number of complete waves produced from the source in one second.
   • **Amplitude of the wave** is the maximum displacement achieved by the medium particles away from their rest positions.
5. *Look at the main book on page* **(51)**.

13

1. a. Velocity of sound in air
   = Frequency × Wavelength
   = 200 × 1.7 = 340 m/s.

   b. Wavelength = $\frac{\text{Wave velocity}}{\text{Frequency}} = \frac{1500}{200} = 7.5$ m.

2. Frequency = $\frac{\text{Wave velocity}}{\text{Wavelength}} = \frac{1800}{6} = 300$ Hz.

3. The distance between the second and the seventh compressions contains 5 waves
   ∴ Wavelength = $\frac{2.5}{5} = 0.5$ metre.
   Sound velocity = Frequency × Wavelength
   = 660 × 0.5 = 330 m/s.

4. Wavelength = $\frac{60}{2} = 30$ cm = 0.3 m.
   Periodic time = $\frac{0.07}{2} = 0.035$ sec.
   Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.035} = 28.6$ Hz.
   Velocity of propagation = Frequency × Wavelength
   = 28.6 × 0.3 = 8.58 m/s.

5. ∵ Velocity = $\frac{\text{Distance covered by the wave (m)}}{\text{Time (s)}}$
   ∴ Time = $\frac{\text{Distance covered by the wave}}{\text{Velocity}}$
   = $\frac{17}{340} = 0.05$ sec.
   ∴ The no. of waves = Frequency × Time
   = 260 × 0.05 = 13 waves.

6. Frequency = $\frac{\text{Number of complete waves}}{\text{Time (second)}}$
   = $\frac{20}{5} = 4$ Hz.
   Wavelength = $\frac{\text{Wave velocity}}{\text{Frequency}} = \frac{8}{4} = 2$ metre.
   The number of waves between the first crest and the third one = 2 waves.
   ∵ Wavelength = $\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$
   ∴ The distance between the first crest and the third one (distance covered by waves) = Wavelength × Number of waves
   = 2 × 2 = 4 metre.

14

(1) 1. Jacuzzi is used to treat :
   – Sprains and cramps by using hot water.
   – Nervous tension by using cold water.
   2. Radio waves are used in radars.

(2) oxygen ⟶ water ⟶ iron.

(3) 1. Sound wave is the odd word.
   The other waves are electromagnetic waves.
   2. Rotary bee motion is the odd word.
   The other motions are oscillatory motions.

15

(1) Due to the transfer of energy from the ball (A) to the ball (B) through the other balls.

(2)

A	B	C
gases	liquids	solids

(3) Because the medium particles (air and smoke particles) vibrate without moving from their places during the propagation of sound waves, which carry energy to the candle flame.

(4) 1. Longitudinal wave.
   2. (1) Wavelength. (2) Compression.
   (3) Rarefaction. (4) Tuning fork.

(5) 1. Mechanical longitudinal waves.
   2. Omar / Because the velocity of sound through solids (iron) is larger than the velocity of sound through gases (CO_2 gas).

(6) 1. Wave (B).
   2. Wave (B).
   3. Wave (A).

(7) 1. The wave velocity is directly proportional to the frequency at constant wavelength.

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2. 100 m/s.

3. $\lambda = \frac{V}{F} = \frac{50}{100} = 0.5$ metre.

$\lambda = \frac{100}{200} = 0.5$ metre.

⑧ Transverse wave,

Wavelength (λ) $= \frac{10}{100} = 0.1$ m

Wave velocity (V) =

$$\frac{\text{Number of complete waves} \times \text{Wavelength } (\lambda)}{\text{Time (seconds)}}$$

$V = \frac{600 \times 0.1}{1 \times 60} = 1$ m/s

⑨ 1. Wavelength =

$$\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$$

$= \frac{4}{2} = 2$ metres.

2. $\because$ Periodic time $= 2 \times 0.2 = 0.4$ sec.

$\therefore$ Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{0.4} = 2.5$ Hz.

3. Amplitude = 1 metre

4. Wave velocity (V)

= Frequency (F) × Wavelength (λ)

$= 2.5 \times 2 = 5$ m/s.

⑩ 1. Amplitude = 2 cm.

2. Periodic time = 0.04 sec.

Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{0.04} = 25$ Hz.

3. Wavelength $= \frac{\text{Velocity}}{\text{Frequency}} = \frac{20}{25}$

$= 0.8$ m.

⑪ 1. The distance (L) = 0.5 m, it is the wavelength.

2. Velocity of sound wave (V)

= Wave frequency (F) × Wavelength (λ)

$= 660 \times 0.5 = 330$ m/s.

⑫ 1. It is the maximum displacement achieved by the medium particles away from their rest positions.

Its value = 3 cm.

2. It is the distance between two successive crests.

Its value = 15 cm.

⑬ 1. Transverse wave.

2. Wavelength (λ) =

$$\frac{\text{The distance which covered by waves}}{\text{Number of waves}}$$

$= \frac{150}{5} = 30$ cm $= 0.3$ m.

3. Frequency (F) $= \frac{\text{Number of complete waves}}{\text{Time in seconds}}$

$= \frac{5}{10} = 0.5$ Hz.

Periodic time (T) $= \frac{1}{F} = \frac{1}{0.5} = 2$ sec.

⑭ 1. a 2. d 3. a 4. d 5. d 6. d

16 Wavelength, Wave amplitude, Wave frequency, Wave velocity, ...

Thinking Skills Questions

1 d

2 Wave velocity.

3 $\because$ The time between 2 successive crests is 0.2

$\therefore$ Periodic time = 0.2 sec.

$\therefore F = \frac{1}{0.2} = 5$ Hz.

4 No. of waves = 10 waves.

Frequency $= \frac{\text{No. of complete waves}}{\text{Time in seconds}} = \frac{10}{1} = 10$ Hz.

Wavelength $= \frac{30}{100} = 0.3$ m.

Wave velocity $= F \times \lambda$

$= 10 \times 0.3 = 3$ m/s.

5 a. $\because$ Source produces a pulse every $\frac{1}{4}$ second

$\therefore$ Periodic time $= \frac{1}{4}$ sec.

$\therefore$ Frequency $= \frac{1}{0.25} = 4$ Hz.

b. Wavelength $= \frac{2}{100} = 0.02$ m.

$V = F \times \lambda = 4 \times 0.02 = 0.08$ m/s.

6 $\because$ The two waves are of the same type and spread in the same medium.

$\therefore$ Their velocities are equal. $\therefore V_1 = V_2$

$F_1 \times \lambda_1 = F_2 \times \lambda_2$

$\frac{\lambda_1}{\lambda_2} = \frac{F_2}{F_1} = \frac{256}{512} = \frac{1}{2}$

7 a. The distance which covered by 40 waves = the radius of the outer circle = 2 metres.

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Wavelength

$= \frac{\text{The distance which covered by waves}}{\text{Number of waves}}$

$= \frac{2}{40} = 0.05$ m.

b. $F = \frac{40}{4} = 10$ Hz.

Velocity $= F \times \lambda = 10 \times 0.05 = 0.5$ m/s.

8 $V = F \times \lambda$

∵ The blue and orange lights are electromagnetic waves.

∵ The velocity of the two waves through air equals 3×10^8 m/s.

$\therefore F_1 \times \lambda_1 = F_2 \times \lambda_2$

(blue light) (orange light)

$\therefore \frac{F_1}{F_2} = \frac{\lambda_2}{\lambda_1} = \frac{6 \times 10^{-7}}{5 \times 10^{-7}} = \frac{6}{5}$

9 $\text{Time} = \frac{\text{Distance covered by the wave}}{\text{Wave velocity}}$

Time of seeing lightning $(T_1) = \frac{1.5 \times 1000}{3 \times 10^8}$

$= 5 \times 10^{-6}$ sec.

Time of hearing thunder $(T_2) = \frac{1.5 \times 1000}{333} = 4.5$ sec.

$\therefore T = T_2 - T_1 = 4.5 - (5 \times 10^{-6}) \simeq 4.5$ sec.

10 a. $V = F \times \lambda = 2.5 \times 0.6 = 1.5$ m/s.

b. $\text{Time} = \frac{\text{Distance covered by the wave}}{\text{Wave velocity}} = \frac{3}{1.5} = 2$ sec.

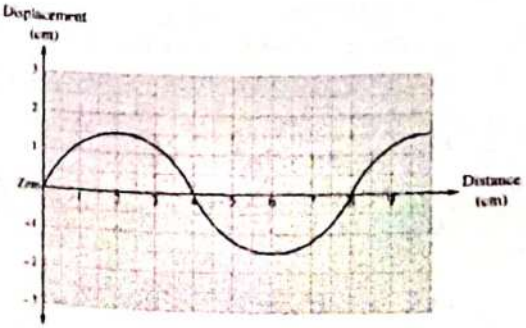
11 (1) a. Wavelength = 4 cm = 0.04 m.

b. Wave amplitude = 3 cm = 0.03 m.

(2) V = 10 cm/s = 0.1 m/s.

$F = \frac{V}{\lambda} = \frac{0.1}{0.04} = 2.5$ Hz.

(3)



Project On UNIT ONE *Answer by Yourself*

Unit Two

Lesson 1

1

1. d	2. c	3. a	4. c	5. b	6. d
7. b	8. c	9. c	10. a	11. b	12. c
13. b	14. b	15. b	16. d	17. c	18. a
19. a	20. d	21. b	22. c	23. d	24. b
25. c	26. b	27. d	28. b	29. b	30. c
31. c	32. c	33. d	34. c	35. b	36. d
37. c					

2 1. b 2. d 3. a

3

1. (✗) ..... the lowest when .....
2. (✗) ..... is more than ..... 3. (✓)
4. (✗) ..... through three different factors sound pitch, sound intensity and sound type.
5. (✓)
6. (✗) The intensity of sound .....
7. (✗) ..... as we move away from the source of sound.
8. (✗) ..... decreases to quarter. 9. (✓)
10. (✗) ..... increases .....
11. (✗) ..... will be fainter, if .....
12. (✗) ..... by their harmonic tones.
13. (✗) The sound intensity ..... 14. (✓)
15. (✗) Ultrasonic waves ..... 16. (✓)

4

1. Sound.
2. Sound waves.
3. Sound velocity.
4. Musical tone.
5. Noise.
6. Sound pitch.
7. Savart's wheel.
8. Sound intensity.
9. The inverse square law of sound.
10. Watt/m^2.
11. Decibel.
12. Silicon.
13. Sound quality.
14. Harmonic tones.
15. Infrasonic waves.
16. Ultrasonic waves.
17. Sonic waves.
18. Infrasonic waves.
19. Ultrasonic waves.
20. Ultrasonic waves.

5

1. vibration
2. mechanical
3. compressions – rarefactions.
4. Wave frequency – Wavelength
5. larger – smaller
6. 17 metres.
7. uniform – piano – violin.

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8. Noise – non-uniform 9. silicon – noise
10. pitch – intensity – quality.
11. sharp – high 12. harsh – low
13. high – low
14. frequency – vibrating body.
15. sharp – harsh 16. inversely
17. pitch (frequency) 18. 300 Hz.
19. speed of rotation.
20. Number of gear teeth – Time in seconds
21. high – low 22. Watt/m^2 – Decibel.
23. amplitude of vibration – area of vibrating surface – direction of wind.
24. perpendicularly – a unit area
25. inversely – the inverse square law of sound.
26. increases – quarter 27. increases
28. decreases – increases – resonance
29. decreases
30. harmonic – fundamental
31. pitch – intensity
32. quality – intensity – pitch.
33. 20 – 20000 – less than 20 – more than 20000
34. 20 Hz – 20000 Hz. 35. Infrasonic
36. bats – dogs – dolphins
37. Ultrasonic – kidney – ureter's

6

1. Because the sound velocity through solids (the ground) is larger than that through air.
2. Because sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.
3. To change the frequency of the produced tone.
4. Because musical note (tone) is of uniform frequency, while noise is of non-uniform frequency.
5. Because it is sound of non-uniform frequency.
6. To protect their ears from the noise.
7. Because the sound of the tuning fork of frequency 251 Hz is low pitch, while that of 512 Hz is high pitch.
8. Because the intensity of sound is inversely proportional to the square of the distance between the ear and the sound source.
9. Because the sound intensity is directly proportional to the square of the amplitude of the vibrating source.
10. Due to the increase of the vibrating surface area.
11. To increase the vibrating surface area which leads to an increase in sound intensity.
12. Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.
13. Due to the difference in harmonic tones that associate the fundamental tone of each of them.
14. Because the range of sounds produced by man lies within the range of sounds heard by dogs.
15. Because dolphins produce ultrasonic waves, while the human ears can't hear sounds of frequencies more than 20 kilohertz.
16. Because man can hear sounds of frequencies range between 20 Hz to 20 kHz.
17. Because these waves accompany the blowing of storms that preceding rainfall.
18. Because they have high ability to kill some types of bacteria and stop the action of some viruses.
19. Because they are used for breaking down of kidney and ureter stones and also for diagnosis of male prostate tumors.

7

1. It is an external factor (or stimulus) that affects the ear causing the sense of hearing.
2. This means that the distance between two successive compressions or two successive rarefactions is 1.5 m.
3. It is the property by which the ears can distinguish between harsh and sharp sounds.
4. It is the property by which the ears can distinguish between sounds either strong or weak sound.
5. It is the measuring unit of noise intensity.
6. The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source.
7. It is the property by which the human ear can distinguish between different sounds according to the nature of the source even if they are equal in intensity and pitch.
8. They are tones that accompany the fundamental tone, but they are higher in pitch and lower in intensity, and differ from one instrument to another.
9. They are sound waves of frequencies lower than 20 Hz.
10. They are sound waves of frequencies ranging from 20 Hz to 20 KHz (20000 Hz).

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11. They are sound waves of frequencies higher than 20 KHz (20000 Hz).

8

1. The wavelength doesn't change.
2. The pitch of the produced sound increases.
3. The intensity of sound decreases to its quarter value.
4. The intensity of sound increases.
5. The intensity of the produced tone increases.
6. The intensity of the produced sound decreases gradually until it stops.
7. The intensity of sound decreases.
8. The intensity of sound increases.
9. The intensity of sound decreases.
10. Man cannot hear these waves.

9

1. Sound velocity. 2. Frequency.
3. The inverse square law of sound.
4. Sound velocity.

10

1. $\text{Frequency} = \frac{\text{No. of cycles}}{\text{Time in seconds}} = \frac{3600}{3 \times 60} = 20$ Hz.

$\text{Velocity of sound} = \text{Frequency} \times \text{Wavelength}$

$= 20 \times 17 = 340$ m/sec.

2. $\text{Wavelength} = \frac{\text{Wave velocity}}{\text{Wave frequency}} = \frac{340}{17} = 20$ m.

3. $\text{Frequency} = \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$600 = \frac{300 \times \text{No. of gear teeth}}{60}$

$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120$ teeth.

4. $\text{Frequency} = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$100 = \frac{30 \times \text{No. of gear teeth}}{60}$

$\text{Number of gear teeth} = \frac{60 \times 100}{30} = 200$ teeth.

5. $\text{Frequency} = \frac{\text{No. of rotations} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$300 = \frac{\text{No. of rotations} \times 100}{2 \times 60}$

$\text{No. of rotations} = \frac{300 \times 2 \times 60}{100} = 360$ rotations.

6. $\text{Frequency} = \frac{\text{No. of rotations} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$200 = \frac{360 \times 50}{\text{Time in seconds}}$

$\text{Time} = \frac{360 \times 50}{200} = 90$ seconds.

$= 1.5$ minute.

11

① The intensity of sound :
- is inversely proportional to the square of the distance between the sound source and the ear.
- is directly proportional to the square of the amplitude of vibration of the sound source.
- is directly proportional to the density of the medium in which the sound travels or propagates through.
- increases when the sound source touches a resonance body (box).
- increases when the sound direction is in the direction of air flow and vice versa.

② 1. Sound velocity = Frequency × Wavelength

2. Sound frequency = $\frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

③ It is used in determining the frequency (pitch) of an unknown sound tone.

④ Increasing the sound intensity by increasing the vibrating surface area.

⑤ 1. first

2. $\text{Frequency} = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$= \frac{200 \times 90}{60} = 300$ Hz.

⑥

Points of comparison	Infrasonic	Sonic	Ultrasonic
Their frequencies :	Less than 20 Hz.	Between 20 Hz to 20 KHz.	More than 20 KHz.
Hearing by man :	Cannot be heard.	Heard.	Cannot be heard.

⑦ Sounds of 25 Hz , 50 Hz can be heard by man. Because man can hear sounds of frequencies ranging from 20 Hz to 20000 Hz only.

⑧ 1. Higher than 20 KHz (20000 Hz).

2. They are used in :
- Breaking down of kidney and ureter stones.

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- Diagnosis of male prostate gland tumors and its effect on bladder.
- Discovering of malignant tumors.
- Sterilizing food, water and milk.

⑨ The sound intensity, because it depends on the vibrating surface area.

12 ① (c)

② Graph (3), because pitch of sound is directly proportional to its frequency.

③ 1. The frequency (pitch) of sound wave (A) is higher than that of (B), but they have the same amplitude (intensity).

2. The amplitude (intensity) of sound wave (B) is higher than that of (C), but they have the same frequency (pitch).

④ (b)

⑤ 1. (c)

2. (b) because it is of the highest frequency.

3. (a) because it is of the lowest frequency.

4. (c) because it is of the largest amplitude.

5. a. stronger.

b. low pitch (rough tone).

⑥ 1. (C) 2. (A)

⑦ 1. (a) because the sound intensity is directly proportional to the density of the medium.

2. the density of the medium.

⑧ 1. (1) 20 (2) 20000

2. (1) a (2) b (3) d

(4) d (5) d (6) c

⑨ - The wave (a) produced from tuning fork because it is a simple (fundamental) wave.
- The wave (c) produced from hammer because it has a non-uniform frequency.
- The wave (b) produced from musical instrument because it is a complex wave.

⑩ The sound intensity of the case (2) is higher than that of the case (1), because the sound intensity increases by increasing the density of the medium in which sound propagates.

Thinking Skills Questions

1 $F = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$F = \frac{1800 \times 34}{120} = 510$ Hz.

$\lambda = \frac{V}{F} = \frac{340}{510} = 0.67$ m.

2 $F = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$F = \frac{300 \times 50}{60} = 250$ Hz.

$250 = \frac{\text{No. of cycles} \times 60}{90}$

$\text{No. of cycles} = \frac{250 \times 90}{60} = 375$ cycles.

3 $\frac{I_1}{I_2} = \frac{(d_2)^2}{(d_1)^2} = \frac{36}{4} = \frac{9}{1}$ (9 : 1)

4 The electromagnetic wave, because its velocity is more greater than that of sound (mechanical) wave.

5 $F_1 = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in second}}$

, $F_2 = \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in second}}$

$\because T_1 = T_2$

$\therefore \frac{F_1}{F_2} = \frac{60 \times 80}{80 \times 90} = \frac{6}{9} = \frac{2}{3}$ (2 : 3)

6 d

7 Because the air density on the mountain's top is less than it on the mountain's base, and the sound intensity weakens by decreasing the density of the medium in which the sound propagates.

8 The gear which its radius is 12 cm.

9 a. The velocity of the sharpest sound wave = the velocity of sound through air = 340 m/s.

b. $\lambda = \frac{V}{F} = \frac{340}{120 \times 10^3} = 2.833 \times 10^{-3}$ m.

c. $\lambda = \frac{V}{F} = \frac{1500}{10 \times 10^3} = 0.15$ m.

10 - The amplitude in fig. (1) $= \frac{4}{2} = 2$ cm.

- The amplitude in fig. (2) = 4 cm.

$\therefore \frac{\text{Intensity of sound (1)}}{\text{Intensity of sound (2)}} = \frac{(\text{Amplitude}_1)^2}{(\text{Amplitude}_2)^2}$

$= \frac{2 \times 2}{4 \times 4} = \frac{1}{4}$ (1 : 4)

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Lesson 2

1

1. b	2. b	3. b	4. a	5. c
6. c	7. a	8. d	9. a	10. d
11. c	12. a	13. d	14. b	15. a
16. c	17. c	18. b	19. d	20. d
21. b	22. a	23. c	24. c	25. b
26. b	27. d			

2

1. ..... is an electromagnetic transverse waves.
2. ..... is 300000 km/sec.
3. ..... of seven colours known as spectrum colours.
4. ..... light into seven spectrum colours.
5. ..... is higher than that .....
6. ..... has the shortest wavelength.
7. Red colour ..... 8. Max Planck .....
9. ..... Planck's constant × Frequency of the photon.
10. ..... directly proportional to the frequency of the light wave.
11. ..... into transparent , translucent and opaque media.
12. ..... allow most light to pass .....
13. Air and pure water are examples of transparent media, but ..... are examples of translucent media.
14. ..... examples of opaque media.
15. ..... through transparent media.
16. ..... through it decreases.
17. ..... in the form of straight lines.
18. ..... and the surface decreases.
19. ..... inversely proportional to the square of the distance .....
20. ..... increases 9 times.

3

1. Light waves. 2. The speed of light.
3. The visible light. 4. The Sun.
5. Analysis of white light. 6. White light.
7. Triangular glass prism.
8. Spectrum colours. 9. Max Planck.
10. Red colour. 11. Violet colour.
12. Photon energy.
13. Opaque medium. 14. Transparent media.
15. Translucent media. 16. Light intensity.
17. The inverse square law of light.

4

1. electromagnetic 2. 380 – 700
3. covered by light in one second.
4. The Sun 5. crests – troughs.
6. seven spectrum 7. white – seven
8. Red – yellow – indigo
9. Red – violet
10. violet – red 11. greater – smaller
12. Max Planck – photons.
13. directly – frequency
14. Planck's constant – Frequency of photon
15. spot lights – stand lamps
16. transparent – translucent – opaque
17. transparent medium.
18. Air – pure water 19. translucent
20. milk – opaque 21. thickness – decreases.
22. transparent – straight
23. falling perpendicular to a unit area of a surface in one second.
24. inversely 25. decreases – quarter.

5

1. Because it is electromagnetic waves which do not need a medium to travel through.
2. Because light waves can propagate through vacuum.
3. Because the light of the Sun consists of seven colours which are called spectrum colours.
4. Because the frequency of red light photon is less than that of orange light photon.
5. Because it has the maximum frequency in spectrum colours.
6. Because the frequency of violet photon is more than that of blue one.
7. Because transparent media permit most light to pass through.
8. Because clear glass permits most light to pass through and objects can be seen clearly through it.
9. Because the thickness of water at the bottom of River Nile is large enough to prevent light to pass through.
10. Because frosted glass is a translucent medium which permits only a part of light to pass through and absorbs the remaining part.
11. Because tissue paper permits only a part of light to pass through and we can see objects through it less clearly.
12. Because aluminium does not permit light to pass through and objects cannot be seen through it.
13. Because it is an opaque medium.
14. Because black honey is an opaque medium that does not permit light to pass through it.

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15. Because intensity of light is inversely proportional to the square of the distance between the surface and light source.

6

1. It is an external factor (or stimulus) that affects the eye causing the sense of vision.
2. The distance covered by light in one second is 3×10^8 m.
3. It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.
4. It is the splitting of white light into seven colours called spectrum colours.
5. It is the medium which permits most light to pass through.
6. It is the medium which permits only a part of light to pass through and absorbs the remaining part.
7. It is the medium that doesn't permit light to pass through.
8. It is the quantity of light falling perpendicular to a unit area of a surface in one second.
9. The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.

7

1. The white light analysis into seven colours.
2. The white light analysis into seven colours.
3. The quantity of light that passes through it decreases.
4. It permits most light to pass through.
5. It permits only a part of light to pass through and absorbs the remaining part.
6. It doesn't permit light to pass through.
7. I will see the picture clearly.
8. I will see the picture less clearly.
9. I will not see the picture.
10. The light intensity decreases.
11. The light intensity decreases to its quarter.

8

1. White – Spectrum colours.
2. Ceramic - Transparent media.
3. Air – Opaque media.
4. Light travels through materialistic media only – Wave nature of light (or properties of light).

9

① *Look at the main book on page* (109).

② a- Light is used in home decorations like :
- Spot lights to illuminate artifacts.
- Ornamented lamps that bring happiness and joy to the place.
- Stand lamps that concentrate light for reading.

b- It analysis the white light into seven spectrum colours.

③ Photon energy = Planck's constant × Photon frequency

④

Points of comparison	Transparent medium	Translucent medium	Opaque medium
Definition :	It is the medium which permits most light to pass through.	It is the medium which permits a part of light to pass through and absorbs the remaining part.	It is the medium that doesn't allow light to pass through.
Examples :	- The clear glass. - Pure water. - Air.	- Frosted glass. - Tissue paper.	- Milk. - Foil paper. - Wood. - Books.

10

① - At (B) the intensity is $\frac{1}{4}$
- At (C) the intensity is $\frac{1}{9}$
- At (D) the intensity is $\frac{1}{16}$

② 1. white light – seven colours – triangular glass prism.
2. Red – Orange – Yellow – Green – Blue – Indigo – Violet.

③ - Ray (1) represents the red colour.
- Ray (2) represents the violet colour.

④ 1. A light spot is formed.
2. The area of the formed light spot on card (D) increases.
3. a. The light passes through the clear glass sheet and the light spot remains formed on card (D).
b. There isn't a light spot formed on card (D), while the light spot is formed on card (B).

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4. Light travels through transparent media in the form of straight lines, whose size (thickness) can be controlled.

11 - Transparent glass : Light bulbs, glass cups, test tubes, lenses.
- Flint glass : Some cups, some lamps.
- Reflecting glass : Mirrors, cinematography.
(The reason : Answer by yourself).

Thinking Skills Questions

1 1. d 2. c 3. c 4. b 5. d

2 Because they give much brighter illumination which increases the intensity of light on the road.

3 Distance $= 1.5 \times 10^8 \times 1000 = 1.5 \times 10^{11}$ m.

Time $= \frac{\text{Distance}}{\text{Speed}} = \frac{1.5 \times 10^{11}}{3 \times 10^8} = 500$ sec.

Time in minutes $= \frac{500}{60} = 8.33$ min.

4 - Card (X) : Transparent medium.
- Card (Y) : Opaque medium.

Lesson 3

1 1. c 2. a 3. b 4. a 5. b 6. d
7. c 8. c 9. a 10. c 11. a 12. c
13. b 14. b 15. d 16. c
17. b (Because the angle of incidence equals the angle of emergence and the incident ray refracts near the normal in the glass).
18. c 19. a 20. a 21. d 22. a
23. a (Because the refractive index of any material is greater than 1)
24. a 25. b 26. c 27. b

2 ① 1. c 2. e 3. f 4. d 5. a
② 1. d 2. b 3. a 4. c

3 1. (✗) Light reflection ..... 2. (✓) 3. (✓)
4. (✗) ..... irregular reflection.
5. (✗) ..... on a piece of white paper is an irregular reflection, while ..... on a plane mirror is regular reflection.
6. (✗) ..... equals 0°
7. (✗) Light refracts .....
8. (✗) ..... is called the optical density of .....
9. (✗) ..... due to the change in the light velocity through .....
10. (✓) 11. (✓)
12. (✗) The absolute refractive index of the .....
13. (✗) ..... its velocity is different in .....
14. (✓) 15. (✓)
16. (✓) 17. (✓)

4 1. Light reflection. 2. Reflecting surface.
3. Regular reflection. 4. Irregular reflection.
5. Reflected ray. 6. Angle of incidence.
7. Angle of reflection.
8. First law of light reflection.
9. Second law of light reflection.
10. Optical density. 11. Light refraction.
12. Angle of refraction. 13. Angle of emergence.
14. Absolute refractive index of a medium.
15. Apparent position. 16. Mirage.

5 1. regular reflection – irregular reflection.
2. regular – irregular 3. different – irregular
4. plane mirrors – regular
5. irregular – regular
6. incidence – incidence.
7. angle of incidence = angle of reflection.
8. reflected – perpendicular – reflecting
9. 55° – 110° 10. on itself – zero.
11. light velocity
12. refraction – optical density.
13. refraction – the normal 14. higher – lower
15. lower – higher
16. refraction – incidence. 17. near – smaller
18. passes – refraction.
19. the velocity of light through air – the velocity of light through another transparent medium.
20. high.
21. apparent shapes of objects – apparent positions of objects – mirage.
22. broken – refraction.
23. apparent – real – refraction.
24. real – apparent 25. Mirage

6

1. Due to reflection of light.
2. Because leather jacket is a rough surface, while stainless steel plate is a smooth surface.
3. Because angle of incidence = angle of reflection = zero.
4. Because the optical density of a medium differs from one medium to another.
5. Due to the difference of the light velocity through the different transparent media.
6. Because water is a transparent medium of higher optical density than air.
7. Because the light ray refracts far from the normal when it travels from glass to air.
8. Due to the difference of light velocity through air than that through glass.
9. Because the velocity of light through air is always greater than that through any other transparent medium.
10. Because the angle of incidence = zero.
11. Due to the refraction of light rays coming from the immersed part in water, where the eye sees the immersed part of the pencil on the extensions of these refracted rays.
12. Due to the refraction of light rays coming from the submerged object (far from the normal) where the eye sees the submerged object on the extensions of the refracted rays.
13. Due to light refraction.
14. Because the ray which falls perpendicular to the interface passes to air without refraction, so the apparent position is the real position.
15. Due to reflection and refraction of light in air layers which differ in the degree of temperature.

7

1. It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.
2. It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.
3. It is the reflection of light rays when they meet (fall on) a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.
4. It is the angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence.
5. It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.
6. It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.
7. It is the ability of the transparent medium to refract light.
8. It is the angle between the refracted light ray and the normal at the point of incidence on the interface.
9. It is the angle between the emergent light ray and the normal at the point of emergence on the interface.
10. It is the ratio between the velocity of light through air to the velocity of light through another transparent medium.
11. This means that the optical density of such medium is high.
    or the velocity of light through such medium is low.
12. It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.

8

1. This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence equals 40°
2. This means that the angle between the refracted light ray and the normal at the point of incidence on the interface equals 20°
3. This means that the angle between the emergent light ray and the line perpendicular to the interface at the point of emergence is 30°
4. This means that the ratio between velocity of light through air to that through water is 1.33

9

1. The light rays are reflected in many directions.
2. The light rays are reflected in one direction.

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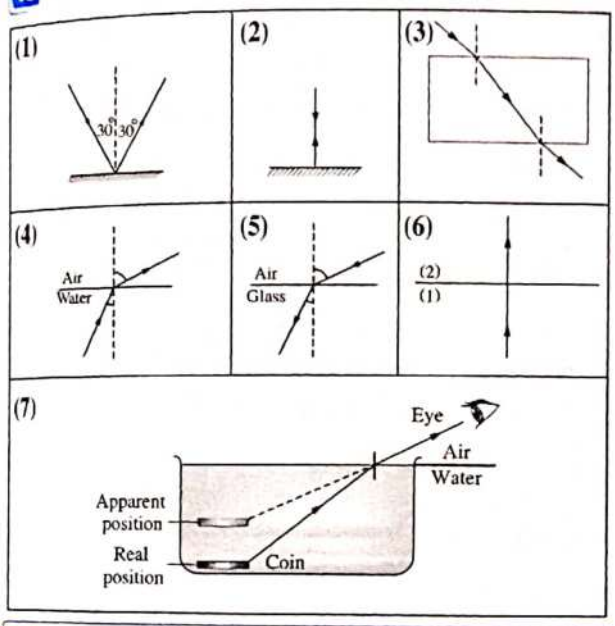
3. It will reflect by an angle of reflection equals 30°
4. It will reflect on itself.
5. It will refract.
6. It will refract far from the normal.
7. It will refract near the normal.
8. It will pass without refraction.
9. It appears as being broken.
10. It will be seen in an apparent position higher than its real position.

10



11 1. Refractive index = $\frac{\text{Velocity of light through air}}{\text{Velocity of light through the medium}}$

2. Angle of incidence = Angle of reflection

12 **Look at the main book on page (129).**

13 1. ***Look at the main book on page* (131).**

2. ***Look at the main book on pages* (134 , 135).**

14 1. Angle of incidence = Angle of reflection = 70°

2. Refractive index of glass

$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$

$1.5 = \frac{3 \times 10^8}{\text{Velocity of light through glass}}$

Velocity of light through glass = $\frac{3 \times 10^8}{1.5} = 2 \times 10^8$ m/sec.

3. Refractive index of diamond

$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through diamond}}$

$= \frac{3 \times 10^8}{1.25 \times 10^8} = \frac{3}{1.25} = 2.4$

4. Refractive index of water

$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$

$\frac{4}{3} = \frac{\text{Velocity of light through air}}{2.25 \times 10^8}$

Velocity of light through air = $\frac{4 \times 2.25 \times 10^8}{3} = 3 \times 10^8$ m/sec.

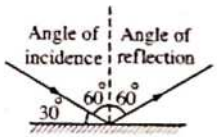
15 ① 1. the reflection of light.

2. the irregular (non-uniform) reflection – rough.

3. the regular (uniform) reflection – smooth.

② 1. Angle of reflection (X) = 60°

2.



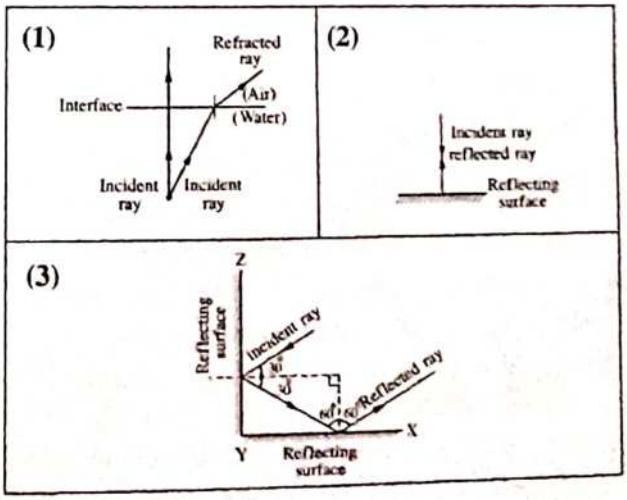
3. Angle of incidence = Angle of reflection

③ 1. incident ray. 2. refracted ray.

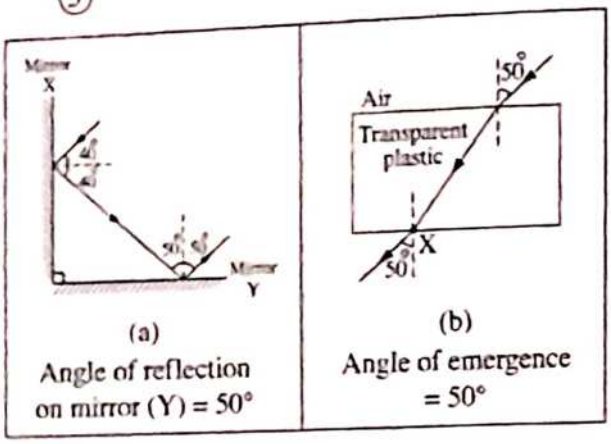
3. angle of incidence.

4. angle of refraction.

④



⑤



(a) Angle of reflection on mirror (Y) = 50°

(b) Angle of emergence = 50°

⑥ 1. light refraction
2. greater than
3. Due to the refraction of light.

Thinking Skills Questions

1 (1) a (2) b

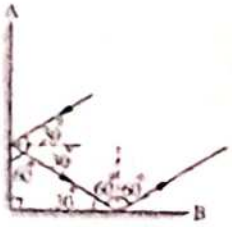
2 To avoid exhaustion of the eye due to light reflection.

3 a.

b. 60° c. 30°

4 (A) because it has more ability to refract light than medium (B).

5



- Angle of reflection from mirror (B) = 60°

6

Project On UNIT Two *Answer by Yourself*

Unit Three

Lesson 1

1

1. d	2. c	3. b	4. d	5. d	6. b
7. c	8. b	9. a	10. c	11. c	12. a
13. c	14. d	15. b	16. c	17. b	18. c
19. d	20. b	21. c	22. a	23. c	24. d
25. c	26. a	27. b	28. c	29. d	30. a
31. c	32. d	33. a	34. b	35. c	

2 1. b – C 2. d – D 3. a – A 4. c – B

3

1. (✗) ..... of sexual reproduction .....
2. (✗) ..... as inflorescence.
3. (✗) ..... the receptacle. 4. (✓) 5. (✓)
6. (✗) ..... is the male reproductive .....
7. (✗) ..... of four chambers ..... 8. (✓)
9. (✗) ..... pollen grains.
10. (✗) ..... ovary, style and stigma. 11. (✓)
12. (✗) ..... are unisexual flowers.
13. (✗) ..... is the gynoecium. 14. (✓)
15. (✗) ..... pollination then fertilization.
16. (✗) ..... from the flower's anther to the stigma.
17. (✓) 18. (✗) The stigmas of air .....
19. (✗) ..... of insect pollinated .....
20. (✗) ..... by air. 21. (✓)
22. (✗) ..... by human.
23. (✗) ..... two male nuclei.
24. (✓) 25. (✓)
26. (✗) ..... many ovules.
27. (✗) ..... asexual reproduction.
28. (✗) ..... the root system.
29. (✗) ..... as wedge grafting.
30. (✗) ..... by attachment grafting.
31. (✗) ..... belongs to orange
32. (✗) ..... by grafting happens .....
33. (✗) Tissue culture is .....
34. (✗) ..... from the upper part .....
35. (✗) ..... in a nutritive medium

4

1. Reproduction process.
2. The flower. 3. The flower.
4. The bract 5. Inflorescence.
6. Receptacle. 7. Calyx.

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8. Calyx. 9. Corolla.
10. Corolla. 11. Androecium.
12. Stamen. 13. Gynoecium.
14. Carpel. 15. Pollen grains.
16. Male flower (♂). 17. Female flower (♀).
18. Hermaphrodite flowers (⚥).
19. Pollination.
20. Self-pollination. 21. Cross pollination.
22. Artificial pollination.
23. Fertilization. 24. Zygote.
25. Micropyle. 26. The ovary.
27. Vegetative (asexual) reproduction.
28. The cut.
29. Reproduction by grafting. 30. Scion.
31. Grafting by attachment.
32. Grafting by wedge.
33. Tissue culture.

5

1. species – extinction.
2. stem – modified 3. flower – sexual
4. bud – bract. 5. inflorescence.
6. pedicle – receptacle 7. green – sepal.
8. Corolla – petal.
9. insects – sexual reproduction
10. Androecium – gynoecium
11. male – stamens. 12. filament – anther.
13. four – pollen grains. 14. female – carpels.
15. ovary – style – stigma. 16. ovules – ovary.
17. androecium – gynoecium – androecium
18. Maize – palms – tulip – petunia
19. ♀ – ♂ 20. sexual – asexual
21. pollination – fertilization.
22. Pollination – stigmas. 23. self – mixed
24. hanged – feathery 25. air – insects
26. Artificial – palm trees.
27. pollen tube – male
28. female cell nucleus (ovum) – zygote.
29. fruit – seed. 30. Olive – bean
31. Vegetative – root – buds.
32. natural – artificial.
33. horizontal root – terrestrial stem
34. root system – shoot system.
35. cutting – grafting – tissue culture
36. root system – shoot system.
37. scion – stock. 38. attachment – wedge.
39. inserted – cleft – large trees.
40. scion – juice
41. multiplying – identical

6

1. To attract insects to the flower which help in the sexual reproduction process.
2. Because it produces pollen grains.
3. Because it produces ovules.
4. Because its flower contains four whorls.
5. Because the flowers contain only male or female reproductive organ.
6. Because their anthers and stigmas are not maturated at the same time.
7. Because its flowers never bloom until the completion of fertilization process.
8. Because the flowers of this plant are unisexual flowers.
9. To be easily opened by air.
10. To catch pollen grains from air.
11. To compensate what are lost in air.
12. To be easily carried by air.
13. To attract insects (like bees) to feed on its nectar.
14. To adhere on the insect's body.
15. Because it takes place by man.
16. Because pollen grains that are transferred by wind are light in weight and dry, while that are transferred by insects are sticky or having coarse surfaces.
17. Because it transfers the pollen grains from a flower to another during absorbing nectar.
18. Because in sugary solutions, the nutrients needed for germination of pollen grains are available.
19. Because the ovary that contains :
    - one ovule gives a fruit with a single seed.
    - many ovules gives a fruit with many seeds.
20. Because the ovary of olive contains only one ovule, while that of bean contains many ovules.
21. Because some plants reproduce sexually through flowers and reproduce asexually through the different parts of the plant without the flower having a role in this process and the resulting individuals are completely identical to the original plant.

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22. To grow the buds buried inside the soil forming the root system and to grow buds above the soil surface forming the shoot system.
23. To make the scion feed on the juice of the stock.
24. Because this kind of reproduction is used only between highly similar plant species.
25. Because it is a process of multiplying a small part of a plant to get many identical parts.

7

1. It is a vital process that aims to secure the existence and continuity of living organisms species by producing new individuals of the same species to prevent them from extinction.
2. It is a short stem whose leaves are modified to form reproductive organs which in turn form seeds inside fruits.
3. It is the green leaf, where the floral bud emerges from its axle and developed into a flower.
4. It is a group of flowers carried on the same axle.
5. It is the first (outermost) whorl of the floral leaves which consists of a group of sepals.
6. It is the second whorl of the floral leaves which consists of a group of petals.
7. It is the third whorl of the floral leaves and it is the male reproductive organ of the flower.
8. It is the fourth (innermost) whorl of the floral leaves and it is the female reproductive organ of the flower.
9. It is the flower that contains only male reproductive organ (androecium).
10. It is the flower that contains only female reproductive organ (gynoecium).
11. It is the flower that contains both male and female reproductive organs.
12. It is the process of transfer of pollen grains from the flower anthers to the stigmas.
13. It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.
14. It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
15. It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.
16. The cell resulting from the fusion of a pollen grain and an ovum nuclei.
17. It is a process of producing new individuals from different parts of the plant without the flower having a role in this process.
18. It is a swollen part from a horizontal root or a terrestrial stem, which contains growing buds and it is used for vegetative reproduction.
19. It is a kind of artificial vegetative reproduction in which a part of a plant that contains growing buds known as the cut is planted.
20. It is a part of root, stem or leaf that contains growing buds taken from a plant for reproduction.
21. It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock.
22. It is a process of multiplying a small part of a carrot plant to get many identical parts.

8

1. It aims to secure the existence and continuity of living organisms species to prevent them from extinction.
2. It is the organ of sexual reproduction in flowering plants.
3. It carries the floral leaves in four different floral whorls.
4. It protects the inner parts of the flower specially before blooming.
5. – It protects the reproductive organs.
   – It attracts insects to the flower, which help in the reproduction process
6. It produces pollen grains.
7. It produces ovules.
8. It is used in vegetative reproduction.
9. Formation of root system and shoot system.
10. To carry and feed the scion.
11. To obtain large numbers of a plant by using a small part of it.

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9

1. It will germinate forming a pollen tube.
2. It will split longitudinally and pollen grains will spread in air like dust.
3. Anthers will not be opened easily by air.
4. Stigmas will not catch pollen grains from air.
5. Insects will not be attracted to the flower.
6. Pollen grains will not adhere on the insect's body.
7. The pollen grain will not germinate.
8. The zygote is formed.
9. The ovary changes into a fruit, the wall of the ovary changes into outer coat of the fruit, the ovule changes into a seed and the wall of the ovule changes into a seed coat.
10. The ovary will grow to become a fruit.
11. The zygote undergoes successive divisions to form the embryo inside the ovary.
12. The ovary changes into a fruit inside it many seeds after completion of fertilization process.
13. Some buds grow forming a root system which grows down, other buds grow forming a shoot system which grows up and after some days, the old tuber changes into a plant that carries many new tubers.
14. The orange plant (scion) feeds on the juice of the naring plant (stock) and grows forming orange fruits.
15. The buds buried inside the soil grow to form the root system of the plant and the buds above the soil surface grow to form the shoot system of the plant.
16. The tissue grows forming a new plant of the same kind.

10 ①

Points of comparison	Calyx	Corolla
• Position :	The first (outermost) whorl of the floral leaves.	The second whorl of the floral leaves.
• Consists of :	A group of green leaves, each leaf called a sepal.	A group of colourful and scented leaves, each leaf called a petal.
• Function :	It protects the inner parts of the flower.	It attracts insects to the flower and protects the reproductive organs.

②

Points of comparison	Androecium	Gynoecium
• Position :	It is the third whorl of the floral leaves.	It is the fourth (innermost) whorl of the floral leaves.
• Its sex :	Male reproductive organ.	Female reproductive organ.
• Its leaves are known as :	Stamens.	Carpels.
• Function :	It produces pollen grains.	It produces ovules.

③

Points of comparison	Male flower	Hermaphrodite flower
• It contains :	Only male reproductive organ.	Both male and female reproductive organs.
• Its kind :	Unisexual.	Bisexual.
• Its symbol :	♂	⚥
• Examples :	Palm and maize.	Tulip and petunia.

④

Self pollination	Cross pollination
It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.	It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

⑤

Pollination	Fertilization
It is the process of transfer of pollen grains from the flower anthers to the stigmas.	It is the process of fusion of the nucleus of male cell (pollen grain) with the nucleus of female cell (ovum) to form the zygote.

⑥

Air-pollinated flowers	Insect-pollinated flowers
• The anthers are hanged. • The stigmas are feathery like and sticky. • The pollen grains are light in weight and dry and produced in huge numbers.	• The petals are coloured and scented. • The pollen grains are sticky or having coarse surface.

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⑦

Points of comparison	Olive fruit	Bean fruit
• Its ovary contains :	One ovule.	Many ovules.
• Its fruit contains :	One seed.	Many seeds.

⑧

Natural vegetative reproduction	Artificial vegetative reproduction
It takes place by many ways such as, reproduction by : rhizomes, corms, tubers, bulbs and offshoots.	It takes place by four ways which are cutting, grafting, tissue culture and layering.

⑨

Grafting by attachment	Grafting by wedge
- In which the scion is attached to the stock.	- In which the scion in the form of a wedge is inserted into a cleft in the stock.
- Ex. : Mango trees.	- Ex. : Large trees.

⑩

Reproduction by tubers	Reproduction by grafting
- Natural vegetative reproduction.	- Artificial vegetative reproduction.
- It takes place by planting a horizontal root (as sweet potatoes) or a terrestrial stem (as potatoes) which contains growing buds.	- It takes place by putting a part of plant which contains more than one bud (scion) on a branch of another plant (stock).
- The produced individual is from the same kind of the original plant.	- The produced individual is from the same scion.
- Ex. : • Sweet potatoes. • Potatoes.	- Ex. : (Between highly similar plant species) : • Oranges & naring. • Apples & pears. • Peaches & apricots.

11 1. Stamen – The rest are parts of the carpel.
2. Tubers – The rest are parts of the flower.
3. Peas – The rest are fruits have only one seed.
4. Tuber – The rest are ways of artificial vegetative reproduction.
5. Pollination – The rest are ways of artificial vegetative reproduction.

12 ① 1. (1) Pedicle. (2) Receptacle. (3) Sepal. (4) Petal. (5) Filament. (6) Anther. (7) Stigma. (8) Style. (9) Ovary.
2. a. Calyx. b. Corolla.
3. Self pollination.
4. Part (3) : It protects the inner parts of the flower specially before blooming.
Part (4) : It attracts insects to the flower.
Part (6) : It produces pollen grains.
Part (9) : It produces ovules.
5. a. (7 , 8 and 9). b. (5 and 6).

② 1. (a) Bisexual flower (⚥).
(b) Female flower (♀).
(c) Male flower (♂).
2. - Mixed pollination in (b) and (c), because they are unisexual flowers.
- Self pollination in (a), because it is bisexual flower.

③ 1. Stamen.
2. (1) Pollen grains. (2) Anther. (3) Filament.
3. It produces pollen grains.
4. The anther splits longitudinally and pollen grains spread in air like dust.
5. a. Self pollination. b. Mixed pollination.

④ 1. (1) Generative nucleus.
(2) Tube nucleus.
(3) Two male nuclei.
(4) Pollen tube.
2. germination of a pollen grain.

⑤ 1. (X) Anther.
(Y) Feathery stigma.
2. (1) Their anthers are hanged to be easily opened by air.
(2) Their stigmas are feathery like and sticky to catch pollen grains from air.
3. The stigmas of the flower catch light and dry pollen grains carried by the air from the anthers of another flower in other plant of the same kind.

⑥ - **Fig. (1) :** Cross pollination, because pollen grains are transferred from the anthers of the flower to the stigmas of another flower in other plant of the same kind.

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- **Fig. (2) :** Self pollination, because pollen grains are transferred from the anthers of the flower to the stigmas of the same flower or the stigmas of another flower in the same plant.

⑦ 1. **Fig. (1) :** Cross pollination by insects as the flower has colourful, scented petals which attract insects.

Fig. (2) : Cross pollination by air, as its anthers are hanged to be easily opened by air and stigmas are feathery like to catch pollen grains from air.

2. **Fig. (1) :** Pollen grains have rough sticky surface to adhere to the insect's body.

Fig. (2) : Pollen grains are light in weight and dry to be easily carried by air.

⑧ 1. Part (X) : - It protects the reproductive organs.
- It attracts insects to the flower, which help in reproduction process.

Part (Y) : It protects the inner parts of the flower.

2. a. Cross pollination.
b. Bisexual flower (hermaphrodite).

⑨ 1. (1) Pollen grain. (2) Pollen tube.
(3) Ovum. (4) Male nucleus.
(5) Micropyle. (6) Ovule.
(7) Ovary.

2. * A fertilized ovum will be formed which is known as "Zygote".
* The name of the process is the fertilization process.

3. a. Part (6). b. Part (7).

⑩ 1. Bisexual flower (hermaphrodite).
2. Ovary.
3. (A) : The ovary contains one ovule.
(B) : The ovary contains many ovules.

⑪ 1. Natural vegetative reproduction by tubers.
2. (1) Old tuber. (2) New tubers.
3. *Look at the main book on pages* **(170).**

⑫ 1. Fig. (1) Grafting by attachment.
Fig. (2) Grafting by wedge.
Fig. (3) Reproduction by cutting.
2. (1) Scion. (2) Stock.
(3) A cut.
3. Grafting by attachment as in fig. (1).

⑬ *Look at the main book on page* **(174).**

Thinking Skills Questions

1. 1. d
2. c/because it doesn't contain the ovary which develops and becomes the fruit after fertilization process.

2. Asexual reproduction, because it takes place in parts of root, stem, leaves or buds and not occurred in a flower.

3. 1. The inner parts of the flower will be harmed.
2. They can't catch pollen grains, so pollination doesn't occur.
3. Fertilization doesn't occur.
4. The reproduction doesn't occur, because there is no adhesion between the scion and stock, therefore the scion will not able to feed on the juice of the stock.

4. a. Due to the occurrence of cross pollination.
b. Preventing self-pollination.

Lesson 2

1.

1. b	2. a	3. c	4. c	5. c	6. a
7. c	8. c	9. c	10. d	11. c	12. d
13. b	14. b	15. b	16. b	17. c	18. b
19. b	20. d	21. a	22. c	23. c	24. a
25. b	26. c	27. d	28. a		

2. 1. d 2. g 3. b
4. f 5. a

3. 1. (✓)
2. (✗) ..... sexual reproduction .....
3. (✗) ..... function of testes.
4. (✗) ..... is 2°C below .....
5. (✗) ..... through vas deferens. 6. (✓)
7. (✗) ..... of the abdominal cavity .....
8. (✓) 9. (✓)
10. (✗) ..... every 56 days.
11. (✗) The progesterone hormone is .....
12. (✗) ....., softness of voice, ...
13. (✗) ..... 45 to 55 years. 15. (✓)
14. (✗) ..... in the upper .....
16. (✗) ..... connects the vagina with .....
17. (✗) ..... during the labour.

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18. (✗) ..... is a static cell .....
19. (✓)
20. (✗) ..... on the 14th day .....
21. (✗) ..... secretes enzymes to .....
22. (✓)
23. (✗) ..... to the uterus to be .....
24. (✗) ..... the pregnancy period.
25. (✗) ..... takes 9 months.
26. (✓)
27. (✗) ..... infect female only.
28. (✗) ..... 1 to 4 days.
29. (✗) ..... of puerperal fever disease.
30. (✓)
31. (✗) ..... by sexual contact.
32. (✗) ..... between 2 to 3 weeks.
33. (✗) ..... from the complications of .....

4

1. Sexual reproduction.
2. Testis.
3. Scrotal sac.
4. Genital associated glands.
5. Testosterone.
6. Epididymis.
7. Vas deferens.
8. Seminal fluid.
9. Penis.
10. Two ovaries.
11. Ovary.
12. Estrogen.
13. Progesterone.
14. Ovulation process.
15. Menstrual cycle.
16. Fallopian tube.
17. Uterus.
18. Ovum.
19. Sperm.
20. Nucleus.
21. Cytoplasm.
22. Head.
23. Midpiece.
24. Tail.
25. Chromosomes.
26. Fertilization in human.
27. Pregnancy period.
28. Embryo.
29. Puerperal sepsis.
30. Incubation period.
31. Syphilis.

5

1. Reproduction process – extinction.
2. two testes – genital associated glands
3. outside – scrotal sac.
4. sperms – testosterone
5. Testosterone – secondary male sex characters.
6. harshness – genital organs – puberty
7. two – sperms.
8. epididymis.
9. epididymis.
10. sperms – testis – urinary genital
11. Cowper's – prostate
12. neutralizes – urethra.
13. two ovaries – fallopian tubes – uterus
14. ovary – almond.
15. abdominal – back.
16. ovum – 28 – ovulation.
17. Estrogen – progesterone
18. testosterone – estrogen
19. menstrual cycle – 28
20. funnel – ovum.
21. cilia – uterus.
22. upper – uterus.
23. uterus – muscular
24. vagina
25. muscular – labour.
26. nucleus – cellular membrane.
27. head – tail.
28. mitochondria – movement.
29. genes – hereditary traits
30. Fertilization – zygote.
31. enzymes – cellular membrane
32. 46
33. zygote.
34. Uterine cancer – prostate cancer
35. gonorrhea – sexual contact.
36. spherical – spiral
37. 1 to 4 days – 2 to 3 weeks.
38. umbilical cord – delivery.
39. tumors – liver

6

1. Because the individuals coming from asexual reproduction are identical to the parent, while in human each individual differs from others.
2. Because it regulates and keeps the temperature of testes 2°C below the normal body temperature, which is the optimum temperature for the growth and development of sperms.
3. Due to the inability of the testes to produce sperms as a result of the rise in temperature of the body cavity by about two degrees above the optimum temperature for the production of sperms.
4. To neutralize the acidity of urethra, so sperms will not die during their passage through urethra.
5. To nourish the sperms.
6. Due to stopping the transfer of the sperms from the testes to the urinary genital duct.
7. Because the seminal fluid neutralizes the acidity of the urethra.
8. To trap the ripe ovum.
9. To direct the ovum towards the uterus.
10. To expand as the fetus grows during the pregnancy period.

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11. To form the placenta which is responsible for the nourishment of fetus during the pregnancy through the umbilical cord.
12. Because mitochondria are responsible for energy production needed for the sperms movement.
13. Because it is responsible for movement of the sperm till it reaches the ovum.
14. Due to the storage of nutrient materials.
15. To dissolve the cellular membrane of the ovum and facilitates its penetration inside the ovum.
16. Because the sperms don't reach the ripe ovum so, fertilization process doesn't happen.
17. To prevent the penetration of any other sperm.
18. Because when the nucleus of the sperm which contains 23 chromosomes fuses with the nucleus of the ovum which contains 23 chromosomes, the zygote (fertilized ovum) is formed which carries the complete number of chromosomes (46 chromosomes).
19. To protect the mother from the infection with some diseases such as puerperal sepsis.
20. To protect her from throat infection or tonsillitis which may cause the infection with puerperal sepsis.
21. To avoid the infection by puerperal sepsis disease.
22. Because it causes the death of the embryos and newly born babies and leads to the increase in deformation rate in embryos.

7

1. It is the age at which the two ovaries completely stop releasing ova.
2. It is the production of ova, where each ovary releases one ripe ovum every 28 days in exchange with the other ovary.
3. It is the fusion of the nucleus of male gamete (sperm) with the nucleus of female gamete (ovum) to form the zygote (fertilized ovum).
4. This means that the sperm contains 23 chromosomes only.
5. It is the period between the fertilization process and delivery which extends for about 9 months.
6. It is the period between the beginning of infection and the appearance of symptoms of the disease.

8

1. To secure the existence and continuity of living organisms species to prevent them from extinction.
2. • Production of sperms.
   • Production of testosterone hormone.
3. It is responsible for the appearance of secondary male sex characters.
4. It regulates and keeps the temperature of testes $2^{\circ}C$ below the normal body temperature, which is the optimum temperature for the growth and development of sperms.
5. It transfers the sperms from testes to the urinary genital duct (urethra).
6. • The final stages of the growth and development of sperms take place in it.
   • It stores sperms.
7. They pour secretions on the sperms to form seminal fluid (alkaline fluid).
8. • It nourishes the sperms.
   • It facilitates the flow of sperms.
   • It neutralizes the acidity of urethra.
9. • Production of ova.
   • Production of female sex hormones (estrogen and progesterone).
10. **Estrogen** : It is responsible for the appearance of secondary female sex characters.
    Progesterone : It is responsible for the continuity of pregnancy.
11. They receive (trap) the ripe ovum and direct it towards the uterus with the aid of :
    • The contraction and relaxation of the muscles in the tube wall.
    • The movement of the lining cilia.
12. It is responsible for nourishment of fetus during pregnancy through the umbilical cord.
13. • It protects the fetus until birth.
    • It nourishes the fetus during pregnancy by the placenta through the umbilical cord.
14. It surrounds the ovum from outside
15. It contains mitochondria which are responsible for energy production needed for the sperm movement.
16. It is responsible for the movement of sperm till reaches the ovum.
17. They carry genes which are responsible for the hereditary traits of the organism.
18. To dissolve the cellular membrane of the ovum during fertilization.

9

1. Fallopian tubes – Organs of male genital system.

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2. Thyroid gland – Male associated genital glands.
3. Epididymis – Organs of female genital system.
4. Cytoplasm – Parts of the sperm.
5. Harshness of voice – Secondary female sex characters.
6. Measles – Sexual transmitted diseases.
7. Vomiting – Symptoms of puerperal sepsis.

10

1. The testes stop producing the sperms and the individual becomes infertile.
2. The sperms can't transfer from the testes to the urinary genital duct and the individual becomes infertile.
3. The sperms will die, so the individual becomes infertile.
4. The sperms will die during their passage through the urethra and the individual becomes infertile.
5. Disappearance of secondary sex characters in the male.
6. Disappearance of secondary sex characters in the female.
7. No pregnancy will continue.
8. They will not be able to direct the ovum towards the uterus.
9. The ovum pushes towards the uterus.
10. The sperms do not reach the ripe ovum and fertilization (pregnancy) doesn't occur.
11. Placenta will not be formed then the nourishment of fetus cannot be occurred, so the fetus dies.
12. Food doesn't reach from the placenta to the fetus, so the fetus dies.
13. The two ovaries completely stop releasing ova, so the menstrual cycle stops.
14. No energy will be produced and the sperm will not be able to move or penetrate the ovum.
15. It will not move, so no fertilization (pregnancy) occurs.
16. It will not be able to penetrate the ovum.
17. The ovum surrounds itself with a membrane that prevents the penetration of any other sperm, then fertilization occurs and the zygote is formed.
18. She will be infected by puerperal sepsis disease.
19. Tumors will appear in different body parts like the liver, bones and parts of genital system, the brain may also be damaged and the patient will die.

11 ①

Points of comparison	Testes	Ovaries
Position :	- In male, in scrotal sac which is hanged between man's thighs.	- In female, in the lower part of the abdominal cavity from the back.
Function :	1. Production of sperms. 2. Production of male sex hormone (testosterone).	1. Production of ova. 2. Production of female sex hormones (estrogen and progesterone).

②

Points of comparison	The sperm	The ovum
• Size :	- Small.	- Relatively large.
• Mobility :	- Mobile.	- Static (not mobile).
• Structure :	- It consists of : the head, midpiece and tail.	- It consists of : the nucleus, cytoplasm and cellular membrane.

③

Points of comparison	Gametes in human	Gametes in plant
Male gametes :	Sperms	Pollen grains
Female gametes :	Ova	Ova

④

Points of comparison	Puerperal sepsis	Syphilis
• The microbe causing disease :	- Spherical-shaped bacteria.	- Spiral-shaped bacteria.
• Methods of infection :	1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to a vagina of recently laboured mother. 2. An infected wound during the labour.	1. Sexual contact with an infected person. 2. From pregnant woman to her fetus through the umbilical cord or during the delivery.
• Incubation period :	1 to 4 days.	2 to 3 weeks.

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12 ① 1. **Signs of puberty in males :**
- Growth of hair in certain body areas (like beard and mustache).
- Harshness of voice.
- Growth and development of genital organs.
- Growth of bones.
- Enlargment of muscles.

2. **Signs of puberty in females :**
- Growth of hair in armpit and pubic.
- Softness of voice.
- Growth and development of breasts.
- Accumulation of fats in some body regions.
- Occurrence of menstrual cycle each 28 days, as long as no pregnancy happens.

② ***Look at the main book on page* (203).**

③ 1. – Symptoms :
(1) High elevation in body temperature.
(2) Chilling. (3) Face paling.
(4) Severe acute pain in lower abdomen.
(5) Bad smelling secretions from the uterus.
– Preventive methods :
(1) Sterilizing the surgical tools during labour.
(2) Wearing masks during labour (delivery).
(3) Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.
(4) The mother should be kept warm and avoid the exposure to air currents.

2. – Symptoms :
(1) Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female).
(2) Appearance of dark brass coloured rashes on the back and hands of the patient.
– Preventive methods :
(1) Preventing the sexual contact with an infected person (preventing the illegal contacts).
(2) Induce abortion of the infected pregnant women.

④ 1. ***Look at the main book on page* (197).**
2. ***Look at the main book on page* (197).**

13 ① 1. Male reproductive system.
2. (1) Urinary bladder. (2) Seminal vesicle.
(3) Prostate gland. (4) Cowper's gland.
(5) Urinary genital duct. (6) Epididymis.
(7) Testis (8) Scrotal sac.
3. They pour secretions on the sperms to form a seminal fluid (alkaline fluid) which :
- Nourishes the sperms.
- Facilitates their flow.
- Neutralizes the acidity of urethra.

4. Vas deferens.
5. • Production of sperms.
• Production of male sex hormone (testosterone).
6. The testes stop producing sperms and the individual becomes sterile.
7. Genital associated glands :
- Seminal vesicles.
- Prostate gland.
- Cowper's glands.

② 1. (1) Fallopian tube. (2) Uterus.
(3) Ovary. (4) Uterus muscles.
(5) Cervix. (6) Vagina.
2. a. Ovary.
b. Fallopian tube. c. Vagina.

③ 1. (1) Testis. (2) Penis.
(3) Urinary genital opening.
(4) Vas deferens. (5) Urinary bladder.
(6) Prostate gland.
2. a. (1) b. (6) c. (4)

④ 1. The structure of the sperm.
2. (1) Head. (2) Midpiece.
(3) Tail
3. It contains mitochondria which are responsible for energy production needed for sperms movement.
4. It secretes enzymes which dissolve the cellular membrane of the ovum.

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⑤ It is the female reproductive system.

1. (1) Uterus. (2) Fallopian tube.
   (3) Ovary. (4) Vagina.
2. – Its inner wall is lined with cilia.
   – It has a muscular wall.
3. Production of female sex hormones, which are :
   – **Estrogen** which is responsible for the appearance of secondary female sex characters.
   – **Progesterone** which is responsible for the continuity of pregnancy.
4. Sperms will not reach the ovum so, fertilization does not happen.

⑥ 1. (1) Uterus. (2) Ovary.
   (3) Fallopian tube.
2. • It protects the fetus until birth.
   • It nourishes the fetus during the pregnancy by the placenta through the umbilical cord.
3. Fertilization process.
4. d

⑦ 1. Fertilization in the beginning of fallopian tube.
2. (1) and (2) have 23 chromosomes. but (7) has 46 chromosomes.
3. zygote – fallopian tube – embryo – uterus.

⑧ 1. Fig. (A) : Spherical shape.
   Fig. (B) : Spiral shape.
2. – Spherical shaped bacteria causes puerperal sepsis.
   – Spiral shaped bacteria causes syphilis.
3. Incubation period from 1 to 4 days.
4. Appearance of tumors in different body parts like : liver, bones, parts of genital system, the brain may also be damaged and the patient will die.

14 – Personal hygiene care.
– Healthy nutration.
– Follow healthy reproductive habits.

Thinking Skills Questions

1 1. d 2. b 3. (A). a (B). b

2 1. (✗) ..... epididymis.
2. (✗) ..... the double number .....

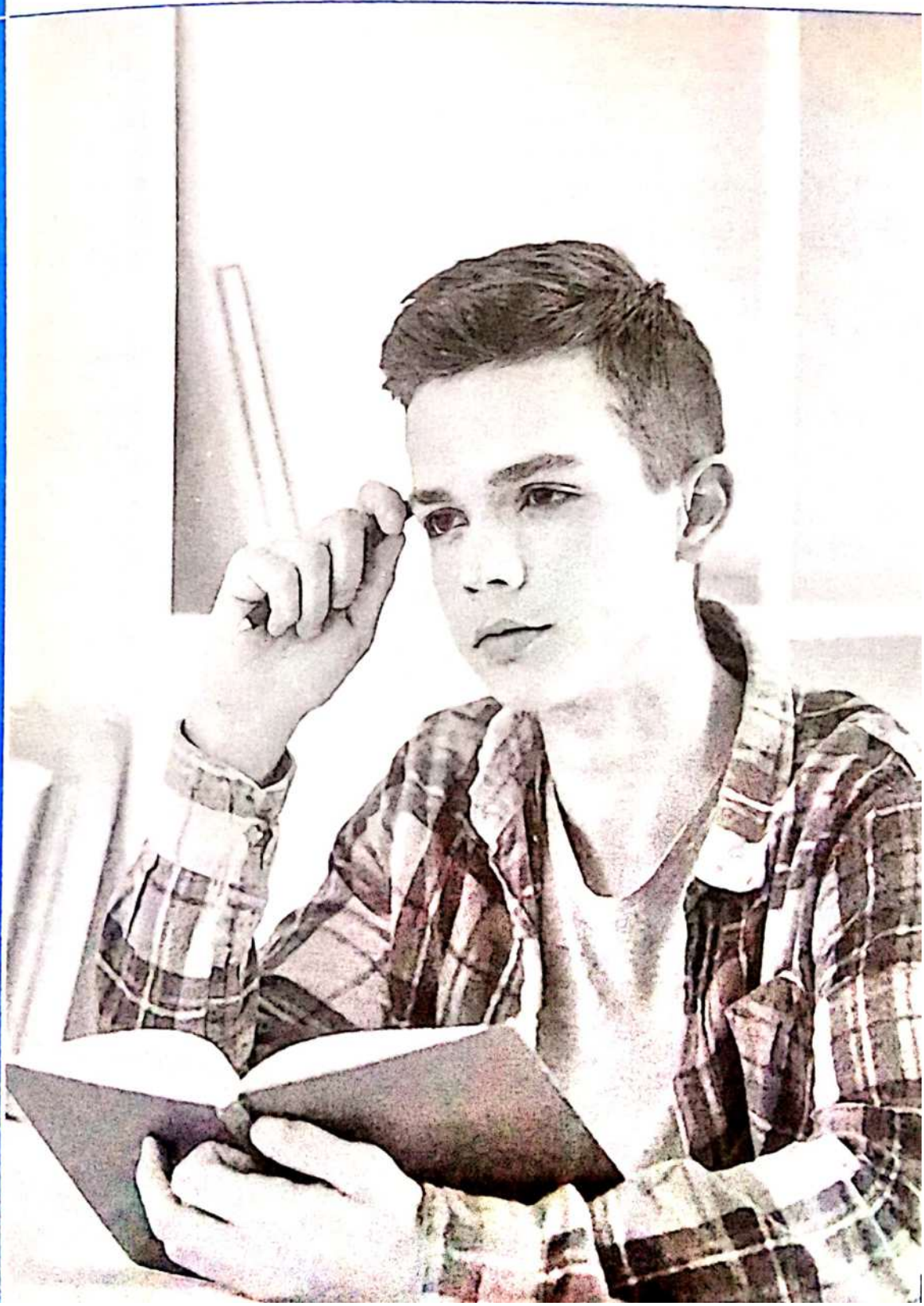
3 Because during fertilization, it fuses with the ovum which contains also 23 chromosomes to form zygote that contains a nucleus of 46 chromosomes (23 pairs of chromosomes)

4 Appearance of secondary male sex characters on the female.

Project On UNIT Three *Answer by Yourself*

PART 2

Guide Answers of Worksheets



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Unit One

Worksheet 1

1 1. Oscillatory motion – wave motion
2. rest – maximum
3. Tuning fork – stretched string
4. simple harmonic
5. mass – squared velocity.

2 1. Because it is graphically represented by a curve.
2. It is a periodic motion, because it is repeated regularly in equal intervals of time and an oscillatory motion, because it is repeated on the two sides of its rest position.

3 1. It is the motion which is regularly repeated in equal periods of time.
2. It is the periodic motion of the oscillating body around its rest point where the motion is repeated through equal intervals of time.

4 Its velocity increases to the maximum value.

Worksheet 2

1 **(A)** 1. b 2. b 3. b 4. b 5. c

(B) 1. 2 cm. 2. 0.2 sec.

3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{0.2} = 5$ Hz.

2 **(A)** 1. (✗) 2. (✓) 3. (✗)

(B) 1. This means that the maximum displacement done by the oscillating body away from its rest position is 0.2 m.
2. This means that the oscillating body makes 652 complete oscillations in one second.
3. This means that the periodic time of this oscillating body is $\frac{1}{3}$ sec.
4. This means that the frequency of this oscillating body is 6 Hz.

3 **(A)** 1. Periodic time. 2. Simple harmonic motion.

(B) 1. Because the periodic time is inversely proportional to the number of complete oscillations made by the tuning fork.
2. Because it is not repeated on the two sides of its rest position.

4 **(A)** 1. the rest position.
2. the amplitude – $\overline{AC}$.
3. A 4. 5 Hz – 0.2 sec.

(B) Its velocity becomes zero.

Worksheet 3

1 **(A)** 1. periodic
2. the ability to propagate and transfer energy

(B) 1. Because water waves need a medium to propagate through, while light waves don't need a medium to propagate through.
2. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).

2 **(A)** 1. (✗) The movement of water waves is ...
2. (✓)
3. (✗) ... according to the direction of vibration of medium particles into ...

(B)

Mechanical waves	Electromagnetic waves
- They need a medium to propagate.	- They do not need a medium to propagate.
- They do not propagate through vacuum.	- They can propagate through vacuum.
- They are : • Transverse waves (as water waves). • Longitudinal waves (as sound waves).	- They are transverse waves as : • Visible light waves. • Radio waves. • Infrared waves
- Their velocity is relatively low.	- Their velocity is great (3×10^8 m/sec).

3 **(A)** It propagates and transfers energy in the direction of propagation.

(B) 1. Longitudinal wave.
2. - No. (1) indicates : the rarefaction of a longitudinal wave.
- No. (2) indicates : the compression of a longitudinal wave.

4 1. The flame of the candle vibrates to the right and left.
2. A longitudinal wave is formed.

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Worksheet 4

1 1. crests – troughs.
2. compression – rarefaction. 3. trough
4. perpendicular to – along

2 (A) 1. This means that the distance between two successive crests or troughs in such wave is 30 cm (0.3 m).
2. It is the area in longitudinal wave at which the medium particles are of lowest density and pressure.
3. It is the highest point of the particles of the medium in transverse wave.
4. This means that the wavelength of this longitudinal wave equals $(1 \times 2 = 2$ metres).

(B) 1. They are mechanical waves because they need a medium to transfer through and transverse waves because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs.
2. Because it can treat sprains and cramps by using hot water and nervous tension by using cold water.

3 (A) 1. (A) Rarefaction. (B) Compression.
2. Longitudinal waves.
3. Wavelength of a longitudinal wave.

(B) 1. The wavelength of the transverse wave is doubled.
2. The particles of the medium propagate perpendicular to the direction of wave propagation.

4 (A) 1. c 2. b 3. d

(B) 1. Metre. 2. Jacuzzi.

Worksheet 5

1 (A) 1. Wave velocity. 2. Periodic time.
3. Wavelength.

(B) 1. Wave amplitude.
2. Law of wave propagation.
3. Periodic time of the wave.

2 (A) 1. This means that the distance covered by all electromagnetic waves in one second in space equals 3×10^8 m.
2. This means that the number of waves produced in one second is 50 waves.
3. This means that the distance between the centres of two successive compressions or rarefactions in such wave is 30 cm.

(B) $V = F \times \lambda$

$\lambda = \frac{85}{100} = 0.85$ m.

$V = 400 \times 0.85 = 340$ m/sec.

3 (A) 1. a) 2.5 b) 0.25 2. frequency.
3. Metre – metre/second
4. smaller – greater
5. Wave frequency
6. the number of complete waves produced from the source

(B) 1. The wavelength does not change.
2. The velocity of wave propagation increases to four times its value.

4 (A) 1. 3 m. 2. 0.4 sec. 3. 2.5 Hz.
4. $V = \lambda \times F = 3 \times 2.5 = 7.5$ m/sec.

(B) 1. b 2. c 3. d 4. c

General Exercise of the School Book on Unit One

1 1. c 2. d 3. d

2 1. Sound wave – Electromagnetic waves.
2. Rotary bee motion – Examples of the oscillatory motion.

3 1. Because it is repeated regularly in equal periods of time.
2. They are mechanical waves, because they need a medium to propagate through and they are transverse waves, because the particles of the medium vibrate perpendicular to the direction of wave propagation forming crests and troughs.
3. Because the light of lightning is electromagnetic waves, while the sound of thunder is mechanical waves, where the speed of electromagnetic waves is much greater than the speed of mechanical waves.

4 1. A transverse wave is formed.
2. The wavelength will decrease to its half value.

5 1. P 2. N

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Model Exam 1 on Unit One

1 **(A)** 1. c 2. a 3. b 4. b

(B) 1. (✓) 2. (✓) 3. (×) 4. (×)

(C) Because the motion of a swing is occurred around the rest position of the swing, where it is repeated through equal intervals of time.

2 **(A)** 1. Metre/second. 2. Jacuzzi.
3. Amplitude. 4. Wave motion.

(B) 1. **Fig. (1) :** represents an oscillatory motion (simple pendulum motion).
Fig. (2) : represents wave motion (transverse wave).
2. ① Direction of wave propagation.
② Crest. ③ Trough.
④ Direction of vibration of the medium particles.
3. Four displacements.

(C)

Point of comparison	Transverse wave	Longitudinal wave
Definition :	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.

3 **(A)** 1. electromagnetic transverse – mechanical longitudinal
2. transverse – compression
3. 4 – amplitude.
4. mechanical – electromagnetic

(B) 1. oscillatory motion.
2. increases
3. oscillatory motion.
4. inversely

(C) This means that the velocity of water wave is $\left(\frac{9 \times 10^4}{60}\right)$ which equals 1500 m/sec.

4 **(A)** 1. Amplitude = 1 m.
2. Periodic time = 2 sec.
3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{2} = 0.5$ Hz.
4. Wavelength $= \frac{4}{2} = 2$ m.

(B) 1. Sound waves, the rest are electromagnetic waves.
2. Pendulum motion, the rest are wave motions.
3. Rotary bee motion, the rest are oscillatory motions.
4. Sound waves, the rest are transverse waves.

(C) The wavelength decreases to its half value.

Model Exam 2 on Unit One

1 **(A)** 1. 8 m. 2. 0.02
3. mass – squared velocity.
4. oscillatory

(B) 1. d 2. b 3. b 4. b

(C) This means that the distance covered by this wave in one second = 340 m.

2 **(A)** 1. (×) The compression .....
2. (×) ..... differs in .....
3. (✓)
4. (×) ..... vibration of medium particles without moving from their positions.

(B) **Fig. (1)** : Due to the transfer of energy from the ball (A) to the ball (B) through the rest of the static balls.
Fig. (2) : d

(C) 1. Wavelength = 0.02 × 2 = 0.04 m.
2. Wave velocity
= Wave frequency × Wavelength
= 60 × 0.04 = 2.4 m/sec.
3. Periodic time $= \frac{1}{\text{Frequency}} = \frac{1}{40} = 0.025$ sec.

3 **(A)** 1. The oscillatory motion.
2. Longitudinal wave.
3. Periodic time.
4. Rarefaction.

(B) 1. In wave motion, medium particles vibrate in their positions.
2. ..... is considered as an oscillatory .....
3. ..... $= \frac{\text{Wave velocity}}{\text{Frequency}}$
4. ..... quarter .....

(C) Because the frequency is inversely proportionnal to the periodic time.

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4 (A) 1. b 2. d 3. a 4. c

(B) 1. Longitudinal wave.

2. (A) Rarefaction. (B) Compression.

3. The wavelength of the longitudinal wave.

4. direction of wave propagation.

(C) It is used to treat :

1. Sprains and cramps by using hot water.

2. Nervous tension by using cold water.

Unit Two

Worksheet 6

1 1. pitch – intensity – quality.

2. vibration of bodies.

3. mechanical longitudinal – compressions – rarefactions.

4. lower 5. inversely

6. uniform – piano – violin.

2 1. Frequency

$$= \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$$

$$1000 = \frac{250 \times \text{No. of gear teeth}}{1.5 \times 60}$$

$$\text{No. of gear teeth} = \frac{1000 \times 1.5 \times 60}{250}$$

$$= 360 \text{ teeth.}$$

2. Velocity (V) = Frequency (F) × Wavelength (λ)

$$= 512 \times \frac{65}{100} = 332.8 \text{ m/sec.}$$

3 1. It is a property by which the ear can distinguish between harsh and sharp voices.

2. This means that the distance between the centres of two successive compressions or two successive rarefactions in such wave equals 3 cm.

3. It is the distance which is covered by the sound waves in one second.

4 (A) 1. Because the sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.

2. To change the frequency of the produced tone.

(B) 1. C

2. Frequency

$$= \frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds}}$$

$$2 \times 180 = \frac{540}{1 \times 60} \times n$$

$$n = \frac{360 \times 60}{540} = 40 \text{ teeth.}$$

∴ The gear no. B

Worksheet 7

1 1. Watt/m^2 2. Inverse square law of sound.

3. Sound intensity. 4. Decibel.

2 (A) 1. c 2. b 3. a

(B) 1. Due to the increase of the vibrating surface area.

2. Because the intensity of sound is inverse' proportional to the square of th between the ear and the sound source.

3 1. Sound intensity is directly proportional to the square of the amplitude of vibration of the sound source.

2. Sound intensity is directly proportional to the density of the medium through which the sound passes.

4 1. - Sound intensity : The two waves have the same intensity.

- Sound pitch : Wave (A) is sharper than wave (B).

2. - Sound intensity : Wave (B) is stronger than wave (C).

- Sound pitch : The two waves have the same pitch.

Worksheet 8

1 (A) 1. (✗) 2. (✗) 3. (✓)

(B) 1. They are sound waves of frequencies ranging from 20 Hz to 20000 Hz (20 KHz).

2. It is the property by which the human ear can distinguish between different sounds according to the nature of the source even if they are equal in intensity and pitch.

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2 1. (2 , 3)

2. (4 only)

3. No, because all of them are sound waves which are mechanical waves that need a medium to travel through.

4. a. (2 , 3) b. (4 only) c. (1 only)

3 1. Because the range of sounds produced by man lies within the range of sounds heard by dogs.

2. Due to the difference in harmonic tones that associate the fundamental tone of each of them.

3. Because they are used in several medical, industrial and military fields.

4 Sounds of (35 Hz , 50 Hz , 1000 Hz , 15000 Hz and 20000 Hz) can be heard by man , because man can hear sounds of frequencies ranging from 20 Hz to 20000 Hz.

Worksheet 9

1 1. It is the distance covered by light in one second.

2. It is an external factor which affects the eye causing the sense of vision.

3. It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.

2 **(A)** 1. Because the frequency of red light is smaller than that of orange light, where the energy of light photon is directly proportional to its frequency.

2. Because it is electromagnetic waves which don't need a medium to propagate through.

(B) - Spot lights : to illuminate artifacts.

- Ornamental lamps : that bring happiness and joy to the place.

- Stand lamps : that concentrate light for reading.

3 1. b 2. a 3. c 4. c 5. d

Worksheet 10

1

Points of comparison	Transparent medium	Translucent medium
• **Definition :**	It is the medium which permits most light to pass through.	It is the medium which permits only a part of light to pass through and absorbs the remaining part.
• **Examples :**	– Air. – Pure water.	– Frosted (Flint) glass. – Tissue paper.

2 1. Opaque medium.

2. Inverse square law of light.

3. Light intensity.

3 1. (✗) 2. (✗) 3. (✓)

4 1. Because black honey is an opaque medium that does not permit light through it.

2. Because the light intensity is inversely proportional to the square of the distance between the surface and the light source.

3. Because both of air and transparent plastic bag are transparent media which allow light to pass through it.

4. Because it doesn't permit light to pass through and objects can't be seen behind it.

Worksheet 11

1 1. directly – frequency

2. Sonic 3. spectrum colours.

4. frequency – wavelength.

5. increases – high pitched (sharp).

2 **(A)** Frequency $= \frac{\text{No. of cycles} \times \text{No. of gear teeth}}{\text{Time in seconds}}$

$$100 = \frac{30 \times \text{No. of gear teeth}}{60}$$

$$\text{No. of gear teeth} = \frac{60 \times 100}{30} = 200 \text{ teeth.}$$

(B) - Ray no. (1) represents the red colour.

- Ray no. (2) represents the violet colour.

3 **(A)** 1. white – spectrum colours.

2. Drill – Musical tones.

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(B) 1. (✗) .... is larger than that through gases.
2. (✓). 3. (✓).

4 (1) Harmonic tone.
(2) Fundamental tone.
- Harmonic tone because they are tones that accompany the fundamental tone, but they are lower in intensity and higher in pitch and differ from one instrument to another.

Worksheet 12

1 (A) 1. Reflecting surface. 2. Angle of incidence.
(B) 1. (2) 2. 30°

2 (A) 1. It is the rebounding (returning back) of light waves in the same medium on meeting a reflecting surface.
2. It is the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence.

(B) 1. **Fig. (1) :** Angle of incidence
= Angle of reflection = $\frac{30}{2}$ = 15°
Fig. (2) : Angle of incidence
= Angle of reflection
= 60°
Fig. (3) : Angle of incidence
= Angle of reflection
= zero
2. Ray number (3) because when we draw the normal we find that the angle of incidence = the angle of reflection.

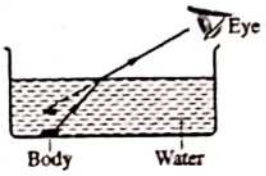
3 (A) • **First law :** Angle of incidence = Angle of reflection.
• **Second law :** The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all lie in one plane perpendicular to the reflecting surface.
(B) 1. b 2. d

4 1. It reflects on itself, because the angle of incidence and the angle of reflection equal zero.
2. They reflect in different (many) directions.

Worksheet 13

1 (A) 1. Due to the difference in light velocity from one medium to another of different optical density.
2. Because the velocity of light through air is always greater than that through any other transparent medium.
3. Due to the refraction of light rays coming from the object, where the eye sees the object at the extensions of refracted rays.
(B) 1. refraction – incidence.
2. refraction – optical density.

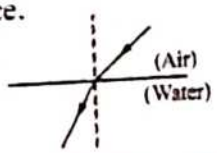
2 (A)



(B) c

3 1. It passes to the other medium without refraction.
2. It appears as being broken, due to light refraction.

4 (A) 1. Mirage.
2. The optical density of the medium.
3. The angle of emergence.
(B) 1. This means that the ratio of the velocity of light through air to the velocity of light through water is 1.3
2. It is the angle between the refracted light ray and the normal at the point of incidence on the interface.
(C) 1. near
2. incidence – refraction.



General Exercise of the School Book on Unit Two

1 1. Infrasonic waves.
2. Opaque medium.
3. Light refraction.

2 1. a (Because the sound pitch is directly proportional to the frequency).
2. b (Because light intensity is inversely proportional to the square of the distance between the source of light and the surface).

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3 1. Photon energy =
Planck's constant × Photon frequency

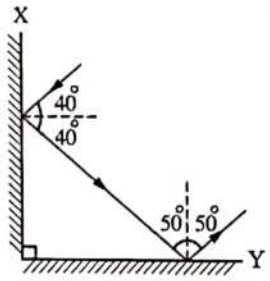
2. Sound frequency (F) =

$$\frac{\text{No. of cycles (d)} \times \text{No. of gear teeth (n)}}{\text{Time in seconds (t)}}$$

4 1. The light rays are reflected in many directions.
2. The white light analysis into seven colours.

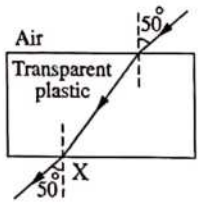
5 The hollow wooden (resonance) box and the air inside it increases the area of the vibrating surface that because sound intensity increases when the source of sound touches a resonance body (box) due to the increase of the vibrating surface area.

6 **(A)**



Angle of reflection on mirror (Y) = 50°

(B)



Angle of emergence = 50°

Model Exam 1 on Unit Two

1 **(A)** 1. a 2. c 3. c 4. c

(B) 1. (✗) 2. (✓) 3. (✓) 4. (✓)

(C) Due to the refraction of light rays coming from the immersed part in water, where the eye sees the pencil on the extensions of the refracted rays, so the pencil appears as being broken.

2 **(A)** 1. Musical tone. 2. Optical density.
3. Spectrum colours. 4. Sound intensity.

(B) 1. It is translucent medium.
2. Because that medium permits only a part of light to pass through and absorbs the remaining part.

(C) This means that the angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence equals 30°

3 **(A)** 1. fundamental tone.
2. Ultrasonic
3. straight
4. more than.

(B) (A) – (B).
- the frequency of wave (A) is more than that of wave (B).

(C) It is used to determine the pitch (frequency of an unknown tone).

4 **(A)** 1. White – Spectrum colours.
2. Ceramic – Transparent media.
3. Air – Opaque media.
4. Sound wave its (F) = 10 Hz – Sonic waves

(B) 1. Wavelength.
2. Photon energy.
3. Inverse square law of sound.
4. Absolute refractive index of glass

(C) Sound frequency (F) =

$$\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth(n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth}$$

Model Exam 2 on Unit Two

1 **(A)** 1. regular reflection – irregular reflection.
2. harmonic tone.
3. real – apparent
4. falling perpendicular to a unit area of a surface in one second.

(B) 1. Sound wave.
2. Light reflection on a plane mirror
3. Air
4. Wood

(C) *Look at the main book on page* (81).

2 **(A)** 1. b 2. d 3. a

(B) 1. - Ray no. (1) represents the red colour.
- Ray no. (2) represents the violet colour.
2. The energy of the photon of red light is smaller than the energy of the photon of violet light, because the energy of photon is directly proportional to the frequency.

(C) *Look at the main book on page* (129).

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3 (A) 1. (✓) 2. (✗) 3. (✓) 4. (✓)

(B) Figure (B), because the angle of incidence equals the angle of emergence and the incident ray refracts near the normal in the glass.

(C) The absolute refractive index of water

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$$

$$= \frac{3 \times 10^8}{2.25 \times 10^8} = 1.33$$

4 (A) 1. (1) 20 2. 20000

2. (1) a (2) b (3) d

(4) d (5) d (6) c

(B) 1. incident ray.
2. refracted ray.
3. angle of incidence.
4. angle of refraction.

(C) Due to reflection and refraction of light in air layers which differ in the degree of temperature.

Unit Three

Worksheet 14

1 1. typical

2. ① Pedicle. ② Receptacle. ③ Sepal.
④ Petal. ⑤ Filament. ⑥ Anther.
⑦ Stigma. ⑧ Style. ⑨ Ovary.

3. carpel – stamen.

2 (A) 1. Because they contain only the male reproductive organ (androecium) or the female reproductive organ (gynoecium) so, they are unisexual not bisexual.

2. To attract insects to the flower which help in sexual reproduction process.

(B) 1. Protection of the inner parts of the flower specially before blooming.

2. It produces ovules inside the ovary.

3 (A) 1. Gynoecium. 2. Androecium.

3. Pollen grains.

(B) It is the bisexual flower which contains both male and female reproductive organs.

4 (A) 1. b 2. a 3. d

(B) 1. anther.

2. ① Filament.
② Pollen chamber.
③ Pollen grains.

Worksheet 15

1 (A) 1. Sexual reproduction – fertilization.

2. Peach – pea

3. man – palm trees.

(B) 1. b 2. a

2 (A) 1. It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

2. It is a vital process that aims to secure the existence and continuity of living organisms species by producing new individuals of the same species to prevent them from extinction.

(B) 1. It germinates forming a pollen tube.

2. They will not attract the insects, therefore the pollination process is not happened and the sexual reproduction doesn't take place.

3. The anther splits longitudinally and the pollen grains spread in air like dust.

3 (A) 1. To compensate what are lost in air.

2. To adhere on the insect's body.

(B) Pollination by air (wind).

Because : – It has hanged anthers (which are easily opened by air).
– It has feathery-like and sticky stigmas to catch pollen grains from air.

4 (A)

Auto pollination	Mixed pollination
– It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant. – It takes place in bisexual flowers.	– It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind. – It takes place in unisexual and bisexual flowers.

(B) ① Pollen grains. ② Stigma.
③ Style. ④ Ovary.
⑤ Micropyle. ⑥ Ovum (egg cell).
⑦ Pollen tube.

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Worksheet 16

1 **(A)** 1. Vegetative – natural – artificial.
2. The tuber – potatoes.
3. a process of multiplying a small part of a plant to get many identical parts.

(B) 1. b 2. c

2 1. ① Scion. ② Stock.
2. Grafting by wedge.
3. a. one bud. b. inserted – cleft

3 (a) upper – stem.
(b) nutritive – nutrients – hormones.
(d) transferred – soil

4 **(A)** The peach plant (scion) feeds on the juice of the apricot plant (stock) and grows forming peach fruits.

(B) • Rhizomes. • Corms.
• Tubers. • Bulbs.

(C) 1. Seed / Ovule.
2. They grow forming new plants of the same kind of plant when grown in a suitable environment.

Worksheet 17

1 **(A)** 1. Male reproductive system in human.
2. ① Seminal vesicle. ② Prostate gland.
③ Cowper's gland. ④ Vas deferens.
⑤ Epididymis. ⑥ Testis.
⑦ Scrotal sac. ⑧ Urinary bladder.
⑨ Penis. ⑩ Urethra.
⑪ Urinary genital opening.
3. -The final stages of the growth and development of sperms take place in it.
- It stores the sperms.

(B) To secure the existence and continuity of living organisms species and to prevent them from extinction.

2 **(A)** 1. epididymis – vas deferens.
2. testosterone – secondary sex characters
3. outside – serotal sac.

(B) 1. Growth of hair in certain body areas like face.
2. Harshness of voice. 3. Growth of bones.
4. Growth and development of genital organs.
5. Enlargement of muscles.

3 **(A)** 1. It regulates and keeps the temperature of testes 2°C below the normal body temperature.
2. It feeds the sperms, facilitates the flow of sperms and neutralizes the acidity of urethra.

(B) Because the individuals coming from asexual reproduction are identical to the parent, while in human, each individual differs from the other, so the type of reproduction in human is sexual reproduction.

4 **(A)** 1. The testes stop producing the sperms and the individual becomes infertile (sterile).
2. The sperms die during their passage through the urethra and the individual becomes infertile.
3. The seminal fluid is not formed which feeds the sperms and neutralizes the acidity of urethra, so the sperms die and the individual becomes infertile.

(B) 1. Testis. 2. Vas deferens. 3. Testosterone.

Worksheet 18

1 **(A)** ① Vagina. ② Cervix.
③ Uterus muscles. ④ Ovary.
⑤ Fallopian tube. ⑥ Uterus.
⑦ Endometrium.

(B) 1. Ovary.
2. Fallopian tube.
3. Uterus.

2 **(A)** 1. It is responsible for nourishment of the fetus during pregnancy through the umbilical cord.
2. It contains mitochondria which are responsible for energy production needed for the sperms movement.

(B) 1. Progesterone hormone.
2. Chromosomes.

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1 (A) 1. Growth of hair in armpit and pubic.
2. Softness of voice.
3. Growth and development of breasts.

(B) 1. a 2. d 3. b

4 (A) 1. The estrogen
2. The sperm

(B) A. 1. the structure of the ovum.
2. the structure of the sperm.
3. cellular membrane.
4. cytoplasm. 5. nucleus.
6. plasma membrane.
7. Head. 8. Midpiece. 9. Tail.

B. (A) produced from the ovary.
(B) produced from the testes.

Worksheet 19

1 (A) 1. Incubation period of the disease.
2. Pregnancy period.

(B) 1. one ripe ovum
2. enzymes – cellular membrane
3. the beginning of fallopian tubes.
4. Syphilis

(C) Because when the nucleus of the sperm which contains 23 chromosomes fuses with the nucleus of the ovum which contains 23 chromosomes, the zygote (fertilized ovum) is formed which contains the complete number of chromosomes (46 chromosomes).

2 (A) 1. c 2. c 3. a 4. d

(B) - The appearance of tumors in different body parts like the liver, bones and parts of genital system.
- The brain may be also damaged and the patient will die.

3 1. Fig. (1) : Spiral bacteria – Syphilis disease.
Fig. (2) : Spherical bacteria – Puerperal sepsis.

2.

Symptoms of the disease caused by fig. (1)	Symptoms of the disease caused by fig. (2)
1. Appearance of painless hard ulcer on the head of penis (in male) and in the vagina and the upper part of cervix (in female). 2. Appearance of dark brass coloured rashes on the back and hands of the patient.	1. High elevation in body temperature. 2. Chills. 3. Face paling. 4. Severe acute pain in lower abdomen. 5. Bad smelling secretions from the uterus.

4 (A) 1. Sterilizing the surgical tools during labour.
2. Wearing masks during labour (delivery).
3. Preventing visits of persons who suffer from respiratory diseases to the mother after delivery.
4. The mother should be kept warm and avoid the exposure to air currents.

(B) 1. By droplets from a person infected with bacteria and suffering from throat infection or tonsillitis to a vagina of recently laboured mother.
2. An infected wound during the labour.

General Exercise of the School Book on Unit Three

1 1. Testis. 2. Ovulation process.
3. Vegetative (asexual) reproduction.

2 1. The wall of the ovary after fertilization .....
2. The progesterone hormone .....
3. Reproduction by grafting .....
4. The ovum is a static cell .....

3 1. Tubers – Leaves of floral whorls of female flower.
2. Measles – Sexually transmitted diseases.

4 1. Because the individuals coming from asexual reproduction are identical to the parent, while in human, each individual differs from the other.
2. To attract insects to the flower which help in the sexual reproduction process.

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5 1. This means that the sperm contains 23 chromosomes only.
2. It is a process of multiplying a small part of a carrot plant to get many identical parts.

6 1. ① Testis. ② Penis.
③ Urinary genital duct.
④ Vas deferens. ⑤ Urinary bladder.
⑥ Prostate gland.
2. (a) ① (b) ⑥ (c) ④

7 *Look at the main book on page* (197).

8 1. Part (X) : It attracts insects to the flower and protects the reproductive organs.
Part (Y) : It protects the inner parts of the flower specially before blooming.
2. (1) Cross pollination.
(2) Bisexual (hermaphrodite) flower.

Model Exam 1 on Unit Three

1 **(A)** 1. Cowper's – male
2. ovum – sperm – 46
3. Flower – reproductive
4. fruit.

(B) ① Style. ② Filament.
③ Petal.
④ Sepal. ⑤ Receptacle. ⑥ Pedicle.
⑦ Stigma. ⑧ Ovary.

(C) To adhere on the insect's body.

2 **(A)** 1. (✓) 2. (✗) 3. (✗) 4. (✓)

(B) 1. Tulip. 2. Progesterone hormone.
3. Prostate cancer disease.
4. Sweet potato.

(C) Producing large numbers of a plant by using a part of it.

3 **(A)** 1. c 2. c 3. a 4. d

(B) 1. Corolla. 2. Placenta.
3. Fallopian tubes. 4. Epididymis.

(C) **The calyx :** It consists of a group of green leaves which are called sepals.

The corolla : It consists of a group of colourful and scented leaves which are called petals.

4 **(A)** 1. Stamen – the rest are parts of the carpel.
2. Measles – the rest are sexual transmitted diseases.
3. Ovary – the rest are parts of stamen.
4. Epididymis – the rest are organs of female genital system.

(B) 1. ① Head. ② Midpiece ③ Tail
2. It is responsible for the movement of the sperm till it reaches the ovum.

(C) The anther will split longitudinally and pollen grains will spread in air like dust.

Model Exam 2 on Unit Three

1 **(A)** 1. (✗) 2. (✗) (3) (✗) 4. (✗)

(B) 1. Fertilization process (the formation of zygote in human).
2. ② 23 chromosomes.
③ 46 chromosomes.

(C) ∵ The adult female produces one ripe ovum every 28 days.
∴ The number of produced ova in one year $= \frac{365}{28} \simeq 13$ ova.
∴ The number of produced ova during 35 years $= 13 \times 35 = 455$ ova.

2 **(A)** 1. fertilization – outer coat of the fruit.
2. ulcer
3. self pollination – mixed pollination.
4. nucleus – cytoplasm – cellular membrane.

(B) • The associated glands are :
1. Seminal vesicles. 2. Prostate gland.
3. Cowper's glands.
• Their function : They pour secretions on the sperms to form a seminal fluid which nourishes the sperms, facilitates the flow of sperms and neutralizes the acidity of urethra.

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(C) It will not move, so no fertilization occurs.

3 (A) 1. b – C 2. d – D 3. a – A 4. c – B

(B) 1. ① Fallopian tube. ② Uterus.
③ Ovary. ④ Uterus muscles.
⑤ Cervix.

2. ① It receives the ripe ovum and directs it towards the uterus.

② • It protects the fetus until birth.
• It nourishes the fetus during the pregnancy by the placenta through the umbilical cord.

③ • Production of ova.
• Production of female sex hormones which are progesterone and estrogen.

(C) To attract insects to the flower which help in the sexual reproduction process.

4 (A) 1. The flower.
2. Fertilization process.
3. Tissue culture.
4. Zygote

(B) Fig. (1) represents the germination of a pollen grain.
Fig. (2) represents the male reproductive system.
Fig. (3) represents a type of reproduction which is the grafting by wedge.
No. ① represents the pollen grain.
No. ② represents the 2 male nuclei.
No. ③ represents the testis.
No. ④ represents the scion.
No. ⑤ represents the stock.

(C) It is the period between the beginning of the infection and the appearance of symptoms of the disease.

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Monthly Tests

March Tests

Model 1

1 **(A)** 1. c 2. d 3. d 4. d

(B) They are longitudinal waves, because the medium particles vibrate along the direction of wave propagation forming compressions and rarefactions and mechanical waves, because they need a medium to propagate through.

2 **(A)** 1. high – low
2. transverse – centre of compression
3. oscillatory – wave

(B) They are sound waves of frequencies ranging from 20 Hz to 20 KHz.

Model 2

1 **(A)** 1. The wavelength of the transverse wave.
2. Frequency. 3. Sound pitch.
4. Oscillatory motion.

(B) Frequency = $\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$$600 = \frac{300 \times \text{No. of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

2 **(A)** *Look at the main book on page* **(40).**

(B) 1. Wave velocity. 2. Frequency.
3. Periodic time. 4. Wavelength.

April Tests

Model 1

1 **(A)** 1. d 2. c 3. d 4. c

(B) The distance covered by light in one second is 3×10^8 m.

2 **(A)** 1. (✓) 2. (✗) 3. (✗) 4. (✓)

(B) To catch pollen grains from air.

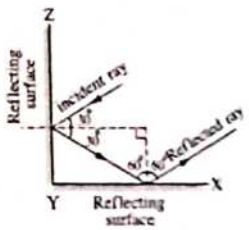
Model 2

1 **(A)** 1. b 2. c 3. e 4. a

(B) The white light analysis into seven colours.

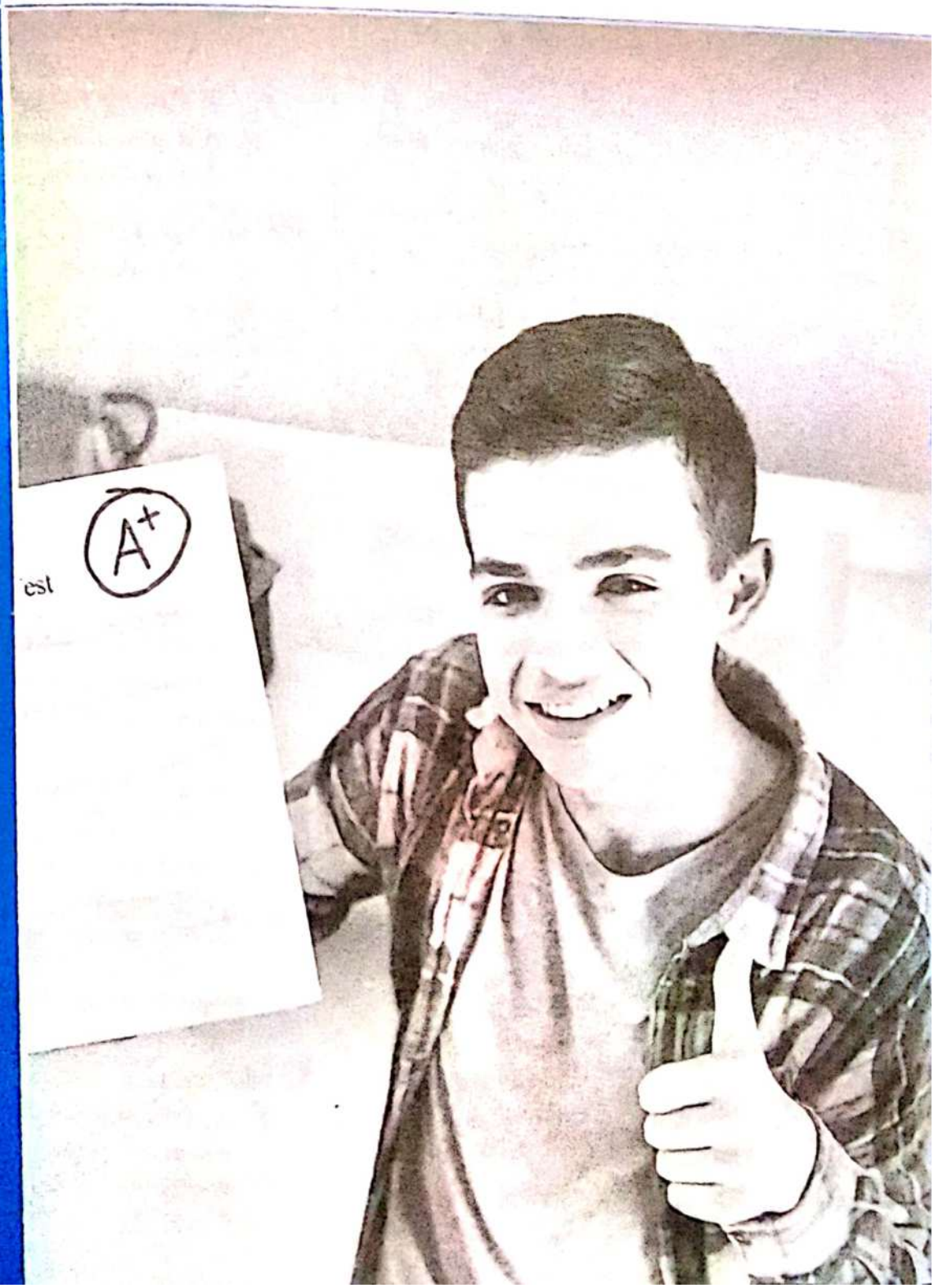
2 **(A)** 1. Photon energy. 2. Inflorescence.
3. Apparent position.
4. Vegetative (asexual) reproduction.

(B)



PART 3

Guide Answers of Final Examinations



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Cairo Governorate

1 Heliopolis Education Zone

1 (A) 1. d 2. a 3. c 4. c

(B) 1. - Longitudinal wave : The particles of the medium vibrate along the direction of wave propagation.

- Transverse wave : The particles of the medium vibrate perpendicular to the direction of wave propagation.

2. - Pollination by air :

1. Anthers are hanged to be easily opened by air.
2. Stigmas are feathery like and sticky to catch pollen grains easily.

- Pollination by insects :

1. Petals are coloured and scented to attract insects to feed on their nectar.
2. Pollen grains are sticky or having a coarse surface to adhere on the insect body.

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{100 \times 1 \times 60}{300} = 20 \text{ gear teeth}$$

2 (A) 1. Because lightning (light waves) is electromagnetic waves but thunder (sound waves) is mechanical waves and the velocity of electromagnetic waves is much greater than that of mechanical waves.

2. Because the frequency of the violet light is greater than that of the red light and there is a directly relation between the quantum of energy (photon energy) and the photon frequency.

3. Because the flowers contain only male or female reproductive organ.

4. Because it is the medium which allows most of light to pass through it and we can see objects clearly through it.

(B) 1. They are used in breaking down kidney and ureter stones and diagnosis of male prostate gland tumors.

2. - It protects the reproductive organs.
- It attracts the insects to the flower which help in the reproduction process.

3. It is used to analyze the white light into 7 spectrum colours.

4. It produces large number of a plant by using a part of it.

(C) 1. It reflects on itself.

2. It will germinate forming a pollentube.

3 (A) 1. 20 : 20000 Hz. 2. root. 3. Progesterone 4. Inflorescence

(B) 1. d 2. c 3. c

(C) 1. The odd word is : sound waves.
The remaining words are : Electromagnetic waves.

2. The odd word is : White.
The remaining words are : From the 7 spectrum colours.

4 (A) 1. Asexual (vegetative) reproduction.

2. Infrasonic waves.

3. Fertilization process.

4. Absolute refractive index of a medium.

(B) 1. (✗) Androecium is .....

2. (✓) 3. (✓)

4. (✗) ..... for the oscillatory motion.

(C) 1. It is the quantity of light falling perpendicular to a unit area of a surface in one second.

2. They are sound waves of frequencies ranging from 20 Hz to 20 KHz.

2 El-Sahel Educational Zone

1 (A) 1. Medical – industrial fields.

2. increases – increasing

3. watt/m^2 – decibel

4. reflection – normal.

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(B) 1. It means that the number of complete oscillations made by the tuning fork in one second = 652 complete oscillations.

2. It is the medium which allows most of light to pass through it and objects can be seen clearly through it.

3. It means that the ratio between the velocity of light through air to the velocity of light through glass = 1.5

4. It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

(C) The importance of petals (corolla) :

- Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.

2 (A) 1. 2 cm.

2. Periodic time = the time of one complete oscillation = 2 sec.

3. Frequency = $\frac{1}{\text{periodic time}} = \frac{1}{2} = 0.5$ Hz.

4. Time of one amplitude = $\frac{1}{4}$ periodic time

$= \frac{1}{4} \times 2 = 0.5$ sec.

(B) 1. Because the angle of incidence = the angle of reflection = zero.

2. Because lightning is electromagnetic waves (light waves) but thunder is mechanical waves (sound waves) and the velocity of electromagnetic waves is much greater than that of mechanical waves.

3. Because the flowers contain only male or female reproductive organ.

(C) ∵ Sound frequency (F)

$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$

∴ Number of gear teeth

$= \frac{\text{Sound frequency} \times \text{Time in seconds}}{\text{Number of cycles}}$

$= \frac{100 \times 1 \times 60}{30} = 200$ gear teeth.

3 (A) 1. Gynoecium. 2. Optical density.
3. Angle of emergence. 4. Sonic waves.

(B) 1. *Look at the notebook on page (96).*

2. *Look at the notebook on page (113).*

(C) 1. ..... is considered as an opaque medium.

2. Light reflection is .....

4 (A) 1. b 2. b 3. a 4. b

(B) 1. **- Mechanical waves :**

They need a medium to propagate through and do not propagate through vacuum.

- Electromagnetic waves :

They do not need a medium to propagate through and propagate through vacuum.

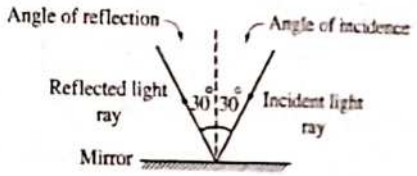
2. **- Stamen :**

It consists of filament and another which produces pollen grains.

- Carpel :

It consists of stigma, style and ovary which produces ovules.

(C)



3 Helwan Educational Zone

1 (A) 1. Oscillatory motion. 2. Optical density.
3. Caly (sepal). 4. Transverse wave.

(B) 1. Because the number of vibrations of sound (number of sound waves) is low, so, the frequency is low and the sound of this animal (lion) is low pitched (harsh or rough).

2. Bisexual flower (Hermaphrodit flower).

3. Wave velocity

= Wave frequency × wavelength

Wavelength = $\frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{10}{2} = 5$ metres.

Wave frequency = $\frac{\text{Number of waves}}{\text{Time in sec.}}$

$= \frac{\frac{1}{2}}{0.2} = 2.5$ Hz.

∴ Wave velocity = 2.5 × 5 = 12.5 m/sec.

4. The angle of reflection = the angle of incidence = zero.

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(C) Because lightning is electromagnetic waves (light waves) but thunder is mechanical waves (sound waves) and the velocity of electromagnetic waves is much greater than that of mechanical waves.

2 (A) 1. Water waves. 2. Analyze light.
3. Watermelon. 4. Pancreas gland.

(B) 1. 20 2. larger than 3. tubers.
4. decreases to quarter.

(C) Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

$= \frac{240}{1 \times 60} = 4$ Hz.

3 (A) 1. c 2. b 3. a 4. a

(B) 1. e 2. d 3. a 4. c

(C) The scion feed on the juice of the stock (apricots) and grows forming fruits belong to the type of the scion (peaches).

4 (A) 1. (✓)
2. (✗) ..... is higher than .....
3. (✓)
4. (✗) ..... is always greater than one.

(B) 1. rarefaction 2. transparent
3. Testosterone 4. equal to

(C) In this step :
- The head of the sperm secretes enzymes to dissolve the cellular membrane of the ovum and Facilitate its penetration inside the ovum
- Only one sperm can penetrate the cellular membrane of the ovum.
- The Ovum surrounds itself with a membrane that prevents the penetration of any other sperm.

4 Heliopolis Modern Language School

1 (A) 1. electromagnetic – mechanical
2. female – zaygote
3. 1 cm – 0.8
4. 60° – 120°

(B) 1. (✗) 2. (✓) 3. (✗) 4. (✓)

(C) 1. It is used to split the white light into 7 spectrum colours.
2. They are used in sterilization of food, water and milk.

2 (A) 1. c 2. c
3. b 4. a

(B) 1. 10 2. decreases to quarter.
3. Mirage 4. Reproduction process

(C) 1. To attract insects to the flower, which help in the reproduction process.
2. It means that the ratio between the velocity of light through air and that through water equals to 1.33.

3 (A)

P.O.C	Mechanical waves	Electromagnetic waves
Definition :	They are the waves which need a medium to propagate and do not propagate through vacuum.	They are the waves which do not need a medium to propagate and propagate through vacuum.
Speed :	Their speed is relatively low.	Their speed is great (3×10^8 m/sec).
Type :	They are transverse or longitudinal waves.	They are transverse waves only.
Examples :	• Water waves (transverse waves) • Sound waves (longitudinal waves)	• Visible light waves. • Infrared waves. • Radio waves.

(B) 1. c 2. c 3. c 4. b

(C) 1. The velocity will be maximum at rest position.
2. It will reflect on itself.

4 (A) 1. • The odd word is : Sound wave.
• The name of the others : Electromagnetic waves.
2. • The odd word is : Root.
• The name of the others : The floral whols of the flower.
3. • The odd word is : Rotary bee motion.
• The name of the others : Oscillatory motion.
4. • The odd word is : White.
• The name of the others : Spectrum colours.

(B) 1. Violet colour. 2. Infrasonic waves.
3. Sound type (quality).
4. Asexual (vegetative) reproduction.

(C) ∵ Sound frequency (F)

$$= \frac{\text{No. of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency} \times \text{Time in seconds}}{\text{No. of cycles}}$$

$$= \frac{200 \times 1 \times 60}{80} = 150 \text{ gear teeth.}$$

5 El-Sayeda Khadija Official Lang. Sch.

1 (A) 1. decibel – Watt/m^2
2. fruit – seed.
3. inversly – the square

(B) 1. It is used to produce large number of a plant by using a part of it.
2. It is used to treat sprains and cramps.
3. They are used in :
- Breaking down kidney and ureter stones.
- Diagnosis of male prostate gland tumors.
- Discovering malignant tumors.

(C) ∵ Sound frequency (F)

$$= \frac{\text{No. of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{300 \times 2 \times 60}{200} = 180 \text{ gear teeth.}$$

2 (A) 1. Flower. 2. Optical density.
3. Longitudinal wave. 4. Photon energy.

(B) 1. The sound intensity increases.
2. The angle of refraction is larger than the angle of incidence because the light ray refract far from the normal.
3. The wave frequency decreases to quarter.
4. The velocity of the oscillatory body will be maximum at its rest position.

(C) ∵ Absolute refractive index of diamond

$$= \frac{\text{The speed of light through air}}{\text{The speed of light through diamond}}$$

∴ The speed of light through diamond

$$= \frac{\text{The speed of light through air}}{\text{Absolute refractive index of diamond}}$$

$$= \frac{3 \times 10^8}{2.4} = 125 \times 10^6 \text{ m/sec.}$$

3 (A) 1. c 2. d 3. b 4. a

(B) 1. • Regular reflection :
The light rays reflect in one direction.
• Irregular reflection :
The light rays reflect in different (many) directions.
2. • Mechanical waves :
They are waves which need a medium to propagate, where they do not propagate through vacuum.
• Electromagnetic waves :
They are waves which do not need a medium to propagate, where they propagate through vacuum.
3. • Pollination by air :
Anthers are hanged to be easily opened by air.
• Pollination by insects :
Petal is coloured and scented to attract insects (like bees) to feed on its nectar.
4. • Transverse waves :
The particles of the medium vibrate perpendicular to the direction of wave propagation.
• Longitudinal waves :
The particles of the medium vibrate along the direction of wave propagation.

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(C) ∵ Wave velocity = Wave frequency × Wavelength

$\therefore$ Wavelength $= \frac{\text{Wave velocity}}{\text{Wave frequency}}$

$= \frac{3 \times 10^{8}}{6 \times 10^{14}} = 5 \times 10^{-7}$

4 (A) 1. sperm 2. a periodic motion.
3. equals to 4. Mirage

(B) 1. They are tones that accompany the fundamental tone but they are higher in pitch and lower in intensity, and differ from one instrument to another.

2. It is the fusion of the nucleus of the male gamete (sperm) with the nucleus of the female gamete (ovum) to form a fertilized ovum (zygote).

3. The distance covered by the wave in one second.

(C) 1. The amplitude = 10 cm.

2. Wavelength $= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{16}{2} = 8$ cm.

3. The frequency $= \frac{\text{Number of waves}}{\text{Time in seconds}}$

$= \frac{2}{0.8} = 2.5$ Hz.

4. Periodic time $= \frac{1}{\text{Frequency}}$

$= \frac{1}{2.5} = 0.4$ sec.

6 Al-Shrouk Educational Zone

1 (A) 1. reproduction by catting – reproduction by grafting.
2. mirage. 3. 20 – 20000
4. vibration 5. the velocity of light.
6. the pitch (frequency) of an unknown tone.
7. Tulip – wall flower

(B) 1. Wavelength $= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{8}{2} = 4$ m.

2. Frequency $= \frac{\text{Number of waves}}{\text{Time in seconds}}$

$= \frac{\frac{1}{2}}{3} = \frac{1}{6}$ Hz.

3. Amplitude = 2 m.

4. Wave velocity = Wavelength × Frequency

$= 4 \times \frac{1}{6} = 0.66$ m/sec.

2 (A) 1. b 2. a 3. c 4. b

(B) a. It protects the inner parts of the flower specially before blooming.

b. They are used in medical field for breaking down kidney and ureterstones.

(C) 1. The motion of a rotary bee is as a periodic motion only because it is repeated regularly at equal time intervals but it is not an oscillatory motion because it is not repeated on the 2 sides of its rest position.

2. Because the flowers contain only male or female reproductive organ.

3 (A) 1. Asexual (vegetative) reproduction.
2. Corolla (petals).
3. Transparent and translucent media.
4. Optical density.

(B) 1. • The red colour is the upper line.
• The violet colour is the lower line.

2. It analysis the white light into 7 spectrum colours.

(C) 1. • Male flower has a male reproductive organ which is called androecium and produces pollen grains.
• Female flower has a female reproductive organ which is called gynoecium and produces ovules.

2. • Mechanical waves need a medium to propagate and cannot propagate through vacuum.
• Electromagnetic waves do not need a medium to propagate and propagate through vacuum.

4 (A) 1. (✓) 2. (✓) 3. (✓) 4. (✗)
5. (✗) 6. (✗)

(B) 1. Photon energy = Planck's constant × Photon frequency

2. Absolute refractive index of a medium $= \frac{\text{The velocity of light through air}}{\text{The velocity of light through the medium}}$

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(C) 1. Irregular light reflection will be occured and the light rays will reflect in different (many) directions.

2. The ovary develops to become a fruit.

Giza Governorate

7 Educational Zone

1 (A) 1. 5 Hz. 2. 30°
3. metre. 4. less than 20

(B) 1. Motion of tuning fork.
2. Sound wave. 3. Tissue paper.
4. Light wave.

(C) It reflects on itself.

2 (A) 1. (✓) 2. (✗) 3. (✗) 4. (✓)

(B) 1. Wood. 2. Testes.
3. Black. 4. Prostate gland.

(C) It is used to determine the pitch (frequency) of an unknown tone.

3 (A) 1. Light refraction. 2. Mirage.
3. Harmonic tones. 4. Fertilization process.

(B) 1. less 2. testosterone.
3. calyx (sepals). 4. straight

(C) The velocity of sound wave in air
= Frequency of sound wave × Wavelength
= 200 × 1.7 = 370 m/sec.

4 (A) 1. a 2. c 3. d 4. b

(B) 1. Second (sec.)
2. metre/second (m/sec.).
3. Metre (m).
4. watt/m^2.

(C) Because the velocity of light through air is always greater than the velocity of light through any transparent medium.

8 Exper. lang. Sch. Directorate

1 (A) 1. 4 – amplitude. 2. crest – trough.
3. white – 7 spectrum 4. seed – fruit.

(B) 1. Increases.
2. potatoes and sweet potatoes.
3. The sperm
4. Testosterone

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{100 \times 1 \times 60}{120} = 50 \text{ gear teeth.}$$

2 (A) 1. Periodic motion.
2. Absolute refractive index.
3. Light reflection.
4. Flower.

(B) 1. Sound wave. 2. Air.
3. The density of the medium.
4. Palm trees.

(C) 1. Periodic time = 2 × 0.2 = 0.4 sec.

$$\text{Frequency} = \frac{1}{\text{Periodic time}} = \frac{1}{0.4} = 2.5 \text{ Hz.}$$

2. Wavelength

$$= \frac{\text{The distance which covered by waves}}{\text{Number of waves}}$$

$$= \frac{4}{2} = 2 \text{ meters.}$$

3 (A) 1. b 2. b 3. a 4. d

(B) 1. - Transverse wave : The particles of the medium vibrate perpendicular to the direction of wave propagation.
- Longitudinal wave : The particles of the medium vibrate along the direction of wave propagation.

2. - Sound : Its velocity is much less than the velocity of light.
- Light : Its velocity = 3×10^8 m/sec.

3. - Fundamental tones : They are lower in the pitch (frequency).
- Harmonic tones : They are higher in the pitch (frequency).

4. - Male flower : Its symbol is ♂.
- Female flower : Its symbol is ♀.

(C) The velocity of the oscillating body becomes maximum when it passes through its rest position.

4 (A) 1. (✗) Motion of the tuning fork is .....
2. (✗) Light ..... 3. (✓)
4. (✗) ..... called sepals.

(B) 1. Wood. 2. White.
3. Drill. 4. Frequency.

(C) Because the angle of incidence = the angle of reflection = Zero.

9 Abou El-Nomros Educational Zone

1 (A) 1. the electromagnetic – vacuum.
2. sexual reproduction – asexual reproduction.
3. 20 – 20000 4. 4 – an amplitude.

(B) 1. Root. 2. Rotary bee.
3. Testis. 4. Ovary.

(C) Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

$$= \frac{960 \times 30}{120} = 240 \text{ Hz.}$$

2 (A) 1. c 2. b 3. c 4. b

(B) 1. Because they are waves which need a medium to propagate and cannot propagate through vacuum.
2. Because the tail is responsible for the movement of the sperm till reaches the ovum.
3. Because they have high ability to kill some types of bacteria and stop the action of some viruses.
4. Because it does not allow light to pass through it and objects cannot be seen through it.

(C) It is the distance covered by the wave in one second.

3 (A) 1. (✓) 2. (✗) 3. (✓) 4. (✗)

(B) 1. Water wave. 2. Potatoes.
3. Voice of woman or sparrow.
4. Clear glass.

(C) 1. 0.4 sec. 2. 2 cm.

4 (A) 1. d 2. c 3. b 4. a

(B) 1. The sound. 2. Decibel.
3. Mirage.
4. Triangular glass prism.

(C) It reflects on itself.

10 Science Inspectorate

1 (A) 1. testosterone – estrogen.
2. regular reflection – irregular reflection
3. green – sepal. 4. 9 Hz – 0.11 sec.

(B) 1. (✗) 2. (✗) 3. (✓) 4. (✗)

(C) 1. Wavelength = $\frac{\text{Distance covered by waves}}{\text{Number of waves}}$

∵ Number of waves = 3 waves.

∴ Wavelength = $\frac{15}{3}$ = 5 meter.

2. Wave velocity = Wavelength × Frequency

∵ Frequency = 100 Hz.

∴ Wave velocity = 5 × 100 = 500 m/sec.

2 (A) 1. a 2. d 3. a 4. a
5. b 6. d 7. b 8. c

(B) 1. 1. Calyx (sepal). 2. Corolla (petal).
3. Anther. 4. Ovule (in the ovary).
2. Bisexual (Hermaphrodite) flower – production of pollen grains (inside the pollen chamber).

(C) 1. Because lightning is electromagnetic waves (light waves) but thunder is mechanical waves (sound waves) and the velocity of the electromagnetic waves is greater than that of mechanical waves.
2. Because they are used in breaking down kidney and ureter stones without any surgical operations, diagnosis of male prostate gland tumors and discovering malignant tumors.
3. Due to the difference of light velocity between the medium that the light transfer from and the glass.

3 (A) 1. Photon energy. 2. Tissue culture.
3. Mirage.
4. Self(auto) pollination.
5. Periodic motion. 6. Wave frequency.
7. Fertilization process.
8. Ovulation process.

(B) 1. Ceramic. 2. White light.
3. Rotary bee. 4. Stamen.

(C) 1. The kinetic energy increases.

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2. The velocity of sound wave in water will increase than that in air, where the velocity of sound in water = 1500 m/s. and that in air = 340 m/s.

1 (A) 1. equals to 2. an opaque
3. high 4. straight
5. an oscillatory 6. Longitudinal
7. half 8. progesterone.

(B) 1. watt/m^2 2. Decibel.

3. They are used to avoid hazards of noise in loud places.

4. It analysis the white light into 7 spectrum colours.

(C) The absolute refractive index of diamond

$$= \frac{\text{The speed of light in air}}{\text{The speed of light in diamond}}$$

$$= \frac{3 \times 10^8}{1.25 \times 108} = 2.4$$

Alexandria Governorate

11 Science Inspectorate

1 (A) 1. The odd word is : Rotary bee motion.
The rest words are : Oscillatory motion words.

2. The odd word is : Sound waves.
The rest words are : Electromagnetic waves.

3. The odd word is : Style.
The rest words are : Parts of the male reproductive organ in flower (stamen).

4. The odd word is : Vas deferens.
The rest words are : Parts of the female reproductive system.

(B) 1. watt/m^2 2. increases.
3. 20 4. wind (air).

(C)

P.O.C	Regular reflection	Irregular reflection
The texture of the reflecting surface :	Smooth	Rough
The direction of the reflected rays :	The light rays which fall on a smooth reflecting surface reflect in one direction.	The light rays which fall on a rough reflecting surface reflect in different (many) directions.

2 (A) 1. Amplitude = 2 cm.

2. Periodic time (T) = $\frac{\text{Time in seconds}}{\text{Number of waves}}$

$= \frac{4}{1} = 4$ sec.

3. Frequency (F) = $\frac{1}{\text{Periodic time}} = \frac{1}{4}$ Hz.

4. Wavelength (λ)

$= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{10}{1} = 10$ m.

(B) 1. Compression. 2. The sound pitch.
3. Violet colour.
4. Fertilized ovum (zygote).

(C) A transverse waves will be formed.

3 (A) 1. c 2. b 3. d 4. a

(B) 1. d 2. c 3. a 4. b

(C) ∵ Sound frequency (F)

$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$

∴ Number of gear teeth

$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$

$= \frac{1200 \times 1 \times 60}{600} = 120$ gear teeth.

4 (A) 1. Corolla (petal) – Calyx (sepal).

2. The protection of the reproductive organs and attraction of insects to the flower which help in the reproduction process.
– the protection of the inner parts of the flower specially before blooming.

3. female flower – male flower.

4. a fruit.

(B) 1. inversely 2. straight
3. greater than 4. single (one) seed

(C) Because the light intensity is inversely proportional to the square of the distance between the light source and the surface according to the inverse square law of light $\left(I \propto \frac{1}{\alpha^2}\right)$.

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12 Al-Montazh Educational Zone

1 **(A)** 1. b 2. c 3. c 4. a
5. d 6. c

(B) 1. - **Regular reflection :**
It is the reflection of light rays when they fall on a smooth reflecting surface, where the incident light rays reflect in one direction.

- **Irregular reflection :**
It is the reflection of light rays when they fall on a rough reflecting surface, where the incident light rays reflect in many (different) direction.

2. - **Sperm :**
It is very small and mobile cell.

- **Ovum :**
It is large in size, spherical and static cell.

(C) a. The time of one complete oscillation = 0.02 sec.

b. $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

or $\frac{1}{\text{periodic time}} = \frac{1}{0.02} = 50$ Hz.

2 **(A)** 1. Optical density.
2. Typical flower. 3. Light refraction.
4. Sound pitch. 5. The angle of incidence.
6. Crest.

(B) 1. It means that the ratio between the velocity of light through air to the velocity of light through glass = 1.5

2. It means that the number of complete oscillations made by the tuning fork in one second = 300 complete oscillations.

3. It is the property by which the ears can distinguish strong or weak sounds.

(C) The first law of light reflection is :
The angle of incidence = The angle of reflection.

3 **(A)** 1. compressions – rarefactions.
2. decibel – watt/m^2
3. female – male
4. 7 – spectrum
5. outside – scrotal sac (scrotum).

(B) 1. Corolla (petal). 2. Calyx (sepal).
3. Anther. 4. Ovary.

4 **(A)** 1. (✗) 2. (✗) 3. (✓)
4. (✓) 5. (✗)

(B) 1. They are used in medical field for breaking down kidney and ureter stones without any surgical operations, diagnosis of male prostate gland tumors and discovering malignant tumors.

2. It analysis the white light into seven spectrum colours.

(C) 1. To attract insects to the flower which help in the reproductive process.

2. Because sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.

13 Borg Al-Arab Educational Zone

1 **(A)** 1. Wave velocity.
2. Hermaphrodite (bisexual) flower.
3. Complete oscillation.
4. Optical density.

(B) 1. carpel 2. progesterone
3. female 4. periodic

(C) ∵ Sound frequency (F)

$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$

∴ Number of gear teeth

$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$

$= \frac{600 \times 1 \times 60}{300} = 120$ gear teeth.

2 **(A)** 1. c 2. a 3. c 4. d

(B) 1. - The unsuitable word is : Sound wave.
- The remaining words are : Electromagnetic waves.

2. - The unsuitable word is : light travels through materialistic media only.
- The remaining words are : Properties of light.

3. - The odd word is : Frequency.
- The remaining words are : Factors affect on the sound intensity.

4. - The odd word is : Pollination.
- The remaining words are : Artificial vegetative reproduction.

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(C) ∵ Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

∴ Number of complete oscillations
= Frequency × Time in seconds
= 6 × 5 × 60 = 1800 oscillations.

3 (A) 1. Perpendicular to
2. the velocity of light through air – the velocity of light through a transparent medium.
3. watt/m^2 – decibel. 4. insects – pollination

(B) 1. b 2. d 3. a

(C) 1. Because the density of carbon dioxide gas is more than that of air since the intensity of sound is directly proportional to the density of the medium.
2. Because the angle of incidence = the angle of reflection = zero.

4 (A) 1. (✓) 2. (✓) 3. (✗) 4. (✗)

(B) 1. It is used to treat sprains and cramps by using hot water and nervous tension by using cold water.
2. It is used to break down kidney and ureter stones without any surgical operations.
3. They produce sperms and male sex hormone (testosterone hormone).
4. It analysis the white light into 7 spectrum colours.

(C) ∵ Wave velocity (V)
= Frequency (F) × Wavelength (λ)

- Frequency (F) = $\frac{\text{Number of waves}}{\text{Time in seconds}}$

$= \frac{\frac{1}{2}}{0.2} = 2.5$ Hz.

- Wavelength (λ)

$= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{6}{2} = 3$ metres.

∴ Wave velocity = 2.5 × 3 = 7.5 m/sec.

Al-Qaliubya Governorate

14 Science Inspect. Qaliub Educ. Zone

1 (A) 1. Frequency of the oscillating body.
2. Sound pitch. 3. Light intensity.
4. Flower. 5. Tissue culture.
6. The line of wave propagation.

(B) 1. The wavelength decreases to half.
2. It will germinate forming a pollen tube.
3. The light rays reflect in different (many) directions.

(C) The velocity of sound wave propagation
= wave frequency × wavelength
= 200 × 1.7 = 340 m/sec.

2 (A) 1. transverse – the compression
2. inversely – square.
3. electromagnetic – 3 × 10^8 m/sec.
4. pollination – fertilization.
5. lower – higher
6. testosterone – estrogen

(B) 1. Because they have high ability to stop the action of some viruses and kill some types of bacteria.
2. Because the frequency of red light photon is less than that of the orange light photon and the photon energy is directly proportional to the photon frequency.
3. Because in maize plant, the transfer of pollen grains is occured from the anthers of the flower to the stimgas of another flower in other plant of the same kind because it is a unisexual flower.

(C) The absolute refractive index of diamond

$= \frac{\text{The velocity of light through air}}{\text{The velocity of light through diamond}}$

$= \frac{3 \times 10^8}{1.25 \times 10^8} = 2.4$

3 (A) 1. d 2. c 3. b
4. d 5. b 6. a

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(B) 1.

P.O.C	Sound waves	Light waves
The propagation :	- They cannot propagate through vacuum and need a medium to propagate through. - The particles of the medium propagate a long the direction of wave propagation.	- They can propagate through vacuum and do not need a medium to propagate through. - The particles of the medium propagate perpendicular to the wave propagation.
The type of wave :	Sound waves are mechanical longitudinal waves.	Light waves are electromagnetic transverse waves.

2.

P.O.C	The ovum	The sperm
The size :	It has a small size.	It has a relatively large size.
The mobility :	It is mobile.	It is static (not mobile).

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth.}$$

4 (A) 1. It is responsible for the continuity of pregnancy.
2. It protects the inner parts of the flower specially before blooming.
3. It contains mitochondria which are responsible for energy production needed for sperms movement.
4. They are used to avoid the hazards of noise in lound places.

(B) 1. - The odd word : Sound wave.
- The rest words are : From the examples of the electromagnetic waves.
2. - The odd word : White.
- The rest words are : Spectrum colours.
3. - The odd word : Milk.
- The rest words are : Transparent media.
4. - The odd word : Epididymis.
- The rest words are : Parts of the female reproductive system.

(C) 1. Frequency (F)

$$= \frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$$

2. The first law of light reflection is :
Angle of incidence = Angle of reflection.

El-Sharkia Governorate

15 Al-Shaheed Sheriff Talat School

1 (A) 1. sharp – rough sounds.
2. transverse – compression
3. fruit – seed. 4. wave – periodic.

(B) 1. b 2. c 3. d 4. a

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth}$$

2 (A) 1. (✓) 2. (✗) 3. (✗) 4. (✗)

(B) 1. White. 2. Sound wave.
3. Air. 4. Epididymis.

(C) Because lightning is electromagnetic waves (light waves) but thunder is mechanical waves (sound waves) and the velocity of electromagnetic waves is much greater than that of mechanical waves.

3 (A) 1. Mixed (cross) pollination.
2. Mirage. 3. Inflorescence.
4. Rarefaction.

(B) 1. Tissue paper.
2. The density of the medium.
3. The motion of tuning fork.
4. Reproduction by cutting.

(C) The periodic time will decrease.

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4 (A) 1. a 2. b 3. c 4. b

(B) 1. fundamental 2. straight
3. Ultrasonic 4. greater than

(C) 50°

Menofia Governorate

16 Shebeen El-Koum Educ. zone

1 (A) 1. 60 – 0.016 2. inversely – directly
3. acidic – basic (alkaline)
4. directly – frequency

(B) 1. Genital associated glands.
2. Receptacle.
3. Uterus.
4. Amplitude.

(C) • Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

$$= \frac{360 \times 40}{60} = 240 \text{ Hz.}$$

• Wave speed = Wavelength × frequency
= 1.4 × 240 = 336 m/sec.

2 (A) 1. Due to the refraction of light rays coming from the fish where the eye sees the fish in an apparent position on the extensions of these refracted rays.
2. Because it is graphically represented by a curve.
3. Because the ovary of peach contains only one ovule, while that of pea contains many ovules.
4. To dissolve the cellular membrane of the ovum and facilitates its penetration inside the ovum.

(B) 1. Tubers. 2. Rotary bee motion.
3. Penis. 4. Sound velocity.

(C) ∵ Wave velocity = Wavelength × Frequency
(V) $(\lambda)_1$ (F)

∴ Wavelength $(\lambda) \propto \frac{1}{\text{Frequency (F)}}$

When the velocity is the same $(V_1 = V_2)$

∵ $F_1 = 512$ Hz. and $F_2 = 256$ Hz.

∴ $\frac{\lambda_1}{\lambda_2} = \frac{F_2}{F_1} = \frac{256}{512} = \frac{1}{2}$

3 (A) 1. (✗) 2. (✗) 3. (✗) 4. (✓)

(B) 1. It analysis the white light into 7 spectrum colours.
2. It is responsible for the appearance of the signs of puberty in male (secondary male sex characters).
3. It is used to determine the sound pitch (frequency) of an unknown tone.
4. It propagates and transfers energy in the direction of propagation.

(C) This means that the periodic time = $\frac{30}{10}$
= 3 seconds.

4 (A) 1. a 2. c 3. c 4. b

(B) 1. The amount of light passes through it will decrease.
2. The incident light ray falls perpendicular to the interface between air and water and passes without refraction, so the apparent position is the real position.
3. The area of the formed light spot increases by increasing the size of the holes.
4. Ultrasonic waves will kill and stop the action of these viruses.

(C) The absolute refractive index of diamond

$$= \frac{\text{The speed of light through air}}{\text{The speed of light through diamond}}$$

$$= \frac{3 \times 10^8}{1.25 \times 10^8} = 2.4$$

Garbia Governorate

17 Science Inspectorate

1 (A) 1. 10 Hz. 2. Infrasonic
3. crests – troughs.
4. self (auto) – mixed (cross)

(B) 1. 10^6 2. olives 3. 56 4. complete

(C) ∵ Absolute refractive index of glass

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$$

∴ The velocity of light through glass

$$= \frac{\text{Velocity of light through air}}{\text{Absolute refractive index of glass}}$$

∵ The velocity of light through air
$= 3 \times 10^8$ m/sec.

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∴ The velocity of light through glass

$= \frac{3 \times 10^8}{1.5} = 2 \times 10^8$ m/sec.

2 **(A)** 1. Tissue culture. 2. Watt/m^2.
3. Wave amplitude. 4. Pregnancy period.

(B) 1. • The odd word is : Filament.
• The other words are : Parts of the female reproductive organ of the flower (gynoecium).
2. • The odd word is : Drill.
• The other words are : Devices give musical tones.
3. • The odd word is : Rotary bee.
• The other words are : From the examples of the oscillatory motion.
4. • The odd is : 10 Hz.
• The others are : Frequencies of sonic waves.

(C) ***Look at the notebook on page (78).***

3 **(A)** 1. (✗) The stigma of air pollinated .....
2. (✗) ..... refracts far from the normal .....
3. (✓) 4. (✓)

(B) 1. a 2. b 3. b 4. c

(C) 1. Wavelength $= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$= \frac{6}{2} = 3$ m.

2. Frequency $= \frac{\text{Number of waves}}{\text{Time in seconds}}$

$= \frac{\frac{1}{2}}{0.3} = 1.66$ Hz

3. Amplitude = 1 m.

4. Wave velocity = wavelength × Frequency

$= 3 \times 1.66 = 4.98$ m/sec.

4 **(A)** 1. It is used to treat sprains and cramps by using hot water and nervous tension by using cold water.
2. It is used to determine the sound pitch (frequency) of an unknown tone.
3. It analysis the white light into 7 spectrum colours.
4. They produce sperms (male gametes) and male sex hormone known as testosterone.

(B) 1. the incident light ray.
2. the refracted light ray.
3. angle of incidence.
4. angle of refraction.

(C) 1. The sound intensity will increase by increasing the vibrating surface area by using a resonance box.
2. It appears broken.

Dakahlia Governorate

18 East Mansoura Educational Zone

1 **(A)** 1. electromagnetic – mechanical
2. $\frac{1}{2}$ sec. – 0.5×10^{-6}
3. Optical density – speed of light
4. testosterone – estrogen

(B) 1. c 2. b 3. c 4. c

(C) 1. third

2. ∵ Sound frequency (F)

$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$

∴ Number of gear teeth

$= \frac{300 \times 1 \times 60}{200} = 90$ gear teeth.

∴ The second gear (which has 90 teeth) produce this sound.

2 **(A)** 1. Longitudinal wave. 2. Receptacle.
3. Musical tone (complex tone).
4. Tissue culture.

(B) 1. 40 cm. 2. greater than
3. greater than 4. The midpiece.

(C) Periodic time = 4 × time of amplitude

$= 4 \times 0.5 = 2$ sec.

∵ Periodic time

$= \frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

∴ Number of complete oscillations

$= \frac{\text{Time in seconds}}{\text{Periodic time}} = \frac{100}{2}$

= 50 complete oscillations.

3 **(A)** 1. • The odd word is : Rotary bee.
• The rest words are : From the examples of the oscillatory motion.

2. • The odd word is : Displacement.
• The rest words are : The law of wave propagation.
3. • The odd word is : Grafting.
• The rest words are : Natural vegetative reproduction.
4. • The odd word is : Softness of voice.
• The rest words are : The signs of puberty in male.

(B) 1. (✓) 2. (✗) 3. (✗) 4. (✗)

(C) It is the maximum displacement achieved by the oscillating body away from its rest position.

4 (A) 1. If the frequency of an oscillating body is 100 Hz, the periodic time is 0.01 sec.
2. By decreasing the length of the string, the sound becomes sharp.
3. Ultrasonic waves are used in discovery of land mines.
4. The wall of the ovary develops to become pericarp and the ovule develops to become a seed.

(B) 1. Violet > Blue > Green > Yellow > Red.
where, the violet colour has the highest energy but the red colour has the lowest energy.
2. The name of the scientist is : Max planck.
3. Zero (As the reflected light ray from the mirror A falls perpendicular or mirror B).
4. figure (C) < figure (A) < figure (B).
where, figure (C) has the lowest sound pitch but figure (B) has the highest sound pitch.

(C) The scientific basis is : the sound intensity of a musical instrument increases by increasing the surface vibrating area by using are sonance box (hollow wooden box), so the strings of musical instruments are fixed on a hollow wooden box to increase their intensity.

Ismailia Governorate

19 Science Inspectorate

1 (A) 1. transverse – compression
2. watt/m^2 – decibel
3. seed – fruit
4. 4 – an amplitude.

(B) 1. • The odd word is : Stamen.
• The rest words are : Parts of the female reproductive organ (gynoecium) in flower.
2. • The odd word is : Sound wave.
• The rest words are : Electromagnetic waves.
3. • The odd word is : Vas deferens.
• The rest words are : Parts of the female reproductive system.
4. • The odd word is : Pollination.
• The rest words are : Artificial vegetative reproduction.

(C) In fig 1 : The angle of reflection = zero.
In fig 2 : The angle of reflection = 60°

2 (A) 1. a 2. a 3. c 4. d

(B) 1. It protects the inner parts of the flower specially before blooming.
2. It is used to treat sprains and cramps by using hot water and nervous tension by using cold water.
3. They are used to discover land mines.
4. It analysis the white light into 7 spectrum colours.

(C) 1. Periodic time = $\frac{\text{Time in seconds}}{\text{Number of waves}}$

$= \frac{4}{1} = 4$ sec.

2. Wave velocity = $\frac{\text{Distance covered by waves}}{\text{Time in seconds}}$

$= \frac{4}{4} = 1$ m/sec.

3 (A) 1. Self (auto) pollination. 2. Wave motion.
3. Opaque medium. 4. Two testes.

(B) 1. Maize flower. 2. Mirage.
3. Water wave. 4. Dolphin or bat.

(C) 1. Because the motion of the oscillating body around its rest point is repeated through equal intervals of time.
2. Because lightning is electromagnetic waves (light waves) but thunderis mechanical waves (sound waves) and the velocity of electromagnetic waves is much greater than that of mechanical waves.

4 (A) 1. fundamental 2. progestrone
3. oscillation 4. seven

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(B) 1. It refracts near the normal and the angle of refraction will be smaller than the angle of incidence.
2. The sound intensity increases by increasing the density of the medium.
3. They reflect in different (many) directions.
4. The light intensity increases by decreasing the distance between the source of light and a surface according to the inverse square law of light $\left(I \propto \frac{1}{d^2}\right)$.

(C) 1. Time = $2 \times 60 = 120$ sec.
2. Sound frequency (F) =

$$\frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

$$= \frac{960 \times 30}{120} = 240 \text{ Hz.}$$

Suez Governorate

20 Science Inspectorate

1 (A) 1. Sonic waves. 2. Angle of emergence. 3. Crest.

(B) 1. (✓) 2. (✗)

(C) ∵ Wave velocity = Wavelength × Frequency

∴ Frequency = 10000 Hz.

$$\therefore \text{Wavelength} = \frac{\text{Wave velocity}}{\text{Frequency}} = \frac{1500}{10000}$$

$$= 0.15 \text{ metre}$$

2 (A) 1. Because dolphins produce ultrasonic waves which have frequencies more than 20000 Hz and the man can hear sonic waves only which have frequencies from 20 to 20000 Hz.
2. Because water is a transparent medium of higher optical density than air.
3. To adhere on the insect's body.
4. Because frequency is inversely proportional to the periodic time and the periodic time is the reciprocal of the frequency $\left(\text{periodic} = \frac{1}{\text{Frequency}}\right)$.

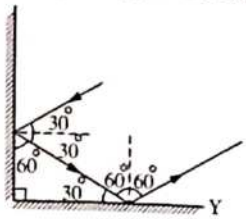
(B) 1. ***Look at the notebook on page (96).***
2. ***Look at the notebook on page (78).***

(C) 1. Male flower.
2. Bisexual (Hermaphrodite) flower.

3 (A) 1. the nucleus of the male gamete – the nucleus of the female gamete – 46
2. light refraction.
3. increase the vibrating surface area and sound intensity.
4. hertz. 5. head – tail.

(B) 1. It analysis the white light into 7 spectrum colours.
2. It is used to determine the sound pitch (frequency) of an unknown tone.

(C)



The angle of reflection on the mirror y = 60°

4 (A) 1. a 2. a 3. b 4. c

(B) 1. It means that the distance between the centres of 2 successive compressions or rarefactions of a sound longitudinal wave = 3 cm.
2. It means that the ratio between the velocity of light in air to the velocity of light through glass = 1.5

(C) ∵ Sound frequency (F) =

$$\frac{\text{Number of cycles (rotations)} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

$$\therefore \text{Number of cycles (rotations)} = \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of gear teeth}}$$

$$= \frac{300 \times 2 \times 60}{100} = 360 \text{ cycles (rotations).}$$

Port Said Governorate

21 Science Inspectorate

1 (A) 1. electromagnetic transverse – mechanical longitudinal
2. four – an amplitude.
3. uniform – non uniform
4. floral – bract.

(B) 1. periodic (oscillatory) 2. sepals.
3. placenta 4. fruit.

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

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∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth.}$$

2 (A) 1. • The odd word is : Rotary bee motion.
• The other words are : Examples of the oscillatory motion.

2. • The odd words is : Stamen.
• The other words are : Parts of the female reproductive organ (gynoecium) of the flower.

3. • The odd word is : Frequency.
• The other words are : The factors affect on the sound intensity.

4. • The odd word is : Pollination.
• The other words are : Artificial vegetative reproduction' ways.

(B) 1. (✗) 2. (✓) 3. (✗) 4. (✓)

(C) ∵ The law of wave propagation is :
Wave velocity (V)
= Wavelength (λ) × Frequency (F)

- Wavelength $= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$$= \frac{2}{1} = 2 \text{ m.}$$

- Frequency $= \frac{\text{Number of waves}}{\text{Time in seconds}}$

$$= \frac{\frac{1}{2}}{2} = \frac{1}{4} \text{ Hz.}$$

∴ Wave velocity (speed) (V) =

$$2 \times \frac{1}{4} = \frac{1}{2} \text{ m/sec.}$$

3 (A) 1. d 2. b 3. b 4. a

(B) 1. The periodic time = 4 × the time of the amplitude = 4 × 0.5 = 2 sec.

2. The angle of reflection = the angle of incidence = zero.

3. • The colour (1) is the red colour.
• The colour (2) is the violet colour.

4. The anther.

(C) A transverse wave is formed which consists of crests and troughs.

4 (A) 1. Frequency. 2. Harmonic tones.
3. Light intensity.
4. Fertilization process.

(B) 1. d 2. c 3. a 4. b

(C)

	High-pitched sound	Low pitched-sound
Frequency	It has high frequency.	It has low frequency.
Example	• Voice of woman. • Voice of sparrow.	• Voice of man. • Voice of lion.

El-Bhaira Governorate

22 Science Inspectorate

1 (A) 1. transverse – compression
2. Hertz – second. 3. Red – violet
4. seed – fruit.

(B) 1. Motion of rotary bee.
2. Ovary.
3. Anther.
4. Tuber.

(C) ∵ The absolute refractive index

$$= \frac{\text{Speed of light in air}}{\text{Speed of light in diamond}}$$

∴ The speed of light in diamond

$$= \frac{\text{Speed of light in air}}{\text{Absolute refractive index}} = \frac{3 \times 10^8}{2.4}$$

$$= 125 \times 10^6 \text{ m/sec.}$$

2 (A) 1. c 2. b 3. b 4. a

(B) 1. 4 2. violet
3. Sonic 4. Androecium

(C) *Look at the notebook page (78).*

3 (A) 1. Periodic motion. 2. Mirage.
3. Syphilis. 4. Tissue culture.

(B) 1. e 2. c 3. a 4. d

(C) 1. Amplitude = 3 m.

2. Wavelength $= \frac{\text{Distance covered by waves}}{\text{Number of waves}}$

$$= \frac{4}{2} = 2 \text{ m.}$$

3. Frequency $= \frac{\text{Number of waves}}{\text{Time in seconds}}$

$$= \frac{\frac{1}{2}}{0.2} = 2.5 \text{ Hz.}$$

4. Wave velocity = Wavelength × Frequency
= 2 × 2.5 = 5 m/sec.

CamScanner

4 **(A)** 1. Red < yellow < Green < Blue.
Where, Red has the lowest energy and blue has the highest energy.
2. Wood > Water > Carbon dioxide > air.
Where, the velocity of sound in wood is the highest but the velocity of sound in air is the lowest.
3. Calyx – Corolla – Stamen – Carpel.
4. Air < Water < Glass < Diamond.
Where, Air has the lowest optical density but the diamond has the highest optical density.

(B) a. 70° b. The angle of refraction.

(C) Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

$$= \frac{480 \times 30}{1 \times 60} = 240 \text{ Hz.}$$

El-Menia Governorate

23 Deirmwas official school for Lang.

1 **(A)** 1. d 2. c 3. d 4. b

(B) 1. Calyx 2. Crest
3. reflection 4. mitochondria

(C) 1. They are transverse waves because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs and mechanical waves because they need a medium to propagate through.
2. Because they have high ability to kill some types of bacteria and stop the action of some viruses.

2 **(A)** 1. Self (auto) pollination.
2. Light intensity. 3. Amplitude.
4. Optical density.

(B) 1. (✓) 2. (✗) 3. (✗) 4. (✓)

(C) 1. It is the fusion of the nucleus of the male gamete (sperm) with the nucleus of the female gamete (ovum) to form a fertilized ovum (zygote).
2. It is the area in the longitudinal wave at which the medium particles are of the lowest density and pressure.

3 **(A)** 1. electromagnetic – mechanical waves
2. 4 – an amplitude.
3. testosterone – estrogene
4. refraction – the normal

(B) 1. White. 2. Rotary bee motion
3. Pollination. 4. Measles.

(C) 1. It analysis the white light into 7 spectrum colours.
2. It stores the sperms.

4 **(A)** 1. c 2. d 3. a 4. b

(B) 1. Anther. 2. Corolla (petal).
3. Calyx (sepal).
4. bisexual (hermaphrodite) flower.

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth.}$$

Assiut Governorate

24 Science Inspectorate

1 **(A)** 1. electromagnetic – mechanical
2. refraction – the normal
3. testosterone – estrogen
4. transverse – compression

(B) 1. • The odd words is : White.
• The remaining words are : Spectrum colours.
2. • The odd word is : Pollination.
• The remaining words are : Artificial vegetative reproduction.
3. • The odd word is : Sound wave.
• The remaining words are : Electromagnetic waves.
4. • The odd word is : Stamen.
• The remaining words are : Parts of the female reproductive organ of the flower (gynoecium).

CamScanner

(C) 1. Because ligthning is electromagnetic waves (light waves) and thunderis mechanical waves (sound waves) and the velocity of the electromagnetic waves is much greater than that of mechanical waves.

2. Due to refraction and reflection of light in air layers which differ in the degree of temperature.

2 (A) 1. straight 2. potatoes.
3. solid. 4. higher

(B) 1. c 2. c 3. b 4. b

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth.}$$

3 (A) 1. Light refraction. 2. Tissue culture.
3. Frequency. 4. Flower.

(B) 1. (✓) 2. (✗) 3. (✗) 4. (✓)

(C) 1. It means that the ratio between the velocity of light through air to that through water = 1.33

2. It means that the distance between the centres of two successive compressions or rarefactions of a sound wave = 30 cm.

4 (A) 1. b 2. c 3. d 4. a

(B) 1. Anther.

2. Feathery like stigmas.

4. • Anthers are hanged to be easily opened by air.
• Stigmas are feathery like and sticky to catch pollen grains from air.

(C) - Longitudinal waves :

The disturbance in which the particles of the medium vibrate along the direction of wave propagation.

- Transverse waves :

The disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.

Qena Governorate

25 Science Inspectorate

1 (A) 1. transverse 2. violet
3. fruit. 4. watt/m^2.

(B) 1. Rotary bee motion. 2. Filament.
3. Thyroid gland. 4. Wood.

(C) Because they have high ability to kill some types of bacteria and stop the action of some viruses.

2 (A) 1. Amplitude. 2. Light refraction.
3. Fertilized ovum (Zygote).
4. Estrogen.

(B) 1. greater than 2. 20 : 20000
3. potatoes. 4. 6

(C) It is the time taken by an oscillating body to make one complete oscillation.

3 (A) 1. c 2. c 3. a 4. c

(B)

P.O.C	Mechanical Waves	Electromagnetic Waves
Definition :	They are waves which need a medium to propagate, where they do not propagate through vacuum.	They are waves which do not need a medium to propagate, where they propagate through vacuum.
Example :	• Water waves. • Sound waves.	• Visible light waves. • Infrared waves. • Radio waves.

(C) ∵ Sound frequency (F)

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

∴ Number of gear teeth

$$= \frac{\text{Sound frequency (F)} \times \text{Time in seconds}}{\text{Number of cycles}}$$

$$= \frac{600 \times 1 \times 60}{300} = 120 \text{ gear teeth.}$$

4 (A) 1. (✓) 2. (✓) 3. (✗) 4. (✓)

(B) 1. Maize plant. 2. Olive fruit.
3. Mirage. 4. Syphilis.

(C) It will reflect on itself.

CamScanner

2021

1 Cairo Governorate

New Cairo Zone
Manor House International School

Answer the following questions :

Question 1

A Complete the following statements :

1. The reflection of light is classified into two types which are ..... and .....
2. Fertilization is the process of fusion of the male cell nucleus with ..... nucleus to form .....
3. Waves are classified according to the ability to propagate and transfer energy into ..... and .....
4. If the angle between the incident light ray and the reflecting surface is 25°, so the angle of reflection = ...
5. The ..... hormone is responsible for the appearance of secondary sexual characteristics in female.

B Write the scientific term :

1. They are sound waves of frequencies less than 20 Hz.
2. The maximum displacement done by the oscillating body away from its original position
3. The distance covered by light in one second.
4. The time taken by the oscillating body to make one complete oscillation.
5. The outer whorl of floral leaves which consists of a group of green leaves.
6. The highest point in the transverse wave.
7. The change of light ray path when it travels from a transparent medium to another transparent medium of different optical density.

Question 2

A What's meant by ... ?

1. Sound pitch.
2. The wave.
3. Pollination in flowe
4. The oscillating body makes 200 oscillations in 2 minutes.
5. Light reflection.

B Correct the underlined words :

1. Angle of **refraction** = angle of reflection.
2. Human ear can distinguish between sounds of frequencies ranging between **10** : 20000 Hz
3. **Ovule** consists of stigma, style and ovary.
4. Particles of the medium vibrate along the direction of the wave propagation in the **transverse** wave.

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Question 3

A What happens when ... ?

1. The sound wave travels from wood to water (concerning its velocity).
2. A pollen grain falls on the stigma of a flower.
3. A light ray falls perpendicular on a reflecting surface.
4. The oscillating body passes its rest position during its movement (concerning its velocity).

B Give reasons for :

1. Sound travels in air with less intensity than its travelling in carbon dioxide gas.
2. The palm flower is unisexual.
3. The motion of the rotary bee is considered as a periodic motion, but it is not an oscillatory motion.
4. Light can travel through free space.
5. The petals of corolla are colourful and scented.
6. Man can't reproduce asexually.

Question 4

A Compare between :

Transverse wave and longitudinal wave (definition, structure and examples).

B Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when a metallic plate touches the teeth of gear. Calculate the number of the gear teeth.

2 Cairo Governorate

Basateen & Dar Al-Salam Educational Administration

Answer the following questions :

Question 1

A Choose the correct answer :

1. The result of multiplying the frequency of an oscillating body by its periodic time equals .....

a. $\frac{1}{2}$ b. $\frac{1}{4}$ c. $\frac{1}{3}$ d. 1

2. Kinetic energy = $\frac{1}{2}$ × .....

a. m/v^2 b. mv^2 c. m^2v^2 d. mv^3

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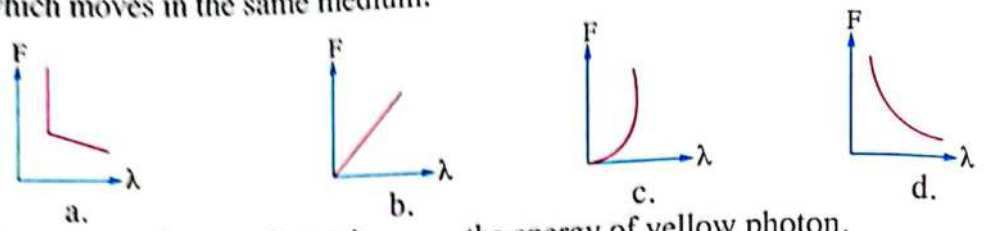
3. Radio waves .....
   a. are transverse mechanical waves.
   b. are longitudinal waves.
   c. propagate through vacuum.
   d. need a medium to propagate through.

4. The graph ..... represents the relation between frequency and wavelength for a wave which moves in the same medium.



a. b. c. d.

5. The energy of green photon is ..... the energy of yellow photon.
   a. greater than b. equal to c. less than d. no correct answer

6. If the distance between a surface and a light source decreases to its half, the light intensity of the surface .....
   a. decreases to its own fourth.
   b. decreases to its half.
   c. increases twice.
   d. increases four times.

7. The sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
   a. stronger b. sharper c. weaker d. harsher

8. Doctors use waves, which have frequency ..... to break down kidney and ureters stones.
   a. less than 20 Hz
   b. equal to 20 Hz
   c. more than 20 KHz
   d. 15 KHz

9. If the angle between the incident light ray and the reflected light ray is 90°, so the angle of reflection will be equal .....
   a. 0° b. 30° c. 45° d. 90°

10. ..... produces pollen grains.
   a. Carpel b. Style c. Stamen d. Petal

11. ..... is an example of plants which reproduce asexually by tuber.
   a. Maize b. Pumpkin c. Palm d. Potato

12. The ovary of the ..... flower contains one ovule.
   a. olive b. tomato c. bean d. pea

B **Savart's wheel rotates with a rate 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear, calculate the number of teeth of the gear.**

Question 2

A **What is meant by ... ?**

1. The wavelength of a sound wave = 30 cm.
2. The angle of reflection of a light ray equals 45°

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C Cross the odd word out, then write the scientific term of the rest :

1. Pendulum motion / Spring motion / Rotary bee motion / Stretched string motion.
2. Sound wave / Light wave / Radio wave / Infrared wave.
3. Milk / Cotton / Air / Human skin.
4. Tulip / Petunia / Wallflower / Palms.
5. Androecium / Calyx / Corolla / Root.

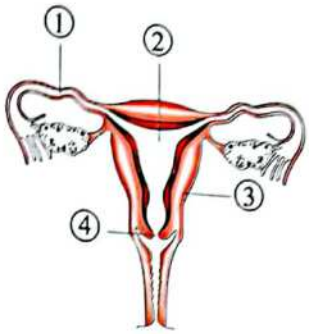
C These are values of absolute refractive index of five substances :

(1.5 – 0.8 – 1.8 – 1.2 – 1.3)

Which of them is wrong ? Why ?

D In the opposite figure :

1. Write the labels from no. ① to ④.
2. What is the function of no. ② ?

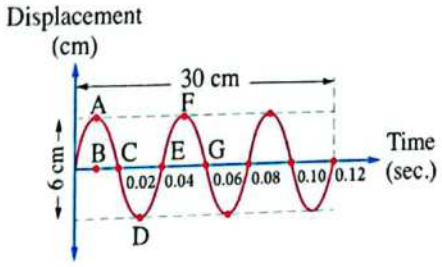


Question 3

A Write the scientific term :

1. The reproduction of some plants by parts of the root, stem or leaves.
2. The cell resulting from the fusion of the pollen grain and the ovum nuclei.
3. The ability of the medium to refract light.
4. The reflection in which light rays recoil in many different directions when falling on the rough surface.
5. The amount of light that falling perpendicular to a unit area of a surface in one second.
6. The maximum displacement of the medium particles away from their rest points.
7. The property of sound by which the human ear can distinguish between sharp and harsh sounds.
8. The number of complete oscillations produced by the oscillating body in one second.

B From the opposite figure, choose the correct answer :



1. The periodic time = ...
   a. 0.02 sec. b. 0.4 sec.
   c. 0.04 sec. d. 0.4 m.
2. Frequency = ...
   a. 0.04 Hz. b. 25 Hz.
   c. 2.5 Hz. d. 0.5 m.
3. The amplitude = ...
   a. 0.2 sec. b. 0.4 sec. c. 6 cm. d. 3 cm.
4. Number of complete oscillations is .....
   a. 1 b. 3 c. $2\frac{1}{2}$ d. 4

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C Which of the following flowers can't form fruits and why ?

(1)

(2)

(3)

Question 4

A Complete the following sentences :

1. The velocity of the oscillating body reaches its ..... value when it passes its rest positio
2. Transverse wave consists of ..... and .....
3. The human ears can't detect the sound waves of frequencies less than ..... and that o frequencies more than .....
4. The fundamental tone has lower ..... and higher ..... than the harmonic tones.
5. The ratio between frequency of red photon to the frequency of violet photon is ..... than one.
6. When light travels from a medium of ..... optical density to another of ..... optical density, it refracts far from the normal line.
7. Types of pollination are ..... and .....

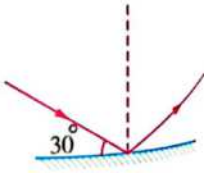
B Calculate the absolute refractive index of diamond given that the velocity of light throug it is 1.25×10^8 m/s. knowing that the velocity of light through air is 3×10^8 m/s.

C Give reasons for :

1. Auto pollination can't happen in sunflower.
2. The light ray that falls perpendicular on a reflecting surface, reflects on itself.
3. The energy of red light photon is less than the energy of violet light photon.
4. The use of ultrasonic waves in milk sterilization.

D Look at the following figures, then complete :

1. Angle of reflection = ...



2. The relation between frequency and periodic time is ..... relation.

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3 Cairo Governorate

El-Zeitoun Educational Zone
El-Ma'aref Language School

Answer the following questions :

Question 1

A Complete the following statements :

1. Absolute refractive index is the ratio between ..... to .....
2. Angle of ..... is the angle between the refracted light ray and .....
3. The measuring unit of noise intensity is ....., while the measuring unit of the periodic time is .....
4. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.

B Write one function for each of the following :

1. The glass prism.
2. Ultrasonic waves.
3. Jacuzzi.
4. Ear plugs.

C Correct the underlined words :

1. The angle of incident of a light ray is **greater than** the angle of reflection.
2. The fish is seen higher than its real position due to **total internal reflection**.
3. **Oscillatory** motion is the motion that is repeated regularly in equal periods of time.
4. **Bract** is a group of flowers arranged on the same axle.
5. **Ovaries** produce sperms and male hormone.

Question 2

A Write the scientific term :

1. A new method to produce large numbers of plants from a small part of it.
2. The ability of the medium to refract light ray.
3. It is the motion produced as a result of the vibration of the particles of the medium in a certain moment and in a definite direction.
4. It is an external stimulus that affects the ear and causes hearing.
5. The process of transfer pollen grains from the flower anther to the stigma.
6. A phenomenon that appears on the desert at noon especially in summer.
7. A tool is used to determine the pitch of an unknown tone.
8. A group of green leaves each of them is called sepal.

B Give reasons for :

1. Olive fruit contains only one seed, while bean fruit contains more than one seed.

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2. When a light ray is incident perpendicular to the reflecting surface, it reflects on itself.
3. The waves produced due to vibration of strings are transverse mechanical waves.
4. The fallopian tubes are lined with cilia.

C Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of one gear, calculate the number of teeth of the gear.

Question 3

A Compare between :

Androecium and gynoecium. (two points only)

B What is meant by ... ?

1. The wavelength of a sound wave is 25 cm.
2. Amplitude.
3. Sound intensity.

C Choose the correct answer :

1. The result of multiplying the frequency by its periodic time equals .....

a. 0.5 b. 0.01 c. 1 d. 0.1

2. Doctors use waves of a frequency ..... to break down kidney and ureter stones.

a. more than 20 Hz b. less than 20 KHz
c. 20 Hz d. more than 20 KHz

3. The produced fruit by grafting belongs to the type of the .....

a. scion. b. cut. c. stock. d. bud.

4. The human skin is considered as a/an ..... medium.

a. transparent b. opaque c. translucent d. no correct answer

5. Fertilization occurs when ..... is formed.

a. embryo b. zygote c. ovum d. corolla

6. Plank's constant = the photon energy divided by photon .....

a. frequency. b. density. c. wavelength. d. amplitude.

7. A pencil seems broken when it is placed in a glass cup of water due to ..... of light.

a. critical angle b. reflection c. rarefaction d. refraction

Question 4

A Put (✓) or (✗) and correct the wrong ones :

1. The pendulum motion is an example of wave motion. ( )

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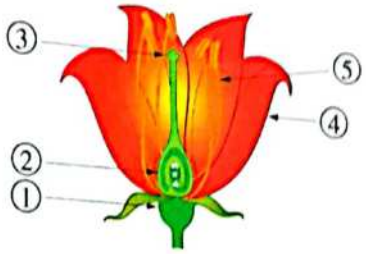
2. The typical flower contains three whorls. ( )
3. After fertilization, the ovary develops to become a flower. ( )
4. Bats, dogs and dolphins can hear ultrasonic waves. ( )
5. Drill is an example of the musical tones. ( )

B What are the factors affecting the sound intensity ? (three points only)

C From the opposite figure, answer the questions :

1. Write the labels on it.
2. Mention the sex of the flower.



4 Cairo Governorate

Abdeen Educational Directorate
Patriarchal College

Answer the following questions :

Question 1

A Complete the following statements :

1. In the transverse wave, the particles of the medium vibrate ..... the direction of wave propagation.
2. In the flower, the corolla consists of coloured leaves, each leaf is called .....
3. The complete oscillation includes ..... successive displacements, each of them is called .....
4. The ratio between the velocity of light through air to the velocity of light through another transparent medium is known as .....
5. The angle of ..... is the angle between the refracted light ray and the ..... at the point of incidence on the separating surface.
6. The outer whorl of the flower is the ..... and it consists of leaves called .....

B What happens when ... ?

1. Fertilization process is completed (concerning the ovary and the ovule of the flower).
2. The frequency of a wave is doubled (concerning the wavelength) when the wave velocity is constant.
3. A light ray falls perpendicular on a reflecting surface.
4. Incidence of a white light ray on one face of a triangular glass prism.

C If the absolute refractive index of water is $\frac{4}{3}$ and the velocity of light through water is 2.25×10^8 m/sec., calculate the velocity of light through air.

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Question 2

A Write the scientific term :

1. The ability of the medium to refract light.
2. The flower which contains both androecium and gynoecium.
3. The motion produced as a result of the vibration of the particles of the medium at a certain moment in a definite direction.
4. The motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.
5. They are sound waves of frequencies less than 20 Hz.
6. The characteristic by which the human ear can distinguish between sounds from different sources even if they are equal in intensity and pitch.

B What's meant by ... ?

1. The oscillating body makes 540 oscillations in a minute and a half.
2. Fertilization process. 3. Mirage phenomenon. 4. Harmonic tones.

C Mention the mathematical relation between :

1. Periodic time and number of complete oscillations made by an oscillating body in a certain time.
2. Sound intensity and the distance between the ear and the sound source.

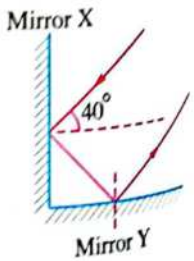
Question 3

A Give reasons for :

1. Pea fruit contains more than one seed.
2. Wood doesn't allow the passage of light through it.
3. Man sometimes has to pollinate palm trees.
4. Stigmas of some flowers are feathery like and sticky.

B Two sound waves, the first of wavelength 1.7 m and the other wave of wavelength 20 m. If the velocity of sound through air is 340 m/sec., which of the two waves is audible and which is non-audible ? Why ?

C According to the opposite figure, calculate the angle of reflection of the ray falls on mirror (Y).



Question 4

A Compare between each of the following :

1. The difference between auto pollination and self pollination (concerning definition and reasons).

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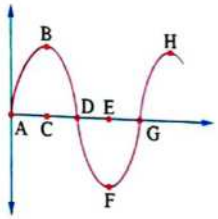
2. The frequency and periodic time (concerning definition and the rule).
3. Mechanical waves and electromagnetic waves (concerning definition and speed).

B Choose the correct answer :

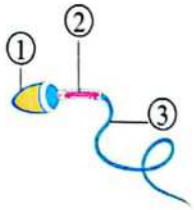
1. Pollination in coloured flowers takes place by .....
   a. insects. b. man. c. water. d. air.
2. The sound velocity is measured in .....
   a. Hertz b. m/sec. c. decibel d. metre
3. The pollen tube contains .....
   a. two male nuclei only. b. two male nuclei and one tube nucleus.
   c. two male nuclei and two tube nuclei. d. one male nucleus and two tube nuclei.
4. The maximum displacement made by the oscillating body away from its original position is .....
   a. amplitude. b. frequency. c. periodic time. d. complete oscillation.
5. The distance between two successive troughs or two successive crests in the transverse wave is .....
   a. wavelength. b. amplitude. c. frequency. d. wave velocity.

C Study the opposite figure, then answer the following questions :



1. The wavelength is the distance between points .....
2. The amplitude of the wave is the distance between the points ..... or .....
3. What is the frequency of this wave if it takes 0.2 sec. to make one complete wave ?

D The opposite figure represents a sperm.
Answer the questions :



1. Label the numbers.
2. What is the function of number ③ ?

5 Cairo Governorate

Heliopolis Educational Zone
Patriarchal College

Answer the following questions :

Question 1

A Complete the following statements :

1. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
3. ..... is the male reproductive organ in the plant, while ..... is the female reproductive organ in the plant.
4. Harmonic tones are lower in ..... and higher in ..... than fundamental tones.

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B Give a reason for each of the following :

1. Vegetative reproduction is considered asexual reproduction.
2. The periodic time decreases as the number of complete oscillations increases.
3. The pen seems broken when it is put in a glass of water.
4. The use of ultrasonic waves in milk sterilization.

C Sound waves of frequency 400 Hz in air and wavelength 85 cm, calculate the velocity of these waves.

Question 2

A Write the scientific term of each of the following :

1. Short stem where the leaves are developed and modified into reproductive organs.
2. The measuring unit of noise intensity.
3. It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
4. The flower that has four whorls.
5. The fusion of one of the male nuclei with the ovum.

B Compare between each of the following :

1. Mechanical waves and electromagnetic waves.
2. Grafting by attachment and grafting by wedge.

C Define :

1. The wavelength of longitudinal wave.
2. Amplitude.

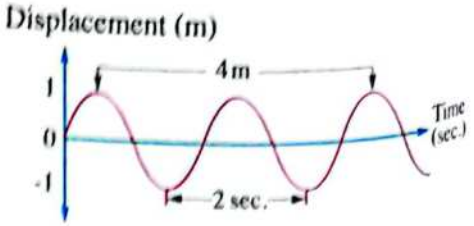
D Choose the correct answer :

1. If the frequency of red colour is 4×10^{12} Hz, so the frequency of the violet colour is ..... $\times 10^{12}$ Hz.
   a. 1.5 b. 3.5 c. 4 d. 7.5
2. The human skin is considered as a/an ..... medium.
   a. transparent b. opaque c. translucent d. no correct answer
3. If the light speed in air is higher than that in another transparent medium, so the refractive index is .....
   a. zero b. 1 c. more than 1 d. less than 1
4. The periodic time of a tuning fork which produces 240 vibrations in one minute is equal .....
   a. 1 sec. b. 4 sec. c. 0.5 sec. d. 0.25 sec.
5. All of the following are parts of female reproductive system except .....
   a. vas deferens. b. uterus. c. ovary. d. fallopian tube.

Question 3

A From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



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C What is meant by ... ?

1. Angle of incidence of a light ray = 30°
2. The number of complete oscillations made by an oscillating body in 10 seconds is 500 complete oscillations.
3. Mixed pollination.

C Mention the importance of each of the following :

1. Calyx in flower.
2. Savart's wheel.
3. Ear plugs.

C Mention only one difference between :

1. Light reflection and refraction.
2. Natural vegetative reproduction and artificial vegetative reproduction.

Question 4

A If the frequency of the sound produced when a metallic plate touches a gear in Savart's wheel is 100 Hz, calculate the number of the gear teeth if the wheel rotates with speed 200 cycles/minute.

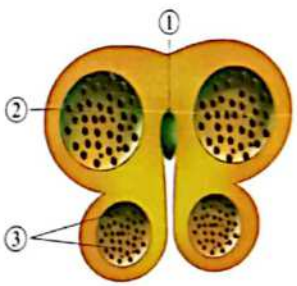
C What happens when ... ?

1. Decreasing the amplitude of the sound source to its half (concerning the sound intensity).
2. A pollen grain falls on a stigma.
3. The seminal fluid is not alkaline.

C Correct the underlined words in the following statements :

1. The produced tone from a tuning fork is called **complicated tone**.
2. The measuring unit of sound intensity is **m/sec**.
3. **Growing** prevents living organisms from extinction.
4. **Rainbow** phenomenon takes place on desert roads at noon specially in summer.
5. Each **stamen** consists of stigma, style and ovary.
6. Coloured **sepals** attract insects for pollination.

C From the opposite figure answer the following :



1. This figure represents a cross section in an .....
2. Label the figure.

C What does each relationship indicate ?

1. $\frac{\text{Velocity of wave propagation}}{\text{Wave frequency}}$
2. Planck's constant × Photon frequency.

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6 Cairo Governorate

East Nasr City Educational Zone
El Seddeek Language School

Answer the following questions :

Question 1

A Write the scientific term :

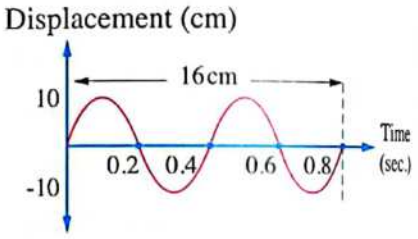
1. The distance covered by the wave in one second.
2. A short stem whose leaves are modified to achieve reproduction in plant.
3. Non-audible waves whose frequencies are less than 20 Hz.
4. Maximum displacement of the oscillating body away from its rest position.
5. A natural phenomenon that occurs on desert roads at noon where objects seem as if they have inverted images over water surface.
6. The transfer of pollen grains from the anthers of a flower to the stigmas of another flower of the same kind.

B Mention the importance of :

1. Ultrasonic waves in military field.
2. Calyx of the flower.

C From the opposite figure, calculate :

1. The amplitude.
2. Periodic time.
3. The frequency.
4. Wave velocity.



Question 2

A Choose the correct answer :

1. If the distance between the centre of the fifth compression and the centre of the ninth compression of a longitudinal wave is 4 m, then the wavelength of this wave is .....
   a. 9 m. b. 1.2 m. c. 1.5 m. d. 1 m.
2. The measuring unit of noise intensity is .....
   a. decibel. b. Hz. c. watt/m^2. d. metre.
3. All of the following plants reproduce sexually except .....
   a. bean plant. b. pea plant. c. potato. d. olive plant.
4. When the distance between the sound source and the ear is doubled, the sound intensity .....
   a. decreases to its half. b. increases twice.
   c. decreases to its quarter. d. increases four times.
5. The male reproductive organ in the flower is .....
   a. gynoecium. b. corolla. c. calyx. d. androecium.

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6. Two gears of Savart's wheel rotate at a same velocity, if the number of teeth of the first gear is 90 teeth and the number of the second is 60 teeth, then the ratio between their frequencies is .....
a. 1 : 2 b. 3 : 2 c. 2 : 1 d. 5 : 2

7. Artificial vegetative reproduction by cutting can be done in .....
a. peach. b. palm. c. grapes. d. olive.

8. If a light ray falls from water to air with an angle of incidence 35°, then the angle of refraction will be .....
a. 47.5° b. 35° c. 28.5° d. 29.5°

B What happens in the following cases ... ?

1. The pollen grain combines with the egg cell of the ovule of a plant.
2. The frequency of an oscillating body increases (concerning its periodic time).

C A gear of Savart's wheel rotates 60 cycles in half minute, If the frequency of the sound produced is 200 Hz, calculate the number of teeth of that gear.

Question 3

A Give reasons for :

1. The sound is heard from all directions that surround the sound source.
2. The refractive index of diamond is greater than one.
3. Palm flower is unisexual.
4. The oscillatory motion is considered as a periodic motion.
5. We see lightning before hearing thunder.
6. The presence of the testes in human male outside the body in the scrotal sac.

B What is meant by ... ?

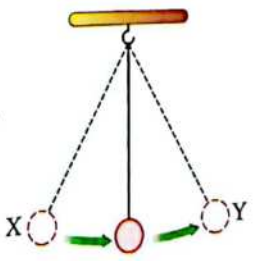
1. Complete oscillation.
2. Fertilization.
3. Ultrasonic waves.
4. Regular reflection of light.

C If the absolute refractive index of water is 1.333, calculate the light speed through water, given that the light speed through air is 3×10^8 m/s.

Question 4

A Complete the following statements :

1. ..... waves are used in breaking the stones of kidneys and ureters.
2. When the opposite oscillating body covers the distance from (X) to (Y) in 0.2 second so its periodic time = ... sec.
3. Light is ..... waves but sound is ..... waves.
4. ..... is a transparent medium of light but wood is a(an) ..... medium.
5. The ovule inside the ovary is converted into ..... after fertilization.
6. Each ovary produces one ripe ovum every ..... days in exchange with the other ovary.



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B Put (✓) or (✗) :

1. The energy of light = Constant × Wavelength. ( )
2. When shooting a bullet at the top of a mountain then shooting at the base, the sound intensity at the top of the mountain is less than that at its base. ( )
3. Androecium in the flower is responsible for producing pollen grains. ( )

C Compare between each of the following :

1. Red light and violet light (according to their energy).
2. Longitudinal wave and transverse wave (according to the vibration of particles only).

7 Giza Governorate — 6th of October Directorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. All of the following are factors affecting sound intensity except .....
   a. amplitude of vibration. b. frequency.
   c. medium density. d. wind direction.
2. A medium that prevents light to pass through it is ..... medium.
   a. transparent b. translucent c. opaque d. no correct answer
3. The submerged object in water as a fish is seen in an apparent position slightly above its real position due to ..... of the light rays.
   a. refraction b. reflection c. analysis d. total internal reflection
4. Reproduction by ..... is used only between plants of highly similar to each other, like orange and naring.
   a. cutting b. grafting c. tissue culture d. tubers
5. From the methods of cross pollination is .....
   a. air. b. insects. c. human. d. all of them.
6. White light analyzes into ..... spectrum colours.
   a. 3 b. 5 c. 7 d. 9
7. The result of multiplying frequency of an oscillating body by its periodic time equals .....
   a. variable value. b. negative value. c. constant value. d. one.
8. The measuring unit of wave velocity is .....
   a. metre. b. metre/sec. c. Hz. d. sec.
9. The motion resulting from the vibration of the medium particles at a certain moment in a specific direction is called ..... motion.
   a. oscillatory b. wave c. transitional d. circular

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C Mention the sex of each of the following flowers :

(a)

(b)

(c)

D Calculate the frequency of an oscillating body that makes 300 complete oscillations in 100 seconds.

Question 2

A Correct the underlined words in the following statements :

1. **Sonic** waves are used in sterilization of milk.
2. From the types of natural vegetative reproduction is **tissue culture**.
3. Frequency of infrasonic waves is less than **2000** Hz.
4. White light travels in **curved** lines.
5. If the distance between the first crest and the second crest on the wave propagation is 10 cm, then the wavelength of this wave is **20** cm.
6. The movement of the clock pendulum is an example of **wave motion**.

B Calculate the number of the gear teeth if Savart's wheel rotates with a velocity of 300 cycles in one minute, given that the frequency is 100 Hz.

C Give reasons for :

1. We see lightning before hearing thunder.
2. The quantum of energy of violet light is greater than the quantum of energy of red light.
3. Flowers pollinated by insects produce coarse pollen grains.
4. The sperm has a long and thin tail.

Question 3

A Complete the following statements :

1. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
2. Complete oscillation consists of ..... displacements (amplitudes).
3. Max Planck proved that the energy of light wave consists of energy quanta known as .....

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4. Reflection of light is classified into two types which are ..... reflection and ..... reflection.
5. The absolute refractive index of any medium is a ratio between the velocity of light through ..... to the velocity of light through .....
6. The calyx of the flower consists of green leaves called .....
7. Stamen consists of anther and .....
8. The ..... hormone in males is responsible for the appearance of secondary sexual characters.

B What happens to each of the following after fertilization ... ?

1. Ovary.
2. Ovule.

C Compare between longitudinal wave and transverse wave. (one point only)

Question 4

A Write the scientific term :

1. The maximum displacement done by an oscillating body away from its rest position.
2. The periodic motion of an oscillating body around its rest point, where the motion is repeated through equal intervals of time.
3. Waves that need medium to travel and can't travel in space.
4. A property by which the human ear can distinguish between strong and weak sounds.
5. Rebounding of light waves in the same medium due to meeting a reflecting surface.
6. Light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.
7. An angle between the incident light ray and the normal at the point of incidence on the interface.
8. The transfer of pollen grains from the anther of a flower to the stigma of the same flower.

B In this figure, find :

1. Angle of incidence.
2. Angle of reflection.

C What is meant by ... ?

1. Periodic time.
2. Fertilization.

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Answer the following questions :

Question 1

A Complete the following :

1. The measuring unit of sound intensity is ..... , while that of noise intensity is .....
2. The cell produced from the fusion of pollen grain with the ovum nuclei is called .....
3. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
4. Sound ..... is the property by which the ear can distinguish between harsh and sharp sounds.
5. The frequency of sonic waves ranges between ..... Hz to ..... Hz.
6. The sound intensity is inversely proportional to ..... , while sound pitch is directly proportional to .....

B Compare between the following :

1. Mechanical waves and electromagnetic waves (concerning the medium).
2. Self pollination and mixed pollination.

Question 2

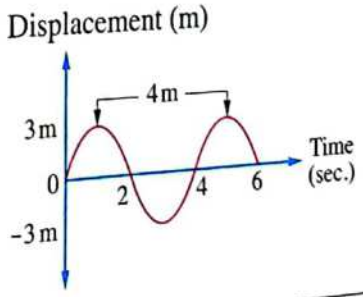
A Write the scientific term :

1. A disturbance that propagates and transfers energy along the direction of propagation.
2. The maximum displacement that is done by a vibrating body away from its original position.
3. A short stem where leaves are modified to perform reproduction.
4. The angle between the emergent light ray and the normal.
5. Distance covered by the wave in one second.
6. Angle of incidence = Angle of reflection.

B Savart's wheel has a metallic plate with a gear having 40 teeth, if the time taken by the wheel to make 400 rotations is 4 seconds, find its frequency.

C From the opposite figure, find :

1. Amplitude.
2. Periodic time.
3. Frequency.
4. Wavelength.
5. Wave velocity.
6. Type of this wave.



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Question 3

A Choose the correct answer :

1. The doctors use waves with a frequency ..... to break down kidney stones.
   a. less than 20 Hz b. 20 Hz c. more than 20 KHz
2. Sound intensity in air is ..... that in carbon dioxide.
   a. less than b. more than c. equal to
3. The absolute refractive index of any material is always ..... one.
   a. less than b. more than c. equal
4. In ..... reflection, the reflected rays are reflected in many directions.
   a. uniform b. irregular c. both (a) and (b)
5. The periodic time of a source that makes 540 oscillations/minute is equal to .....
   a. 9 seconds. b. $\frac{1}{9}$ second. c. $\frac{1}{9}$ oscillation/second.
6. If the angle between the incident light ray and the reflected light ray is 40°, so the angle of reflection equals .....
   a. 90° b. 80° c. 20°

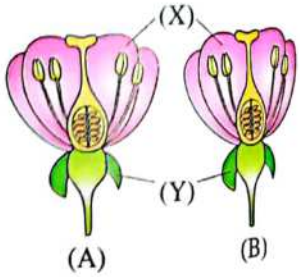
B What happens to each of the following ... ?

1. A light ray falls perpendicular on a reflecting surface.
2. Ovary after fertilization.
3. A light ray travels from a transparent medium of high optical density to another of lower optical density.

C What is meant by inverse square law of sound ?

Question 4

A The opposite figure shows two flowers of two plants from the same species :



1. What is the name of parts (X) and (Y) ?
2. Mention the function of parts (X) and (Y) ?
3. What is the sex of flowers (A) and (B) ?

B Give reasons for :

1. The stigmas of air pollinated flowers are feathery like and sticky.
2. The oscillatory motion is considered as a periodic motion.
3. We see lightning before hearing thunder.
4. Piano sound differs from that of violin even if they have the same pitch and intensity.

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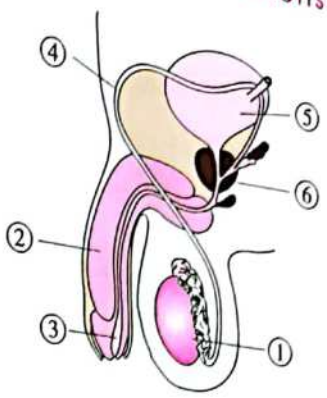
C Study the opposite figure, then answer the following questions :

1. What does the figure represent ?
2. Label the figure.



9 Giza Governorate

El-Haram Directorate
Al-Mostakbal Modern Language School

Answer the following questions :

Question 1

A Complete the following :

1. The complete oscillation includes ..... displacements, each is called .....
2. The frequency of sonic waves ranges between ..... Hz to ..... KHz.
3. The voice of women is ..... pitched, while the voice of men is ..... pitched.
4. Types of pollination are ..... and .....

B What is meant by ... ?

1. Fertilization.
2. Periodic motion.
3. The first law of light reflection.

C Calculate the periodic time of a source that makes 600 oscillations in one minute.

Question 2

A Choose the correct answer :

1. All of the following are factors affecting sound intensity except .....
   a. amplitude of vibration.
   b. medium density.
   c. frequency.
   d. wind direction.
2. One amplitude is ..... of a complete oscillation.
   a. four times
   b. quarter
   c. half
   d. equal one
3. The outer whorl of the flower is called .....
   a. petal.
   b. calyx.
   c. stamen.
   d. corolla.
4. All of these sounds are of uniform frequency except the sound of .....
   a. piano.
   b. violin.
   c. loudspeakers.
   d. guitar.
5. The highest point in the transverse wave is called .....
   a. trough.
   b. compression.
   c. crest.
   d. rarefaction.

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6. The distance covered by the wave in unit time is called .....

a. wavelength. b. wave velocity. c. sound velocity. d. light velocity.

B Compare between the following :

Regular reflection and irregular reflection.

C Calculate the frequency of a musical tone similar to the frequency produced by Savart's wheel rotates with a velocity of 120 cycles in a minute given that the number of the gear's teeth is 30 teeth.

Question 3

A State the type of each of the following flowers and give reason :

(a) (b) (c)

B Give reasons for :

1. Clear glass is a transparent medium.
2. The human ear distinguishes between sounds from different sources even if they are equal in intensity and pitch.
3. The absolute refractive index of any transparent medium is always greater than one.
4. Palm flowers are unisexual.
5. The light ray that falls perpendicular on a reflecting surface, reflects on itself.

C Mention the function of the following :

1. Androecium.
2. Ultrasonic waves in medical and military fields.
3. Fallopian tube.
4. Testis.

Question 4

A Write the scientific term :

1. The transfer of pollen grains from the anther of one flower to the stigma of the same flower.
2. The measuring unit of sound intensity.
3. The number of complete oscillations made by the body in one second.
4. It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times.
5. The maximum displacement made by an oscillating body away from its point of rest.
6. The change of light path when it travels from a transparent medium to another.

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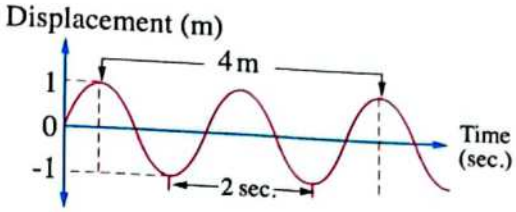
B Compare between the following :

Mechanical waves and electromagnetic waves.

C From the opposite figure, calculate :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



10 Giza Governorate

Dokki Zone
Orouba Language School

Answer the following questions :

Question 1

Choose the correct answer :

1. If the periodic time of an oscillatory body is 0.1 sec., so the number of complete oscillations in one minute is .....
   a. 10 b. 600 c. 120 d. 60
2. If the distance between the centre of the third compression and the fifth compression on the wave propagation is 20 cm, the wavelength of this wave is ..... cm.
   a. 40 b. 20 c. 10 d. 5
3. The sound velocity is the greatest through .....
   a. vacuum. b. solids. c. liquids. d. gases.
4. All of the following are electromagnetic waves except ..... waves.
   a. light b. sound c. infrared d. radio
5. The voice of Adam differs from that of Sara because they are different in .....
   a. age. b. intensity. c. pitch. d. kind.
6. The sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
   a. stronger b. sharper c. weaker d. harsher
7. All of the following are factors affecting sound intensity except .....
   a. amplitude of vibration. b. medium density.
   c. frequency. d. wind direction.
8. If the angle between the incident light ray and the reflecting surface is 50°, so the angle between the incident ray and the reflected ray equals .....
   a. 40 b. 50 c. 60 d. 80
9. The quantum of energy of green light is ..... the quantum of energy of yellow light.
   a. greater than b. equal to c. smaller than d. no correct answer

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10. ..... media do not allow light to pass through it.
    a. Transparent b. Translucent c. Opaque d. no correct answer
11. The floral whorl which is absent in the female flower is .....
    a. calyx. b. corolla. c. androecium. d. gynoecium.
12. The innermost whorl of the male flower is .....
    a. gynoecium. b. androecium. c. corolla. d. calyx.

Question 2

A Give reasons for :

1. Sound waves are mechanical waves, while radio waves are electromagnetic waves.
2. Sound travelling in air has less intensity than that travelling in carbon dioxide.
3. Man cannot hear all sounds produced by dolphins.
4. The ray falling perpendicular on the separating surface between two media different in the optical density doesn't refract.
5. Occurrence of mirage phenomenon in desert region at noon.
6. Light can travel through free space.

B Write the scientific term :

1. An oval-shaped gland that produces male cells.
2. The period between fertilization and delivery.

Question 3

A What happens when ... ?

1. You throw a stone in water.
2. You look at a pencil partially immersed in water.
3. The syphilis infected person is not treated.

B Calculate the number of complete oscillations that are made by a body in 2 minutes if its frequency 6 Hz.

C What is the importance (uses) of ... ?

1. Ultrasonic waves. 2. Triangle glass prism.

Question 4

A Compare between the following :

1. Transverse waves and longitudinal waves.
2. Regular reflection and irregular reflection.

B What is meant by ... ?

1. First law of reflection. 2. Visible light. 3. Mirage.

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C Mention the name of the figure and complete the labels on the drawing :

11 Alexandria Governorate

Middle Zone
Science Inspectorate

Answer the following questions :

Question 1

A Complete the following statements :

1. The measuring unit of sound intensity is .....
2. As the amplitude increases, the sound intensity .....
3. Infrasonic waves are sound waves of frequencies less than ..... Hz.
4. When a light ray falls perpendicular on a reflecting surface the angle of reflection equals .....
5. In the flower, a group of stamens forms .....
6. The natural vegetative reproduction in sweet potatoes is done by .....

B Cross out the odd word then mention the scientific term of the rest :

1. Sound waves / Light waves / Infrared waves / Radio waves.
2. Stigma / Filament / Ovary / Style.
3. Ovary / Epididymis / Uterus / Vagina / Cervix.

C Compare between the following :

1. Auto pollination and mixed pollination in plants (concerning the definition).
2. Regular reflection and irregular reflection (concerning the texture of the reflecting surface and the direction of the reflected rays).

Question 2

A Write the scientific term of each of the following :

1. The point of the lowest density and pressure in the longitudinal wave.
2. A natural phenomenon that appears on desert in summer at noon as a result of light reflection and refraction.
3. The colour which has the maximum deviation in spectrum colours.
4. Bodies don't allow the passage of light through them.
5. A new method to produce large numbers of plants from small parts of it.
6. The cell resulting from the fusion of the pollen grain nucleus with the egg nucleus.

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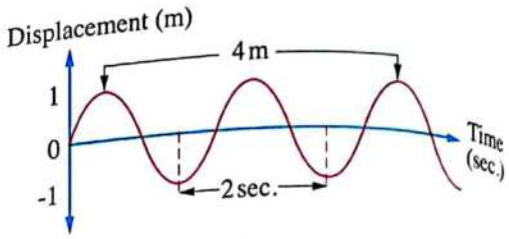
B From the opposite figure, find :



1. Amplitude.
2. Periodic time.
3. Frequency.
4. Wavelength.

C What happens ... ?

1. When a light ray passes from air to glass.
2. To the ovary after fertilization in plant.

Question 3

A Choose the correct answer :

1. The clock pendulum motion is an example of ..... motion.
   a. wave b. oscillatory c. circular d. one direction
2. One amplitude equals ..... of a complete oscillation.
   a. $\frac{1}{2}$ b. $\frac{1}{3}$ c. $\frac{1}{4}$ d. $\frac{1}{8}$
3. Sound of frequency 200 Hz is ..... than sound of frequency 100 Hz.
   a. weaker b. sharper c. harsher d. stronger
4. The sound velocity is maximum in .....
   a. vacuum. b. gases. c. liquids. d. solids.
5. The swollen part upon the pedicle on which the floral whorls exist is called .....
   a. stem. b. receptacle. c. bract. d. leaves.
6. Grafting by attachment can be carried to the ..... trees.
   a. grapes b. sugar cane c. roses d. mango

B Mention the use or importance of the following :

1. Ultrasonic waves in medical field.
2. Jacuzzi.
3. Triangular glass prism.
4. Corolla.

C Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear. Calculate the number of gear teeth.

Question 4

A Correct the underlined words :

1. The relation between frequency and wavelength is **constant** relation.
2. The light travels in **curved** lines.
3. The absolute refractive index of any material is always **smaller than** one.
4. In pollination by **water** the flower has feathery like and sticky stigma.
5. Olive fruit is a **multi-seed** fruit.
6. Buds buried inside the soil grow to form the **shoot** system.

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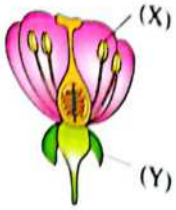
B Give reasons for :

1. The piano sound differs from that of the violin even if they have the same sound properties.
2. On doubling the distance between the light source and the surface, the light intensity decreases.

C In the opposite figure :

1. Mention the name of parts (X) and (Y).
2. What is the function of part (Y) ?
3. Identify the sex of this flower.



12 Alexandria Governorate — El-Agamy Educational Zone

Answer the following questions :

Question 1

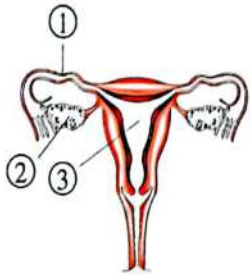
A Complete the following statements :

1. The measuring unit of noise intensity is ..... , while ..... is the measuring unit of the amplitude.
2. Light reflection is classified into ..... and .....
3. After fertilization, the ovary grows forming the ..... , while the ovule is converted into .....
4. The glass prism is used to analyse the ..... light into ..... colours.

B Give reasons for :

1. We see lightning before hearing thunder.
2. Occurrence of mirage phenomenon.
3. The petals of corolla are colourful and scented.

C Look at the opposite diagram, then answer the following :



1. What is the name of this system ?
2. What is the number of structure which secretes progesterone ?
3. What is the number of structure in which fertilization occurs ?
4. What is the number of structure in which the fetus is growing ?

Question 2

A Choose the correct answer :

1. If the angle between the incident light ray and the reflected light ray is 30° so, the angle of reflection is .....

a. 30 b. 15 c. 60 d. 40

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2. Pollen grains are produced from the .....
a. ovary. b. calyx. c. anther. d. gynoecium.

3. The periodic time of a tuning fork which makes 240 waves in one minute equals .....
a. 1 sec. b. 4 sec. c. 0.5 sec. d. 0.25 sec.

4. ..... waves are longitudinal waves.
a. Water b. Light c. Sound d. Radio

B Mention one function of ... ?

1. Jacuzzi. 2. Calyx in flower. 3. Savart's wheel. 4. Tissue culture.

C What happens if ... ?

1. A light ray falls perpendicular to the interface between two different transparent media.
2. Light falls on a flint glass.
3. The anther and the ovary don't grow at the same time.

Question 3

A Write the scientific term :

1. The ability of the medium to refract light.
2. The flower that contains the four whorls.
3. Changing the path of light when it travels between two different transparent media.
4. A property of sound by which ears can distinguish between sharp and rough sounds.

B Calculate the number of gear's teeth when Savart's wheel makes 600 cycles in one minute to produce a tone of frequency 300 Hz.

C Give one example for :

1. Unisexual flower.
2. Fruit has many ovules.
3. Transparent medium.
4. Natural vegetative reproduction.

Question 4

A Mention one difference between :

1. Transverse waves and longitudinal waves.
2. Self pollination and cross pollination.
3. Infrasonic waves and ultrasonic waves.

B Correct the underlined words :

1. The movement of the clock pendulum is an example of <u>wave motion</u>.

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2. The sound intensity **decreases**, when the source of sound touches an empty box.
3. **Yellow** colour is the first colour in spectrum colours.
4. Each carpel consists of ovary, **filament** and stigma.

D Calculate the wave velocity of a longitudinal wave if you know that its frequency is 150 Hz and its wavelength is 10 cm.

D Define :
1. Complete oscillation.
2. Speed of light.

13 Alexandria Governorate — El-Gomrok Zone

Answer the following questions :

Question 1

A Complete the following statements :
1. The measuring unit of noise intensity is ..... , while the measuring unit of sound intensity is .....
2. Savart's wheel is used to determine the ..... of an unknown tone.
3. The stigmas are feathery like and sticky to .....
4. ..... is the reflection of light rays when they meet a rough surface.
5. A pencil partially immersed in water appears as being .....
6. The angle between the incident light ray and the reflecting surface is 30°, so the angle of reflection will be equal to .....
7. The periodic time of an oscillating body which makes 480 oscillations in one minute equals .....

B Give reasons for :
1. Sound travelling in carbon dioxide has higher intensity than in air.
2. A light ray transfers from a transparent medium to another and doesn't refract.
3. Sound waves are mechanical waves, while radio waves are electromagnetic waves.
4. Vas deferens is important in the male reproductive system.

C Calculate the absolute refractive index of glass if the velocity of light in glass is 2×10^8 m/sec. knowing that the velocity of light through air is 3×10^8 m/sec.

Question 2

A Write the scientific term :
1. The ability of the medium to refract light.

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2. Short stem where the leaves are modified into reproductive organs.
3. Sound waves of frequencies less than 20 Hz.
4. Natural phenomenon that takes place on the desert roads in summer where objects seem as inverted images.
5. Light intensity is inversely proportional to the square of the distance.
6. A new method of producing large numbers of plants from a small part of it.

B Compare between the following : (2 points only)

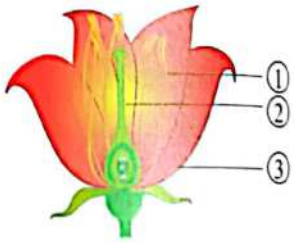
1. Sound pitch and sound intensity.
2. Androecium and gynoecium.

C What is meant by ... ?

1. Pollination.
2. The amplitude of an oscillating body is 3 cm.

Question 3

A The opposite figure represents the typical flower :



1. Label the figure.
2. What's the type of pollination, that happens in this flower ?

B Correct the underlined words :

1. The absolute refractive index is **equal to** one.
2. Human can distinguish sounds of frequencies between **10 : 20** Hz.
3. **Olive** fruit contains more than one seed.
4. Sweet potato is considered as a **stem**.
5. **Estrogen** hormone is responsible for continuity of the pregnancy.

Question 4

A What happens when ... ?

1. A light ray falls perpendicular on a reflecting surface.
2. A pollen grain falls on the stigma of a flower.
3. The oscillating body passes its rest position during its movement (concerning its velocity).

B Mention one example for :

1. A transverse wave.
2. Regular reflection.
3. Oscillatory motion.

C Savart's wheel rotates with a rate of 300 cycles per minute. Calculate the number of teeth of the gear if the frequency equals 600 Hz.

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14 Al-Qaliubya Governorate

Al Obour Educational Directorate
Al Resala Language School

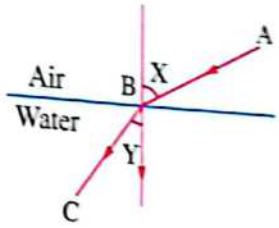
Answer the following questions :

Question 1

A Complete the following statements :

1. Sound pitch is a property by which ear can distinguish between ..... and .....
2. There are two types of reproduction in plants which are ..... and .....
3. Sound wave velocity = ... × .....
4. Waves are classified according to the ability to propagate and transfer energy into ..... and ..... waves.
5. Carpels produce ..... inside the .....
6. The frequency of sonic waves ranges between ..... Hz and ..... Hz.
7. ..... motion is the motion which is regularly ..... in equal periods of time.
8. The calyx is a group of ..... leaves, each leaf is called .....

B From the opposite figure, answer :



1. The ray (AB) represents .....
2. The ray (BC) represents .....
3. Angle (X) is .....
4. Angle (Y) is .....

C Compare between the following :

1. Male flower and hermaphrodite flower (One point only).
2. Regular and irregular light reflection (One point only).
3. Violet and red lights (Concerning: the frequency).
4. Light waves and sound waves (Two points).

Question 2

A Write the scientific term :

1. The fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.
2. An organ in the flower, which consists of filament and anther.
3. Sound waves of frequencies more than 20 KHz.
4. The maximum displacement of the medium particles away from their rest positions.
5. A floral whorl in the flower, whose function to attract insects as it is colourful and scented.

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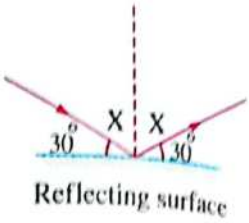
B From the opposite figure :



1. Calculate the angles of incidence and reflection.
2. What can you conclude from this figure ?
3. What will happen if this light ray falls perpendicular on the reflecting surface ?

C Put (✓) or (✗) and correct the wrong ones :

1. Sound velocity through liquids is more than that through gases. ( )
2. The pollen grains of the air pollinated flowers are sticky and have coarse surface. ( )
3. If the angle between the incident light ray and the reflecting surface is 40°, so the angle of reflection equals 40° according to the first law of light reflection. ( )
4. If the speed of sound wave through air = 340 m/sec. and the frequency of a vibrating body = 170 Hz, so the wavelength = 2 metres. ( )

D There are some types of flowers in front of you :

(a) (b) (c)

1. State the type of flowers (a) and (b).
2. In which one of these flowers, pollination can be mixed pollination and in which one can be self pollination ? Give reasons for your answer.
3. Which of these flowers can't form fruits ?

Question 3

A Choose the correct answer :

1. If the angle between the incident light ray and the reflected light ray is 90°, so the angle of incidence equals .....
   a. 0° b. 90° c. 45° d. no correct answer
2. The light waves are ..... waves.
   a. mechanical transverse b. electromagnetic transverse
   c. mechanical longitudinal d. electromagnetic longitudinal
3. The human ear can hear sounds of frequency .....
   a. 50 KHz. b. 30 KHz. c. 300 Hz. d. 5 Hz.
4. The measuring unit of noise intensity is .....
   a. decibel. b. watt/m^2 c. Hz. d. metre/sec.

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5. The amplitude of the simple pendulum is ..... of a complete oscillation.

a. four times b. a quarter c. a half d. double

6. The floral whorl, which is absent in the female flower is .....

a. calyx. b. corolla. c. androecium. d. gynoecium.

B Give reasons for :

1. The ultrasonic waves are used in milk sterilization.
2. Olive fruit contains only one seed, while pea fruit contains more than one seed.
3. We see lightning before hearing thunder.
4. To pick up a coin which has fallen in water, we must look at it vertically.
5. The uterus has a muscular wall.

C 1. Calculate the time in minutes taken by Savart's wheel to make 600 cycles, if the frequency of the sound produced by touching a metallic plate with a gear of 60 teeth is 300 Hz.

2. From the opposite figure, choose the correct answer :

a. The periodic time = ...

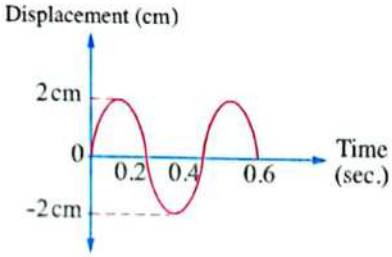
(0.2 sec. – 0.4 sec. – 0.6 sec. – 0.4 m)

b. Frequency = ...

(0.2 sec. – 0.4 Hz – 2.5 cycle/sec. – 0.4 m)

c. The amplitude = ...

(0.2 sec. – 0.4 sec. – 2 cm – 0.4 cm)



Question 4

A Correct the following statements :

1. The inner most whorl of a female flower is the androecium and the number of its whorls is four.
2. When the light ray travels from glass to air, it refracts near to the normal, because the air has higher optical density than glass.
3. The oscillating body of frequency 360 Hz makes 180 complete oscillations in half a minute.
4. Ultrasonic waves that can be heard by man have frequencies less than 20 Hz.
5. Air and clear water are examples of translucent media, while tissue paper and flint glass are examples of opaque media.
6. The fish is seen lower than its real position in the fish tank.

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B Mention the mathematical relation between each of the following :

1. Frequency and periodic time.
2. The sound frequency and the number of teeth in Savart's wheel.
3. The first law of light reflection.
4. Frequency and number of complete oscillations made by an oscillating body at a certain time.

C Cross the odd word out, then state the relation among the remaining words :

1. Sound waves / Light waves / Radio waves / Infrared waves.
2. Red / Orange / White / Violet.
3. Stigma / Stamen / Ovary / Style.
4. Pendulum's motion / Spring motion / Rotary bee motion / Swing's motion.

D What happens ... ?

1. To the ovary and ovule after fertilization.
2. When the distance between the light source and a surface is doubled (concerning the light intensity).
3. When the frequency of a wave is doubled (concerning the wavelength) when the wave velocity is constant.
4. When you put a ringing mobile phone on a resonance box (concerning the sound intensity).

15 El-Sharkia Governorate

East Zagazig Educational Zone
Omar Al-Farouk (O.L.S.)

Answer the following questions :

Question 1

A Complete the following statements :

1. Hermaphrodite flowers take the symbol ..... , while male flowers take the symbol .....
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
3. After fertilization in plants, ovule changes into ..... , but ovary converts into .....
4. A complete oscillation consists of ..... displacements, each one is called .....
5. The measuring unit of sound intensity is ..... , while the measuring unit of noise intensity is .....

B Mention the use or function of the following :

1. Savart's wheel.
2. Sepals in a flower.
3. Petals in a flower.
4. Jacuzzi.

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Question 2

A Write the scientific term :

1. A new method to produce large numbers of plants from a small part of it.
2. It is a way of pollination which takes place by the help of man.
3. The scientist who proved that the energy of light waves is composed of photons.
4. The sexual reproductive organ in the plant.
5. The time needed by the oscillating body to make a complete oscillation.
6. The cell resulting from the fusion of the pollen grain and the ovum nuclei.
7. The ability of the transparent medium to refract light.
8. A medium that does not allow light rays to pass through.

B Compare between the following :

1. Self pollination and mixed pollination (concerning: the definition).
2. Red colour and violet colour (concerning: the deviation and the closest to the prism apex and base).

C Calculate the frequency of an oscillating body that makes 300 complete oscillations in half a minute (mention the used mathematical relation).

Question 3

A Give reasons for :

1. We see lightning before hearing thunder.
2. The use of ultrasonic waves in milk sterilization.
3. Palm flowers are unisexual.

B What is meant by ... ?

1. Absolute refractive index of water is 1.33
2. The wavelength of a sound wave is 1.5 m.

C Complete the opposite figures after redrawing them in your answer sheet then complete the following statements :

1. In fig. (1) the angle of reflection = ...
2. In fig. (2) the angle of incidence = ...

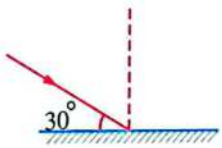

Fig. (1)

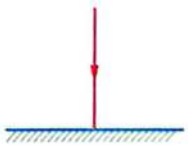
Fig. (2)

Question 4

A Choose the correct answer :

1. The tuber is a root like .....

a. sweet potatoes. b. potatoes. c. grapes. d. roses.

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2. The human ear can distinguish sounds of frequency .....
   a. 50 KHz. b. 50 Hz. c. 30 KHz. d. 30000 KHz.
3. The anther in plants has ..... chambers containing pollen grains.
   a. 3 b. 2 c. 4 d. no correct answer
4. The result of multiplying the frequency of an oscillating body by its periodic time equals .....
   a. $\frac{1}{4}$ b. 2 c. $\frac{1}{2}$ d. 1
5. Sound of frequency 200 Hz is ..... than sound of frequency 100 Hz.
   a. sharper b. stronger c. harsher d. weaker
6. The right ovary produces a ripe ovum every ..... days.
   a. 28 b. 56 c. 23 d. 46

B What happens when ... ?

1. Pollen grains mature and become well developed (concerning: the anther).
2. The light ray travels from air to glass (concerning: the refracted ray).
3. An oscillating body passes the point of rest (concerning: the velocity).

C Calculate the wavelength in metre for a visible light wave of frequency 6×10^{14} Hertz and velocity 3×10^{8} m/s (mention the used mathematical relation).

16 El-Menofia Governorate

Kowesna Educational Zone
Science Inspectorate

Answer the following questions :

Question 1

A Complete the following statements :

1. Sound travels through air as pulses of ..... and .....
2. Waves are classified according to the ability to propagate and transfer energy into ..... waves and ..... waves.
3. There are two types of pollination in flowers, which are ..... and .....
4. The measuring unit of sound intensity is ..... , while the measuring unit of noise intensity is .....
5. Gynoecium is the ..... reproductive organ of the flower and it consists of a group of .....

B Savart's wheel rotates with a rate of 300 cycles per minute, a sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear, calculate the number of teeth of the gear.

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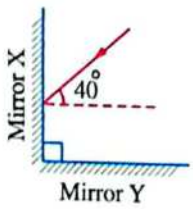
C What will happen when ... ?

1. Light ray falls perpendicular on a reflecting surface.
2. Increasing the frequency of a wave to its double value when the wave velocity is constant (concerning the wavelength).

Question 2

A Choose the correct answer :

1. From the opposite figure, the angle of reflection of the ray on mirror (Y) is .....



a. 50 b. 20 c. 70

2. Sound wave travels in air with velocity 330 m/sec. and has a wavelength 0.1 m, so its frequency equals .....

a. 330 KHz. b. 330 Hz. c. 3300 Hz.

3. Tulip is an example for ..... flower.

a. female b. male c. bisexual

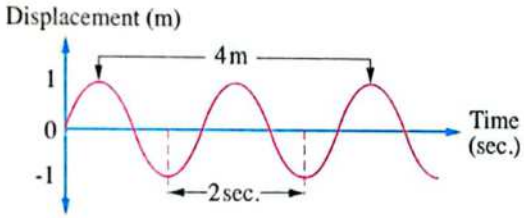
4. The ratio between the periodic time of a tuning fork vibrates with 100 Hz, and the periodic time of another tuning fork vibrates with 200 Hz respectively equals .....

a. 1:1 b. 2:1 c. 1:2

5. After fertilization, the ..... develops to become a seed.

a. flower b. ovary c. ovule

B From the opposite figure, find :



1. Wavelength.
2. Periodic time.
3. Frequency.
4. Wave velocity.
5. Amplitude.

C What is meant by ... ?

1. Sound pitch.
2. Reproduction by grafting.

Question 3

A Write the scientific term :

1. The motion which is regularly repeated in equal periods of time on the two sides of rest position.
2. It is a short stem whose leaves are modified to form the sexual reproduction.
3. It is the medium which permits most light to pass through.
4. Waves of frequencies ranging from 20 Hz to 20000 Hz.
5. The intensity of sound at a certain point is inversely proportional to the square of the distance between this point and the sound.

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6. It is a natural phenomenon that takes place on desert roads at noon due to reflection and refraction of light in air layers.
7. The scientist who discovered that the energy of photon depends on its frequency.

B Correct the underlined words :

1. The angle of incidence equals **half the angle of reflection**.
2. Fusion between the pollen grain and the ovum is called **pollination**.
3. Changing the light ray path when it faces a transparent object is considered **light reflection**.
4. Reproduction by tubers can be used in **apples and pears**.
5. As the density of the medium decreases, the **amplitude increases**.
6. **Bract** is a group of flowers arranged on the same axle.
7. **The ovaries** are adapted to receive the ovum and deliver it to uterus.
8. The **ovum** consists of head, middle part and tail.

C Compare between the following : (one point only)

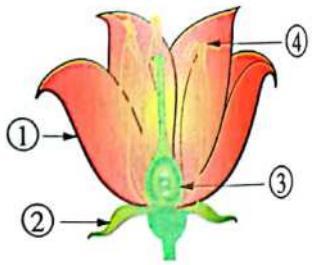
1. Musical tones and noises.
2. Vegetative reproduction and flowering reproduction.

Question 4

A Give reasons for :

1. Stigmas of flowers are sticky.
2. The absolute refractive index of any medium is always more than one.
3. The piano sound differs from that of violin even if they are having the same intensity and pitch.
4. The energy of red light photon is less than that of orange light photon.
5. The floor of the swimming pool appears higher than its real position.

B From the opposite figure :



1. Label the figure.
2. What is the sex of the flower ?
3. What is the function of number ② ?

C Mention one function for each of the following :

1. Ultrasonic waves.
2. Jacuzzi.
3. Resonance box in some musical instruments.

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17 Al-Gharbeya Governorate

Al-Gharbeya Educational Directorate
Department of Language Schools Supervision

Answer the following questions :

Question 1

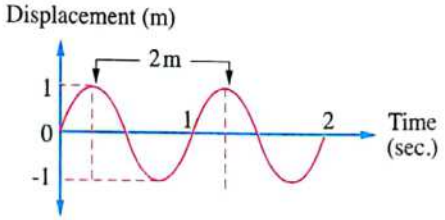
A Complete the following statements :

1. When a tuning fork vibrates, the produced ..... is transferred in the form of ..... waves.
2. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
3. In the uniform reflection, the light rays reflect in ..... direction when they fall on a ..... surface.
4. The male organ in the flower is ..... , while the female organ is .....

B Compare between each of the following :

1. Longitudinal wave and transverse wave (in term of wavelength).
2. Transparent medium and opaque medium (in term of definition).
3. Pollen grain and ovum (in terms of mobility "movement" and number).

C From the opposite figure, find :



1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.

Question 2

A Choose the correct answer :

1. The result of multiplying the frequency of an oscillating body by its periodic time equals .....

   a. $\frac{1}{4}$ b. $\frac{1}{3}$ c. $\frac{1}{2}$ d. one

2. The human ear can distinguish sounds of frequency .....

   a. 50 KHz. b. 30 KHz. c. 200 Hz. d. 5 Hz.

3. A sound wave travels in air with velocity 330 m/s and has a wavelength of 0.1 m, its frequency is .....

   a. 330 KHz. b. 33 KHz. c. 3300 Hz. d. 330 Hz.

4. After fertilization, the ovary develops to become a .....

   a. fruit. b. sepal. c. petal. d. flower.

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B What will happen when ... ?

1. The frequency of a wave increases to the double of its value (concerning the wavelength) when the wave velocity is constant.
2. Light ray travels from glass to air.
3. Pollen grains mature and become well developed.

C Savart's wheel rotates with a rate of 300 cycles per minute, a sound frequency of 600 Hz is produced when an elastic plate touches the teeth of the gear, calculate the number of teeth of the gear.

Question 3

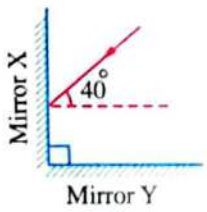
A Write the scientific term of each of the following :

1. The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time.
2. The maximum displacement achieved by an oscillating body away from its point of rest.
3. The ability of the medium to refract light rays.
4. Short stem where leaves are developed and modified into reproductive organs.

B Give a reason for each of the following :

1. We see lightning before hearing thunder.
2. The light ray that falls perpendicular on a glistening surface, reflects on itself.
3. Palm flower is unisexual.

C Complete the opposite figure to determine the angle of reflection of the light ray on mirror (Y).



Question 4

A Put (✓) or (✗) :

1. The movement of the clock pendulum is an example for wave motion. ( )
2. The velocity of sound waves propagation in air is greater than that of light waves. ( )
3. The submerged object in water is seen in an apparent position slightly above its real position. ( )
4. Reproduction by tubers happens in orange and bitter orange. ( )

B Mention the importance of :

1. Ultrasonic waves (one importance is enough).
2. The calyx in the flower.

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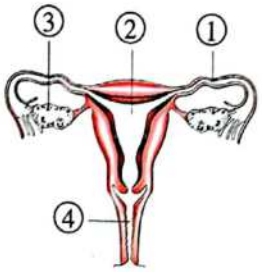
C Calculate the absolute refractive index of diamond giving that the speed of light through it = 1.25×10^8 m/s and the speed of light through air = 3×10^8 m/s.

D Study the opposite figure which represents the female genital system, then answer the following questions :



1. Replace the numbers present in the figure with suitable labels.
2. What is the organ in which :
   (a) Ova are produced ?
   (b) The ovum is fertilized ?

18 Dakahlia Governorate

Educational Directorate
Belkas Administration

Answer the following questions :

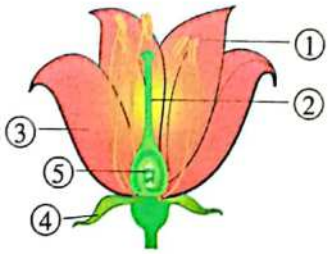
Question 1

A Write the scientific term :

1. Fusion of the nucleus of the male cell with the nucleus of the female cell.
2. The disturbance that propagates and transfers energy in the direction of propagation.
3. The area in the longitudinal wave, at which the medium particles are of the highest density and pressure.
4. Short stem where leaves are developed and modified into reproductive organs.
5. Sound waves of frequencies less than 20 Hertz.
6. The ability of the medium to refract light rays.
7. The reproduction of some plants by parts of the root, stem or leaves.
8. It transfers the sperms from the testes to the urethra.

B Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with a velocity of 960 cycles in two minutes, given that the number of teeth of the gear is 30 teeth.

C Complete the labels on the figure, and mention :



1. The sex of the flower.
2. Its symbol.
3. The way of reproduction.

Question 2

A Complete the following statements :

1. A new method to produce large numbers of plants from a small part of it is called .....
2. The absolute refractive index of a medium is the ratio between ..... to .....

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3. The energy of the photon is ..... proportional to the ..... of the light wave.
4. ..... colour has the longest wavelength, while ..... colour has the shortest wavelength.
5. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
6. If the vertical distance between crest and trough is 4 cm, the amplitude equals ..... cm.

B What happens in each of the following cases ... ?

1. Increasing the frequency of a wave to its double value when the wave velocity is constant (concerning the wavelength).
2. To the ovary after fertilization in plants.
3. Light ray travels from water to air.
4. To the ovule after fertilization in plants.

Question 3

A Choose the correct answer :

1. If the frequency of an oscillating body is 10 Hz, so the periodic time is .....
   a. 10 sec. b. 0.01 sec. c. 0.1 sec. d. 1 sec.
2. The sound of frequency 500 Hz is ..... than the sound of frequency 100 Hz.
   a. stronger b. sharper c. weaker d. harsher
3. When the distance between the light source and a certain surface is doubled, the light intensity on the surface .....
   a. decreases to quarter. b. increases four times.
   c. is doubled. d. remains constant.
4. The angle of incidence of light is ..... its angle of reflection.
   a. larger than b. smaller than c. equal to d. no correct answer
5. The value of absolute refractive index does not equal .....
   a. 1.5 b. 1.8 c. 1 d. 1.3
6. Flowers pollinated by air characterized by all of the following except .....
   a. hanged anthers. b. feathery like stigmas.
   c. scented petals. d. light pollen grains.
7. If the distance between the centre of the third compression and that of the fifth compression is 20 cm, the wavelength of this wave is .....
   a. 40 cm. b. 20 cm. c. 10 cm. d. 5 cm.
8. All of the following are factors affecting sound intensity except the .....
   a. amplitude of vibration. b. medium density.
   c. frequency. d. wind direction.

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B What is the meant by ... ?

1. Pollination.
2. Angle of refraction of a light ray is 45°
3. Sonic waves.
4. Sound velocity through air is 340 m/s.

Question 4

A Put (✓) or (✗) :

1. The velocity of the oscillating body is minimum when it passes its rest position. ( )
2. The corolla is the male reproductive organ in the flower. ( )
3. Infrasonic waves are used in breaking down stones of kidney. ( )
4. Sound can be heard from all directions that surround the sound source. ( )
5. Harmonic tones that accompany the fundamental tone are lower in pitch. ( )
6. Reproduction by tubers can be used in apples and pears. ( )
7. The fish is seen higher than its real position in the fish tank. ( )
8. Complete oscillation consists of $\frac{1}{4}$ amplitude. ( )
9. Wood doesn't allow the passage of light through it. ( )
10. The measuring unit of sound intensity is decibel. ( )

B Sound waves of frequency 200 Hz and wavelength 1.7 metre, calculate :

1. The velocity of sound waves propagation in air.
2. The wavelength of these waves of frequency 200 Hz when they propagate in water with velocity 1500 m/s.

19 Ismailia Governorate

Educational Directorate
Science Inspectorate

Answer the following questions :

Question 1

A Choose the correct answer :

1. The speed of the ball of the simple pendulum ..... as we move away from the rest position.
   a. doesn't affect b. decreases c. is doubled d. no correct answer
2. The origin of the peach fruit seed is the .....
   a. ovary. b. carpel. c. stigma. d. ovule.
3. Human ear cannot distinguish the sound of frequency equals .....
   a. 50 Hz. b. 30 Hz. c. 300 Hz. d. 5 Hz.
4. The ..... colour light in the spectrum colours has the highest deviation.
   a. white b. red c. violet d. yellow

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5. The corolla leaves are called .....

a. petals. b. carpels. c. stamens. d. sepals.

6. Regular reflection appeared on .....

a. the skin. b. a plan mirror. c. a tree leaf. d. a piece of wood.

B Calculate the frequency of a musical tone similar to the frequency of a produced tone using Savart's wheel rotated with a velocity of 960 cycles in 2 minutes, given that the number of teeth of the gear is 30 teeth.

C Mention one importance for each of the following :

1. The calyx in the flower.
2. Jacuzzi.
3. Ultrasonic waves in industry.

Question 2

A Compare between the following :

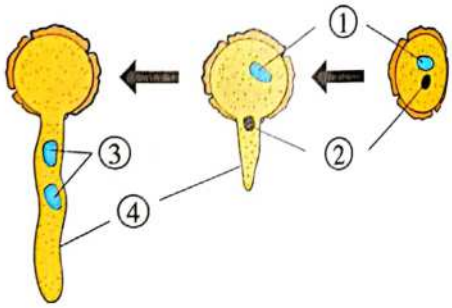
1. Transparent and translucent medium (related to the definition).
2. Noise intensity and sound intensity (related to the measuring unit).

B Write the scientific term :

1. The group of flowers that carried on the same axle.
2. The distance that a wave travels in one second.
3. The product of Planck's constant times the frequency of photon.
4. A modern way of multiplying a small part of the plant to get a large numbers of plants.
5. It is a property by which the ears can distinguish between sound levels, either sharp or harsh.
6. The ratio between the speed of light in air and its speed in a transparent medium.

C From the opposite figure :

1. The figure represents .....
2. Write the labels of the figure.
3. Select the number of the parts that share in producing the zygote.



Question 3

A Give reasons for :

1. We see lightning before hearing the sound of thunder.
2. Stigmas of some flowers are feathery like and sticky.
3. Occurrence of mirage phenomenon in desert.

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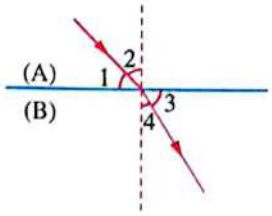
B Complete the following statements :

1. ..... waves are transverse waves, while ..... waves may be longitudinal or transverse waves.
2. Oscillatory motion and ..... motion are from ..... motion.
3. Reproduction by tubers is a ..... reproduction, while reproduction by grafting is an ..... reproduction.
4. Light intensity is ..... proportional to ..... of the distance between the surface and the source.
5. The flower of pumpkins is ..... flower, while the flower of tulip is ..... flower.

C From the opposite figure, find the number that refers to the following :



1. The angle of incidence.
2. The angle of refraction.
3. Which medium (A) or (B) is greater in the optical density ?

Question 4

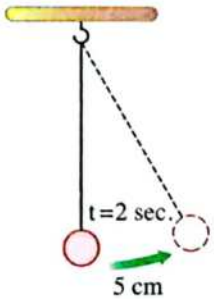
A What happens when ... ?

1. Increasing the density of a medium (related to the sound intensity).
2. Vibration of particles of a medium perpendicularly to the direction of wave propagation.
3. The incidence of a light ray perpendicularly on the reflecting surface.

B Correct the underlined words :

1. The simple harmonic motion is considered the simplest form of **transition motion**.
2. The big coloured flowers are pollinated by **air**.
3. The crest in the transverse wave is equivalent to the **bottom** in the longitudinal wave.
4. We see the submerged objects in water in a **lower** position than its real position.

C From the opposite figure, calculate the following :



1. Amplitude.
2. Periodic time.
3. Frequency.

D Mention the function of each of the following :

1. The scrotal sac.
2. Seminal fluid.

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20 Port Said Governorate

Port Said Educational Zone

Answer the following questions :

Question 1

A Choose the correct answer :

1. When the distance between the source of light and the surface of a wall is doubled, the light intensity on the surface .....
   a. decreases to quarter. b. increases to double.
   c. remains constant. d. no correct answer.
2. The human ear can distinguish sounds of frequency .....
   a. 50 KHz. b. 30 KHz. c. 300 KHz. d. 50 Hz.
3. If the frequency of an oscillating body is 6 Hz, so the periodic time is ..... sec.
   a. 6 b. 3 c. $\frac{1}{3}$ d. $\frac{1}{6}$
4. Pollen grains are formed inside the ..... of the flower.
   a. carpel b. anther c. ovary d. calyx
5. The photon energy = Planck's constant × .....
   a. wavelength. b. velocity. c. amplitude. d. frequency.
6. The distance between two successive compressions is called .....
   a. frequency. b. periodic time. c. wavelength. d. velocity.

B Give reasons for :

1. The petals of corolla are colourful and scented.
2. The light ray that falls perpendicular on a reflecting surface, reflects on itself.

C Calculate the frequency of a wave if its velocity is 50 m/s and its wavelength is 2 metres.

Question 2

A Complete the following statements :

1. When you look at a coin in a glass of water, its ..... position appears to be lower than the ..... position.
2. The glass prism is used to analyze the ..... light into ..... colours.
3. The bisexual flower contains ..... and ..... but the male flower contains ..... only.
4. Sharp tones have ..... frequency, while rough tones have ..... frequency.
5. The maximum displacement done by the oscillating body away from its rest point is called .....
6. Stamen of the flower consists of ..... and .....
7. The sperm consists of ..... , midpiece and .....

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B Compare between transparent medium and opaque medium according to :

1. Definition.
2. Examples (two examples for each medium).

C Mention one importance for each of the following :

1. Ultrasonic waves.
2. Savart's wheel.

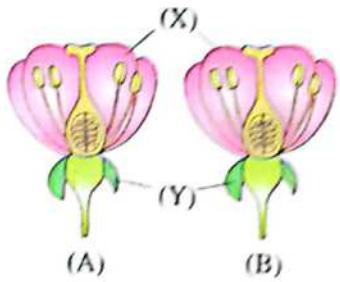
Question 3

A Write the scientific term of each of the following :

1. Wave consists of crests and troughs.
2. The number of complete oscillations produced by the oscillating body in one second.
3. Short stem where leaves are developed and modified into reproductive organs.
4. The ability of the medium to refract light rays.
5. The waves which need a medium to propagate.
6. The reflection in which the light rays recoil in many directions, when falling on a rough surface.

B The opposite figure shows two flowers of two plants of the same species :

1. What's the function of parts (X) and (Y) ?
2. Pollen grains from the flower (A) are transferred to the ova in flower (B) :
   a. What's the type of pollination that happened ?
   b. What's the sex of flower (A) ?



C What is meant by ... ?

1. Sonic waves.
2. Light intensity.

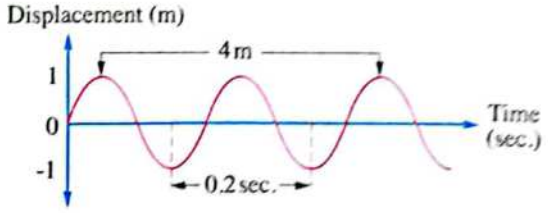
Question 4

A Put (✓) or (✗) and correct the wrong ones :

1. Stigma is the male reproductive organ in the flower. ( )
2. The movement of pendulum is an example for the wave motion. ( )
3. Bats, dogs and dolphins can hear ultrasonic waves. ( )
4. The sound intensity decreases, when the source of sound touches an empty box. ( )
5. The light ray refracts towards the normal when it travels from air to glass. ( )

B From the opposite figure, find :

1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.



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21 Damietta Governorate

Damietta Educational Directorate
Science Inspectorate

Answer the following questions :

Question 1

A Complete the following statements :

1. Sharp tones have ..... frequencies, while rough tones have ..... frequencies.
2. A complete oscillation consists of ..... successive displacements and each of them is called .....
3. The absolute refractive index of water is the ratio between ..... to .....
4. The two methods of reproduction by grafting are the grafting by ..... and by .....
5. The measuring unit of the frequency is ..... but the measuring unit of the noise intensity is .....

B Mention one use (function) for each of the following :

1. Androecium.
2. Ultrasonic waves in the medical field.
3. Tissue culture.
4. Savart's wheel.

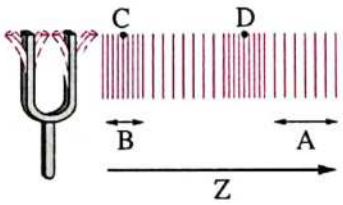
C Sound waves of frequency 400 Hz in air and wavelength 85 cm. Calculate the velocity of these waves.

Question 2

A Write the scientific term of each of the following :

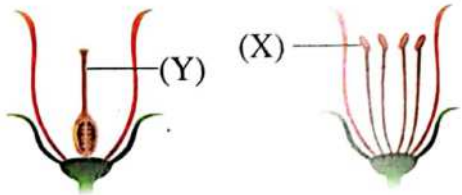
1. They are complex tones composed of a fundamental tone associated by other tones higher in pitch and lower in intensity.
2. A phenomenon that appears in the desert as a result of reflection and refraction of light.
3. The measuring unit of the sound intensity.
4. The fertilized ovum.
5. The transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

B (1)



1. What is the kind of the produced wave ?
2. Label points (A) and (B).
3. What's the name of the distance between (C) and (D) ?
4. The arrow (Z) refers to the .....

(2)



(A) (B)

1. What is the name of parts (X) and (Y) ?
2. Mention the function of part (X).
3. What is the sex of flowers (A) and (B) ?

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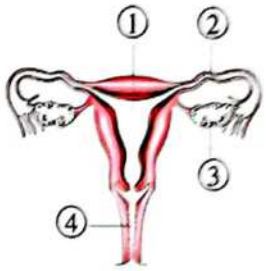
C Study this figure, then answer the questions :



1. What does this figure represent ?
2. Replace the numbers in the figure by suitable labels.
3. What is the label in which the embryo is delivered to life ?

Question 3

A Choose the correct answer :

1. The human ear can hear sounds of frequency ..... KHz.
   a. 10 b. 50 c. 70 d. 90
2. The ovum contains ..... of the genetic material of the plant species.
   a. double b. half c. quarter d. all
3. The artificial vegetative reproduction is done in plants by .....
   a. grafting. b. cutting. c. tissue culture. d. all the previous.
4. When the incident light ray reflects on itself, the angle of incidence equals .....
   a. 0° b. 90° c. 120° d. 180°
5. After fertilization, the ovary develops to become the .....
   a. seed. b. flower. c. fruit. d. embryo.

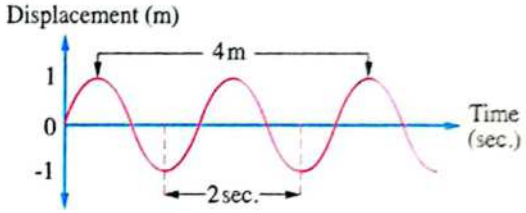
B What is meant by ... ?

1. The inverse square law of light. 2. Sound pitch. 3. Flower.

C What happens in the following cases ... ?

1. Incidence of a white light ray on one face of a triangular glass prism.
2. A pollen grain falls on the stigma of a flower.

D From the opposite figure, find :



1. Wavelength.
2. Frequency.
3. Amplitude.
4. Wave velocity.

Question 4

A Give reasons for :

1. Light can travel through space.
2. The flower of bean plant is bisexual.
3. Sound intensity in the presence of carbon dioxide gas as a medium is higher than that in air.
4. Peach fruit contains only one seed.

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B Compare between each of the following :

1. Pollination and fertilization (one point only for each one).
2. Regular and irregular reflection of light.
3. Transverse wave and longitudinal wave.

C Correct the underlined words :

1. The human skin is considered as **translucent medium**.
2. The energy of light quantum is directly proportional to its **wavelength**.
3. The pollen grains of insect pollinated flowers are **smooth**.
4. **Bract** is a group of flowers arranged on the same axle.
5. Reproduction by tubers can be used in **apples and pears**.

22 El-Behira Governorate — Ismail Elhabrouk Formal Language School

Answer the following questions :

Question 1

A Complete the following statements :

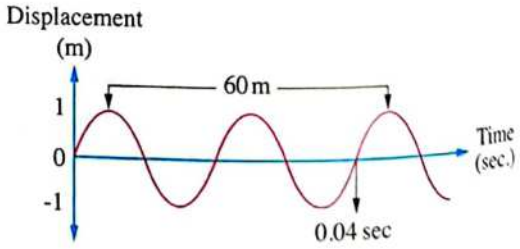
1. Pollen grains which spread by wind are produced by ..... numbers, and their weights are .....
2. Sounds can be classified into two groups, musical tones of ..... frequency and noises of ..... frequency.
3. The measuring unit of sound intensity is ..... , while the measuring unit of noise intensity is .....
4. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.

B Give a reason for each of the following :

1. The fish in water is seen in an apparent position slightly above its real position.
2. The petals of corolla are colourful and scented.
3. We see lightning before hearing thunder.
4. The nucleus of a sperm or an ovum contains half the hereditary material.

C From the opposite figure, calculate :

1. Frequency.
2. Wavelength.
3. Velocity of the wave.



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Question 2

A Choose the odd word out, then link between the rest words :

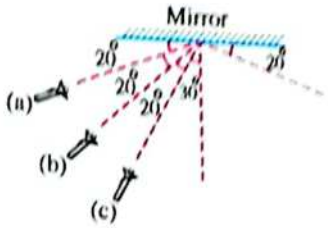
1. Water waves / Radio waves / Light waves / Infrared waves.
2. Sound wave its (F) = 100 Hz / Sound wave its (F) = 1 KHz / Sound wave its (F) = 40 Hz / Sound wave its (F) = 10 Hz.
3. Anther / Pollen grains / Ovary / Filament.

B Mention one use or importance for each of the following :

1. Hot water in Jacuzzi.
2. Gynoecium.
3. Savart's wheel.

C The opposite figure represents a torch emits light falls on a mirror :

1. Torch ..... represents the following reflection.
2. The angle between the reflected light ray and its incident light ray = ...
3. Identify the second law of reflection of light.



Question 3

A Choose the correct answer :

1. The angle of incidence is greater than the angle of refraction, when a light ray travels .....
   a. from glass to air.
   b. from air to glass.
   c. in the same medium.
   d. no correct answer.
2. The absolute refractive index of water is .....
   a. 0.5
   b. 0.8
   c. 0.33
   d. 1.33
3. The produced fruits by grafting belong to the type of the .....
   a. scion.
   b. cut.
   c. stock.
   d. bud.
4. TV produces sound if Hany was standing at distance 6 m away from it then approached towards the TV to reach 2 m away from it, so the intensity of sound .....
   a. decreases to quarter.
   b. increases to double.
   c. decreases to $\frac{1}{9}$
   d. increases 9 times.
5. Sound of frequency 200 Hz is ..... than the sound of frequency 100 Hz.
   a. sharper
   b. stronger
   c. harsher
   d. weaker
6. From the typical flowers is .....
   a. palm.
   b. maize.
   c. petunia.
   d. pumpkins.

B What happens when ... ?

1. Incidence of light rays on a rough surface.
2. Distance covered by an electromagnetic wave in space is doubled (concerning its velocity).
3. Pollen grains transfer from the anther to the stigma of the same flower.

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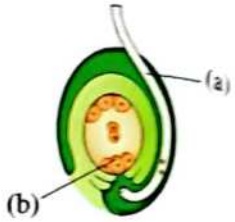
C From the opposite figure :



1. Part (a) represents .....
2. When one of the two male nuclei fuses with (b), ... is formed.
3. After fertilization, the ovule of this plant converts into ..... , then the ovary converts into .....
4. Identify fertilization process.

Question 4

A Correct the underlined words :

1. When a light ray falls perpendicular to a mirror its angle of reflection = 180°.
2. Reproduction by tubers can be used in **apples**.
3. Sound intensity **is inversely proportional to the amplitude** of the vibration of the sound source.
4. The velocity of the oscillating body reaches minimum **when it passes the point of rest**.

B Calculate the number of gear teeth of Savart's wheel, if a musical tone similar to the frequency of an emitted tone = 160 Hz, and Savart's wheel rotated with a velocity of 960 cycles in three minutes.

C Ahmed used a glass prism to analyse the white light into seven spectrum colours, then he concluded that :

1. The colour which makes the maximum deviation is ..... , but the smallest deviation is .....
2. The colour which has the greatest energy is ..... because .....

23 El-Fayoum Governorate

Science Supervision
For Governmental Language School

Answer the following questions :

Question 1

A Complete the following statements :

1. The crest in the ..... wave is equivalent to the ..... in the longitudinal wave.
2. The human ear can distinguish sounds of frequencies between ..... and .....
3. Male organ in the flower is ..... , while female organ in the flower is .....
4. The human skin is considered ..... medium, while pure glass is ..... medium for light.

B What is meant by ... ?

1. Periodic time.
2. Fertilization in plant.
3. Light refraction.

C What is the importance of ... ?

1. Savart's wheel.
2. Triangular glass prism.
3. Tissue culture.

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Question 2

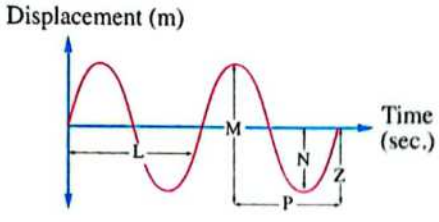
A Correct the underlined words :

1. Light propagates in **zigzag** lines.
2. Reproduction by tubers happens by roots in **orange**.
3. After fertilization in plants, the ovule develops to become **the fruit**.
4. Sound pitch depends on the **amplitude** of the source.
5. A complete oscillation comprises of **two** amplitudes.
6. The angle between the incident light ray and the reflected light ray = 100°, so the angle of reflection = **60°**

B Compare between each of the following :

1. Mechanical waves and electromagnetic waves (according to the medium of propagation and the speed).
2. Pollination by air and pollination by insects (two characteristics of the flower).

C The opposite figure represents an oscillatory motion for a simple pendulum. Choose the letter that denotes :



1. The oscillation of the pendulum forming $\frac{3}{4}$ complete oscillation.
2. The amplitude.

Question 3

A Write the scientific term :

1. The property by which the ears can distinguish between sounds with respect to the nature of the source even if they are equal in pitch and intensity.
2. A natural phenomenon takes place on the desert roads at noon especially in the summer times.
3. The motion produced as a result of the vibration of the particles of the medium at a certain moment and in a certain direction.
4. Sound waves of frequencies less than 20 Hz.
5. Short stem where leaves are developed and modified into reproductive organs.
6. A genital disease caused by spiral bacteria.

B Choose the correct answer to complete the following statements :

1. The quantum of energy of green light is ..... the quantum of energy of yellow light.
   a. greater than b. equal to c. less than d. no correct answer
2. Light waves are ..... waves.
   a. mechanical transverse b. electromagnetic longitudinal
   c. electromagnetic transverse d. mechanical longitudinal

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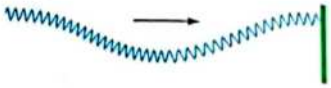
3. The result of multiplying the frequency of an oscillating body by its periodic time equals .....

a. variable value. b. negative value. c. constant value. d. one.

4. A sound wave travels in air with velocity 330 m/s and has a wavelength of 0.1 m, its frequency is .....

a. 330 KHz. b. 3300 Hz. c. 33 KHz. d. 330 Hz.

5. In the opposite figure, the particles of the medium (the coil) vibrate .....



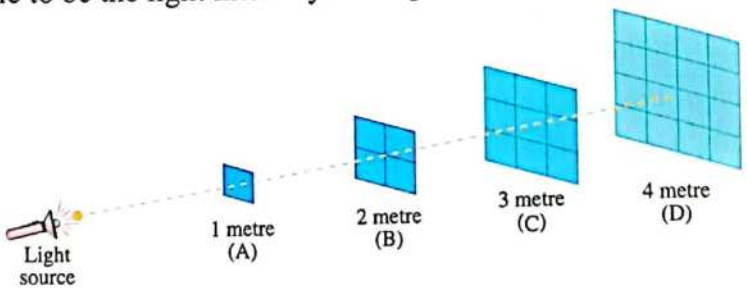
a. to the right only. b. upwards only.

c. to right and left. d. upwards and downwards.

C Calculate the absolute refractive index of diamond given that the speed of light in it $= 1.25 \times 10^8$ m/s and the velocity of light in air equals 3×10^8 m/s.

D In the following figure, the light intensity of the surface at point (A), equals the unity. Choose from the following values : $(\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{6}, \frac{1}{9}, \frac{1}{12}, \frac{1}{16})$

What is suitable to be the light intensity at the points (B), (C) and (D) ?



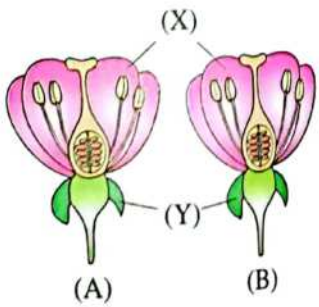
Question 4

A Give reasons for :

1. Palm flowers are unisexual.
2. The light ray that is incident perpendicular on a glistening surface reflects on itself.
3. Oscillatory motion is considered as a periodic motion.

B Savart's wheel rotates with a rate of 300 cycles per minute. A sound of frequency 600 Hz is produced when an elastic plate touches the teeth of the gear, calculate the number of teeth of the gear.

C The opposite figure shows two flowers of two plants of the same species :



1. What's the function of the parts (X) and (Y) ?
2. Pollen grains from the flower (A) are transferred to the ova in flower (B) :
   a. What's the type of pollination that happened ?
   b. What's the sex of flower (A) ?

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24 El-Minia Governorate

Educational Directorate
Minia Kawmia Language School

Answer the following questions :

Question 1

A Choose the correct answer :

1. All of the following are factors affecting sound intensity except the .....
   a. amplitude of vibration. b. medium intensity.
   c. frequency. d. wind direction.
2. We can determine the speed of wave propagation from the relation : Speed = ...
   a. $\frac{\text{Wavelength}}{\text{Frequency}}$ b. $\frac{\text{Frequency}}{\text{Wavelength}}$
   c. Frequency + Wavelength. d. Frequency × Wavelength.
3. The ovule after fertilization becomes a .....
   a. seed. b. seed coat. c. fruit. d. coat of fruit.
4. The amplitude of the simple pendulum is ..... of a complete vibration.
   a. four times b. a quarter c. a half d. double

B Compare between : Sonic waves and ultrasonic waves.

C Mention the importance of :

1. Savart's wheel.
2. Glass prism.

Question 2

A Write the scientific term :

1. The ability of the medium to refract light rays.
2. A new method to produce large numbers of plants from a small part of it.
3. The periodic motion made by a body around its point of rest, where the motion is repeated through equal intervals of time.
4. A property of sound by which the ear can distinguish between sharp and rough sounds.

B Give reasons for :

1. Flowers pollinated by insects produce coarse pollen grains.
2. We see lightning before hearing thunder.
3. The piano sound differs from that of the violin even if they have the same intensity and pitch.
4. The energy of red light photon is less than that of orange light photon.

Question 3

A Correct the underlined words :

1. The absolute refractive index of any transparent medium is always **less** than one.
2. Reproduction by tubers happens in **orange and bitter orange**.

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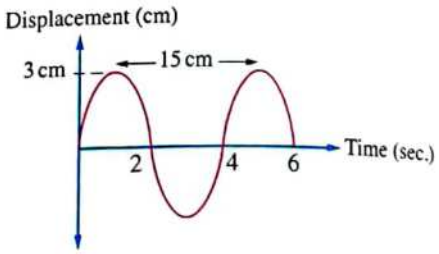
3. The wave that propagates along the direction of vibration of the medium particles is called **transverse** wave.
4. Light travels in **curved** lines.

B What happens when ... ?

1. Light ray falls perpendicular on a reflecting surface.
2. The oscillating body passes its rest position during its movement (concerning its velocity).

C From the opposite figure, calculate :



1. Wavelength.
2. Frequency.
3. Amplitude.
4. Periodic time.

Question 4

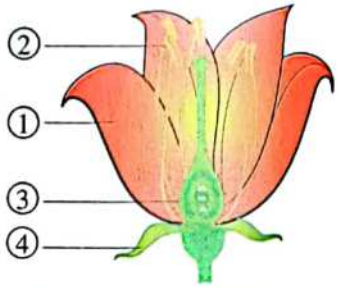
A What is meant by ... ?

1. The distance that is covered by a visible light wave in space in two seconds is 6×10^8 metres.
2. The angle of refraction of a light ray = 60°
3. The time taken by a spring to make 60 complete oscillations is 1 minute.

B Cross out the odd word, then write down the relation between the rest of words :

1. Ovary / Style / Stamen / Stigma.
2. Simple pendulum motion / Spring motion / Rotary bee motion / Stretched string motion.
3. Development of breasts / Harshness of voice / Menstrual cycle / Growth of hair in armpit and pubic.

C Label the figure :



① .....
② .....
③ .....
④ .....

25 Qena Governorate

Qeft Educational Administration
Qeft Official Language School

Answer the following questions :

Question 1

A Complete the following statements :

1. Sound is from ..... waves that can't travel through .....
2. In the flower, the calyx consists of ..... , but a group of petals forms .....

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3. The high pitched sound waves have high ..... and small .....
4. Waves are classified according to their ability to propagate and transfer energy into ..... and .....
5. Light ..... is the change of light path when it travels from a transparent medium to another one of different .....

B Calculate the speed of light through diamond given that the absolute refractive index of it = 2.4 and the speed of light through air = 3×10^8 m/s.

C Compare between the following :

1. Regular reflection and irregular reflection (direction of the reflected rays).
2. Longitudinal waves and transverse waves (direction of vibration of medium particles).
3. Zygote and pollen grain (the number of genetic material).

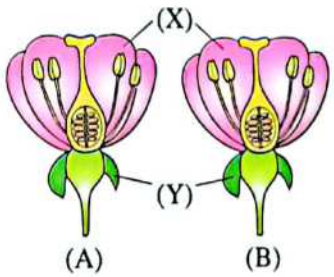
Question 2

A Correct underlined words :

1. Complete oscillation consists of $\frac{1}{4}$ amplitude.
2. The motion of the rotary bee is considered as **an oscillatory motion**.
3. The **infrasonic** waves are used in breaking down kidney stones.
4. Sound pitch is increased by **decreasing** the frequency.
5. Speed of sound in water is slower than in **air**.

B Look at the opposite figure, then answer the following :

1. What is the function of the parts (X) and (Y) ?
2. Pollen grains from flower (A) are transferred to the ova in flower (B) :
   a. What is the type of pollination that happened ?
   b. Write two methods for this kind of pollination.
   c. What is the sex of the flower (B) ?
   d. Write the name of two plants having the same sex of flower shown in the figure.



Question 3

A Write the scientific term :

1. A property by which the ear can distinguish between strong and weak sounds.
2. The angle between the reflected ray and the normal at the incidence point on the reflecting surface.
3. A disturbance causes the vibration of the medium particles.
4. The measuring unit of the sound intensity.

B Give reasons for :

1. We can distinguish between different sounds even if they have the same pitch and intensity.

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2. We see lightning before hearing thunder.
3. Appearance of secondary female sex characters in human.

C What happens when ... ?

1. Increasing the wavelength four times for the same velocity (concerning the wave frequency).
2. Falling of a pollen grain on a stigma of the same flower (the type of pollination).

D Calculate the frequency of a musical tone similar to the tone produced from Savart's wheel rotating with a velocity of 960 cycles in two minutes, knowing that the number of gear teeth = 30 teeth.

Question 4

A Choose the correct answer :

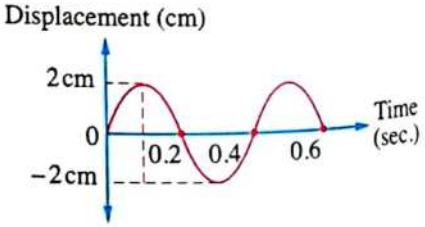
1. The ratio between the periodic time of a tuning fork vibrates with 100 Hz, and the periodic time of another tuning fork vibrates with 200 Hz equals .....
   a. 1 : 1 b. 2 : 1 c. 1 : 2 d. zero
2. The zygote contains ..... of the genetic material of the sperm.
   a. half b. double c. quarter d. three times
3. The light ray refracts ..... the normal when it travels from air to glass.
   a. near to b. away from c. perpendicular to d. along
4. All of the following are from the factors affecting sound intensity except the .....
   a. amplitude. b. frequency. c. density of medium. d. wind direction.
5. Sound wave of frequency 400 Hz and wavelength 85 cm, so its velocity = ...
   a. 340 m/s. b. 34000 m/s. c. 3.4 m/s. d. 0.034 m/s.

B Put (✓) or (✗) and correct the wrong ones :

1. The fish is seen higher than its real position in the fish tank. ( )
2. The complete oscillation includes four successive amplitudes. ( )
3. The velocity of the oscillating body is maximum when it passes through the original position. ( )
4. Androecium is the female reproductive organ in plant. ( )
5. Sperms move from the vagina to fallopian tubes through the uterus. ( )
4. The age of menopause in female ranges between 11 to 14 years. ( )

C From the opposite figure, calculate :

1. Amplitude.
2. Periodic time.
3. Frequency.



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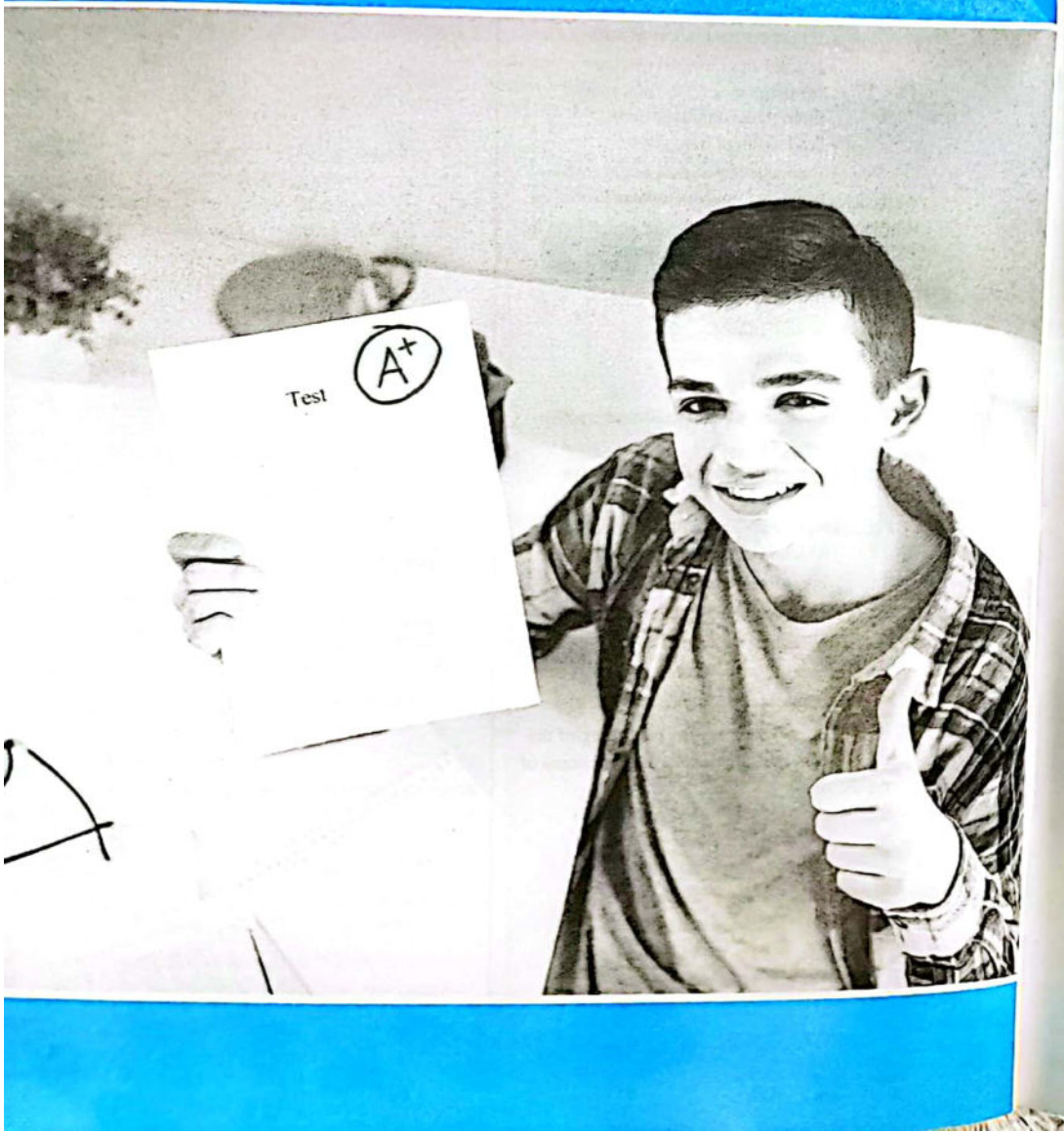
PART 3

Guide Answers of Final Examinations



Guide Answers of Final Examinations 2020

Cairo Governorate

1 Manor House International School

1 **A** 1. regular (uniform) reflection - irregular (non-uniform) reflection.
2. the female cell - zygote.
3. mechanical waves - electromagnetic waves.
4. 65°
5. estrogen

B 1. Infrasonic waves.
2. Amplitude.
3. Speed of light.
4. Periodic time.
5. Calyx.
6. The crest.
7. Light refraction.

2 **A** 1. It is the property by which the ear can distinguish (differentiate) between harsh and sharp voices.
2. It is the disturbance that propagates and transfers energy in the direction of propagation.
3. It is the process of transfer of pollen grains from the flower anthers to the stigmas.
4. The frequency of the oscillating body is $(\frac{200}{120})$ which equals 1.6 Hz.
5. It is the rebounding of light waves in the same medium on meeting a reflecting surface.

B 1. incidence
2. 20
3. Carpel
4. longitudinal

3 **A** 1. The velocity of sound decreases.
2. It will germinate forming a pollen tube.
3. It will reflect on itself.
4. Its velocity increases to the maximum value.

B 1. Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.
2. Because the flower contains only male or female reproductive organ.
3. It is a periodic motion because it is repeated regularly in equal time intervals, but it is not an oscillatory motion because it is not repeated on the two sides of its rest position.
4. Because light waves are electromagnetic waves which do not need a medium to propagate through.
5. To attract insects to the flower which help in the sexual reproduction process.
6. Because the individuals coming from asexual reproduction are identical to the parent, while in human each individual differs from others.

4 **A** *Look at the main book on pags (44, 45).*

B Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

2 Basateen & Dar Al-Salam Zone

1 **A** 1. d 2. b 3. c 4. d
5. a 6. d 7. b 8. c
9. c 10. c 11. d 12. a

B Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

2 **A** 1. The distance between the centres of two successive compressions or two successive rarefactions is 30 cm (0.3 m).
2. The angle between the reflected light ray and the line perpendicular to the reflecting surface at the point of incidence = 45°

B 1. Rotary bee motion, the rest are : Oscillatory motions.
2. Sound wave, the rest are : Electromagnetic waves.
3. Air, the rest are : Opaque media.
4. Palms, the rest are : Bisexual (hermaphrodite) flowers.
5. Root, the rest are : Parts of the flower.

C (0.8), because the refractive index of any material is greater than one.

D 1. (1) Fallopian tube. (2) Uterus. (3) Uterus muscles. (4) Cervix.
2. It protects and nourishes the fetus during the pregnancy until birth.

3 **A** 1. Vegetative reproduction.
2. Zygote.

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3. Optical density of the medium.
4. Irregular (non-uniform) reflection.
5. Light intensity.
6. Wave amplitude.
7. Sound pitch.
8. Frequency.

O 1. c 2. b 3. d 4. b

C No. (3), because it doesn't contain the ovary which develops and becomes the fruit after fertilization process.

4 **A** 1. maximum
2. crests – troughs.
3. 20 Hz – 20 KHz.
4. pitch – intensity
5. less
6. higher – lower
7. self (auto) pollination – mixed (cross) pollination.

O Refractive index of diamond

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through diamond}}$$

$$= \frac{3 \times 10^8}{1.25 \times 10^8} = \frac{3}{1.25} = 2.4$$

C 1. Because their anthers and stigmas are not maturated at the same time.
2. Because angle of incidence = angle of reflection = zero.
3. Because the frequency of red light photon is less than that of violet light photon.
4. Because they have high ability to kill some types of bacteria and stop the action of some viruses.

O 1. 60° 2. inverse

3 El-Ma'aref Language School

1 **A** 1. the velocity of light through air – the velocity of light through another transparent medium.
2. refraction – the normal at the point of incidence on the interface.
3. decibel – second.
4. transverse – centre of compression

O 1. It analysis the white light into seven spectrum colours.
2. Breaking down kidney and ureter stones without any surgical operations.
3. It is used to treat sprains and cramps by using hot water.
4. They are used to avoid hazards of noise in loud places.

C 1. equal to
2. the refraction of light rays.
3. Periodic
4. Inflorescence
5. Testes

2 **A** 1. Tissue culture.
2. Optical density of the medium.
3. Wave motion. 4. Sound.
5. Pollination. 6. Mirage.
7. Savart's wheel. 8. Calyx.

O 1. Because the ovary of olive contains only one ovule, while that of bean contains many ovules.
2. Because angle of incidence = angle of reflection = zero.
3. They are transverse because the medium particles vibrate perpendicular to the direction of wave propagation forming crests and troughs and mechanical because they need a medium to propagate through.
4. To direct the ovum towards the uterus.

C Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

3 **A** ***Look at the main book on page (164).***

O 1. The distance between the centres of two successive compressions or two successive rarefactions is 25 cm (0.25 m).
2. It is the maximum displacement done by the oscillating body away from its rest position.
3. It is the property by which the ear can distinguish (differentiate) strong or weak sounds.

C 1. c 2. d 3. a
4. b 5. b 6. a
7. d

4 **A** 1. (✗) ..... oscillatory motion.
2. (✗) ..... four whorls.
3. (✗) ..... a fruit.
4. (✓)
5. (✗) Violin is .....

O ***Look at the main book on page (85).***

C 1. ① Receptacle. ② Ovule.
③ Stigma. ④ Petal.
⑤ Filament.
2. Hermaphrodite flower.

4 Abdeen Patriarchal College.

1 **A** 1. perpendicular to
2. a petal.
3. four – amplitude.
4. absolute refractive index of a medium.
5. refraction – normal to the surface
6. calyx – sepals.

O 1. The ovary will grow to become a fruit and the ovule will develop to become a seed.
2. The wavelength decreases to its half value.
3. It will reflect on itself.
4. The white light analysis into seven colours.

C The absolute refractive index of water

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through water}}$$

$$1.33 = \frac{\text{Velocity of light through air}}{2.25 \times 10^8}$$

Velocity of light through air $= 1.33 \times 2.25 \times 10^8$
$= 3 \times 10^8$ m/sec.

2 **A** 1. Optical density of the medium.
2. Bisexual (hermaphrodite) flower.
3. Wave motion.
4. Complete oscillation.
5. Infrasonic waves.
6. Sound quality (type).

O 1. The frequency of the oscillating body is $(\frac{540}{90})$ which equals 6 Hz.
2. It is the process of fusion of the nucleus of the male cell with the nucleus of the female cell to form the zygote.
3. It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.
4. They are tones that accompany the fundamental (basic) tone but they are higher in pitch and lower in intensity and differ from one instrument to another.

C 1. Periodic time $= \frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$

2. Sound intensity $\propto \frac{1}{\text{Square of the distance}}$

3 **O** 1. Because the ovary of pea contains many ovules.
2. Because it is an opaque medium.
3. To ensure the pollination process, as pollination is difficult to occur by insects or by air.
4. To catch pollen grains from air.

O Wave velocity = Wave frequency × Wavelength

Wave frequency of the first wave $= \frac{340}{1.7}$
$= 200$ Hz.

Wave frequency of the second wave $= \frac{340}{20}$
$= 17$ Hz.

The first wave is audible, because its frequency lies within the range of sounds heard by man (from 20 Hz to 20 KHz), while the second wave is non-audible, because its frequency lies within the range of sounds that the human ears can't hear (less than 20 Hz).

C Angle of reflection of the ray falls on mirror (Y) = 50°

4 **A** 1. ***Look at the main book on page (169).***
2.

P.O.C.	Frequency	Periodic time
Definition:	It is the number of complete oscillations made by an oscillating body in one second.	It is the time taken by an oscillating body to make one complete oscillation.
The rule :	Frequency = Number of complete oscillations / Time in seconds	Periodic time = Time in seconds / Number of complete oscillations

3. ***Look at the main book on page (46).***

O 1. a 2. b 3. b
4. a 5. a

C 1. B & H
2. B & C – E & F
3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{0.2} = 5$ Hz.

O 1. ① Head.
② Midpiece.
③ Tail.

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2. It is responsible for the movement of the sperm till it reaches the ovum.

5 Heliopolis Patriarchal College

1 **A** 1. high – low
2. transverse – centre of compression
3. Androecium – gynoecium
4. intensity – pitch

B 1. Because it takes place via parts of roots, stem, leaves or buds.
2. Because the number of complete oscillations is inversely proportional to the periodic time.
3. Due to the refraction of light rays coming from the immersed part in water, where the eye sees the immersed part of the pen on the extensions of these refracted rays.
4. Because they have high ability to kill some types of bacteria and stop the action of some viruses.

C Velocity of sound = Frequency × Wavelength
$= 400 \times 0.85 = 340$ m/sec.

2 **A** 1. The flower. 2. Decibel.
3. Longitudinal wave. 4. Typical flower.
5. Fertilization.

B 1.

Mechanical waves	Electromagnetic waves
- They need a medium to propagate. - They do not propagate through vacuum. - They are transverse or longitudinal waves. - Their velocity is relatively low. Ex. : • Water waves (transverse waves). • Sound waves (longitudinal waves).	- They do not need a medium to propagate. - They propagate through vacuum. - They are transverse waves only. - Their velocity is great (3×10^8 m/sec.). Ex. : • Visible light waves. • Infrared waves. • Radio waves (used in radars).

2.

Grafting by attachment	Grafting by wedge
- In which the scion is attached to the stock. - Ex. : Mango trees.	- In which the scion in the form of a wedge is inserted into a cleft in the stock. - Ex. : Large trees.

C 1. It is the distance between the centres of two successive compressions or rarefactions.
2. It is the maximum displacement done by the oscillating body away from its rest position.

D 1. d 2. b 3. c 4. d 5. a

3 **A** 1. Wavelength = $\frac{4}{2} = 2$ m.
2. Frequency = $\frac{\text{no. of waves}}{\text{time}} = \frac{1}{2} = 0.5$ Hz.
3. Amplitude = 1 m.
4. Wave velocity = Wavelength × Frequency
$= 2 \times 0.5 = 1$ m/sec.

B 1. The angle between the incident light ray and the line perpendicular to the reflecting surface at the point of incidence is 30°
2. The frequency of the oscillating body is $(\frac{500}{10})$ which equals 50 Hz.
3. It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

C 1. Protection of the inner parts of the flower specially before blooming.
2. It is used to determine the pitch (frequency) of an unknown tone.
3. They are used to avoid the hazards of noise in loud places.

D 1. - **Light reflection :** The angle of incidence equals the angle of reflection.
- **Light refraction :** The angle of incidence does not equal the angle of refraction.
2. - **Natural vegetative reproduction :** It takes place by many ways such as, reproduction by : rhizomes, corms, tubers, bulbs and offshoots.
- **Artificial vegetative reproduction :** It takes place by four ways which are cutting, grafting, tissue culture and layering.

4 **A** Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$
$100 = \frac{200 \times \text{Number of gear teeth}}{60}$
Number of gear teeth $= \frac{100 \times 60}{200} = 30$ teeth.

B 1. The intensity of sound decreases to its quarter.

2. It will germinate forming a pollen tube.
3. The sperms will die during their passage through the urethra and the individual becomes infertile.

C 1. fundamental (basic) tone. 2. watt/m^2
3. Reproduction 4. Mirage
5. carpel 6. petals

D 1. anther.
2. (1) Filament. (2) Pollen chamber.
(3) Pollen grains.

E 1. Wavelength. 2. Photon energy.

6 El Seddeek Language School

1 **A** 1. Wave velocity.
2. The flower.
3. Infrasonic waves.
4. Amplitude. 5. Mirage.
6. Cross pollination.

B 1. The discovery of landmines.
2. It protects the inner parts of the flower specially before blooming.

C 1. Amplitude = 10 cm = 0.1 m.
2. Periodic time = 0.4 sec.
3. Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.4} = 2.5$ Hz.
4. Wave velocity = $\frac{\text{Distance covered by the wave}}{\text{Time}}$
$= \frac{16}{0.8} = 20$ cm/sec.
$= 0.2$ m/sec.

2 **A** 1. d 2. a 3. c
4. c 5. d 6. b
7. c 8. a

B 1. The zygote will be formed.
2. The periodic time decreases.

C Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$
$200 = \frac{60 \times \text{Number of gear teeth}}{30}$
Number of gear teeth $= \frac{200 \times 30}{60} = 100$ teeth.

3 **A** 1. Because sound travels through air as spheres of compressions and rarefactions whose centre is the sound source.
2. Because the velocity of light through air is always greater than that through diamond.
3. Because the flower contains only male or female reproductive organ.
4. Because it is repeated regularly in equal periods of time.
5. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
6. Because it regulates and keeps the temperature of testes 2°C below the normal body temperature, which is the optimum temperature for the growth and development of sperms.

B 1. It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.
2. It is the process of fusion of the nucleus of the male cell with the nucleus of the female cell to form the zygote.
3. They are sound waves of frequencies higher than 20 KHz.
4. It is the reflection of light rays when they meet (fall on) a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.

C The absolute refractive index of water
$= \frac{\text{Velocity (speed) of light through air}}{\text{Velocity (speed) of light through water}}$
$1.333 = \frac{3 \times 10^8}{\text{Velocity (speed) of light through water}}$
Speed of light through water $= \frac{3 \times 10^8}{1.333}$
$= 2.25 \times 10^8$ m/s.

4 **A** 1. Ultrasonic 2. 0.4
3. transverse electromagnetic - longitudinal mechanical
4. Air – opaque 5. a seed
6. 28

D 1. (×) 2. (✓) 3. (✓)

E 1. **The energy of red light** is smaller than **the energy of violet light**.
2. - **Longitudinal wave :** The particles of the medium vibrate along the direction of wave propagation.
- **Transverse wave :** The particles of the medium vibrate perpendicular to the direction of wave propagation.

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Giza Governorate

7 6th of October Educational Zone

1 **A** 1. b 2. c 3. a 4. b 5. d
6. c 7. d 8. b 9. b

B (a) Bisexual (hermaphrodite) flower.
(b) Female flower.
(c) Male flower.

C Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$
$= \frac{300}{100} = 3$ Hz.

2 **A** 1. Ultrasonic
2. reproduction by tubers.
3. 20 4. straight 5. 10
6. oscillatory motion.

B Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$100 = \frac{300 \times \text{Number of gear teeth}}{60}$

Number of gear teeth $= \frac{100 \times 60}{300} = 20$ teeth.

C 1. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
2. Because the frequency of violet light is greater than that of red light.
3. To adhere on the insect's body.
4. Because it is responsible for movement of the sperm till it reaches the ovum.

3 **A** 1. mechanical – electromagnetic
2. four 3. photons.
4. regular (uniform) – irregular (non-uniform)
5. air – another transparent medium.
6. sepals. 7. filament.
8. testosterone.

B 1. The ovary will grow to become a fruit.
2. The ovule will become a seed.

C - **Longitudinal wave :** It consists of compressions and rarefactions.
- **Transverse wave :** It consists of crests and troughs.

4 **A** 1. Amplitude.
2. Oscillatory motion.
3. Mechanical waves.
4. Sound intensity.
5. Light reflection.
6. The inverse square law of light.
7. Angle of incidence of light ray.
8. Self pollination.

B 1. Angle of incidence = zero
2. Angle of reflection = zero

C 1. It is the time taken by an oscillating body to make one complete oscillation.
2. It is the process of fusion of the nucleus of the male cell with the nucleus of the female cell to form the zygote.

8 Beverly Hills Language School

1 **A** 1. watt/m^2 – decibel.
2. zygote.
3. transverse – centre of compression
4. pitch
5. 20 – 20000
6. the square of the distance – the frequency.

B 1. - **Mechanical waves :** They need a medium to propagate.
- **Electromagnetic waves :** They do not need a medium to propagate.
2. - **Self pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.
- **Mixed pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

2 **A** 1. The wave.
2. Amplitude.
3. The flower.
4. Angle of emergence.
5. Wave velocity.
6. The first law of light reflection.

B Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$
$= \frac{400 \times 40}{4} = 4000$ Hz.

C 1. Amplitude = 3 m.
2. Periodic time = 4 sec.
3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{4} = 0.25$ Hz.
4. Wavelength = 4 m.

5. Wave velocity = Wavelength × Frequency
$= 4 \times 0.25 = 1$ m/sec.
6. It is a transverse wave.

3 **A** 1. c 2. a 3. b 4. b 5. b 6. c

B 1. It will reflect on itself.
2. The ovary will grow to become a fruit.
3. It will refract far from the normal.

C The intensity of sound at a point is inversely proportional to the square of the distance between that point and the sound source.

4 **A** 1. Part (X) : Corolla (petals).
Part (Y) : Calyx (sepals).
2. Part (X) :
- Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.
Part (Y) : Protection of the inner parts of the flower specially before blooming.
3. Flowers (A) and (B) are bisexual (hermaphrodite) flowers.

B 1. To catch pollen grains from air.
2. Because it is repeated regularly in equal periods of time.
3. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
4. Due to the difference in harmonic tones that associate the fundamental tone of each of them.

C 1. The male reproductive system.
2. (1) Testis.
(2) Penis.
(3) Urinary genital opening.
(4) Vas deferens.
(5) Urinary bladder.
(6) Prostate gland.

9 Al-Mostakbal Modern Language School

1 **A** 1. four – amplitude.
2. 20 – 20
3. high – low
4. self (auto) pollination – mixed (cross) pollination.

B 1. It is the process of fusion of the nucleus of the male cell with the nucleus of the female cell to form the zygote.
2. It is a motion which is regularly repeated in equal periods of time.
3. Angle of incidence = Angle of reflection.

C Periodic time = $\frac{\text{Time in seconds}}{\text{Number of complete oscillations}}$
$= \frac{60}{600} = 0.1$ sec.

2 **A** 1. c 2. b 3. b 4. c 5. c 6. b

B

Regular reflection	Irregular reflection
It is the reflection of light rays when they fall on a smooth (uniform) and glistening reflecting surface, where the incident light rays reflected in one direction.	It is the reflection of light rays when they fall on a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

C Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$
$= \frac{120 \times 30}{60} = 60$ Hz.

3 **A** (a) Bisexual flower (⚥), because it contains male and female reproductive organs.
(b) Female flower (♀), because it contains female reproductive organ only.
(c) Male flower (♂), because it contains male reproductive organ only.

B 1. Because clear glass permits most light to pass through and objects can be seen clearly through it.
2. Due to the difference in the harmonic tones that associate the fundamental tone produced from the source of sound.
3. Because the velocity of light through air is always greater than that through any other transparent medium.
4. Because the flowers contain only male or female reproductive organ.
5. Because angle of incidence = angle of reflection = zero.

C 1. Production of pollen grains.
2. In medical field :
- Breaking down kidney and ureter stones without any surgical operations.

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- Diagnosis of male prostate gland tumors and its effect on bladder.
- Discovering malignant tumors.

In military field : Discovering of landmines.

3. Receiving the ripe ovum and pushing it towards the uterus with the aid of :
   - The contraction and relaxation of the muscles in the tube wall.
   - The movement of the lining cilia.
4. Production of sperms and testosterone hormone.

4 **A** 1. Self pollination. 2. Watt/m^2.
3. Frequency. 4. Mirage.
5. Amplitude. 6. Light refraction.

B

Mechanical waves	Electromagnetic waves
- They need a medium to propagate. - They do not propagate through vacuum. - They are transverse or longitudinal waves. - Their velocity is relatively low. Ex. : • Water waves (transverse waves). • Sound waves (longitudinal waves).	- They do not need a medium to propagate. - They propagate through vacuum. - They are transverse waves only. - Their velocity is great (3×10^8 m/sec.). Ex. : • Visible light waves. • Infrared waves. • Radio waves (used in radars).

C 1. Wavelength $= \frac{4}{2} = 2$ m.

2. - Periodic time $= \frac{2}{1} = 2$ sec.

- Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{2} = 0.5$ Hz.

3. Amplitude = 1 m.

4. Wave velocity = Wavelength × Frequency
$= 2 \times 0.5 = 1$ m/sec.

10 Orouba Language School

1 1. b 2. c 3. b 4. b
5. c 6. b 7. c 8. d
9. a 10. c 11. c 12. b

2 **A** 1. Because sound waves need a medium to propagate through, while radio waves don't need a medium to propagate through.

2. Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.

3. Because dolphins produce ultrasonic waves, while the human ears can't hear sounds of frequencies more than 20 kilohertz.
4. Because the angle of incidence = zero.
5. Due to reflection and refraction of light in air layers which differ in the degree of temperature.
6. Because light waves are electromagnetic waves which do not need a medium to propagate through.

B 1. Testis.
2. The pregnancy period.

3 **A** 1. Concentric circles propagate on the water surface.
2. It appears as being broken.
3. Tumors will appear in different body parts like the liver, bones and parts of genital system, the brain may also be damaged and the patient will die.

B Frequency $= \frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

$6 = \frac{\text{Number of complete oscillations}}{2 \times 60}$

Number of complete oscillations $= 6 \times 120$
$= 720$ oscillations

C *1. Look at the main book on page (93).*

2. Look at the main book on page (113).

4 **A** 1.

Points of comparison	Transverse waves	Longitudinal waves
• Definition :	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
• Composition :	Crests and troughs.	Compressions and rarefactions.
• Wavelength :	It is the distance between two successive crests or troughs.	It is the distance between the centres of two successive compressions or rarefactions.
• Examples :	Water waves.	Sound waves.

2.

Regular reflection	Irregular reflection
It is the reflection of light rays when they fall on a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.	It is the reflection of light rays when they fall on a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

B 1. Angle of incidence = Angle of reflection.
2. It is one of the components of electromagnetic spectrum of wavelength ranges between 380 : 700 nanometres.
3. It is a natural phenomenon that takes place on the desert roads at noon especially in the summer times, where objects on the road sides seem as if they have inverted images on a wet area.

C – A typical flower.
① Sepal.
② Petal.
③ Anther.
④ Ovary.

Alexandria Governorate

11 Middle Educational Zone

1 **A** 1. watt/m^2. 2. increases.
3. 20 4. zero.
5. androecium. 6. tubers.

B 1. Sound waves, the rest are : Electromagnetic waves.
2. Filament, the rest are : Parts of the carpel.
3. Epididymis, the rest are : Organs of female genital system.

C 1.

Auto pollination	Mixed pollination
It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.	It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

2.

Points of comparison	Regular reflection	Irregular reflection
1. The texture of the reflecting surface.	Smooth and glistening.	Rough.
2. The direction of the reflected rays.	The incident light rays are reflected in one direction.	The incident light rays are reflected in different directions.

2 **A** 1. The rarefaction.
2. Mirage.
3. Violet colour.
4. Opaque bodies.
5. Tissue culture.
6. Zygote.

B 1. Amplitude = 1 m.
2. Periodic time = 2 sec.
3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{2} = 0.5$ Hz.
4. Wavelength $= \frac{4}{2} = 2$ m.

C 1. It will refract near the normal.
2. The ovary will grow to become a fruit.

3 **A** 1. b 2. c 3. b 4. d 5. b 6. d

B 1. - Breaking down kidney and ureter stones without any surgical operations.
- Diagnosis of male prostate gland tumors and its effect on bladder tumors.
- Discovering malignant tumors.

2. It is used to treat sprains and cramps by using hot water and nervous tension by using cold water.
3. It analysis the white light into seven spectrum colours.
4. - Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.

C Sound frequency (F) =
$\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$600 = \frac{300 \times \text{Number of gear teeth}}{60}$

Number of gear teeth $= \frac{600 \times 60}{300} = 120$ teeth.

4 **A** 1. inverse 2. straight
3. greater than 4. air
5. single seed 6. root

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C 1. Due to the difference in harmonic tones that associate the fundamental tone of each of them.
2. Because intensity of light is inversely proportional to the square of the distance between the surface and light source.

C 1. Part (X) : Anther.
Part (Y) : Sepal.
2. It protects the inner parts of the flower specially before blooming.
3. Bisexual (hermaphrodite) flower.

12 El-Agamy Educational Zone

1 **A** 1. decibel – metre.
2. regular (uniform) reflection – irregular (non-uniform) reflection.
3. fruit – a seed.
4. white – seven

B 1. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
2. Due to reflection and refraction of light in air layers which differ in the degree of temperature.
3. To attract insects to the flower which help in the sexual reproduction process.

C 1. Female reproductive system.
2. ②
3. ①
4. ③

2 **A** 1. b 2. c 3. d 4. c

B 1. It is used to treat sprains and cramps by using hot water.
2. Protection of the inner parts of the flower specially before blooming.
3. It is used to determine the pitch (frequency) of an unknown tone.
4. Producing large numbers of a plant by using a part of it.

C 1. It will pass without refraction.
2. The flint glass permits only a part of light to pass through and absorbs the remaining part.
3. Mixed (cross) pollination will occur.

3 **A** 1. Optical density of the medium.
2. Typical flower. 3. Light refraction.
4. Sound pitch.

B Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$300 = \frac{600 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{300 \times 60}{600} = 30 \text{ teeth.}$$

C 1. Palm flower.
2. Bean fruit.
3. Clear glass.
4. Reproduction by tubers.

4 **A** 1. - **Transverse waves :** They consist of crests and troughs.
- **Longitudinal waves :** They consist of compressions and rarefactions.
2. - **Self pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.
- **Cross pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.
3. - **Infrasonic waves :** Their frequencies are lower than 20 Hz.
- **Ultrasonic waves :** Their frequencies are higher than 20 KHz.

B 1. oscillatory motion.
2. increases
3. Red 4. style

C Wave velocity = Frequency × Wavelength
= 150 × 0.1 = 15 m/sec.

D 1. It is the motion of an oscillating body when it passes by a fixed point on its path two successive times in the same direction.
2. It is the distance which is covered by light in one second.

13 El-Gomrok Educational Zone

1 **A** 1. decibel – watt/m^2.
2. pitch (frequency)
3. catch pollen grains from air.
4. Irregular (non-uniform) reflection
5. broken.
6. 60°
7. 0.125 sec.

B 1. Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.
2. Because the light rays falls perpendicular to the interface between the two transparent media, so the angle of incidence is equal to the angle of refraction equals zero.
3. Because sound waves need a medium to propagate through, while radio waves don't need a medium to propagate through.
4. Because it helps in transferring of sperms from the testes to urethra.

C Absolute refractive index of glass

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through glass}}$$

$$= \frac{3 \times 10^8}{2 \times 10^8} = \frac{3}{2} = 1.5$$

2 **A** 1. Optical density of the medium.
2. The flower.
3. Infrasonic waves.
4. Mirage.
5. The inverse square law of light.
6. Tissue culture.

B 1. *Look at the main book on page (94).*
2. *Look at the main book on page (164).*

C 1. It is the process of transfer of pollen grains from the flower anthers to the stigmas.
2. The maximum displacement done by the oscillating body away from its rest position is 3 cm (0.03 m).

3 **A** 1. ① Filament. ② Style.
③ Petal.
2. Self pollination.

B 1. greater than
2. 20 : 20000
3. Bean
4. root.
5. Progesterone

4 **A** 1. It will reflect on itself.
2. It will germinate forming a pollen tube.
3. Its velocity increases to the maximum value.

B 1. Visible light wave.
2. Light reflection from a plane mirror.
3. Pendulum motion.

C Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

Al-Qaliubya Governorate

14 Al Resala Language School

1 **A** 1. harsh – sharp voices.
2. sexual reproduction – asexual reproduction.
3. Wave frequency – Wavelength
4. mechanical – electromagnetic
5. ovules – ovary. 6. 20 – 20000
7. Periodic – repeated
8. green – a sepal.

B 1. incident ray. 2. refracted ray.
3. angle of incidence.
4. angle of refraction.

C 1. *Look at the main book on page (167).*
2. *Look at the main book on page (133).*
3. - **Violet light :** It has the highest frequency in the spectrum colours.
- **Red light :** It has the lowest frequency in the spectrum colours.
4. - **Light waves :** - They propagate through vacuum.
- They are transverse electromagnetic waves.
- **Sound waves :** - They do not propagate through vacuum.
- They are longitudinal mechanical waves.

2 **A** 1. Fertilization in plants. 2. Stamen.
3. Ultrasonic waves.
4. Wave amplitude. 5. Corolla.

B 1. Angle of incidence = 90° – 30° = 60°
Angle of reflection = 90° – 30° = 60°
2. Angle of incidence = Angle of reflection
3. It will reflect on itself.

C 1. (✓)
2. (×) ... of insects pollinated ...
3. (×) ... the angle of reflection equals 50° ...
4. (✓)

D 1. Flower (a) : Bisexual (hermaphrodite) flower.
Flower (b) : Female flower.

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2. Mixed pollination occurs in (b) and (c), because they are unisexual flowers.
- Self pollination occurs in (a), because it is bisexual flower.

3. Flower (c).

3 O 1. c 2. b 3. c 4. a 5. b 6. c

O 1. Because they have high ability to kill some types of bacteria and stop the action of some viruses.
2. Because the ovary of olive contains only one ovule, while that of pea contains many ovules.
3. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
4. Because the ray which falls perpendicular to the interface passes to air without refraction, so the apparent position is the real position.
5. To expand as the fetus grows during the pregnancy period.

C 1. Sound frequency (F)

$$= \frac{\text{Number of cycles(d)} \times \text{Number of gear teeth(n)}}{\text{Time in seconds(t)}}$$

$$300 = \frac{600 \times 60}{\text{Time in seconds}}$$

$$\text{Time in seconds} = \frac{600 \times 60}{300} = 120 \text{ sec.}$$

$$\text{Time in minutes} = \frac{120}{60} = 2 \text{ min.}$$

2. a. 0.4 sec. b. 2.5 cycle/sec. c. 2 cm

4 O 1. ..... is the gynoecium ..... is three.
2. ....., it refracts far from the normal, ... lower optical .....
3. ..... of frequency 6 Hz .....
4. Sonic waves ..... frequencies ranging from 20 Hz to 20 KHz.
5. ..... of transparent media, while ..... of translucent media.
6. ..... higher than .....

O 1. Frequency $= \frac{1}{\text{Periodic time}}$

2. Sound frequency

$$= \frac{\text{Number of cycles} \times \text{Number of gear teeth}}{\text{Time in seconds}}$$

3. Angle of incidence = Angle of reflection

4. Frequency $= \frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

C 1. Sound waves – Electromagnetic waves.
2. White – Spectrum colours.
3. Stamen – Parts of the carpel.
4. Rotary bee motion – Oscillatory motions.

O 1. The ovary will grow to become a fruit and the ovule will become a seed.
2. The light intensity decreases to its quarter.
3. The wavelength decreases to its half value.
4. The intensity of sound increases.

El-Sharkia Governorate

15 Omar Al-Farouk (O.L.S.)

1 O 1. ♀ , ♂
2. transverse – centre of compression
3. a seed – a fruit. 4. four – amplitude.
5. watt/m^2 – decibel.

O 1. It is used to determine the pitch (frequency) of an unknown tone.
2. Protection of the inner parts of the flower specially before blooming.
3. - Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.
4. It is used to treat :
- Sprains and cramps by using hot water.
- Nervous tension by using cold water.

2 O 1. Tissue culture.
2. Artificial pollination.
3. Max Planck. 4. The flower.
5. Periodic time. 6. Zygote.
7. Optical density of the medium.
8. Opaque medium.

O 1. - **Self pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of the same flower or to another flower in the same plant.
- **Mixed pollination :** It is the transfer of pollen grains from the anthers of a flower to the stigmas of another flower in other plant of the same kind.

2. - **Red colour :** - It has the lowest deviation in the spectrum colours.
- It is the closest to the prism apex.
- **Violet colour :** - It has the highest deviation in the spectrum colours.
- It is the closest to the prism base.

C Frequency $= \frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$

$$= \frac{300}{30} = 10 \text{ Hz.}$$

3 O 1. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
2. Because they have high ability to kill some types of bacteria and stop the action of some viruses.
3. Because the flowers contain only male or female reproductive organ.

O 1. The ratio between the velocity of light through air to that through water is 1.33
2. The distance between the centres of two successive compressions or two successive rarefactions is 1.5 m.

C

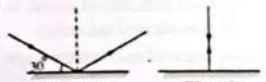

Fig. (1) Fig. (2)

1. 60° 2. zero

4 O 1. a 2. b 3. c 4. d 5. a 6. b

O 1. The anther will split longitudinally and pollen grains will spread in air like dust.
2. It will refract near the normal.
3. Its velocity increases to the maximum value.

C Wavelength $= \frac{\text{Wave velocity}}{\text{Frequency}} = \frac{3 \times 10^8}{6 \times 10^{14}}$

$$= 5 \times 10^{-7} \text{ m.}$$

El-Menofia Governorate

16 Kowesna Educational Zone

1 O 1. compressions – rarefactions.
2. mechanical – electromagnetic
3. self (auto) pollination – mixed (cross) pollination.
4. watt/m^2 – decibel.
5. female – carpels.

O Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

C 1. It will reflect on itself.
2. The wavelength decreases to its half value.

2 O 1. a 2. c 3. c 4. b 5. c

O 1. Wavelength $= \frac{4}{2} = 2$ m.
2. Periodic time = 2 sec.
3. Frequency $= \frac{1}{\text{Periodic time}} = \frac{1}{2} = 0.5$ Hz.
4. Wave velocity = Wavelength × Frequency
$= 2 \times 0.5 = 1$ m/sec.
5. Amplitude = 1m.

C 1. It is the property by which the ear can distinguish (differentiate) between harsh and sharp voices.
2. It is a kind of artificial vegetative reproduction in which a part of plant which contains more than one bud known as scion is selected to be placed on a branch of another plant known as the stock.

3 O 1. Oscillatory motion.
2. The flower.
3. Transparent medium.
4. Sonic waves.
5. The inverse square law of sound.
6. Mirage. 7. Max Planck.

O 1. the angle of reflection.
2. fertilization.
3. light refraction. 4. potatoes.
5. sound intensity decreases.
6. Inflorescence
7. Fallopian tubes
8. sperm

C 1. - **Musical tones :** Tones of uniform frequency.
- **Noises :** Sounds of non-uniform frequency.
2. - **Vegetative reproduction :** Asexual reproduction.
- **Flowering reproduction :** Sexual reproduction.

4 O 1. To catch pollen grains from air.

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2. Because the velocity of light through air is always greater than that through any other transparent medium.
3. Due to the difference in harmonic tones that associate the fundamental tone of each of them.
4. Because the frequency of red light photon is less than that of orange light photon.
5. Due to light refraction.

O 1. ① Petal. ② Sepal. ③ Ovary. ④ Anther.
2. Bisexual (hermaphrodite) flower.
3. Protection of the inner parts of the flower specially before blooming.

C 1. Breaking down kidney and ureter stones without any surgical operations.
2. It is used to treat sprains and cramps by using hot water.
3. It is used to increase the sound intensity of the produced tone.

Al-Gharbeya Governorate

17 Al-Gharbeya Educational Zone

1 **A** 1. sound – longitudinal
2. transverse – centre of compression
3. one – smooth
4. androecium – gynoecium.

O 1. - **Longitudinal wave :** The wavelength is the distance between the centres of two successive compressions or rarefactions.
- **Transverse wave :** The wavelength is the distance between two successive crests or troughs.
2. - **Transparent medium :** It is the medium which permits most light to pass through.
- **Opaque medium :** It is the medium that doesn't permit light to pass through.
3. - **Pollen grain :** - Mobile.
- Produced in large numbers.
- **Ovum :** - Not mobile (static).
- Produced in few numbers.

C 1. Wavelength = 2 m.

2. Frequency = $\frac{\text{Number of complete oscillations}}{\text{Time in seconds}}$
$= \frac{2}{2} = 1$ Hz.

3. Amplitude = 1 m.
4. Wave velocity = Wavelength × Frequency
$= 2 \times 1 = 2$ m/sec.

2 **A** 1. d 2. c 3. c 4. a

B 1. The wavelength decreases to its half value.
2. It will refract far from the normal.
3. The anther will split longitudinally and pollen grains will spread in air like dust.

C Sound frequency (F) =
$\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

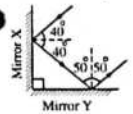
$600 = \frac{300 \times \text{Number of gear teeth}}{60}$

Number of gear teeth = $\frac{600 \times 60}{300} = 120$ teeth.

3 **A** 1. Oscillatory motion. 2. Amplitude.
3. Optical density of the medium.
4. The flower.

B 1. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
2. Because angle of incidence = angle of reflection = zero.
3. Because the flower contains only male or female reproductive organ.

C



Angle of reflection on mirror (Y) = 50°

4 **A** 1. (×) 2. (×) 3. (✓) 4. (×)

B 1. Breaking down kidney and ureter stones without any surgical operations.
2. Protection of the inner parts of the flower specially before blooming.

C Refractive index of diamond
$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through diamond}}$

$= \frac{3 \times 10^8}{1.25 \times 10^8} = \frac{3}{1.25} = 2.4$

O 1. ① Fallopian tube. ② Uterus. ③ Ovary. ④ Vagina.
2. (a) Ovary. (b) Fallopian tube.

Dakahlia Governorate

18 Belkas Educational Zone

1 **A** 1. Fertilization. 2. The wave.
3. The compression.
4. The flower. 5. Infrasonic waves.
6. Optical density of the medium.
7. Vegetative reproduction.
8. Vas deferens

B Sound frequency (F)
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$= \frac{960 \times 30}{120} = 240$ Hz.

C ① Anther. ② Style. ③ Petal. ④ Sepal. ⑤ Ovum.
1. Bisexual (hermaphrodite) flower.
2. ♂ 3. Sexual reproduction.

2 **A** 1. tissue culture.
2. the velocity of light through air – the velocity of light through another transparent medium.
3. directly – frequency 4. Red – violet
5. high – low 6. 2

O 1. The wavelength decreases to its half value.
2. The ovary will grow to become a fruit.
3. It will refract far from the normal.
4. The ovule will become a seed.

3 **A** 1. c 2. b 3. a 4. c 5. c
6. c 7. c 8. c

O 1. It is the process of transfer of pollen grains from the flower anthers to the stigmas.
2. The angle between the refracted light ray and the normal at the point of incidence on the interface equals 45°
3. They are sound waves of frequencies ranging from 20 Hz to 20 KHz (20000 Hz).
4. The distance covered by sound waves in one second is 340 m.

4 **A** 1. (×) 2. (×) 3. (×) 4. (✓)
5. (×) 6. (×) 7. (✓) 8. (×)
9. (✓) 10. (×)

O 1. Velocity of sound = Frequency × Wavelength
$= 200 \times 1.7 = 340$ m/sec.

2. Wavelength = $\frac{\text{Velocity}}{\text{Frequency}} = \frac{1500}{200} = 7.5$ m.

Ismailia Governorate

19 Science Inspectorate

1 **A** 1. b 2. d 3. d 4. c 5. a 6. b

O Sound frequency (F) =
$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$

$= \frac{960 \times 30}{120} = 240$ Hz.

C 1. Protection of the inner parts of the flower specially before blooming.
2. It is used to treat sprains and cramps by using hot water.
3. Sterilization of food, water and milk.

2 **A** 1. - **Transparent medium :** It is the medium which permits most light to pass through.
- **Translucent medium :** It is the medium which permits only a part of light to pass through and absorbs the remaining part.
2. - **Noise intensity :** Decibel.
- **Sound intensity :** Watt/m^2

O 1. The inflorescence. 2. Wave velocity.
3. Photon energy. 4. Tissue culture.
5. Sound pitch.
6. Absolute refractive index of a medium.

C 1. germination of a pollen grain.
2. ① Generative nucleus.
② Tube nucleus.
③ Two male nuclei.
④ Pollen tube.
3. Parts no. ③

3 **A** 1. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
2. To catch pollen grains from air.
3. Due to reflection and refraction of light in air layers which differ in the degree of temperature.

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O 1. Electromagnetic – mechanical
2. wave – periodic
3. natural vegetative – artificial vegetative
4. inversely – the square
5. unisexual – bisexual

C 1. 2 2. 4 3. Medium (B).

4 **O** 1. The intensity of sound increases.
2. Transverse waves are formed.
3. It will reflect on itself.

O 1. oscillatory motion. 2. insects.
3. centre of compression 4. higher

C 1. Amplitude = 5 cm = 0.05 m.
2. Periodic time = 4 × 2 = 8 sec.
3. Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{8}$
= 0.125 Hz.

O 1. *Look at the main book on page (195).*
2. *Look at the main book on page (197).*

Port Said Governorate

20 Port Said Educational Zone

1 **O** 1. a 2. d 3. d 4. b 5. d 6. c

O 1. To attract insects to the flower which help in the sexual reproduction process.
2. Because angle of incidence = angle of reflection = zero.

C Wave velocity = Frequency × Wavelength
50 = Frequency × 2
Frequency = $\frac{50}{2}$ = 25 Hz.

2 **O** 1. real – apparent
2. white – seven spectrum
3. androecium – gynoecium – androecium
4. high – low 5. amplitude.
6. filament – anther.
7. head - tail.

O *Look at the main book on page (115).*

C 1. Breaking down kidney and ureter stones without any surgical operations.
2. It is used to determine the pitch (frequency) of an unknown tone.

3 **O** 1. Transverse wave. 2. Frequency.
3. The flower.
4. Optical density of the medium.
5. Mechanical waves.
6. Irregular (non-uniform) reflection.

O 1. Part (X) : - Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.
Part (Y) : Protection of the inner parts of the flower specially before blooming.
2. a. Mixed (cross) pollination.
b. Bisexual (hermaphrodite) flower.

C 1. They are sound waves of frequencies ranging from 20 Hz to 20 KHz (20000 Hz).
2. It is the quantity of light falling perpendicular to a unit area of a surface in one second.

4 **O** 1. (×) Androecium is .....
2. (×) ..... oscillatory motion. 3. (✓)
4. (×) ..... increases ..... 5. (✓)

O 1. Wavelength = $\frac{4}{2}$ = 2 m.
2. Periodic time = 0.2 sec.
Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.2}$ = 5 Hz.
3. Amplitude = 1 m.
4. Wave velocity = Wavelength × Frequency
= 2 × 5 = 10 m/sec.

Damietta Governorate

21 Damietta Educational Zone

1 **O** 1. high – low 2. four – amplitude.
3. the velocity of light through air – the velocity of light through water.
4. attachment – wedge. 5. hertz – decibel.

O 1. Production of pollen grains.
2. - Breaking down kidney and ureter stones without any surgical operations.
3. Producing large numbers of a plant by using a part of it.
4. It is used to determine the pitch (frequency) of an unknown tone.

C Wave velocity = Frequency × Wavelength
= 400 × 0.85 = 340 m/sec.

2 **O** 1. Harmonic tones. 2. Mirage.
3. Watt/m^2 4. Zygote.
5. Mixed (cross) pollination.

O (1) 1. Longitudinal wave.
2. (A) Rarefaction.
(B) Compression.
3. The wavelength.
4. direction of wave propagation.

(2) 1. (X) Anther.
(Y) Style.
2. It produces pollen grains.
3. - Flower (A) is a female flower.
- Flower (B) is a male flower.

C 1. Female genital system.
2. (1) Uterus. (2) Fallopian tube.
(3) Ovary. (4) Vagina.
3. Label (4)

3 **O** 1. a 2. b 3. d 4. a 5. c

O 1. The light intensity of a surface is inversely proportional to the square of the distance between the surface and the source of light.
2. It is the property by which the ear can distinguish (differentiate) between harsh and sharp voices.
3. It is a short stem whose leaves are modified to reproductive organs which in turn form seeds inside fruits.

C 1. The white light analysis into seven spectrum colours.
2. It will germinate forming a pollen tube.

O 1. Wavelength = $\frac{4}{2}$ = 2 m.
2. Periodic time = 2 sec.
Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{2}$ = 0.5 Hz.
3. Amplitude = 1m.
4. Wave velocity = Frequency × Wavelength
= 0.5 × 2 = 1 m/sec.

4 **O** 1. Because it is electromagnetic waves, which don't need a medium to propagate through.
2. Because the flower contains both male and female reproductive organs.
3. Because the density of carbon dioxide gas is more than that of air, since sound intensity is directly proportional to the density of the medium.
4. Because the ovary of peach contains only one ovule.

O 1.

Pollination	Fertilization
It is the process of transfer of pollen grains from the anthers of a flower to the stigmas.	It is the process of fusion of the nucleus of male cell with the nucleus of female cell to form the zygote.

2.

Regular reflection	Irregular reflection
It is the reflection of light rays when they fall on a smooth (uniform) and glistening reflecting surface, where the incident light rays are reflected in one direction.	It is the reflection of light rays when they fall on a rough (non-uniform) reflecting surface, where the incident light rays are reflected in different directions.

3.

Points of comparison	Transverse wave	Longitudinal wave
• Definition :	It is a disturbance in which the particles of the medium vibrate perpendicular to the direction of wave propagation.	It is a disturbance in which the particles of the medium vibrate along the direction of wave propagation.
• Composition :	Crests and troughs.	Compressions and rarefactions.
• Wavelength :	It is the distance between two successive crests or troughs.	It is the distance between the centres of two successive compressions or rarefactions.
• Example :	Water waves.	Sound waves.

C 1. an opaque medium. 2. frequency.
3. sticky. 4. Inflorescence.
5. potatoes.

El-Behira Governorate

22 Ismail Elhabrouk Language School

1 **O** 1. huge – light.
2. uniform – non-uniform
3. watt/m^2 – decibel.
4. transverse – centre of compression

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B 1. Due to the refraction of light rays coming from the object where the eye sees the fish in an apparent position on the extension of these refracted rays.
2. To attract insects to the flower which help in the sexual reproduction process.
3. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
4. Because during fertilization, they fuse together to form zygote that contains a nucleus of 46 chromosomes (23 pairs of chromosomes).

C 1. Frequency $= \frac{2}{0.04} = 50$ Hz.

2. Wavelength $= \frac{60}{2} = 30$ m.

3. Wave velocity = Frequency × Wavelength
$= 50 \times 30 = 1500$ m/sec.

2 **A** 1. Water waves – Electromagnetic waves.
2. Sound wave its (F) = 10 Hz – Sonic waves.
3. Ovary – Parts of stamen.

B 1. It is used to treat sprains and cramps.
2. Production of ovules.
3. It is used to determine the pitch (frequency) of an unknown tone.

C 1. (a) 2. 140°
3. The incident light ray, the reflected light ray and the normal to the surface of reflection at the point of incidence, all locate in one plane perpendicular to the reflecting surface.

3 **A** 1. b 2. d 3. a 4. d 5. a 6. c

B 1. The light rays are reflected in many directions.
2. Its velocity doesn't change.
3. Self pollination occurs.

C 1. pollen tube. 2. zygote.
3. a seed – a fruit.
4. It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.

4 **A** 1. zero. 2. potatoes.
3. is directly proportional to the square of the amplitude.
4. when it goes far from its rest point.

B Sound frequency (F) =

$$\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$160 = \frac{960 \times \text{Number of gear teeth}}{180}$$

$$\text{Number of gear teeth} = \frac{160 \times 180}{960} = 30 \text{ teeth.}$$

C 1. violet – red.
2. violet – it has the maximum frequency in spectrum colours.

El-Fayoum Governorate

23 Science Supervision

1 **A** 1. transverse - centre of compression
2. 20 Hz – 20 KHz.
3. androecium – gynoecium.
4. opaque – transparent

B 1. It is the time taken by an oscillating body to make one complete oscillation.
2. It is the process of fusion of the nucleus of the male cell (pollen grain) with the nucleus of the female cell (ovum) to form the zygote.
3. It is the change of light path when it travels from a transparent medium to another transparent medium of different optical density.

C 1. It is used to determine the pitch (frequency) of an unknown tone.
2. It analysis the white light into seven spectrum colours.
3. Producing large numbers of a plant by using a part of it.

2 **A** 1. straight. 2. sweet potatoes.
3. the seed. 4. frequency
5. four 6. 50°

B 1. *Look at the main book on page (46).*
2. *Look at the main book on page (170).*

C 1. P 2. N

3 **A** 1. Sound quality (type). 2. Mirage.
3. Wave motion. 4. Infrasonic waves.
5. The flower.
6. Syphilis.

B 1. a 2. c 3. d 4. b 5. d

C The absolute refractive index of diamond

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through diamond}}$$

$$= \frac{3 \times 10^8}{1.25 \times 10^8} = \frac{3}{1.25} = 2.4$$

D At (B) the intensity is $\frac{1}{4}$
At (C) the intensity is $\frac{1}{9}$
At (D) the intensity is $\frac{1}{16}$

4 **A** 1. Because the flowers contain only male or female reproductive organ.
2. Because angle of incidence = angle of reflection = zero.
3. Because it is repeated regularly in equal periods of time.

B Sound frequency (F) =

$$\frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$600 = \frac{300 \times \text{Number of gear teeth}}{60}$$

$$\text{Number of gear teeth} = \frac{600 \times 60}{300} = 120 \text{ teeth.}$$

C 1. Part (X) : - Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.

Part (Y) : Protection of the inner parts of the flower specially before blooming.

2. a. Mixed (cross) pollination.
b. Bisexual (hermaphrodite) flower.

El-Minia Governorate

24 Minia Kawmia Lang. School

1 **A** 1. c 2. d 3. a 4. b

B *Look at the main book on page (91).*

C 1. It is used to determine the pitch (frequency) of an unknown tone.
2. It analysis the white light into seven spectrum colours.

2 **A** 1. Optical density of the medium.
2. Tissue culture. 3. Oscillatory motion.
4. Sound pitch.

B 1. To adhere on the insect's body.
2. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
3. Due to the difference in harmonic tones that associate the fundamental tone of each of them.
4. Because the frequency of red light photon is less than that of orange light photon.

3 **A** 1. greater 2. potatoes.
3. longitudinal 4. straight

B 1. It will reflect on itself.
2. Its velocity increases to the maximum value.

C 1. Wavelength = 15 cm = 0.15 m.
2. Frequency $= \frac{1}{4} = 0.25$ Hz.
3. Amplitude = 3 cm = 0.03 m.
4. Periodic time $= \frac{1}{0.25} = 4$ sec.

4 **A** 1. The velocity of the visible light wave in space is $\left(\frac{6 \times 10^8}{2}\right)$ which equals 3×10^8 m/sec.
2. The angle between the refracted light ray and the normal at the point of incidence on the interface equals 60°
3. The periodic time of this spring is $\left(\frac{60}{60}\right)$ which equals 1 sec.

B 1. Stamen – Parts of the carpel.
2. Rotary bee motion – Oscillatory motions.
3. Harshness of voice – Secondary female sex characters.

C ① Petal. ② Anther.
③ Ovary. ④ Sepal.

Qena Governorate

25 Qeft Official Lang. School

1 **A** 1. mechanical – vacuum.
2. a group of sepals – the corolla.
3. frequency – wavelength.

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4. mechanical waves – electromagnetic waves.
5. refraction – optical density.

D The absolute refractive index of diamond

$$= \frac{\text{Velocity of light through air}}{\text{Velocity of light through diamond}}$$

$$2.4 = \frac{3 \times 10^8}{\text{Velocity of light through diamond}}$$

Velocity of light through diamond

$$= \frac{3 \times 10^8}{2.4} = 1.25 \times 10^8 \text{ m/sec.}$$

C 1. - **Regular reflection :** The incident light rays are reflected in one direction.
- **Irregular reflection :** The incident light rays are reflected in different directions.

2. - **Longitudinal waves :** The particles of the medium vibrate along the direction of wave propagation.
- **Transverse waves :** The particles of the medium vibrate perpendicular to the direction of wave propagation.

3. - **Zygote :** It contains the complete number of genetic material.
- **Pollen grain :** It contains half the number of genetic material.

2

A 1. 4 2. a periodic motion.
3. ultrasonic 4. increasing
5. wood.

B 1. Part (X) : - Protection of reproductive organs of the flower.
- Attraction of insects to the flower, which help in the reproduction process.

Part (Y) : Protection of the inner parts of the flower specially before blooming.

2. a. Mixed (cross) pollination.
b. - Pollination by air (wind).
- Pollination by insects.
c. Bisexual (hermaphrodite) flower.
d. - Tulip.
- Petunia.

3

A 1. Sound intensity.
2. Angle of reflection of light ray.
3. The wave. 4. Watt/m^2.

B 1. Due to the difference in the harmonic tones that associate the fundamental tone produced from the source of sound.
2. Because the velocity of light waves of lightning (electromagnetic waves) is much greater than that of sound waves of thunder (mechanical waves).
3. Due to the production of estrogen hormone.

C 1. The wave frequency decreases to its quarter value.
2. Self pollination occurs.

D Sound frequency (F)

$$= \frac{\text{Number of cycles (d)} \times \text{Number of gear teeth (n)}}{\text{Time in seconds (t)}}$$

$$= \frac{960 \times 30}{120} = 240 \text{ Hz.}$$

4

A 1. b 2. b 3. a 4. b 5. a

B 1. (✓) 2. (✓) 3. (✓)
4. (✗) Gynoecium ....
5. (✓)
6. (✗) ... between 45 to 55 years.

C 1. Amplitude = 2 cm = 0.02 m.
2. Periodic time = 0.4 sec.
3. Frequency = $\frac{1}{\text{Periodic time}} = \frac{1}{0.4} = 2.5$ Hz.

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