

Teacher's Hand Book 8th Physics

EXERCISE - 1

I. Choose the correct answer:

1. In a given system of units, the ratio of the unit of volume to the area gives the unit of: **Ans:** (b) length
2. Which of the following is not a derived quantity? **Ans:** (b) The height of a room
3. The volume of a single liquid drop can be measured using a: **Ans:** (c) pipette
4. Which of the following is the CGS unit of relative density? **Ans:** (d) None of these
5. If the units of length and time are doubled, the unit of speed: **Ans:** (c) remains constant
6. The number of significant figures in 10. 02 is: **Ans:** (d) None of these
7. The figures shown in options represent the zero positions of a screw-gauge when the studs just touch. Which figure has positive zero error? **Ans:** (a)
8. A screw gauge has a negative zero error. Which is correct?

Ans: (c) Correction = + [(n – coinciding C.S. division) × L.C.]

II. Say True or False

1. Length, mass, time and force are physical quantities. **Ans:** True
2. Physical quantities are divided into two categories. **Ans:** True
3. Vernier calipers are used to measure the length of small objects. **Ans:** True
4. Screw gauge is used to measure time. **Ans:** False
5. Area is a derived quantity. **Ans:** True

III. Concept Questions

1. What is a fundamental unit?

Ans: A unit chosen by convention that is independent of other units and cannot be derived from them.

2. Write any four fundamental units.

Ans: Metre (m) for length, kilogram (kg) for mass, second (s) for time, ampere (A) for electric current.

3. What are derived quantities?

Ans: Physical quantities that are expressed algebraically in terms of fundamental quantities (e.g., speed = distance / time).

4. How do you find the volume of irregular solids heavier than water and insoluble?

Ans: By the displacement (overflow) method: immerse the solid fully in a graduated cylinder or overflow can filled with water and measure the volume of water displaced.

5. How do you find the volume of an insoluble solid but lighter than water?

Ans: Attach the solid to a sinker (a heavy object) of known volume, submerge both, measure the combined displaced volume, then subtract the sinker's volume.

IV. Multi Correct Choice Type

1. The fundamental quantities of measurement are ... **Ans:** (b) Time, (c) Mass
2. Which among these are not fundamental units of measurement? **Ans:** (a) Metre s⁻², (c) Metre s⁻¹
3. The density of an object is related to its ... **Ans:** (b) Mass, (c) Volume
4. Which among these are units of the CGS system? **Ans:** (a) Second, (c) cm
5. Which among these are not SI units of measurement? **Ans:** (a) Foot, (b) Celsius

V. Reasoning Type Questions:

1 **Statement-1** : Hertz is used to measure frequency.

Statement-2 : Frequency is a derived quantity.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

2 **Statement-1** : The unit of charge is coulomb.

Statement-2 : Power is measured in watt.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

3 **Statement-1** : Rainfall is measured in millimetres.

Statement-2 : Millimetre is the unit to measure volume.

Ans: (c) Statement-1 is true & statement-2 is false.

4 **Statement-1** : Vernier calipers are used to measure length.

Statement-2 : Vernier calipers were designed by French mathematician Vernier in 1630.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

5 **Statement-1** : The screw gauge is used to measure the width of small objects.

Statement-2 : The screw gauge works on the principle of the screw and nut.

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

Application Skill Achiever

1. The time periods of two simple pendulums of different lengths is the same on two different planets. If the lengths of the two pendulums are in the ratio of 1 : 9, then what is the ratio of the accelerations due to gravity on the two planets?

Ans: Let the length of pendulum1 be L_1

Length of pendulum1 be L_2

Acceleration due to gravity of planet1 be g_1

Acceleration due to gravity of planet2 be g_2

$$\frac{L_1}{L_2} = \frac{1}{9} \text{ then } \frac{g_1}{g_2} = ?$$

$$2\pi\sqrt{\frac{L_1}{g_1}} = 2\pi\sqrt{\frac{L_2}{g_2}}$$

$$\Rightarrow \frac{L_1}{g_1} = \frac{L_2}{g_2} \Rightarrow \frac{L_1}{L_2} = \frac{g_1}{g_2}$$

$$\therefore \frac{g_1}{g_2} = \frac{1}{9}$$

2. If the length of a seconds pendulum on a planet is 2 m, then what is the acceleration due to gravity on the surface of that planet?

Ans: $L = 2 \text{ m}$, $T = 2$

$$T = 2\pi\sqrt{\frac{L}{g}} \Rightarrow \sqrt{\frac{L}{g}} = \frac{T}{2\pi} \Rightarrow g = \frac{4\pi^2}{T^2} \times L = 4 \times 3.14^2 \times 2 = 78.8768 \text{ m/sec}^2$$

3. 7.9 kg of steel scrap was melted and recast into a cuboid of block 20 cm long, 10 cm wide and 5 cm high. What is the density of steel cuboid?

Ans: Volume of the melted cuboid = $20 \times 10 \times 5 = 1000 \text{ cm}^3$

$$\text{Density} = 7.9 / 1000 = 0.0079 \text{ kg / cm}^3$$

4. What is least count of a vernier calipers having 20 vernier divisions when 1 M.S.D. = 0.1 cm?

Ans: No. of divisions on vernier scale = 20

$$1 \text{ M.S.D.} = 0.1 \text{ cm}$$

$$\text{LC} = 1 \text{ M.S.D.} / \text{Number of vernier scale division} = 0.1/20 = 0.005 \text{ cm}$$

5. If the time taken by the bob of a simple pendulum to go from one extreme position to the other extreme position is 0.75 s. Find the time period of the pendulum.

Ans: Time period = $0.75 \times 2 = 1.5$ sec.

6. The 4th division of the Vernier coincides with 3rd division of main scale find the zero correction.

Ans: The 4th division of the vernier scale coincides with the 3rd division of the main scale.

The zero error = $-4 \times .01 = -0.04$ cm.

7. The Vernier Caliper has 10 divisions on the Vernier scale. 1 cm on main scale is divided into 20 equal parts. Find the least count of the Vernier.

Ans: Division on the vernier scale $N = 10$

Divisions on main scale in each cm = 20

$$\therefore 1 \text{ main scale division} = \frac{1}{20} = 0.05 \text{ cm}$$

$$\therefore \text{least count} = \frac{MSD}{N} = \frac{0.05}{10} = 0.005 \text{ cm}$$

8. The main scale reading of a gold bar is 8.2 cm. The 8th division on Vernier scale is found to coincide with 9th division on the main scale. Find the length of the gold bar.

Ans: MSR = 8.2 cm; VSR = 8; LC = 0.01

The length of the gold bar = MSR + (VSR $\times$ LC)

$$= 8.2 + (8 \times 0.01)$$

$$= 8.2 \text{ cm} + .08 \text{ cm} = 8.28 \text{ cm}.$$

9. Find the least count of a screw gauge whose head is divided into 50 divisions and moves through 5mm for 5 rotations of the head.

Ans: Distance moved by 5 rotations = 5mm

$$\text{Pitch of the screw} = \frac{5}{5} = 1 \text{ mm}$$

$$\text{Least count} = \frac{\text{Pitch}}{\text{No. Of Division on the head}} = \frac{1 \text{ mm}}{50} = 0.02 \text{ mm}$$

10. The least count of a screw gauge is 0.01. If it moves 4mm in 10 rotations, find the number of head scale division.

Ans: The least count of the screw gauge = 0.01

It moves 4 mm in 10 rotations

$$\text{Pitch of the screw gauge} = \frac{4}{10} = 0.4 \text{ mm}$$

$$\text{The no of divisions on the head} = \frac{\text{Pitch}}{LC} = \frac{0.4}{0.01} = 40$$

No. of head scale division is 40

EXERCISE - 2

I. Choose the Correct Answer:

1. Muscular force is a _____ force. **Ans:** (a) Contact
2. Friction force is due to _____. **Ans:** (a) Relative motion between two surfaces in contact
3. Which among these is a non-contact force? **Ans:** (c) Magnetic force
4. Gravitational force is a _____. **Ans:** (b) Non-Contact force
5. Which among these is a contact force? **Ans:** (c) Friction force
6. Every object on Earth's surface is _____. **Ans:** (b) Pulled towards the center of earth by gravitational force
7. Which among these about gravitational constant G is correct?
Ans: (c) The G value is constant irrespective of place and location on earth.
8. In outer space, the astronauts experience weightlessness due to _____. **Ans:** (d) None of these
9. The friction that exists between two surfaces when a body rolls on a surface is called _____.
Ans: (c) Rolling friction
10. Which of the following is not correct about friction by liquids and gases?
Ans: (a) Gases exert friction but liquids don't exert friction on the bodies moving through them.

II. Say True or False:

1. Newton & Dyne are units of energy. **Ans:** False
2. Electrostatic force is a contact force. **Ans:** False
3. The weight of an object depends upon its mass. **Ans:** True
4. Rolling friction is less than sliding friction. **Ans:** True
5. The direction of frictional force is always opposite to the direction of motion of an object. **Ans:** True

III. Concept Questions:

1. Write any three effects of force.

- Ans:**
- o Changes motion (speed/direction).
 - o Deforms shape (e.g., stretching a spring).
 - o Stops a moving object.

2. Write any two contact forces and any two non-contact force.

- Ans:** **Any two contact forces:** Friction, Muscular force.
Any two non-contact forces: Gravity, Magnetic force.

3. What is the difference between mass and weight?

- Ans:** Mass vs. Weight:
Mass: Scalar quantity (kg), constant everywhere.
Weight: Force (N), depends on gravity ($W=m \times g$).

4. What is rolling friction?

- Ans:** **Rolling friction:** Friction when an object rolls over a surface (e.g., wheels on road).

IV. Multi Correct Choice Type:

1. Pushing a shopping trolley is an example of:

- Ans:** (a) Applying Force, (b) Push

2. Which among these are combination of push and pull?

- Ans:** (a) Load lifted by pulley (pull), (b) Erasing with rubber (push-pull).

3. Which among these are effects of force?

- Ans:** (a) Change direction, (b) Change shape, (c) Change size.

4. Which among these are examples of non-contact forces?

Ans: (b) Gravitational force, (c) Magnetic force.

5. Which among these are correct about weight and mass?

Ans: (b) Weight = $9.8 \times \text{mass}$, (c) Weight/Mass = 9.8.

V. Reasoning Type Questions:

1. **Statement-1 :** Friction is a force acting when one body slides over the surface of another body.

Statement-2 : Friction is a non-contact force.

Ans: (c) Statement-1 is true & statement-2 is false.

2. **Statement-1 :** Newton is a bigger unit than dyne to measure force.

Statement-2 : $1 \text{ N} = 10^5 \text{ dyne}$

Ans: (c) Statement-1 is true & statement-2 is false.

3. **Statement-1 :** Gases exert friction on the bodies moving through them.

Statement-2 : Liquids exert friction on the bodies moving through them.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

4. **Statement-1 :** The friction that exists between the surfaces in contact when there is no relative motion is called static friction.

Statement-2 : The direction of friction force is always opposite to the direction of motion of the object.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

5. **Statement-1 :** An astronaut experiences weightlessness.

Statement-2 : In outer space there is no gravitational force.

Ans: (d) Statement-1 is false & statement-2 is true.

Application Skill Achiever:

1. Convert 45000 dynes into Newton.

Ans: $45000 \times 10^{-5} = 0.45 \text{ Newton}$

2. Convert 2.4 Newton into dynes.

Ans: $2.4 \times 10^5 = 240000 \text{ dynes}$

3. A force of 24 Newton is applied to a mass of 3 kg. Find the acceleration. Consider the coefficient of friction of air is zero.

Ans: Given $F = 24 \text{ Newton}$, $\text{Mass} = 3 \text{ Kg}$

$$F = M \times A \Rightarrow A = F/M = 24/3 = 8 \text{ ms}^{-2}$$

4. If the mass of a moving object is 50kg, what force will be required to speed up the object at a rate of 2 ms^{-2} ?

Ans: Given $M = 50 \text{ kg}$, $A = 2 \text{ m/s}^2$

$$F = M \times A = 50 \times 2 = 100 \text{ Newton}$$

5. To accelerate a vehicle to 3 m/s^2 what force will be needed if the mass of the vehicle is equal to 100 kg?

Ans: Given $A = 3 \text{ ms}^{-2}$, $M = 100 \text{ kg}$

$$F = M \times A = 100 \times 3 = 300 \text{ Newton}$$

6. If 1000N force is required to accelerate an object to the rate of 5 m/s^2 , what will be the weight of the object?

Ans: Given $F = 1000 \text{ Newton}$, $A = 5 \text{ m/s}^2$

$$F = M \times A$$

$$\therefore M = F/A = 1000/5 = 200 \text{ Kg}$$

$$\text{Weight} = m \times a = 200 \times 9.8 = 1960 \text{ N}$$

7. After applying a force of 1000 N an object of mass 2000 kg will achieve what acceleration?

Ans: Given $F = 1000$ Newton, Mass = 2000 Kg

$$F = M \times A \Rightarrow A = F/M = 1000/2000 = 0.5 \text{ m/s}^2$$

8. A force of 240 N is applied to a body. Convert the force to dyne.

Ans: 1 newton = 10^5 dyne

$$240 \text{ newton} = 10^5 \times 240 = 2.4 \times 10^7 \text{ dyne.}$$

9. A force of 2.4 N is applied to a body. Express the force to kgf.

Ans: 1 newton = $\frac{1}{9.8} \text{ kgf}$

$$\therefore 2.4 \text{ N} = 2.4 \times \frac{1}{9.8} \text{ kgf} = \frac{1}{4} \text{ kgf}$$

10. What is the acceleration a vehicle having 800kg of mass will get after applying a force of 400N?

Ans: $m = 800 \text{ kg}$, $f = 400 \text{ N}$

$$\therefore \text{Acceleration } a = \frac{f}{m} = \frac{400}{800} \text{ m/s}^2 = 0.5 \text{ m/s}^2$$

EXERCISE - 3

I. Choose the Correct Answer:

- | | |
|---|---|
| 1. Turning a pen screw is an example of | Ans: (b) Couple |
| 2. What happens when the length of the lever increases? | Ans: (a) The mechanical advantage increases |
| 3. The principle used in gears: | Ans: (a) Wheel and axle |
| 4. A crowbar is an example of: | Ans: (a) Class 1 lever |
| 5. A bottle opener is an example of: | Ans: (b) Class 2 lever |
| 6. An example of a couple: | Ans: (c) Locking and unlocking doors using a key |
| 7. Screw Jack works based on the principle of: | Ans: (c) Screw and lever |
| 8. See Saw is an example of _____ lever. | Ans: (a) Class 1 |
| 9. In a first-class lever: | Ans: (a) Fulcrum is located between load and force |
| 10. Scissors is an example of _____ lever. | Ans: (a) Class 1 |

II. Say True or False:

- | | |
|---|-------------------|
| 1. The weight being lifted by the simple machines is called work. | Ans: False |
| 2. A machine can be used to obtain a gain in speed. | Ans: True |
| 3. Wedges are compound machines. | Ans: False |
| 4. Levers are classified into three types. | Ans: True |
| 5. See-saw is a class-2 lever. | Ans: False |

III. Concept Questions:

1. What is a compound machine?

Ans: A compound machine is a device that is made by combining two or more simple machines. These machines work together to make a task easier. For example, a wheelbarrow combines a lever and a wheel & axle.

2. Explain the structure of a Class-1 lever with an example.

Ans: In a Class-1 lever, the fulcrum is placed between the effort and the load.

Example: Seesaw

Structure: Effort — Fulcrum — Load

When you apply force (effort) on one side, the load on the other side moves in the opposite direction.

3. Explain the structure of a Class-2 lever with an example.

Ans: In a Class-2 lever, the load is placed between the effort and the fulcrum.

Example: Wheelbarrow

Structure: Fulcrum — Load — Effort

This type of lever increases force and is helpful in lifting heavy loads with less effort.

4. Explain the structure of a Class-3 lever with an example.

Ans: In a Class-3 lever, the effort is applied between the load and the fulcrum.

Example: Tongs or Human arm

Structure: Fulcrum — Effort — Load

This type of lever increases speed or distance, but more effort is required.

5. Write any two uses of wheel & axle.

Ans: Drawing water from a well using a pulley with a wheel & axle.

Steering a car using a steering wheel, which uses the wheel & axle principle.

IV. Multi Correct Choice Type:

- Which among these are not simple machines? **Ans:** (b) Mixer-grinder, (c) Transistors
- Which among these are wedges? **Ans:** (a) Knife, (b) Axe
- Which among these are correct about first class levers? **Ans:** (a) Changes force direction, (c) Fulcrum is middle.
- Which among these are correct about second class lever? **Ans:** (c) Nut cracker is an example.
- Which among these are correct about 3rd class levers? **Ans:** (b) Fishing rod is an example.

V. Reasoning Type Questions:

- Statement-1 :** Levers are classified into 3 types

Statement-2 : A single pulley reverses the direction of a force

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

- Statement-1 :** A fixed pulley does not change position.

Statement-2 : Pulleys makes work easier by changing the direction of the applied force.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

- Statement-1 :** A wedge is a simple machine used to push two objects apart.

Statement-2 : A wedge is usually made up of two inclined planes.

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

- Statement-1 :** The third class lever does not give any mechanical advantage.

Statement-2 : If two pulleys are used; it takes half the effort to lift something but the rope should be pulled twice as far

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

- Statement-1 :** Use of pulleys makes work easier by changing the direction of the applied force.

Statement-2 : In a movable pulley system the load moves in the same direction.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

Application Skill Achiever:

- Danny is 60lbs, Maria is 40lbs, both are balanced on seesaw that is 10ft. If the fulcrum is x ft away from Danny, what is x?

Ans: $60x = 40(10 - x)$

$$\Rightarrow 60x = 400 - 40x$$

$$\Rightarrow 60x + 40x = 400$$

$$\Rightarrow 100x = 400 \Rightarrow x = 400/100 = 4$$



2. John, Peter and Jane weigh 80, 60 and 50 lbs respectively. John sits 3 ft., Peter sits 5 ft. and Jane sits 6 ft. from the fulcrum on the same side. How far must their 200 lb. father sits from the fulcrum in order to balance them?

Ans: Mass of John = 80 kg

Position of John from Fulcrum = 3 feet

Mass of Peter = 60 kg

Position of Peter from Fulcrum = 5 feet

Mass of Jane = 50 kg

Position of Jane from Fulcrum = 6 feet

Mass of father = 200 kg

Position of father from Fulcrum = x

$$(80 \times 3 + 60 \times 5 + 50 \times 6) = 200x$$

$$x = 840/200 = 4.2 \text{ feet}$$

$\therefore$ Position of father from Fulcrum = 4.2 feet



3. Find the percentage efficiency of a system, where a load of 20 kgf is lifted by an effort of 4 kgf, with a single movable pulley.

Ans: V.R. of single movable pulley = No. of supporting segments of string = 2

$$\text{M.A of single movable pulley} = \frac{L}{E} = \frac{20}{4} = 5$$

$$\% \text{ Efficiency} = \frac{\text{M.A.}}{\text{V.R.}} \times 100 = \frac{5}{2} \times 100 = 250\%$$

4. The length of a stapler (fulcrum - load - force) is 32 cm. A force of 20 kgf is used to staple a book, using the stapler where the book is kept 10 cm from the fulcrum. Find the force required to staple the book without using the stapler.

Ans: Effort arm = 32 cm; Load arm = 10 cm; Effort E = 20 kgf; L = ?

$$\frac{\text{Load}}{\text{Effort}} = \frac{\text{Effort Arm}}{\text{Load Arm}}$$

$$\text{Load} = \frac{\text{Effort Arm}}{\text{Load Arm}} \times \text{Effort} = \frac{32}{10} \times 20 = 64 \text{ kgf}$$

5. Deepak checked the mass of himself along with his school bag as 52 kg. He sits on a seesaw at a distance of 3 feet from the middle of the seesaw. And to maintain balance he keeps his bag at a distance of 10 feet from the middle of the seesaw. What is the mass of his bag?

Ans: Suppose the mass of Deepak = x kg

The mass of the school bag = (52 - x) kg on the seesaw.

Deepak sat one side and bag kept another side so

$$3 \times x = 10 (52 - x)$$

$$\Rightarrow 3x = 520 - 10x$$

$$\Rightarrow 3x + 10x = 520$$

$$\therefore = \frac{520}{13} = 40 \text{ kg}$$

The mass of Deepak is 40 kg

The mass of his school bag = 52 - 40 = 12 kg.

6. In a single movable pulley system a load of 120N is lifted by an effort of 20N. Find the efficiency of the pulley system.

Ans: Load on the pulley system = 120 N

Effort required = 20 N

$$\text{Efficiency of the pulley system} = \frac{120\text{N}}{20\text{N}} \times 100\% = 600\%$$

EXERCISE - 4

I. Choose the Correct Answer:

- In a circular motion, the centripetal force is _____. **Ans:** (b) Towards the center
- Change of angular position is called _____. **Ans:** (b) Angular displacement
- Change of angular velocity per unit time is called _____. **Ans:** (b) Angular acceleration
- Angular velocity at a particular instant is called _____. **Ans:** (b) Instantaneous angular velocity
- The unit of angular displacement is _____. **Ans:** (b) Radian
- Centripetal force $F_N =$ _____. **Ans:** (a) $\frac{mv^2}{r}$
- Which among these is correct about angular acceleration? _____ **Ans:** (b) $\alpha = \frac{\omega^2 - \omega^1}{t}$
- If v stands for linear velocity and w stands for angular velocity, which among these is correct? _____ **Ans:** (c) $v = r\omega$
- The maximum velocity with which a vehicle can go round a level curve without skidding is _____. **Ans:** (d) None of these
- The maximum velocity with which a vehicle can go round a slanted curve without skidding is _____. **Ans:** (c) $\sqrt{rg \tan\theta}$

II. Say True or False:

- Acceleration of a particle having uniform circular motion is constant. **Ans:** False
- If a particle is in non uniform circular motion, angular velocity w is not constant. **Ans:** True
- The maximum velocity with which a vehicle can go round a level curve without skidding is $\sqrt{\mu rg}$. **Ans:** False
- Dimensional formula for acceleration is $M^0L^2T^{-2}$. **Ans:** False
- In circular roads the outer part of the road is somewhat raised comparable to the inner part. **Ans:** True

III. Concept Questions:

1. What is circular motion?

Ans: Circular motion is the motion of an object along a circular path or a curved path with a fixed radius. In this motion, the object continuously changes direction but stays at the same distance from a central point.

2. Write any two examples of circular motion.

Ans: The motion of the hands of a clock.

The rotation of a ceiling fan.

3. What is angular position?

Ans: Angular position is the angle made by an object in circular motion with respect to a fixed reference line. It tells where the object is on the circular path at a given time, usually measured in radians or degrees.

4. What is angular displacement?

Ans: Angular displacement is the change in angular position of an object as it moves along a circular path. It is measured in radians and tells how much angle the object has covered from its starting point.

5. What is angular acceleration?

Ans: Angular acceleration is the rate of change of angular velocity with time. It tells us how quickly the rotational speed of an object is increasing or decreasing. It is measured in radians per second² (rad/s²).

IV. Multi Correct Choice Type:

1. The examples of circular motion are _____

Ans: (a) Revolution of planets around the sun., (c) Revolution of electrons around the nucleus.

2. Which among these are not examples of circular motion?

Ans: (c) Movement of simple pendulum

3. Which among these are correct about centripetal force?

Ans: (a) If the radius increases the centripetal force decreases
(b) If the mass increases the centripetal force also increases
(c) If the velocity increases, the centripetal force also increases.

4. Which among these are correct about angular displacement?

Ans: (a) It is a difference of two angles, (b) The SI unit of angular displacement is radian.

5. Which among these are not constant in uniform circular motion?

Ans: (a) Acceleration, (c) Velocity

V. Reasoning Type Questions:

1. **Statement-1** : The rate of change of angular displacement per unit time is called as angular velocity.

Statement-2 : Change in angular position is called angular acceleration.

Ans: (c) Statement-1 is true & statement-2 is false.

2. **Statement-1** : Acceleration of a particle having uniform circular motion is constant.

Statement-2 : Angular displacement is an angle.

Ans: (d) Statement-1 is false & statement-2 is true.

3. **Statement-1** : The angular velocity at a particular instant is called instantaneous angular velocity.

Statement-2 : The centripetal force is towards the centre

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

4. **Statement-1** : Centripetal acceleration

$$A_n = V^2/R$$

Where v = speed of the particle at a given point and R= radius of the circle

Statement-2 : Angular displacement $\Delta\theta = \theta_2 - \theta_1$ where θ_2 is the final angle and θ_1 is in the initial angle.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

5. **Statement-1** : In circular roads the necessary centripetal force is provided by friction.

Statement-2 : In real life the necessary centripetal force is provided by banking of roads.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

6. **Statement-1** : Angular velocity (ω) = $r\omega$

Statement-2 : $\omega = \frac{d\theta}{dt}$

Ans: (c) Statement-1 is true & statement-2 is false.

Application Skill Achiever:

1. What is the centripetal force of a object moving in a circular motion? If its mass is 2.4 kg and velocity is 20 m/s. And the radius of the circular path is 10 m.

Ans: Given $m = 2.4$ kg, $v = 20$ m/s, $r = 10$ m, Centripetal force = ?

$$\text{Centripetal force} = \frac{mv^2}{r} = \frac{2.4 \times 20 \times 20}{10} = 96N$$

2. The angular velocity of an object moving in a circular motion is 1.2 radian per sec. If the radius of the part is 20 meters. What is its Linear velocity?

Ans: Given Angular velocity = 1.2 radian per second, Radius = 20 M., Linear velocity = ?

$$v = r\omega = 20 \times 1.2 = 24 \text{ m}$$

3. At what maximum velocity a vehicle can go round a level curve without skidding? If the radius of the path is 20 meters and coefficient of friction is 0.7.

Ans: Given Radius = 20 m, coefficient of friction = 0.7, Maximum velocity = ?

$$u = \sqrt{\mu rg} = \sqrt{0.7 \times 20 \times 9.8} = 11.7 \text{ m/s}$$

4. A ball tied to a rope is revolved around a point. The centripetal force is measured 24 N. The length of the rope is 12 meter. If the mass of the ball is 2 kg find its velocity,

Ans: Given Centripetal force = 24 N, Radius = 12 m, Mass = 2 kg, Velocity = ?

$$\frac{mv^2}{r} = 24N$$

$$\text{Centripetal force} = \Rightarrow \frac{2 \times v^2}{12} = 24N \text{ mv}^2$$

$$\therefore v = 12 \text{ m/sec.}$$

$$\therefore \text{Velocity} = 12 \text{ m/s}$$

5. Find the centripetal force of a moving rock of mass 120kg moving with a velocity 40km/hr. The radius of the path is 30 meter.

Ans: Mass of the rock = 120kg

$$\text{Velocity} = 40 \text{ km/hr} = \frac{40000}{60 \times 60} = \frac{400}{36} \text{ m/sec.}$$

Radius of the path = 30m

$$\text{Centripetal force} = \frac{mv^2}{r} = \frac{120 \text{ kg} \times \frac{400}{36} \times \frac{400}{36}}{30} = 49.38N$$

6. Find the angular displacement if the initial angle is 2 radians and final angle is 3.2 radians.

Ans: Initial angle = 2 radian

Final angle = 3.2 radian

$$\therefore \text{Angular displacement} = (3.2 - 2) \text{ radian} = 1.2 \text{ radian}$$

7. A satellite is moving in a circular path. Which moves 30° in 12 minutes. Find out its angular velocity.

Ans: The satellite moves 30° in 12 minutes

$$\therefore \text{angular velocity} = \frac{30}{12} \text{ degree per minute}$$

8. A toy aeroplane is moving in a circular motion. Its centripetal force is measured as 1200 N. If the velocity is doubled what will be the centripetal force.

Ans: Centripetal force = 1200 N

If the velocity is doubled the centripetal force will be

$$\frac{mv^2}{r} = \frac{m \times (v \times 2) \times (v \times 2)}{r} = \frac{mv^2}{r} \times 4 = 1200 \times 4 = 4800 \text{ N}$$

9. A particle is moving in a circular motion with a velocity of 2 km/sec. If its mass is 25 gm and radius of the path is 250 m, find the centripetal force.

Ans: Velocity = 2 km/sec = 2000 m/s

Mass = 25 g = 0.02 kg

Radius of the path = 250 m.

$$\text{Centripetal force} = \frac{mv^2}{r} = \frac{0.02 \text{ kg} \times 2000 \text{ m/s} \times 2000 \text{ m/s}}{250 \text{ m}} = 400 \text{ N}$$

10. Satellite 1 is moving at velocity of 6 m/sec and satellite 2 is moving at a speed of 12 m/sec. The mass of both the satellites are equal. If the radius of the path of satellite 2 is twice the radius of the path of satellite 1. Which satellite has more centripetal force?

Ans: Velocity of satellite 1 = $v_1 = 6 \text{ m/s}$

Velocity of satellite 2 = $v_2 = 12 \text{ m/s}$

Mass of both the satellite = m

Radius of satellite 1 = R

Radius of satellite 2 = $2R$

$$\text{Centripetal force of satellite 1} = \frac{mv^2}{r} = \frac{m \times 6 \times 6}{r} = \frac{36m}{r} \text{ N}$$

$$\text{Centripetal force of satellite 2} = \frac{mv^2}{r} = \frac{m \times 12 \times 12}{2r} = \frac{72m}{r} \text{ N}$$

The centripetal force of satellite 2 is more.

11. A 0.5 mass is rotating in a horizontal circle of radius 20 cm. calculate the centripetal force acting on it. If its angular speed of revolution is 0.8 rad/s.

Ans: Mass of the object = 0.5 kg.

Radius $r = 20 \text{ cm} = 0.2 \text{ m}$.

Angular velocity = 0.8 rad/sec.

Its linear velocity $v = \omega r = 0.8 \times 0.2 = 0.16 \text{ m/sec}$.

$$\text{The centripetal force acting on it } F = \frac{mv^2}{r} = \frac{0.5 \times 0.16 \times 0.16}{0.2} = 0.064 \text{ N}$$

12. A stone of mass 150 g is rotated in a horizontal circle 10 m/s which is attached to the end of a 1 m long string. Find out the acceleration and centripetal force of the stone.

Ans: Mass of the stone = 150 gm.

Velocity $v = 10 \text{ m/sec}$.

Radius $r = 1 \text{ m}$.

$$\text{Acceleration } a = \frac{v^2}{r} = \frac{10 \text{ m/sec} \times 10 \text{ m/sec}}{1 \text{ m}} = 100 \text{ m/sec}^2$$

The centripetal force $F = ma = 0.15 \text{ kg} \times 100 \text{ m/sec}^2 = 15 \text{ N}$.

EXERCISE - 5

I. Choose the Correct Answer:

1. Transversal wave propagates through _____. **Ans:** (b) Solids and liquids
2. Waves in a spring is an example of _____. **Ans:** (b) Longitudinal wave
3. Light waves are _____. **Ans:** (a) Electromagnetic waves
4. Which among these is correct about mechanical and non mechanical waves?
Ans: (a) Mechanical waves need a medium for propagation but non mechanical waves don't need any medium for propagation
5. The highest part of a transversal wave is _____. **Ans:** (b) Crest
6. In transversal wave the particles _____. **Ans:** (c) Vibrate and perpendicular to the direction.
7. Light waves are _____. **Ans:** (a) Electromagnetic waves
8. Propagation of sound from one place to another is an example of _____. **Ans:** (b) Wave motion
9. The lower most part of a wave is called _____. **Ans:** (b) Trough
10. Which among these about crest and trough is correct? **Ans:** (c) Both A and B.

II. Say True or False:

1. When wave propagates, the medium also moves along with the wave. **Ans:** False
2. The velocity of a wave is constant in a homogeneous medium. **Ans:** True
3. Gases don't poses elastic properties. **Ans:** False
4. X-ray is an electromagnetic wave. **Ans:** True
5. Transverse waves can be produced on the surface of liquid. **Ans:** True
6. Sound wave is an electromagnetic wave. **Ans:** False
7. A transverse wave can be polarized. **Ans:** True
8. Electromagnetic waves are transverse in nature. **Ans:** True
9. Sound wave can travel in space. **Ans:** False
10. When a wave is transmitted in a medium energy is neither transfer nor received from one particle to another. **Ans:** False

III. Concept Questions:

1. Write any two characteristics of wave.

- Ans:**
- o Transfer energy without permanent displacement of the medium.
 - o Can be reflected, refracted, or diffracted.

2. What are the two types of waves?

- Ans:**
- o Transverse (e.g., light, water ripples).
 - o Longitudinal (e.g., sound, spring oscillations).

3. Write the name of any four electromagnetic waves.

- Ans:** Radio waves, microwaves, visible light, X-rays.

4. What is frequency of a wave?

- Ans:** Frequency is the number of waves that pass a point in one second. It is measured in Hertz (Hz).

5. What is wave length?

- Ans:** Wavelength is the distance between two consecutive crests or troughs in a transverse wave, or between two compressions or rarefactions in a longitudinal wave.

6. Is any medium required for propagation of electromagnetic wave?

- Ans:** No, electromagnetic waves do not need a medium; they can travel through a vacuum.

7. Write any two properties of electromagnetic waves.

- Ans:** o They travel at the speed of light in a vacuum (approximately 3×10^8 m/s).
o They are transverse waves and consist of electric and magnetic fields oscillating perpendicular to each other.

8. Write few lines about sound wave.

- Ans:** Sound is a mechanical longitudinal wave that travels through a medium like air, water, or solids. It is produced by vibrations and needs a medium to propagate.

9. Write any one difference between transverse and longitudinal waves.

- Ans:** o In transverse waves, particles of the medium move perpendicular to the direction of the wave.
o In longitudinal waves, particles move parallel to the direction of the wave.

10. Define compression and rarefaction.

- Ans:** o Compression is the region in a longitudinal wave where particles are close together.
o Rarefaction is the region where particles are spread apart.

IV. Multi Correct Choice Type:

1. Which among these are examples of wave motion?

- Ans:** (b) Propagation of sound, (c) Formation of ripples on the surface of water

2. Which among these are correct about mechanical and non mechanical wave?

- Ans:** (a) Mechanical waves need a medium for propagation,
(c) Non mechanical waves do not need a medium for propagation.

3. Which among these are properties of electromagnetic waves?

- Ans:** (b) Electromagnetic waves can be polarized, (c) Electromagnetic waves are transverse in nature

4. Which among these are correct about the frequency of a wave?

- Ans:** (a) Frequency is measured in hertz., (c) Frequency is the number of wave cycles per second.

5. Which among these are correct about wave length?

- Ans:** (b) The symbol denoted for wave length is λ , (c) The wave length is related to frequency.

V. Reasoning Type Questions:

1. **Statement-1** : The wave velocity $v = f \lambda$

Statement-2 : The electromagnetic waves require mediums for propagation.

- Ans:** (c) Statement-1 is true & statement-2 is false.

2. **Statement-1** : Wave motion is possible only in elastic medium.

Statement-2 : Waves travel at different velocity in different medium.

- Ans:** (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

3. **Statement-1** : When a wave travels, the medium also moves along with the wave.

Statement-2 : When a wave is transmitted in a medium, energy is transferred from one particle to another.

- Ans:** (d) Statement-1 is false & statement-2 is true.

4. **Statement-1** : Sound wave is electromagnetic

Statement-2 : Sound waves form magnetic effect around it.

- Ans:** (e) Both the statements are false.

5. **Statement-1** : Light waves can be polarized.

Statement-2 : Electromagnetic waves can be polarized and light is a kind of electromagnetic wave.

- Ans:** (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

6. **Statement-1** : A transverse wave is made up of crest and troughs.
Statement-2 : A longitudinal wave is made up of compressions and rarefactions.
Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.
7. **Statement-1** : The velocity of electromagnetic wave is equal to the velocity of light.
Statement-2 : Electromagnetic wave have velocity.
Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.
8. **Statement-1** : Wave velocity - Frequency x Wave length.
Statement-2 : Hz is in the unit used to measure frequency.
Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

Application Skill Achiever

1. **An oscillator oscillates 2500 times in 2 minutes. What is its frequency in Hz?**

Ans: An oscillator oscillates 2500 times in 2 minutes (120 seconds)
Frequency = $2500/120 = 20.8 \text{ Hz}$

2. **A sound wave traveling at 350 m/s has a frequency of 500 Hz. What is its wavelength?**

Ans: A sound wave travels 350 m/s ($v = 350 \text{ m/s}$)
Frequency = 500 Hz ($f = 500 \text{ Hz}$)
Formula used in this problem $v = f\lambda$

$$\text{Re-arrange the formula Wave length } (\lambda) = \frac{v}{f} = \frac{350}{500} = 0.7 \text{ m}$$

3. **Frequency of a wave motion is 250 Hz. What is its time period?**

Ans: Frequency of a wave motion = 250 Hz.

$$\text{Time period} = \frac{1}{f} = \frac{1}{250} \text{ sec.}$$

4. **A sound wave traveling in air has a wavelength of $1.6 \times 10^{-2} \text{ m}$. If the velocity of sound is 320 m/s, calculate the frequency of sound.**

Ans: Wavelength = 1.6×10^{-2} , Velocity = 320 m/s

$$\text{Frequency} = \frac{v}{\lambda} = \frac{320}{1.6 \times 10^{-2}} = 20000 \text{ Hz}$$

5. **A sound wave travels 2.462 km in 8.73 s. What is the velocity of the sound?**

Ans: A sound wave travels 2.462 km in 8.73 s.

Standard unit of velocity is meter per second.

So the sound wave travels 2462 meters in 8.73 seconds

$$\text{Velocity} = \frac{s}{t} = \frac{2462 \text{ m}}{8.73 \text{ sec.}} = 282 \text{ m/s}$$

EXERCISE - 6

I. Choose the Correct Answer:

- Which among these is not a fluid? **Ans:** (c) Ice
- Density is defined as _____. **Ans:** (a) Mass/Volume
- Pressure is defined as _____. **Ans:** (b) Force/Area
- The unit used to measure pressure is _____. **Ans:** (c) Pascal
- Which among these is correct about pressure inside water? **Ans:** (a) More deep, more pressure
- Railway tracks are laid on wooden, concrete or iron sleepers, so that _____.
Ans: (a) Pressure developed due to the weight of the train is distributed uniformly by the sleepers.
- What is correct about an ideal fluid? **Ans:** (b) An ideal fluid has zero viscosity and zero compressibility.
- Relative density is _____. **Ans:** (c) The ratio of the density of the body to the density of water at 4°C.

II. Say True or False:

- The substances having the property of flowing from one place to another are called fluids. **Ans:** True
- The SI units for density is kg/m^3 . **Ans:** True.
- When a body is partly or fully immersed in a liquid, the pressure is more at the bottom than at the top. **Ans:** True
- An ideal fluid has zero viscosity. **Ans:** True
- Bemoulli's equation is derived from the principle of conservation of linear momentum. **Ans:** False
- Density is defined as an object's mass per unit volume. **Ans:** True
- High density objects has tightly packed particles. **Ans:** True
- A sharp needle is able to pierce the skin but not a dull needle. **Ans:** True

III. Concept Questions:

1. What is relative density?

Ans: Relative density is the ratio of the density of a substance to the density of water. It has no unit, because it is a pure number.

$$\text{Formula: Relative Density} = \frac{\text{Density of Substance}}{\text{Density of Water}}$$

2. Write the law's of flotation.

Ans: The laws of flotation are:

- o A body floats in a liquid if the weight of the liquid displaced is equal to the weight of the body.
- o A body sinks if its weight is more than the weight of the liquid displaced.
- o A body rises if its weight is less than the weight of the displaced liquid.

3. Write Archimedia principle.

Ans: Archimedes' Principle states that:

A body immersed fully or partially in a fluid experiences an upward force (buoyant force) equal to the weight of the fluid displaced by the body.

4. Write Bemoulli's theorem.

Ans: Bernoulli's Theorem states that:

For an incompressible and non-viscous fluid, the total energy (pressure energy + kinetic energy + potential energy) remains constant at all points in a streamline flow.

This explains why pressure decreases when the speed of a fluid increases.

5. Define pressure.

Ans: Pressure is the force applied per unit area.

$$\text{Formula: Pressure} = \frac{\text{Force}}{\text{Area}}$$

It is measured in Pascals (Pa), where $1 \text{ Pa} = 1 \text{ N/m}^2$

IV. Multi Correct Choice Type:

1. Choose the fluids from the given options

Ans: b) Liquid Carbon dioxide, (c) Water

2. Choose the right statement about density.

Ans: (a) The SI unit of density is kg/m^3

(b) The higher the density, the tighter the particles placed inside.

(c) Density is a physical property

3. Which among these are correct about pressure?

Ans: (b) Pressure = force/area, (c) N/m^2 is the unit for pressure

4. Which among these are qualities of ideal fluid?

Ans: (c) Zero viscosity

5. Which among these are correct about pressure due to liquid?

Ans: (a) The pressure due to liquid alone is the difference of hydrostatic pressure and atmospheric pressure can also be called as gauge.

(b) The pressure at a given point due to liquid is independent of amount of liquid.

V. Reasoning Type Questions:

1. **Statement-1** : It is difficult to walk on sand

Statement-2 : Sand yields when a person walks on it

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

2. **Statement-1** : A sharp needle is able to pierce the skin but not a dull needle.

Statement-2 : A sharp needle gives more pressure than a dull needle

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

3. **Statement-1** : When a body is partly or fully immersed in a liquid, the pressure at the bottom is more than the pressure at the top.

Statement-2 : When a body is partly or fully immersed in a liquid, the pressure at the top is more than the pressure at the bottom.

Ans: (c) Statement-1 is true & statement-2 is false.

4. **Statement-1** : Force of buoyancy = Weight of the displaced water.

Statement-2 : When a body is fully immersed in a liquid, the volume of the liquid displaced is equal to the volume of the body.

Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

5. **Statement-1** : Magnus effect is due to spinning of cricket ball

Statement-2 : Due to Magnus effect the cricket ball moves in a straight line.

Ans: (c) Statement-1 is true & statement-2 is false.

6. **Statement-1** : An ideal fluid has no viscosity.

Statement-2 : An ideal fluid is compressible.

Ans: (c) Statement-1 is true & statement-2 is false.

7. **Statement-1** : Aeroplanes has wings with spherical shape to lift it up.

Statement-2 : In a flying aeroplane the pressure below it is more than the pressure above it.

Ans: (d) Statement-1 is false & statement-2 is true.

8. **Statement-1** : When a body is partly or fully immersed in water the pressure is more at the bottom then the pressure at top.

Statement-2 : The pressure inside a liquid is proportional to its distance from the surface of the liquid (top).

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

9. **Statement-1** : Pressure = force per area.

Statement-2 : Pressure increases if force is increased.

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

10. **Statement-1** : Wooden or concrete iron sleepers are laid under railway tracks such that the pressure generated by the weight of the train is distributed uniformly.

Statement-2 : Pressure generated by the weight of the train is zero when the train is not moving.

Ans: (c) Statement-1 is true & statement-2 is false.

Application Skill Achiever

1. You have a solid rock with a volume of 30cm^3 and a mass of 60g. What is its density?

Ans: Volume of a solid rock = 30 cm^3 , mass = 60 g

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{60}{30} = 2\text{ g/cm}^3$$

2. A sphere has radius .5 m. Find its density, if its mass is 240 kgs.

Ans: Radius of a sphere = 0.5 m, mass = 240 kg

$$\text{Volume of the sphere} = \frac{4}{3}\pi r^3 = \frac{4}{3} \times 3.1415 \times .5\text{m} \times .5\text{m} = 0.5\text{m}^3$$

$$\text{Density} = \frac{\text{mass}}{\text{volume}} = \frac{240}{.5} = 480\text{ kg/m}^3$$

3. A cubical object has mass 15 kg and volume 75 cm^3 . Find its relative density.

Ans: Given mass = 15 kg (Convert into gram i.e. 15000 g)

$$\text{Volume} = 75\text{ cm}^3$$

$$\text{Density of water} = 1\text{g/cm}^3$$

$$1\text{ cm}^3 \text{ of water makes mass} = 1\text{g}$$

$$75\text{ cm}^3 \text{ of water makes mass} = 1 \times 75 = 75\text{ g}$$

$$\text{Relative density} = \frac{\text{Mass of any volume of substance}}{\text{Mass of equal volume of water}} = \frac{15000}{75} = 200$$

4. The side of a cube measures to 20 m. Its mass is 400 kg. It is on a table. What is the pressure at the bottom side of the cube?

Ans: Side of the cube = 20 m, mass = 400kg

$$\text{Bottom area of the cube} = \text{side} \times \text{side} = 20 \times 20 = 400\text{ m}^2$$

$$\text{The weight of the cube as a force } F = w = mg = 400 \times 10 = 4000\text{ N}$$

$$\text{Pressure} = \frac{\text{weight}}{\text{BottomArea}} = \frac{4000}{400} = 10\text{ Pascal}$$

5. The radius of a cylinder is 0.5 m. Its height is 12 m. What is the pressure at the bottom side of the cylinder, if it is placed vertically?

Ans: Radius of the cylinder = 0.5 m, Height = 12

$$\text{Bottom surface area of the cylinder} = \pi r^2 = 3.1415 \times 0.5 \times 0.5 = 0.78\text{ m}^2$$

$$\text{Weight of the cylinder as a force } F = w = \text{mass} \times g = \text{mass} \times 10$$

$$\text{Pressure} = \frac{\text{Force}}{\text{BottomArea}} = \frac{\text{mass} \times 10}{0.78} = \text{mass} \times 12.8\text{ Pascal}$$

6. A cone of 250 gm has a base radius 12 cm and height 14 cm. Find its density.

Ans: Mass of the cone = 250 g; Base radius of the cone = 12 cm; Height = 14cm

$$\therefore \text{Volume of the cone} = \frac{1}{3} \pi r^2 h = \frac{1}{3} \times \frac{22}{7} \times 12 \times 12 \times 14 = 2112 \text{ cm}^3$$

$$\therefore \text{Density of the cone} = \frac{\text{Force}}{\text{BottomArea}} = \frac{250g}{2112 \text{ cm}^3} = 0.118g / \text{cm}^3$$

7. The density of an irregular alloy is 40 gm/cm³. If its mass is 95 gms, what is its volume?

Ans: Density of the alloy = 40g/cm³; Mass of the alloy = 95 gms.

$$\therefore \text{Volume of the alloy} = \frac{m}{d} = \frac{95g}{40g / \text{cm}^3} = 2.375 \text{ cm}^3$$

8. A cylinder has base radius 1.4 cm and height 7 cm. If its mass is 175 gm, what is the pressure at the bottom, if it is kept vertically?

Ans: Radius of the cylinder = 1.4 cm; Height = 7 cm.; Mass = 175 gm

$$\text{Pressure of the cylinder at the bottom} = \frac{\text{mass}}{\text{BottomArea}} = \frac{175g}{\frac{22}{7} \times 1.4 \times 1.4 \text{ cm}^2} = 28.4g / \text{cm}^2$$

EXERCISE - 7

I. Choose the Correct Answer:

- In a plane mirror if the object is real then _____. **Ans:** (a) The image is virtual
- In a plane mirror the point of intersection of incident rays is called as _____. **Ans:** (b) Object
- In a plane mirror the part of intersection of the corresponding reflected rays is called as _____. **Ans:** (b) Image
- The angle made by the incident ray with normal to the surface is called as the _____. **Ans:** (b) Angle of incidence
- The angle made by the reflected ray with the normal to the surface is called as the _____. **Ans:** (c) Angle of reflection
- The angle made by the incident ray with the surface is called as _____. **Ans:** (b) Glancing angle
- The angle made by the incident ray with the reflected ray is called as _____. **Ans:** (b) Angle of deviation
- Magnification in a plain mirror m = _____. **Ans:** (a) Size of image / Size of object
- If the object is real the image formed by a plain mirror is _____. **Ans:** (a) Virtual, erect, same size, same distance
- If a plain mirror is rotated by an angle θ anti clockwise, the reflected ray is turned by _____. **Ans:** (b) 2θ , anti-clockwise

II. Say True or False:

- A concave mirror is a spherical mirror whose reflecting surface is towards the center of the sphere of which the mirror is a part. **Ans:** True
- Convex mirrors are spherical. **Ans:** True
- The focal point lies in the front of a concave mirror. **Ans:** True
- The focal point lies behind the convex mirror. **Ans:** True
- Paraxial rays in a spherical mirror are close to the principal axis. **Ans:** True
- If the reflected rays intersect, the point of intersection is called real image. **Ans:** True
- The angle made by the reflected ray with normal is called the angle of incidence. **Ans:** True
- The point on the mirror at the middle of the surface is called center. **Ans:** False
- The line joining the pole and center of curvature is called principal axis. **Ans:** True
- When light bounces off an object is called reflection. **Ans:** False

III. Concept Questions:

1. What is the 1st law of reflection?

Ans: The first law of reflection states that:

The incident ray, the reflected ray, and the normal at the point of incidence all lie in the same plane.

2. What is the second law of reflection?

Ans: The second law of reflection states that:

The angle of incidence is equal to the angle of reflection.

$$\angle i = \angle r$$

3. What is a real image?

Ans: A real image is formed when light rays actually meet after reflection or refraction.

- It can be projected on a screen.
- It is usually inverted.

Example: Image formed by a concave mirror when the object is placed beyond the focus.

4. What is a virtual image?

Ans: A virtual image is formed when light rays appear to meet after reflection or refraction.

- It cannot be projected on a screen.
- It is usually upright.

Example: Image seen in a plane mirror.

5. What are marginal rays?

Ans: Marginal rays are the outermost rays of a beam of light that strike the mirror or lens at the edge (margin) of its surface.

They help in determining the outer boundary of the image formed and play a role in image clarity and aberration.

IV. Multi Correct Choice Type:

1. When light enters into a different transparent medium

Ans: (a) A portion of light is absorbed; (c) A portion of light is reflected to the first medium.

2. Which among these are characteristics of the image of a real object?

Ans: (a) If the object is real the image is virtual.

3. In a plane mirror

Ans: (a) Angle of incidence is equal to the angle of reflection.

(c) The sum of angle of incidence and glancing angle is 90° .

4. The correct statement about real image & virtual image

Ans: (a) Real image is formed when the reflected rays intersect.

(c) Virtual image is formed by intersection of extended reflection rays.

5. Which among these are correct about concave mirror?

Ans: (a) The focal length of a concave mirror is half of the radius of the mirror.

(b) Its reflecting surface is towards the centre.

V. Reasoning Type Questions:

1. **Statement-1 :** Convex mirror is spherical mirror

Statement-2 : The reflecting surface of a convex mirror is away from the centre.

Ans: (a) Both statements are correct and statement-2 is the correct explanation of statement-1.

2. **Statement-1** : The point on the mirror at the middle of the surface is called pole.
Statement-2 : The distance between the centre of curvature to pole of the mirror is called radius of curvature.
Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.
3. **Statement-1** : The diameter of the enclosed circular portion of the curved mirror is called aperture of the mirror.
Statement-2 : The distance of the focus from the pole of the mirror is called the focal length of the mirror.
Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.
4. **Statement-1** : The rays which are very close to the principal axis is called marginal rays.
Statement-2 : Paraxial rays are away from the principal axis.
Ans: (e) Both the statements are false.
5. **Statement-1** : The number of reflections using two parallel plane mirrors including the first reflection is equal to $L/d \tan \theta$.
Statement-2 : The focal length is half of the radius.
Ans: (b) Both statements are correct but statement-2 is not correct explanation of statement-1.

Application Skill Achiever

1. An object is placed at a distance of 30 cm from a concave mirror of focal length 20 cm. Where will the image be formed?

Ans: **Given,** Object distance, $u = -30$ cm; Focal length, $f = -20$ cm; Image-distance, $v = ?$

$$\text{Mirror formula is } \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = -\frac{1}{20} + \frac{1}{30} = -\frac{1}{60}$$

$$v = -60$$

The image will be formed at a distance of 60 cm.

2. A 2.0 cm high object is placed perpendicular to the principal axis of a concave mirror. The distance of the object from the mirror is 30 cm, and its image is formed 60 cm from the mirror, on the same side of the mirror as the object. Find the height of the image formed.

Ans: **Given,** Object height (h_1) = +2 cm; object distance (u) = -30 cm; image distance (v) = -60 cm;
 image height (h) = ?

$$m = -\frac{v}{u} = \frac{h}{h_1}$$

$$\Rightarrow \frac{h}{h_1} = -\frac{v}{u}$$

$$\Rightarrow \frac{h}{-2} = -\frac{-60}{-30} \Rightarrow h = 4$$

Thus the height of the image formed = 4 cm.

3. A 1.2-cm-long pin is placed perpendicular to the principal axis of a convex mirror of focal length 12 cm, at a distance of 8 cm from it. (a) Find the location of the image

Ans: **Given** Height of the object = 1.2 cm; Focal length = +12 cm; object distance = -8 cm

$$\text{According to mirror formula } \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{12} - \frac{1}{-8} = \frac{5}{24}$$

$$V = 4.8 \text{ cm}$$

So the distance of the image is +4.8 cm

The positive sign shows that the image is formed on the other side of the optical centre.

4. An object is placed at a distance of 20cm from a convex mirror of focal length 25cm. Calculate the position of the image.

Ans: Given $u = -20$ cm; $f = +15$ cm; $v = ?$

Using mirror formula, we have, $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$

$$\Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{15} - \frac{1}{-20} = \frac{7}{60}$$

$$\therefore v = 8.5 \text{ cm}$$

The image formed behind the mirror and forms virtual

5. A 2.0 cm high object is placed at a distance of 20cm from a concave mirror. A real image is formed at 40 cm from the mirror. Calculate the focal length of the mirror and size of the image.

Ans: Given $h = 2$ cm; $u = -20$ cm; $v = -40$ cm

Using mirror formula, we have $\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = -\frac{1}{20} - \frac{1}{40} = -\frac{3}{40}$

$$F = -13.33 \text{ cm}$$

Size of the image formula $\frac{h_1}{h} = -\frac{v}{u}$

$$\Rightarrow \frac{h_1}{2} = -\frac{-40}{-20}$$

$$H_1 = -4 \text{ cm}$$

The size of the image is 4cm.

6. A concave mirror of focal length 25 cm, forms an image at a distance of 50 cm. Find the distance of the object.

Ans: Focal length $f = 25$ cm.; Distance of image $v = 50$ cm.

Distance of the object $u = ?$

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

$$\Rightarrow \frac{1}{u} = \frac{1}{f} - \frac{1}{v} \Rightarrow \frac{1}{u} = \frac{1}{25} - \frac{1}{50} = \frac{1}{50}$$

$$\therefore u = 50 \text{ cm.}$$

The distance of the object is 50cm.

7. An object is placed at distance of 15 cm from a concave mirror and the image is formed at a distance of 5 cm. Find the focal length.

Ans: Distance of the object $u = 15$ cm; Distance of the image $v = 5$ cm

Focal length = ?

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{1}{15} + \frac{1}{5} = \frac{4}{15}$$

The focal length is 3.75 cm.

8. Object A is placed at a distance of 12 cm from a concave mirror and object B is placed at a distance of 20 cm. If the image of object A is formed at a distance of 6 cm. Find the location of the image formed by object B.

Ans: For Object A: Distance of the object $u = 12\text{cm}$; Distance of the image $v = 6\text{ cm}$; Focal length = ?

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{1}{12} + \frac{1}{6} = \frac{1}{4}$$

The focal length is 4cm.

For object B: Distance of object $u = 20\text{cm}$.; Focal length $f = 4\text{cm}$. Distance of image $v = ?$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{4} - \frac{1}{20} = \frac{1}{5}$$

The Distance of the image of object B is 5 cm.

EXERCISE - 8

I. Choose the Correct Answer:

1. A motor works on the principles of _____. **Ans:** (c) Electromagnetism
2. Which among these is not a magnetic substance? **Ans:** (b) Copper
3. The line joining the poles of a magnet is called _____. **Ans:** (b) Magnetic axis
4. When you break a magnet **Ans:** (b) Both parts become perfect magnets
5. The North pole of the magnet of the earth is located at **Ans:** (b) South pole
6. The magnet found in nature are called _____ magnets. **Ans:** (a) Natural
7. The distance between the magnetic poles is called _____. **Ans:** (c) Magnetic length

II. Say True or False:

1. The earth behaves like a magnet. **Ans:** True
2. Same pole of magnets attracts each other. **Ans:** False
3. A magnetic field is the region around a magnet where magnetic force act. **Ans:** True
4. A magnet can be produced by passing current through a coil bound over a steel rod or a soft iron rod. **Ans:** True
5. In every magnet the poles exist in pairs. **Ans:** True

III. Concept Questions:

1. Write any two properties of a magnet.

- Ans:** o A magnet attracts magnetic materials like iron, cobalt, and nickel.
o Like poles repel each other, and unlike poles attract each other.

2. What is a temporary magnet?

Ans: A temporary magnet is a material that behaves like a magnet only when placed near a permanent magnet or under electric current. It loses its magnetism when the cause is removed.

Example: An iron nail becomes magnetic when rubbed with a magnet.

3. How can you make a magnet? Write any one method.

Ans: By rubbing method: Rub a magnetic material like an iron bar with one pole of a permanent magnet in one direction several times. The material becomes magnetized.

4. What is an electromagnet?

Ans: o An electromagnet is a type of magnet in which magnetism is produced by electric current.

- o It is made by winding a wire around a soft iron core and passing current through the wire.

5. Write the structure of an electric bell.

Ans: An electric bell consists of:

- o Electromagnet
- o Soft iron armature
- o Hammer
- o Bell
- o Spring
- o Switch and connecting wires

When current flows, the electromagnet attracts the armature, which hits the bell, and then breaks the circuit momentarily, repeating the process rapidly.

6. Explain the right hand thumb rule.

Ans: The Right-Hand Thumb Rule is used to find the direction of the magnetic field around a current-carrying conductor.

Rule: If you hold the current-carrying conductor in your right hand with your thumb pointing in the direction of the current, then the fingers curl in the direction of the magnetic field.

7. What is electric generator?

Ans: An electric generator is a device that converts mechanical energy into electrical energy. It works on the principle of electromagnetic induction — moving a coil in a magnetic field produces electricity.

8. What is the use of a transformer?

Ans: A transformer is used to increase or decrease the voltage of alternating current (AC) in electric circuits.

- o A step-up transformer increases voltage.
- o A step-down transformer decreases voltage.

IV. Multi Correct Choice Type:

1. Which among these are properties of a magnet? **Ans:** (a) Attractive property, (b) Directive property.
2. The magnetic materials are _____ **Ans:** (b) Cobalt, (c) Nickel.
3. The non magnetic materials are _____ **Ans:** (b) Silver, (c) Graphite.
4. If material A repels material B then _____ **Ans:** (a) Material A is a magnet, (c) Material B is a magnet.
5. Which among these are required to make an electro magnet? **Ans:** (a) Soft iron core, (c) Winding coil.

Application Skill Achiever

1. A transformer rated at a primary voltage 7200 volts and a secondary voltage of 240 volts. What is the turns ratio?

Ans: The secondary voltage = 240 volts

$$\text{The turns ratio} = \frac{7200}{240} = 30 : 1$$

2. A transformer that with a 200 volt primary. It has a primary with 800 turns and secondary with 160 turns of wire. Find the secondary output in volts.

Ans: The primary voltage = 200 volts

Primary turns = 800

Secondary turns = 160

$$\text{Secondary output volt} = \frac{V_1}{N_1} \times N_2 = \frac{200}{800} \times 1600 = 400 \text{Volts}$$