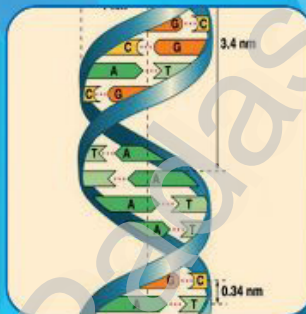
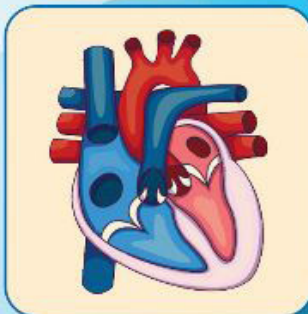
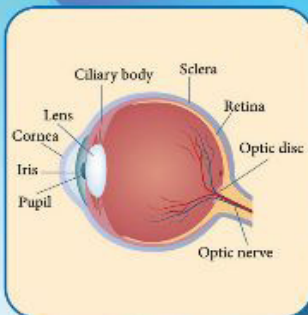


# MERCY SCIENCE

A Guide with a Difference



### Salient Features

- ❖ Choose the correct answer, Fill in the blanks
- ❖ State whether True or False, Match the following
- ❖ Assertion & Reasoning, Hot Questions
- ❖ Answer Briefly, Solve the given problem
- ❖ Answer the following in detail
- ❖ Practicals (Physics, Chemistry, Biology)
- ❖ First Mid - Term & Quarterly Exam Qn. Papers
- ❖ Second Mid - Term & Half yearly Exam Qn. Papers
- ❖ Five Model Question Papers

2023-24

Revised Edition

10

Bookback Questions & Answers  
PTA & Exam Questions (Interior)

# MERCY SCIENCE

## STANDARD - X

**Bookback Questions & Answers  
PTA & Exam Questions (Interior)**

### *Salient Features*

- ★ Choose the correct answer, Fill in the blanks
- ★ State whether True or False, Match the following
- ★ Assertion & Reasoning, Hot Questions
- ★ Answer Briefly, Solve the given problem
- ★ Answer the following in detail
- ★ Practicals (Physics, Chemistry, Biology)
- ★ First Mid - Term & Quarterly Exam Qn. Papers
- ★ Second Mid - Term & Half yearly Exam Qn. Papers
- ★ Five Model Question Papers

## MERCY Publications

43, Bunder Street, Chennai - 600 001

For Orders : 744 92 000 92 / 97100 02490 / 70102 31425

**Price Rs. : 230.00**

Kindly send me your study materials to [padasalai.net@gmail.com](mailto:padasalai.net@gmail.com)

Unit	Title
<b>Physics</b>	
1	Laws of Motion
2	Optics
3	Thermal Physics
4	Electricity
5	Acoustics
6	Nuclear Physics
<b>Chemistry</b>	
7	Atoms and Molecules
8	Periodic Classification of Elements
9	Solutions
10	Types of Chemical Reactions
11	Carbon and its Compounds
<b>Biology</b>	
12	Plant Anatomy and Plant Physiology
13	Structural Organisation of Animals
14	Transportation in Plants and Circulation in Animals
15	Nervous System
16	Plant and Animal Hormones
17	Reproduction in Plants and Animals
18	Genetics
19	Origin and Evolution of Life
20	Breeding and Biotechnology
21	Health and Diseases
22	Environmental Management
23	Visual Communication
❖	Practicals (Physics, Chemistry & Biology)
❖	First Mid - Term & Quarterly Exam Qn. Papers
❖	Second Mid - Term & Half yearly Exam Qn. Papers
❖	Five Model Question Papers

# Public Exam Question Paper

## March - 2023

Time Allowed : 3 hours]

[Maximum Marks : 75

- Instructions :** (1) Check the question paper for fairness of printing. If there is any lack of fairness, inform the Hall Supervisor immediately.
- (2) Use **Blue** or **Black** ink to write and underline and pencil to draw diagrams.

**Note :** This question paper contains **four** parts.

### Part - I

- Note :** i) Answer all the questions. **12 × 1 = 12**
- ii) Choose the most appropriate answer from the given **four** alternatives and write the option code and the corresponding answer.

- Magnification of a convex lens is always :
  - Positive
  - Negative
  - Either positive (or) negative
  - zero
- In which of the following reaction, the mass number decreases by four of the daughter nucleus ?
  - $\alpha$  decay
  - $\beta$  decay
  - $\gamma$  decay
  - neutron decay
- The gram molecular mass of water is :
  - 2 g
  - 16 g
  - 18 g
  - 8 g
- Which of the following is the universal solvent ?
  - Acetone
  - Benzene
  - Water
  - Alcohol
- The secondary suffix used in IUPAC nomenclature of an aldehyde is \_\_\_\_\_.
  - ol
  - oic acid
  - al
  - one
- The heart of amphibians posses \_\_\_\_\_ chambers.
  - 3
  - 4
  - 2
  - 5
- Kreb's cycle takes place in \_\_\_\_\_.
  - chloroplast
  - mitochondrial matrix
  - stomata
  - inner mitochondrial membrane
- Bipolar neurons are found in :
  - retina of eye
  - cerebral cortex
  - embryo
  - respiratory epithelium
- Syngamy results in the formation of \_\_\_\_\_.
  - zoospores
  - conidia
  - zygote
  - chlamydospores

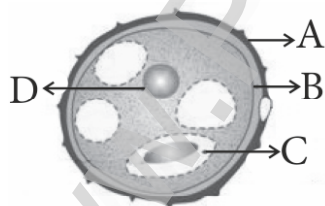
10. Match the following :
- |               |       |                          |
|---------------|-------|--------------------------|
| 1) Sarcoma    | (i)   | Excessive hunger         |
| 2) Carcinoma  | (ii)  | Excessive thirst         |
| 3) Polydipsia | (iii) | Connective tissue cancer |
| 4) Polyphagia | (iv)  | Stomach cancer           |
- a) (1) - (iii), (2) - (iv), (3) - (ii), (4) - (i)  
 b) (1) - (iv), (2) - (iii), (3) - (i), (4) - (ii)  
 c) (1) - (i), (2) - (iii), (3) - (iv), (4) - (ii)  
 d) (1) - (iv), (2) - (i), (3) - (ii), (4) - (iii)
11. 9 : 3 : 3 : 1 ratio is due to :
- |                           |                  |
|---------------------------|------------------|
| a) Segregation            | b) Crossing over |
| c) Independent assortment | d) Recessiveness |
12. The term Ethnobotany was coined by :
- |                |                      |
|----------------|----------------------|
| a) Khorana     | b) J. W. Harshberger |
| c) Ronald Ross | d) Hugo de Vries     |

### Part - II

Answer any SEVEN questions, Q.No. 22 is compulsory.

7 × 2 = 14

13. Define inertia. Give its classification.  
 14. Why does the sky appear blue in colour ?  
 15. Define one Calorie.  
 16. Mention any two applications of Avogadro's Law.  
 17. List out the parasitic adaptations in leech.  
 18. What are the structures involved in the protection of brain ?  
 19. Identify the parts A, B, C and D in the given figure.



20. Define genetic engineering.  
 21. What is Sprite ?  
 22. Calculate the amount of energy released when a radioactive substance undergoes fusion and results in a mass defect of 2 kg.

### Part - III

Answer any SEVEN questions, Q.No. 32 compulsory.

7 × 4 = 28

23. Deduce the equation of force using Newton's Second Law of Motion.  
 24. Differentiate the eye defects : Myopia and Hypermetropia.  
 25. a) What do you understand by the term Ultrasonic Vibration ?  
 b) What is meant by reflection of sound ?

26. a) What is an amalgam ? Give an example.  
b) Mention any two uses of copper.
27. Explain the mechanism of cleansing action of soap.
28. a) Name the three basic tissue systems in a flowering plant.  
b) What are the factors affecting photosynthesis ?
29. Enumerate the functions of blood.
30. How do rainwater harvesting structures recharge ground water ?
31. a) What do you understand by the term phenotype and genotype?  
b) What are allosomes ?
32. a) Calculate the pH of 0.01 M solution of  $\text{HNO}_3$ .  
b) A solution is prepared by dissolving 25 g sugar in 100 g of water. Calculate the mass percentage of solute.

### Part - IV

**Answer all the questions. Draw diagrams wherever necessary.**

**3 × 7 = 21**

33. i) State Joule's Law of Heating.  
ii) An alloy of nickel and chromium is used as the heating element. Why ?  
iii) How does a fuse wire protect electrical appliances ?  
(OR)
- b) i) What is longitudinal wave ?  
ii) What is a nuclear reactor ? Explain its essential parts with their functions.
34. a) i) Define : Atomicity.  
ii) Calculate the percentage of sulphur in  $\text{H}_2\text{SO}_4$ .  
iii) In what way hygroscopic substances differ from deliquescent substances.  
(OR)
- b) i) Differentiate reversible and irreversible reaction.  
ii) What is neutralization reaction ? Give an example.  
iii) Give any three characteristics of homologous series.
35. a) i) Which hormone induces parthenocarpy in tomatoes ?  
ii) Why is thyroid hormone referred as 'personality hormone' ?  
iii) Explain Lamarck's theories of evolution.  
(OR)
- b) i) Which enzyme cuts DNA at specific sites ?  
ii) Name two maize hybrids rich in amino - acid, lysine.  
iii) Explain smoking hazards and the harmful effects of tobacco.

# PHYSICS

## 1. Laws of Motion

### Important Formulae

1	Weight	$W = mg$
2	Force	$F = m \times a$
3	Torque	$\tau = F \times d$
4	Principle of moment 's	$F_1 d_1 = F_2 \times d_2$
5	Impulse	$J = F \times t$
6	Newton's universal law of gravitational force	$F = \frac{GMm}{r^2}$
7	Acceleration due to gravity	$g = \frac{GM}{R^2}$
10	Apparent weight : i. When lift is moving upwards ii. When lift is moving downwards	$R = m (g + a)$ $R = m (g - a)$
11	Apparent weight : i. When lift is at rest ii. When lift is falling down freely	$R = mg$ $R = 0$
12	Linear Momentum	$P = mv$
13	Moment of couple	$M = F \times S$
14	Mass of Earth	$M = \frac{gR^2}{G}$
15	Conservation of linear momentum	$m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2$
16	Moment of couple = Force $\times$ perpendicular distance between line of action of forces.	$M = F \times s$
17	Weight = Mass $\times$ acceleration due to gravity	$W = m \times g$
18	Acceleration	$a = \frac{v-u}{t}$
19	Parallel force acting in the force same direction	$F_{\text{net}} = F_2 + F_1$
20	Parallel unequal force are acting in opposite direction	$F_{\text{net}} = F_2 - F_1$ (OR) $F = F_2 - F_1$

## Bookback Questions & Answers

### I. Choose the correct answer

1. Inertia of a body depends on
  - a) weight of the object
  - b) acceleration due to gravity of the planet
  - c) mass of the object
  - d) Both a & b

**Ans : c) mass of the object**
2. Impulse is equal to (PTA - 1)
  - a) rate of change of momentum
  - b) rate of force and time
  - c) change of momentum
  - d) rate of change of mass

**Ans : c) change of momentum**
3. Newton's III law is applicable
  - a) for a body is at rest
  - b) for a body in motion
  - c) both a & b
  - d) only for bodies with equal masses

**Ans : c) both a & b**
4. Plotting a graph for momentum on the Y-axis and time on X-axis, slope of momentum - time graph gives
  - a) Impulsive force
  - b) Acceleration
  - c) Force
  - d) Rate of force

**Ans : c) Force**
5. In which of the following sport the turning of effect of force used
  - a) swimming
  - b) tennis
  - c) cycling
  - d) hockey

**Ans : c) cycling**
6. The unit of 'g' is  $\text{m s}^{-2}$ . It can also be expressed as
  - a)  $\text{cm s}^{-1}$
  - b)  $\text{N kg}^{-1}$
  - c)  $\text{Nm}^2 \text{kg}^{-1}$
  - d)  $\text{cm}^2 \text{s}^{-2}$

**Ans : b)  $\text{N kg}^{-1}$**
7. One kilogram force equals to
  - a) 9.8 dyne
  - b)  $9.8 \times 10^4 \text{ N}$
  - c)  $98 \times 10^4 \text{ dyne}$
  - d) 980 dyne

**Ans : c)  $98 \times 10^4 \text{ dyne}$**
8. The mass of a body is measured on planet Earth as M kg. When it is taken to a planet of radius half that of the Earth then its value will be \_\_\_\_ kg.
  - a) 4 M
  - b) 2M
  - c) M/4
  - d) M

**Ans : d) M**
9. If the Earth shrinks to 50% of its real radius its mass remaining the same, the weight of a body on the Earth will
  - a) decrease by 50%
  - b) increase by 50%
  - c) decrease by 25%
  - d) increase by 300%

**Ans : d) increase by 300%**
10. To project the rockets which of the following principle(s) is / (are) required? (Dept, Sep.-21,22)
  - a) Newton's third law of motion
  - b) Newton's law of gravitation
  - c) law of conservation of linear momentum
  - d) both a and c

**Ans : d) both a and c**



## II. Fill in the blanks

1. To produce a displacement \_\_\_\_\_ is required.

**Ans : force**

2. Passengers lean forward when sudden brake is applied in a moving vehicle. This can be explained by \_\_\_\_\_.

**Ans : inertia of motion**

3. By convention, the clockwise moments are taken as \_\_\_\_\_ and the anticlockwise moments are taken as \_\_\_\_\_.

**Ans : negative, positive**

4. \_\_\_\_\_ is used to change the speed of car.

**Ans : Torque or Gear**

5. A man of mass 100 kg has a weight of \_\_\_\_\_ at the surface of the Earth.

**Ans : Weight =  $m \times g = 100 \times 9.8 \text{ N} = 980 \text{ N}$**

## III. State whether the following statements are true or false. Correct the statement if it is false

1. The linear momentum of a system of particles is always **conserved**.

**Ans : False**

**Correct statement :** The linear momentum of a system of particles is always **conserved if no external force acts on it**.

2. Apparent weight of a person is **always** equal to his actual weight.

**Ans : False**

**Correct statement :** Apparent weight of a person is **not always** equal to his actual weight.

3. Weight of a body is **greater** at the equator and **less** at the polar region.

**Ans : False**

**Correct statement :** Weight of a body is **minimum** at the equator. It is **maximum** at the poles.

4. Turning a nut with a spanner having a **short** handle is so easy than one with a **long** handle.

**Ans : False**

**Correct statement :** Turning a nut with a spanner having a **long** handle is easier than one with a **short** handle.

5. There is no gravity in the orbiting space station around the Earth. So the astronauts feel weightlessness.

**Ans : False**

**Correct statement :** Astronauts fall freely around the earth due to their **huge orbital velocity**.

## IV. Match the following

(PTA - 1)

	Column I	Column II
a.	Newton's I law	propulsion of a rocket
b.	Newton's II law	Stable equilibrium of a body
c.	Newton's III law	Law of force
d.	Law of conservation of Linear momentum	Flying nature of bird

Ans :	Column I	Column II
a.	Newton's I law	Stable equilibrium of a body
b.	Newton's II law	Law of force
c.	Newton's III law	Flying nature of bird
d.	Law of conservation of Linear momentum	propulsion of a rocket

## V. Assertion &amp; Reasoning. Mark the correct choice as

- If both the assertion and the reason are true and the reason is the correct explanation of assertion.
- If both the assertion and the reason are true, but the reason is not the correct explanation of the assertion.
- Assertion is true, but the reason is false.
- Assertion is false, but the reason is true.

1. **Assertion** : The sum of the clockwise moments is equal to the sum of the anti clockwise moments.

**Reason** : The principle of conservation of momentum is valid if the external force on the system is zero.

**Ans** : **b) Both the assertion and the reason are true, but the reason is not the correct explanation of the assertion.**

2. **Assertion** : The value of 'g' decreases as height and depth increases from the surface of the Earth.

**Reason** : 'g' depends on the mass of the object and the Earth.

**Ans** : **c) Assertion is true, but the reason is false.**

## VI. Answer briefly

1. Define inertia. Give its classification.

(Sep.-22, April -23)

- ★ The inherent property of a body to resist any change in its state of rest or the state of **uniform motion**, unless it is influenced upon by an external unbalanced force is known as **inertia**.

**Classification of inertia :**

- Inertia of rest
- Inertia of motion
- Inertia of direction.

2. **Classify the types of forces based on their application.** (Sep.-22)

**Like parallel forces** : Two or more forces of equal or unequal magnitude acting along the same direction, parallel to each other are called like parallel forces.

**Unlike parallel forces** : If two or more equal forces or unequal forces act along opposite directions parallel to each other, then they are called unlike parallel forces.

3. **If a 5 N and a 15 N forces are acting opposite to one another. Find the resultant force and the direction of action of the resultant force.**

**Data :**

$$F_1 = 5\text{N} \quad F_2 = 15\text{N} \quad R = ?$$

**Solution :**

$$R = F_1 + (-F_2)$$

$$R = F_1 - F_2$$

$$R = 5 - 15$$

$$\therefore \text{Resultant force} = -10\text{N.}$$

Resultant force of  $-10\text{N}$  is acting in the direction of  $15\text{N}$ .

4. **Differentiate mass and weight.** (May-22)

	Mass	Weight
1	It is the quantity of matter contained in the body.	It is the gravitational force exerted on a body due to the Earth's gravity alone.
2	Its SI unit is kilogram (kg)	Its SI unit is newton (N)
3	Mass is a scalar quantity.	Weight is a vector quantity
4	Mass measured by using <b>physical balance</b> .	Weight can be measured by using <b>spring balance</b> .

5. **Define moment of a couple.**

**Moment of a couple :**

- ★ Rotating effect of a couple is known as moment of a couple.
- ★ Moment of a couple = Force  $\times$  perpendicular distance between the lines of action of forces.

$$M = F \times S.$$

6. **State the principle of moments.**

- ★ The principle of moments states that when a number of like or unlike parallel forces act on a rigid body and the body is in equilibrium, then the algebraic sum of the moments in the clockwise direction is equal to the algebraic sum of the moments in the anticlockwise direction.

Moment in clockwise direction = moment in anticlockwise direction

$$F_1 \times d_1 = F_2 \times d_2$$

**7. State Newton's second law.****(Dept., May-22)**

- ★ The force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force.

$$F = m \times a$$

**8. Why a spanner with a long handle is preferred to tighten screws in heavy vehicles?**

- ★ A spanner with a long handle gives high torque with less force.
- ★ So tightening screws in heavy vehicles is easy with using a long handle spanner.

$$\tau = F \times d$$

**9. While catching a cricket ball the fielder lowers his hands backwards. Why?**

- ★ In cricket, a fielder pulls back his hands while catching the ball.
- ★ He experiences a smaller force for a longer interval of time, to catch the ball resulting in a lesser impulse on his hands.

**10. How does an astronaut float in a space shuttle?**

- ★ An astronaut floats in a space shuttle because both are in the state of weightlessness.
- ★ Both are experiencing equal acceleration towards Earth as free fall bodies. Astronauts are not floating but are falling freely.

**VII. Solve the given problems.**

- Two bodies have a mass ratio of 3:4 The force applied on the bigger mass produces an acceleration of  $12 \text{ ms}^{-2}$ . What could be the acceleration of the other body, if the same force acts on it.**

**Data :**

$$\text{Mass ratio of two bodies is} = 3:4$$

$$\text{Mass of smaller body } m_1 = 3\text{kg}$$

$$\text{Mass of bigger body } m_2 = 4 \text{ kg}$$

$$\text{Acceleration due to force applied by bigger body } a_2 = 12 \text{ ms}^{-2}$$

$$\therefore \text{Acceleration due to the same force on the small body } a_1 = ?$$

**Solution :**

According to Newton's Second Law of Motion

$$F = m \times a$$

$$F_1 = m_1 a_1 \text{ and } F_2 = m_2 a_2$$

$$F_1 = 3 a_1 \text{ and } F_2 = 4 \times 12$$

$$F_2 = 48\text{N}$$

As the forces are equal

$$\begin{aligned} F_1 &= F_2 \\ 3a_1 &= 48 \\ \therefore a_1 &= \frac{48}{3} \\ \therefore a_1 &= \mathbf{16\text{ms}^{-2}} \end{aligned}$$

So acceleration due to the same force on the smaller body  $a_1 = 16\text{ms}^{-2}$ .

2. A ball of mass 1 kg moving with a speed of  $10\text{ms}^{-1}$  rebounds after a perfect elastic collision with the floor. Calculate the change in linear momentum of the ball.

**Data :**

$$\begin{aligned} \text{Mass of the ball } m &= 1\text{kg} \\ \text{Initial velocity } u &= 10\text{ms}^{-1} \\ \text{Final velocity } v &= -10\text{ms}^{-1} \\ \therefore \text{Change in linear momentum} &= m(v - u) = mv - mu. \end{aligned}$$

**Solution :**

$$\begin{aligned} \text{Momentum before collision} &= mu \\ &= 1 \times 10 \\ &= 10\text{kg ms}^{-1} \\ \text{Momentum after collision} &= mv \\ &= -(1 \times 10) \\ &= -10\text{kg m}^{-1} \\ \therefore \text{Change in momentum} &= mv - mu \\ &= -10 - 10 \\ &= \mathbf{-20\text{ kg ms}^{-1}}. \end{aligned}$$

3. A mechanic unscrew a nut by applying a force of 140 N with a spanner of length 40 cm. What should be the length of the spanner if a force of 40 N is applied to unscrew the same nut?

**Data :**

$$\begin{aligned} \text{Force } F_1 &= 140\text{N} \\ \text{Length } L_1 &= 40\text{cm} = 40 \times 10^{-2}\text{m} \\ \text{Force } F_2 &= 40\text{N} \\ \text{Length } L_2 &= ? \end{aligned}$$

**Solution :**

$$\begin{aligned} F_1 \times L_1 &= F_2 \times L_2 \\ \text{Length of the spanner } L_2 &= \frac{F_1 \times L_1}{F_2} \\ L_2 &= \frac{140 \times 40 \times 10^{-2}}{40} \\ L_2 &= \mathbf{140 \times 10^{-2} \text{ (or) } 1.4\text{m}}. \end{aligned}$$

4. The ratio of masses of two planets is 2 : 3 and the ratio of their radii is 4 : 7 Find the ratio of their accelerations due to gravity.

**Data :**

The ratio of masses of two bodies is  $m_1 : m_2$

i.e. 2 : 3

Mass of the smaller body  $m_1 = 2 \text{ kg}$

Mass of the bigger body  $m_2 = 3 \text{ kg}$

Radius of the smaller body  $R_1 = 4 \text{ km}$

Radius of the bigger body  $R_2 = 7 \text{ km}$

i.e.  $R_1 : R_2 = 4 : 7$

$\therefore$  ratio of their accelerations due to gravity  $g_1 : g_2 = ?$

**Solution :**

We know that, acceleration due to gravity is

$$g = \frac{GM}{R^2}$$

$$g_1 = \frac{GM_1}{R_1^2} \text{ and } g_2 = \frac{GM_2}{R_2^2}$$

$$\therefore \frac{g_1}{g_2} = \frac{\frac{GM_1}{R_1^2}}{\frac{GM_2}{R_2^2}} = \frac{M_1}{M_2} \times \frac{R_2^2}{R_1^2}$$

$$\frac{g_1}{g_2} = \left(\frac{M_1}{M_2}\right) \left(\frac{R_2}{R_1}\right)^2$$

$$\frac{g_1}{g_2} = \left(\frac{2}{3}\right) \left(\frac{7}{4}\right)^2$$

$$\frac{g_1}{g_2} = \left(\frac{2}{3}\right) \times \frac{7}{4} \times \frac{7}{4} = \frac{49}{24}$$

$$\therefore \text{ratio of } g_1 : g_2 = 49 : 24.$$

### VIII. Answer in detail

1. What are the types of inertia? Give an example for each type. (PTA - 3, Sep.-22)

**Inertia of rest : T**

- ★ The resistance of a body to change its state of rest is called inertia of rest.

**E.g. :** When you vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down.

**Inertia of motion :**

- ★ The resistance of a body to change its state of motion is called inertia of motion.

**E.g. :** An athlete runs some distance before jumping. Because this will help him jump longer and higher.

**Inertia of direction :**

- ★ The resistance of a body to change its direction of motion is called inertia of direction.

**E.g. :** When you make a sharp turn while driving a car, you tend to lean sideways.

2. State Newton's laws of motion? (Sep.-21,22)

i) Newton's First Law :

- ★ Every body continues to be in its state of rest or the state of uniform motion along a straight line unless it is acted upon by some external force.

ii) Newton's Second Law of Motion :

- ★ The force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force. This law helps us to measure the amount of force. So, it is also called as 'law of force'.

iii) Newton's Third Law of Motion :

- ★ Newton's third law states that 'for every action, there is an equal and opposite reaction. They always act on two different bodies.'

3. Deduce the equation of a force using Newton's second law of motion. (April-23)

Newton's Second Law of Motion :

- ★ The force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force. Let 'm' be the mass of a moving body, moving along a straight line with an initial speed u.
- ★ After a time interval of 't', the velocity of the body changes to 'v' due to the impact of an unbalanced external force F.

$$\text{Initial momentum of the body } P_i = mu$$

$$\text{Final momentum of the body } P_f = mv$$

$$\begin{aligned} \text{Change in momentum } \Delta p &= P_f - P_i \\ &= mv - mu \end{aligned}$$

By Newton's Second law of motion,

Force,  $F \propto$  rate of change of momentum.

$$F \propto \text{Change in momentum / time}$$

$$F \propto (mv - mu) / t$$

$$F = \frac{km(v-u)}{t}$$

Here, k is the proportionality constant ,  $k = 1$  in all systems of units

$$\text{Hence } F = \frac{m(v-u)}{t}$$

Since, acceleration = Change in velocity / time

$$a = \frac{(v-u)}{t}$$

Hence, we have

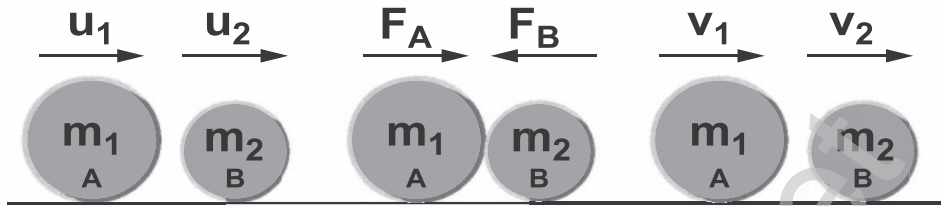
$$F = m \times a$$

$$\text{Force} = \text{mass} \times \text{acceleration.}$$

4. State and prove the law of conservation of linear momentum. (Dept.)

**The principle of conservation of linear momentum :**

- ★ There is no change in the linear momentum of a system of bodies as long as no net external force acts on them. Let us prove the law of conservation of linear momentum with the following illustration.



**Conservation of linear momentum**

**Proof :**

- ★ Let two bodies A and B having masses  $m_1$  and  $m_2$  move with initial velocity  $u_1$  and  $u_2$  in a straight line.
- ★ Let the velocity of the first body be higher than that of the second body. i.e.  $u_1 > u_2$
- ★ During an interval of time  $t$  seconds, they tend to have a collision. After the impact, both of them, move along the same straight line with a velocity  $v_1$  and  $v_2$  respectively.

Force on body B due to A,

$$F_B = \frac{m_2(v_2 - u_2)}{t}$$

Force on body A due to B,

$$F_A = \frac{m_1(v_1 - u_1)}{t}$$

By Newton's III Law of motion,

$$\text{Action force} = \text{Reaction force}$$

$$F_A = -F_B$$

$$\frac{m_1(v_1 - u_1)}{t} = \frac{-m_2(v_2 - u_2)}{t}$$

$$m_1v_1 - m_1u_1 = -m_2v_2 + m_2u_2$$

$$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2 \quad \boxed{1}$$

- ★ The above equation confirms that in the absence of an external force, the algebraic sum of the momentum after collision is numerically equal to the algebraic sum of the momentum before collision. Hence the law of conservation linear momentum is proved.

5. Describe rocket propulsion. (PTA - 4, Sep.-20,22)

- ★ Propulsion of rockets is based on the law of conservation of linear momentum as well as Newton's III law of motion.
- ★ Rockets are filled with a fuel (either liquid or solid) in the propellant tank.
- ★ When the rocket is fired, this fuel is burnt and a hot gas is ejected with high speed from the back nozzle producing a huge momentum.



- ★ To balance this momentum, an equal and opposite reaction force is produced which makes the rocket project forward.
- ★ While in motion, the mass of the rocket gradually decreases until the fuel is completely burnt out. Since there is no net external force acting on it, the linear momentum of the system is conserved.
- ★ The mass of the rocket decreases by altitude that results in the gradual increase in the velocity of the rocket.
- ★ At one stage, it reaches a velocity which is sufficient to just escape from the gravitational pull of the Earth. This velocity is called escape velocity.

## 6. State the universal law of gravitation and derive its mathematical expression.

### Newton's Universal law of Gravitation :

- ★ This law states that every particle of matter in this universe attracts every other particle with a force. This force is directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of these masses. The direction of the force acts along the line joining the masses. Let  $m_1$  and  $m_2$  be the masses of two bodies A and B placed at  $r$  metres apart in space.

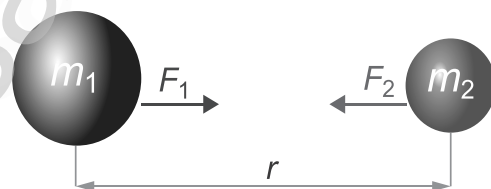
$$\text{Force} \propto m_1 \times m_2$$

$$F \propto \frac{1}{r^2}$$

- ★ On combining the above two expressions

$$F \propto \frac{m_1 \times m_2}{r^2}$$

$$\therefore F = \frac{Gm_1 m_2}{r^2} \quad \boxed{1}$$



Gravitational force between two masses

- ★ Where  $G$  is the universal gravitational constant. Its value in SI Unit is  $6.674 \times 10^{-11} \text{ Nm}^2\text{kg}^{-2}$ .

## 7. Give the applications of universal law of gravitation.

### Application of Newton's law of gravitation :

- ★ Dimensions of the heavenly bodies can be measured using the gravitation law. Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy. It helps in discovering new stars and planets.
- ★ One of the irregularities in the motion of stars is called 'wobble' which leads to the disturbance in the motion of a planet nearby. In this condition the mass of the star can be calculated using the law of gravitation.
- ★ Helps to explain germination of roots. It is due to the property of geotropism which is the property of a root responding to the gravity.
- ★ Helps to predict the path of the astronomical bodies.

**IX. HOT Questions.**

1. Two blocks of masses 8 kg and 2 kg respectively lie on a smooth horizontal surface in contact with one other. They are pushed by a horizontally applied force of 15 N. Calculate the force exerted on the 2 kg mass.

**Data :**

Mass of block 1,	$m_1 = 8 \text{ kg}$
Mass of block 2,	$m_2 = 2 \text{ kg}$
Total mass,	$m = m_1 + m_2$
$m$	$= 8 + 2$
$m$	$= 10 \text{ kg}$
Force, $F_1$	$= 15 \text{ N}$
Force exerted on 2 kg,	$F_2 = ?$

**Solution :**

Force,	$F_1 = \text{mass} \times \text{acceleration}$
	$F_1 = ma$
	$F_1 = 10 \times a$
	$a = \frac{F_1}{10} = \frac{15}{10} = 1.5 \text{ ms}^{-2}$
Force exerted on $m_2$ (2kg) is,	$F_2 = m_2 \times a$
	$F_2 = 2 \times 1.5$
	$F_2 = 3 \text{ N.}$

2. A heavy truck and a bike are moving with the same kinetic energy. If the mass of the truck is four times that of the bike, then calculate the ratio of their momenta. (Ratio of momenta = 2:1)

**Data :**

$$\text{Kinetic energy of the truck} = \frac{1}{2} m_t v_t^2$$

$$\text{Kinetic energy of the bike} = \frac{1}{2} m_b v_b^2$$

$$\text{Kinetic energy of the truck} = \text{Kinetic energy of the bike}$$

$$\frac{1}{2} m_t v_t^2 = \frac{1}{2} m_b v_b^2 \quad (1)$$

$$\text{Also, } m_t = 4m_b \quad (2)$$

Substituting (2) in (1)

$$\frac{1}{2} (4) m_b v_t^2 = \frac{1}{2} m_b v_b^2$$

$$4v_t^2 = v_b^2$$

$$\therefore v_t = \frac{1}{2} v_b \quad (3)$$

$\therefore$  Ratio of the momenta, i.e..  $m_t v_t : m_b v_b$  ?

**Solution :**

$$\frac{P_{\text{truck}}}{P_{\text{bike}}} = \frac{m_t v_t}{m_b v_b}$$

$$\frac{P_{\text{truck}}}{P_{\text{bike}}} = \frac{4m_b}{m_b v_b} \cdot \frac{1}{2} v_b$$

$$\frac{P_{\text{truck}}}{P_{\text{bike}}} = \frac{4}{2}$$

$$\frac{P_{\text{truck}}}{P_{\text{bike}}} = \frac{2}{1}$$

$$\therefore \frac{P_{\text{truck}}}{P_{\text{bike}}} = \frac{2}{1} \text{ (or) } \frac{P_{\text{bike}}}{P_{\text{truck}}} = \frac{1}{2} = 1 : 2.$$

3. **“Wearing a helmet and fastening the seat belt is highly recommended for safe journey”**  
**Justify your answer using Newton’s laws of motion.**

- ★ During the motion of car and two wheelers, when the brakes are applied, the vehicles slow down but our body tends to continue in the same state of motion due to inertia. So this causes injury to passengers. Hence they are advised to wear a helmet and the seat belt.

### PTA & Exam Questions (Interior)

#### I. Choose the correct answer

1. F be the force between the two bodies placed at a certain distance. If the distance between them is doubled, then the gravitational force F will be \_\_\_\_\_. (PTA-5)  
 a) 2 F                      b) F/2                      c) F/4                      d) 4F

**Ans : c) F/4**

2. The force required to produce an acceleration of  $1 \text{ cm s}^{-2}$  on a body of mass 1 g is \_\_\_\_\_. (PTA-6)  
 a) 1 N                      b) 10                      c)  $10^2$  dyne                      d) 1 dyne

**Ans : d) 1 dyne**

#### V. Assertion and Reason

1. **Understand the assertion statement and the reason given and choose the correct choice.** (PTA - 2)

**Assertion :** When a person swims he pushes the water using the hands backwards and the water pushes the person in the forward direction.

**Reason :** For every action there is an equal and opposite reaction.

- a) Both the assertion and the reason are true and the reason is the correct explanation of the assertion.  
 b) Both the assertion and the reason are true, the reason is not the correct explanation of the assertion.  
 c) Assertion is true but the reason is false.  
 d) Both the assertion and the reason are false.

**Ans : a) Both the assertion and the reason are true and the reason is the correct explanation of the assertion.**

**VII. Give short answers**

1. **Why the apples weigh more at poles than at equator?** (PTA - 3)

- Weight of a body varies from one place to another place on the earth.
- Since it depends on the acceleration due to gravity of the earth ( $g$ ) weight of a body is **more at the poles than at the equatorial region.**
- So the apples weigh more at poles than at equator.

2. **Write a short notes on gears.** (Sep.-20)

- A gear is a **circular wheel** with teeth around its rim.
- It helps to change the **speed of rotation** of a wheel by **changing the torque** and helps to transmit power.

**VIII. Give long answers**

1. i) **Shock absorbers are used in luxury buses. Why?** (PTA - 2)

- Luxury buses are fitted with springs and shock absorbers to reduce jerk while moving on uneven roads. For the comfort purpose, shock absorbers are used to absorb (or) damp the shock (or) unwanted oscillation of the bus due to damaged roads.

ii) **Name the law of motion used in flying of birds. Give another example for the same law.** (PTA - 2)

**Newton III law of motion :**

- Rocket propulsion
- **Another example :** When a person swims, he pushes the water using the hands backwards (Action) and the water pushes the swimmer in the forward direction (Reaction)

iii) **A weight of a man is 686 N on the surface of the earth. Calculate the weight of the same person on moon. ('g' value of a moon is  $1.625 \text{ ms}^{-2}$ )** (PTA - 2)

**Solution :**

Acceleration due to gravity $g = 9.8 \text{ ms}^{-2}$
--

$$\begin{aligned} \text{Weight (w)} &= 686 \text{ N} \\ \text{gravity (g)} &= 9.8 \text{ ms}^{-2} \end{aligned}$$

Formula = $w = m \times g$
----------------------------

$$\begin{aligned} m &= \frac{w}{g} \\ m &= \frac{686}{9.8} \end{aligned}$$

$m = 70 \text{ kg}$
---------------------

Acceleration due to gravity surface of the Moon = $1.625 \text{ ms}^{-2}$
---

$\therefore w = m \times g$
-----------------------------

$$\begin{aligned} w &= 70 \times 1.625 \\ w &= \mathbf{113.75 \text{ N}} \end{aligned}$$

2. A body of mass  $m$  is initially moving with a velocity  $u$ . When a force  $F$  acts on the body it picks up velocity  $v$  in  $t$  second so that the acceleration is produced. Using this data derive the relation between the force, mass and acceleration. (PTA - 5)

**Solution :**

**Newton Second law :**

- Force acting on a body is directly proportional to the rate of change of linear momentum of the body and the change in momentum takes place in the direction of the force.

It is also called as "Law of force"

Initial momentum of the body  $P_i = mu$

Final momentum of the body  $P_f = mv$

$\therefore$  change in momentum :  $\Delta p = P_f - P_i$   $\Delta p = mv - mu$

By Newton's second Law of motion.

$F \propto \frac{\text{Change in momentum}}{\text{time}}$

$F \propto \frac{mv - mu}{t}$

$F = \frac{Km(v - u)}{t}$

$K$  - Proportionality constant  $K = 1$

$F = \frac{m(v-u)}{t}$   $\frac{v-u}{t} = a$

Since acceleration

$a = \frac{v-u}{t}$   $F = m \times a$

**Force = mass  $\times$  acceleration.**

### IX. Analogy

1. Opening a door; Moment of force, (PTA - 4)

Opening a water tap : \_\_\_\_\_

**Ans :** Moment of a couple

2. Pushing a bus by a group of people; Like a parallel forces (PTA - 4)

Tug of war : \_\_\_\_\_

**Ans :** Unlike parallel force

### XI. Numerical problems

1. Calculate the velocity of a moving body of mass 5 kg whose linear momentum is 2 kg  $\text{ms}^{-1}$ . (Dept.)

**Solution :**

Linear momentum = 2 kg  $\text{ms}^{-1}$

Mass = 5 kg

Velocity = ?

$\text{Linear momentum} = \text{Mass} \times \text{velocity}$

Velocity =  $\frac{\text{Linear momentum}}{\text{Mass}}$

$V = \frac{2}{5}$

$V = 0.4 \text{ ms}^{-1}$

2. A lift is moving downwards with an acceleration of  $1.8 \text{ ms}^{-2}$ , What is the apparent weight realised by a man of mass  $50 \text{ kg}$ ? (PTA - 1)

Solution :

$$\begin{aligned} \text{Acceleration} &= 1.8 \text{ ms}^{-2} \\ \text{Mass} &= 50 \text{ kg} \\ \text{Gravity (g)} &= 9.8 \text{ ms}^{-2} \\ \text{Apparent weight R} &= ? \end{aligned}$$

$$\boxed{\text{Formula; } R = m(g - a)}$$

$$\begin{aligned} R &= 50 [9.8 - 1.8] \\ R &= 50 \times 8 \\ \mathbf{R} &= \mathbf{400N}. \end{aligned}$$

3. A force of  $5 \text{ N}$  applied on a body produces an acceleration  $5 \text{ cm s}^{-2}$ . Calculate the mass of the body. (PTA - 5)

Solution :

$$\begin{aligned} \text{Force (F)} &= 5\text{N} \\ \text{acceleration (a)} &= 5 \text{ cms}^{-2} = 0.05 \text{ ms}^{-2} \\ \text{Mass (m)} &= ? \end{aligned}$$

Newton II Law :  $\boxed{F = ma}$

$$m = \frac{F}{a}$$

$$m = \frac{5}{0.05} \times \frac{100}{100}$$

$$m = \frac{100}{\cancel{5}_1}$$

$$\mathbf{m} = \boxed{100 \text{ kg}}.$$

4. At what height from the centre of the earth's surface, the acceleration due to gravity will be  $1/4$ th of its value on the surface of the earth. (PTA - 6)

Data :

Height from the centre of the Earth,  $R' = R + h$

The acceleration due to gravity at that height,  $g' = g/4$

Solution :

$$g = \frac{GM}{R^2}, g' = \frac{GM}{R'^2}$$

$$\frac{g}{g'} = \left(\frac{R'}{R}\right)^2 = \left(\frac{R+h}{R}\right)^2 = \left(1 + \frac{h}{R}\right)^2$$

$$4 = \left(1 + \frac{h}{R}\right)^2$$

$$2 = 1 + \frac{h}{R} \text{ or } h = R. R' = 2R$$

$$\therefore R^1 = R + h$$

$$R^1 = R + R$$

$$\mathbf{R} = \mathbf{2R}$$

From the centre of the Earth, the object is placed at twice the radius of the earth.

## 2. Optics

### Important Formulae

1	Magnification	$\Rightarrow m = \frac{h_1}{h} \text{ (or) } m = \frac{v}{u}$
2	Power of Lens	$P = \frac{1}{f}$
3	Lens Maker's formula	$\frac{1}{f} = (\mu - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right)$
4	Lens formula	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
5	Refractive index	$\mu = \frac{C_a}{C_m}$
6	Snell's law	$\Rightarrow \frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$
7	Myopia, Focal length of required concave lens	$\Rightarrow f = \frac{xy}{x - y}$
8	Velocity of light	$c = v\lambda$
9	Rayleigh's scattering law	$S \propto \frac{1}{\lambda^4}$
10	Hypermetropia	$f = \frac{dD}{d - D}$
11	Myopia Focal length of the concave lens	$f = \frac{xy}{x - y}$
12	Hypermetropia Focal length of the convex lens	$f = \frac{dD}{d - D}$

### Bookback Questions & Answers

#### I. Choose the correct answer

- The refractive index of four substances A, B, C and D are 1.31, 1.43, 1.33, 2.4 respectively. The speed of light is maximum in  
 a) A                      b) B                      c) C                      d) D

**Ans : a) A**

- Where should an object be placed so that a real and inverted image of same size is obtained by a convex lens (May-22)  
 a) f                      b) 2f                      c) infinity                      d) between f and 2f

**Ans : b) 2f**

3. A small bulb is placed at the principal focus of a convex lens. When the bulb is switched on, the lens will produce (PTA - 3)
- a) a convergent beam of light                      b) a divergent beam of light  
c) a parallel beam of light                            d) a coloured beam of light

**Ans : c) a parallel beam of light**

4. Magnification of a convex lens is (April-23)
- a) Positive    b) negative  
c) either positive or negative                            d) zero

**Ans : c) either positive or negative**

5. A convex lens forms a real, diminished point sized image at focus. Then the position of the object is at
- a) focus                      b) infinity                      c) at  $2f$                       d) between  $f$  and  $2f$

**Ans : b) infinity**

6. Power of a lens is  $-4D$ , then its focal length is
- a) 4m                      b)  $-40m$                       c)  $-0.25 m$                       d)  $-2.5 m$

**Ans : c)  $-0.25 m$**

7. In a myopic eye, the image of the object is formed
- a) behind the retina                                      b) on the retina  
c) in front of the retina                                      d) on the blind spot

**Ans : c) in front of the retina**

8. The eye defect 'presbyopia' can be corrected by (PTA - 2, Sep.-20)
- a) convex lens      b) concave lens      c) convex mirror      d) Bi focal lenses

**Ans : d) Bi focal lenses**

9. Which of the following lenses would you prefer to use while reading small letters found in a dictionary?
- a) A convex lens of focal length 5 cm      b) A concave lens of focal length 5 cm  
c) A convex lens of focal length 10 cm      d) A concave lens of focal length 10 cm

**Ans : a) A convex lens of focal length 5 cm**

10. If  $V_B$ ,  $V_G$ ,  $V_R$  be the velocity of blue, green and red light respectively in a glass prism, then which of the following statement gives the correct relation?
- a)  $V_B = V_G = V_R$                                       b)  $V_B > V_G > V_R$   
c)  $V_B < V_G < V_R$                                       d)  $V_B < V_G > V_R$

**Ans : c)  $V_B < V_G < V_R$**

## II. Fill in the blanks

1. The path of the light is called as \_\_\_\_\_.

**Ans : ray of light**

2. The refractive index of a transparent medium is always greater than \_\_\_\_\_.

**Ans : one**

3. If the energy of incident beam and the scattered beam are same, then the scattering of light is called as \_\_\_\_\_ scattering.

**Ans : elastic**



4. According to Rayleigh's scattering law, the amount of scattering of light is inversely proportional to the fourth power of its \_\_\_\_\_.

**Ans : wave length**

5. Amount of light entering into the eye is controlled by \_\_\_\_\_.

**Ans : Iris**

### III. Say True or False. If false correct it

1. Velocity of light is **greater** in denser medium than in **rarer** medium.

**Ans : False**

**Correct statement :** Velocity of light is lesser in **rarer** medium than in **denser** medium.

2. The power of lens depends on the focal length of the lens.

**Ans : True**

3. Increase in the converging power of eye lens cause 'hypermetropia'.

**Ans : False**

**Correct statement :** Increase in the converging power of eye lens causes 'Myopia'.

4. The **convex** lens always gives a small virtual image.

**Ans : False**

**Correct statement :** The **concave** lens always gives a small virtual image.

### IV. Match the following

	Column I		Column II
1	Retina	a	Path way of light
2	Pupil	b	Far point comes closer
3	Ciliary muscles	c	near point moves away
4	Myopia	d	Screen of the eye
5	Hypermetropia	e	Power of accommodation

Ans :		Column I		Column II
	1	Retina	a	Screen of the eye
	2	Pupil	b	Path way of light
	3	Ciliary muscles	c	Power of accommodation
	4	Myopia	d	Far point comes closer
	5	Hypermetropia	e	near point moves away

### V. Assertion and reasoning type. Mark the correct choice as

- a) If both assertion and reason are true and reason is the correct explanation of assertion.
- b) If both assertion and reason are true but reason is not the correct explanation of assertion.
- c) Assertion is true but reason is false.
- d) Assertion is false but reason is true.

1. **Assertion :** If the refractive index of the medium is high (denser medium) the velocity of the light in that medium will be small
- Reason :** Refractive index of the medium is inversely proportional to the velocity of the light.
- Ans :** a) **both assertion and reason are true and reason is the correct explanation of assertion.**
2. **Assertion :** Myopia is due to the increase in the converging power of eye lens.
- Reason :** Myopia can be corrected with the help of concave lens.
- Ans :** b) **both assertion and reason are true but reason is not the correct explanation of assertion.**

## VI. Answer Briefly

### 1. What is refractive index?

- ★ The ratio of speed of light in vacuum to the speed of light in a medium is defined as the refractive index of that medium.

$$\mu = \frac{c}{v}$$

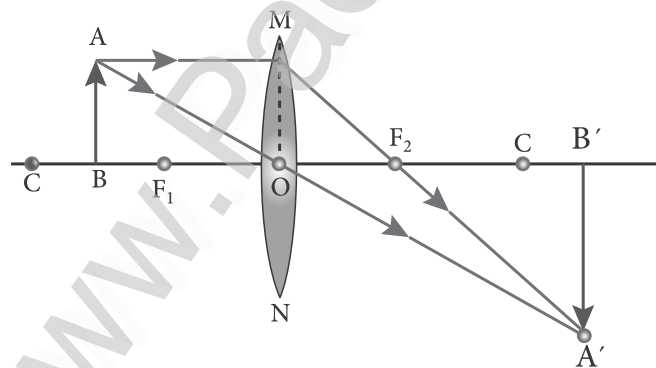
### 2. State Snell's law.

(Sep.-22)

- ★ The ratio of the sine of the angle of incidence and sine of the angle of refraction is equal to the ratio of refractive indices of the two media.

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$$

### 3. Draw a ray diagram to show the image formed by a convex lens when the object is placed between F and 2F. (Dept.)



Object placed between F and C

### 4. Define dispersion of light.

- ★ When a beam of white light or composite light is refracted through any transparent media such as glass or water, it is split into its component colours. This phenomenon is called as dispersion of light.

### 5. State Rayleigh's law of scattering.

(PTA - 3)

- ★ Rayleigh's law of scattering states that the amount of scattering is inversely proportional to the fourth power of the wavelength. This is called as Rayleigh scattering law.

$$\text{Amount of scattering} \propto \frac{1}{\lambda^4}$$

**6. Differentiate convex lens and concave lens.****(PTA - 3)**

S.No	Convex Lens	Concave Lens
1	A convex lens is thicker in the middle than at edges.	A concave lens is thinner in the middle than at edges.
2	It is converging.	It is diverging.
3	It produces real images.	It produces a virtual image.
4	It is used to treat <i>hyper meteropia</i> .	It is used to treat <i>myopia</i> .

**7. What is power of accommodation of eye?**

- ★ The ability of the eye lens to focus nearby as well as the distant objects is called power of accommodation of eye.

**8. What are the causes of 'Myopia'?**

- ★ *Myopia*, also known as short sightedness, occurs due to the lengthening of eye ball.
- ★ Nearby objects can be seen clearly but distant objects cannot be seen clearly.
- ★ The focal length of the eye lens is reduced or the distance between the eye lens and retina increases.
- ★ Due to this, the images of distant objects are formed before the retina.

**9. Why does the sky appear blue in colour?****(PTA - 1, April - 23)**

- ★ When sunlight passes through the atmosphere, the blue colour (shorter wavelength) is scattered to a greater extent than the red colour (longer wavelength). This scattering causes the sky to appear blue in colour.

**10. Why are traffic signals red in colour?****(PTA - 4)**

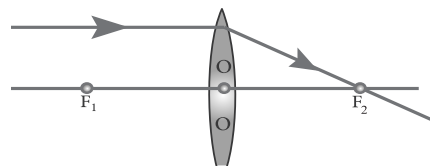
- ★ Red has the longest wavelength.
- ★ It is mostly scattered by atmospheric particles. As a result whether it is fog or smoke - red light passes comparatively easily through them.

**VII. Give the answer in detail****1. List any five properties of light.****(May-22)**

- ★ Light is a form of energy Light always travels along a straight line.
- ★ Light does not need any medium for its propagation. It can even travel through vacuum.
- ★ The speed of light in vaccum or air is  $c = 3 \times 10^8 \text{ms}^{-1}$ .
- ★ Different coloured light has different wavelength and frequency.

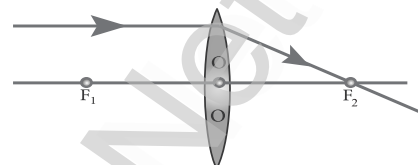
2. Explain the rules for obtaining images formed by a convex lens with the help of ray diagram.

**Rule : 1 :** When a ray of light strikes the convex lens obliquely at its optical centre, it continues to follow its path without any deviation.



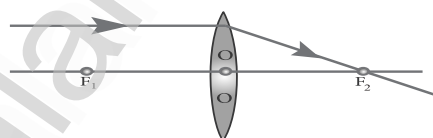
Rays passing through the optical centre

**Rule : 2 :** When rays parallel to the principal axis strike a convex lens, the refracted rays are converged to (convex lens) or appear the principal focus.



Rays passing parallel to the optic axis

**Rule : 3 :** When a ray passing through (convex lens) or directed towards the principal focus strikes a convex lens, the refracted ray will be parallel to the principal axis.



Rays passing through or directed towards the principal focus

3. Differentiate the eye defects: Myopia and Hypermetropia. (PTA-6, Sep.-21, 22, April-23)

S.No	Myopia	Hypermetropia
1	Myopia is short sightedness	It is long sightedness.
2	It is due to the lengthening of the eye ball	It is due to the shortening of the eye ball.
3	Near by object can be seen clearly.	Distance object can be seen clearly.
4	With this defect, distant objects cannot be seen clearly.	With this defect, nearby objects cannot be seen clearly.
5	The focal length of the eye lens is reduced.	The focal length of eye lens is increased.
6	The far point will not be at infinity.	The near point will not be at 25 cm.
7	The far point has come closer.	The near point has moved further.
8	The images of distant objects are formed before the retina.	The images of nearby objects are formed behind the retina.
9	It can be corrected by using a concave lens.	It can be corrected by using a convex lens.
10	This defect is known as myopia.	This defect is known as hypermetropia.

#### 4. Explain the construction and working of a 'Compound Microscope'.

##### Construction:

- ★ Compound microscope is used to view or deduce the tiny objects. A compound microscope consists of two convex lenses. The lens with the shorter focal length is placed near the object, and is called as 'objective lens' or 'objective piece'.
- ★ The lens with larger focal length and larger aperture placed near the observer's eye is called as 'eye lens' or 'eye piece'. Both the lenses are fixed in a narrow tube with adjustable provision.

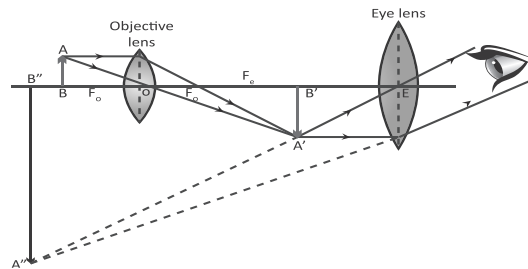


Image formation in compound microscope

##### Working :

- ★ The object (AB) is placed at a distance slightly greater than the focal length of the objective lens ( $u > F_o$ ). A real, inverted and magnified image ( $A^1B^1$ ) is formed at the other side of the objective lens. This image behaves as the object for the eye lens.
- ★ The position of the eye lens is adjusted in such a way, that the image ( $A^1B^1$ ) falls within the principal focus of the eye piece. This eye piece forms a virtual, enlarged and erect image ( $A''B''$ ) on the same side of the object.

### VIII. Numerical Problems

1. An object is placed at a distance 20cm from a convex lens of focal length 10cm. Find the image distance and nature of the image.

##### Data :

Distance of an object	$u$	=	20cm
Focal length of convex lens	$f$	=	10 cm
Image distance	$v$	=	?
Nature of the image		=	?

##### Solution :

If the object is placed on the left side of the lens, then  $f = 10$  cm,  $u = -20$ cm.

$$\begin{aligned} \frac{1}{f} &= \frac{1}{v} - \frac{1}{u} \\ \frac{1}{v} &= \frac{1}{f} + \frac{1}{u} \\ \frac{1}{v} &= \frac{1}{10} + \frac{1}{(-20)} \\ \frac{1}{v} &= \frac{1}{10} - \frac{1}{20} \\ \frac{1}{v} &= \frac{20-10}{200} = \frac{10}{200} \\ \frac{1}{v} &= \frac{1}{20} \\ v &= \mathbf{20\text{ cm}} \end{aligned}$$

(-ve sign indicates the inverted image)

2. An object of height 3cm is placed at 10cm from a concave lens of focal length 15cm. Find the size of the image.

**Data :**

Object distance  $u = -10\text{cm}$  [Object is placed on the left side]

Focal length  $f = -15\text{ cm}$

Let image distance  $v = ?$

Height of the object  $h = 3\text{ cm}$

**Solution :**

We know

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

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

$$\frac{1}{v} = \frac{1}{-15} + \frac{1}{-10}$$

$$\frac{1}{v} = \frac{-10 - 15}{150}$$

$$\frac{1}{v} = \frac{-25}{150} = \frac{-1}{6}$$

$$\therefore v = -6\text{cm}$$

Distance of image  $v = -6\text{cm}$ .

Magnification  $m = \frac{\text{Distance of the image}}{\text{Distance of the object}}$

$$m = \frac{v}{u}$$

$$m = \frac{6}{10}$$

$$m = 0.6$$

And magnification  $m = \frac{h^1}{h} = \frac{\text{height of the image}}{\text{height of the object}}$

$$m = \frac{h^1}{h}$$

$$0.6 = \frac{h^1}{3}$$

$$\therefore h^1 = 0.6 \times 3$$

$$h^1 = 1.8$$

$\therefore$  Size of the image,  $h^1 = 1.8\text{cm}$ .

## IX. Higher order thinking (HOT) questions

- While doing an experiment for the determination of focal length of a convex lens, Raja Suddenly dropped the lens. It got broken into two halves along the axis. If he continues his experiment with the same lens, (a) can he get the image? (b) Is there any change in the focal length?
  - ★ Yes, he can get the image.
  - ★ The focal length of the lens will be doubled.
- The eyes of the nocturnal birds like owl are having a large cornea and a large pupil. How does it help them?
  - ★ The large pupil opens wider and allows the maximum amount of light to enter the eye in the dark.
  - ★ Their lens is large and situated near the retina. This also allows a lot of light to register on the retina. The retina contains two types of light - sensing cells rods and cones.
  - ★ Cones are responsible for the coloured vision and required bright, focussed light.

## PTA & Exam Questions

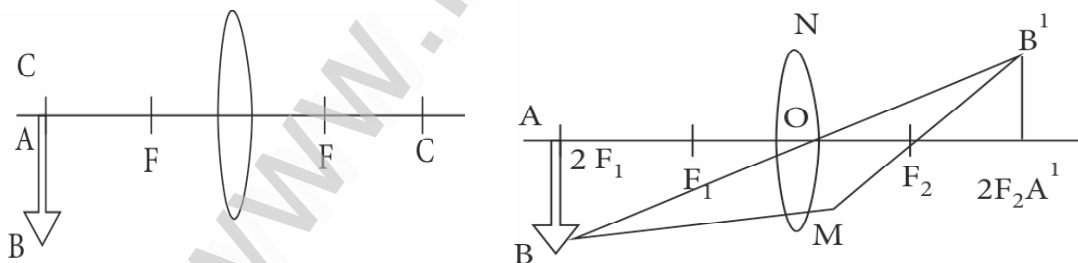
### I. Choose the correct answers

- The scattered light in Raman scattering contains \_\_\_\_\_ lines. (PTA - 5)
  - a) Rayleigh's
  - b) Stokes
  - c) Antistokes
  - d) all the above

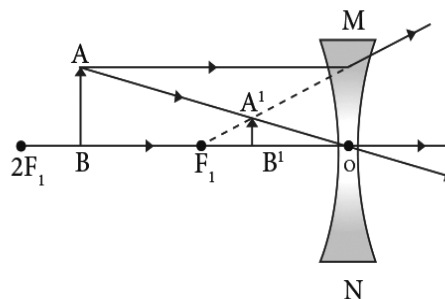
Ans : d) all the above

### VII. Give short answers

- An object AB is placed at the centre of curvature C of the convex lens as shown in the picture. Complete the ray diagram. (PTA - 1)



- Complete the ray diagram of a concave lens. (PTA - 6)



3. **In common What is the value of least distance of distinct vision of a human?(PTA - 6)**
- In common, the value of least distance of distinct vision of a human is 25 cm.
4. **Write any two applications of concave lens. (Sep.-21)**
- Concave lenses are used as eye lens of “Galilean Telescope”.
  - They are used in wide angle spy hole in doors.
  - They are used to correct the defect of vision called “Myopia”.
5. **Write any two applications of concave lens. (Sep.-21)**
- Concave lenses are used as eye lens of “Galilean Telescope”.
  - They are used in wide angle spy hole in doors.
  - They are used to correct the defect of vision called “Myopia”.
6. **What are the uses of Simple microscope ? (Sep.-20)**
- Simple microscopes are used,
- By watch repairers and jewellers
  - To read small letters clearly
  - To observe parts of flower, insects etc.
  - To observe finger prints in forensic science.
7. **List the advantages of Telescopes. (PTA - 3)**
- Elaborate view of the Galaxies, Planets, stars and other heavenly bodies is possible.
  - Camera can be attached for taking photograph for the celestial objects.
  - Telescope can be used even with the low intensity of light.
8. **Write any two applications of concave lenses. (Sep.-21)**
- Eye lens of ‘Galilean Telescope’.
  - In wide angle spy hole in doors.
  - To correct the defect of vision called ‘Myopia’.

## VII. Long answers

1. **A student in a class room can read text book but he / she can't see the letters on the black board distinctly. Write the name of his / her eye defect and what is the cause? Suggest a remedy. (PTA - 1)**

Name of the defect - Myopia

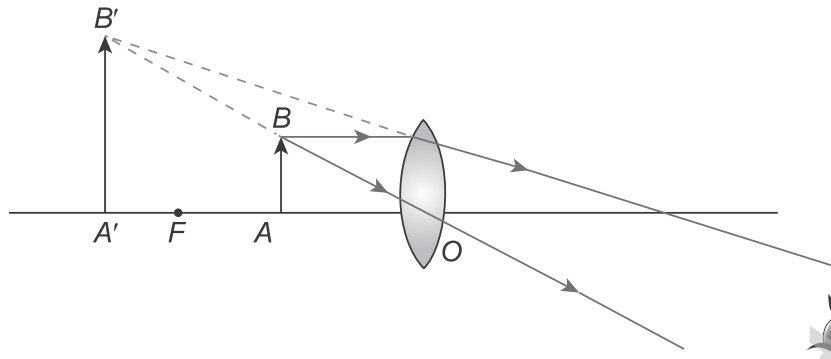
- It is also known as short sightedness.
- It occurs due to the lengthening of eye ball.
- Nearby object can be seen clearly but distant object cannot be seen clearly.

**Remedy :**

- This defect can be corrected using a concave lens.



2. i) Draw the ray diagram of image formation in simple microscopes. (PTA - 2)



### Image formation in simple microscope

- ii) Find the position and write the nature and size of the image form.

#### Nature :

- Simple microscope has a convex lens of short focal length it is held near the eye to get an enlarged image of small objects.

#### Position :

- Let an object (AB) is placed at a point within the principal focus ( $U < f$ ) of the convex lens, the observer eye is placed just behind the lens.
- As per this position the convex lens produces an erect, virtual and enlarged image ( $A'B'$ )

#### Size :

- The image formed is of the same size of the object and the distance is equal to the least distance of distinct vision (D). For normal Human eye ( $D = 25 \text{ cm}$ )

## XI. Numerical problems

2. A beam of light passing through a diverging lens of focal length 0.3 m appears to be focused at a distance 0.2 m behind the lens. Find the position of the object. (Sep.-20)

#### Solution :

$$f = -3.0 \quad v = 0.2\text{m}$$

Formula

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

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

$$\frac{1}{u} = \frac{1}{-0.2} - \frac{1}{-0.3}$$

$$\frac{1}{u} = \frac{-10}{6}$$

$$u = \frac{-6}{10}$$

$$u = -0.6 \text{ m}$$

1. The power of a lens is  $-2D$ . Find the focal length of a lens.

(PTA - 4)

**Solution :**

$$P = \frac{1}{f} \text{ or } f = \frac{1}{P}$$

$$f = \frac{1}{-2} = -0.5\text{m}$$

$$f = -0.5 \text{ m}$$

3. A person with myopia can see objects placed at a distance of 4m. If he wants to see objects at a distance of 20m, what should be the focal length and power of the concave lens he must wear ?

(May-22, Sep.-22)

**Data :**

$$x = 4\text{m}, y = 20\text{m},$$

$$\text{focal length } f = ?$$

$$\text{Power of the correction lens} = ?$$

**Solution :**

We know

Focal length of the correction lens is

$$f = \frac{xy}{x - y}$$

$$f = \frac{4 \times 20}{4 - 20} = \frac{80}{-16}$$

$$f = -5\text{m}$$

$$\text{Power of the correction lens } P = \frac{1}{f} = -\frac{1}{5}$$

$$P = -0.2D.$$

4. An object of height 3 cm is placed at 10 cm from a convex lens which produces an image at 20 cm from its optical centre. Calculate the magnification and height of the image produced.

(PTA - 5)

**Solution :**

$$h = 3 \text{ cm (Height)}$$

$$\text{Object distance (u)} = 10 \text{ cm}$$

$$\text{Image distance (v)} = 20 \text{ cm}$$

$$\text{Magnification } = m = \frac{v}{u}$$

$$m = \frac{20}{10}$$

$$m = 2$$

ii) Height of the image

$$\text{Magnification } = m = \frac{h^1}{h}$$

$$h^1 = h \times 2$$

$$h^1 = 3 \times 2$$

$$h^1 = 6 \text{ cm.}$$

5. Calculate the frequency of visible light having wavelength  $3000\text{A}^\circ$  travelling in vacuum. (PTA-5)

**Solution :**

$$\begin{aligned}\text{Wave length } \lambda &= 3000 \text{ A}^\circ && \boxed{\therefore 1\text{A}^\circ = 10^{-10}\text{m}} \\ &= 3000 \times 10^{-10}\end{aligned}$$

$$\text{Velocity of light} = 3 \times 10^8 \text{ ms}^{-1}$$

$$\text{Frequency } (\nu) = \frac{\text{Velocity } (v)}{\text{Wave length } (\lambda)}$$

$$\nu = \frac{3 \times 10^8}{3000 \times 10^{-10}}$$

$$\nu = \frac{1 \times 10^8}{1000 \times 10^{-10}}$$

$$\nu = \frac{1 \times 10^8 \times 10^{10}}{1000}$$

$$\nu = \frac{1 \times 10^{18}}{10^3} = \frac{1 \times 10^{15} \times 10^3}{10^3}$$

$$\text{Frequency } (\nu) = 10^5 \text{ hertz.}$$

# CHEMISTRY

## 7. Atoms and Molecules

### Important Formulae

1. Volume at S.T.P = One mole of any gas occupies 22.4 litre or 22,400ml. at STP.
2. Number of moles = Mass / atomic mass

$$\text{Number of mole} = \frac{\text{Mass}}{\text{Molecular Mass}}$$

$$\text{Number of mole} = \frac{\text{Number of atom}}{6.023 \times 10^{23}}$$

$$\text{Number of mole} = \frac{\text{Number of molecules}}{6.023 \times 10^{23}}$$

$$= \text{Volume at S.T.P.} / 22.4.$$

6. Mass % of an element in a compound

$$= \frac{\text{Mass of that element in the compound}}{\text{Molecular mass of the compound}} \times 100$$

7. Average atomic mass of an element = Mass of 1st isotopes  $\times$  % abundance of 1<sup>st</sup> Isotope + (Mass of 2nd isotope  $\times$  % abundance of 2<sup>nd</sup> Isotope)

Atomic mass expressed in gram is called gram atomic mass.

H  $\rightarrow$  1g                      O  $\rightarrow$  16g                      C  $\rightarrow$  12g

Cl  $\rightarrow$  35.5 g                      N  $\rightarrow$  14g                      S  $\rightarrow$  32 g

1. Monoatomic - Metals and noble gases.

2. Diatomic - Hydrogen      H<sub>2</sub>

Nitrogen      N<sub>2</sub>

Oxygen      O<sub>2</sub>

3. Triatomic - ozone      O<sub>3</sub>

4. Polyatomic - Phosphorus      P<sub>4</sub>

5. Atomicity =  $\frac{\text{Molecular mass}}{\text{Atomic mass}}$

6. Molar volume of gas at STP - 22.4 litre at STP. (or) 22.400 ml.

7. No. of mole =  $\frac{\text{Given volume of gas at STP}}{\text{Molar volume at STP}}$

## Bookback Questions & Answers

### I. Choose the best answer

1. Which of the following has the smallest mass?  
 a)  $6.023 \times 10^{23}$  atoms of He                      b) 1 atom of He  
 c) 2 g of He    d) 1 mole atoms of He

**Ans : b) 1 atom of He**

2. Which of the following is a triatomic molecule? (Dept., PTA - 1)  
 a) Glucose                      b) Helium                      c) Carbon dioxide                      d) Hydrogen

**Ans : c) Carbon dioxide**

3. The volume occupied by 4.4 g of  $\text{CO}_2$  at S.T.P  
 a) 22.4 litre                      b) 2.24 litre                      c) 0.24 litre                      d) 0.1 litre

**Ans : b) 2.24 litre**

4. Mass of 1 mole of Nitrogen atom is  
 a) 28 amu                      b) 14 amu                      c) 28 g                      d) 14 g

**Ans : d) 14 g**

5. Which of the following represents 1 amu?  
 a) Mass of a C – 12 atom                      b) Mass of a hydrogen atom  
 c)  $1/12^{\text{th}}$  of the mass of a C – 12 atom  
 d) Mass of O – 16 atom

**Ans : c)  $\frac{1}{12^{\text{th}}}$  of the mass of a C – 12 atom**

6. Which of the following statements is incorrect?  
 a) 12 gram of C – 12 contains Avogadro's number of atoms  
 b) One mole of oxygen gas contains Avogadro's number of molecules  
 c) One mole of hydrogen gas contains Avogadro's number of atoms  
 d) One mole of electrons stands for  $6.023 \times 10^{23}$  electrons

**Ans : c) One mole of hydrogen gas contains Avogadro's number of atoms**

7. The volume occupied by 1 mole of a diatomic gas at S.T.P is  
 a) 11.2 litre                      b) 5.6 litre                      c. 22.4 litre                      d) 44.8 litre

**Ans : c) 22.4 litre**

8. In the nucleus of  ${}_{20}\text{Ca}^{40}$ , there are  
 a) 20 protons and 40 neutrons                      b) 20 protons and 20 neutrons  
 c) 20 protons and 40 electrons                      d) 40 protons and 20 electrons

**Ans : b) 20 protons and 20 neutrons**

9. The gram molecular mass of oxygen molecule is (Sep.-22)  
 a) 16 g                      b) 18 g                      c) 32 g                      d) 17 g

**Ans : c) 32 g**

10. 1 mole of any substance contains \_\_\_\_\_ molecules.  
 a)  $6.023 \times 10^{23}$                       b)  $6.023 \times 10^{-23}$                       c)  $3.0115 \times 10^{23}$                       d)  $12.046 \times 10^{23}$

**Ans : a)  $6.023 \times 10^{23}$**

**II. Fill in the blanks**

1. Atoms of different elements having \_\_\_\_\_ mass number, but \_\_\_\_\_ atomic numbers are called isobars.

**Ans : same, different**

2. Atoms of one element can be transmuted into atoms of other element by \_\_\_\_\_.

**Ans : neutrons**

**(PTA - 4)**

3. The sum of the numbers of protons and neutrons of an atom is called its \_\_\_\_\_.

**Ans : mass number**

4. Relative atomic mass is otherwise known as \_\_\_\_\_.

**Ans : standard atomic weight**

5. The average atomic mass of hydrogen is \_\_\_\_\_ amu.

**Ans : 1.008**

6. If a molecule is made of similar kind of atoms, then it is called \_\_\_\_\_ atomic molecule.

**Ans : homo**

**(PTA - 6)**

7. The number of atoms present in a molecule is called its \_\_\_\_\_.

**Ans : atomicity**

**(PTA - 4)**

8. One mole of any gas occupies \_\_\_\_\_ ml at S.T.P.

**Ans : 22,400**

9. Atomicity of phosphorous is \_\_\_\_\_.

**Ans : four**

**III. Match the following**

1	8 g of O <sub>2</sub>	4 moles	<b>Ans :</b>	1	0.25 moles
2	4 g of H <sub>2</sub>	0.25 moles		2	2 moles
3	52 g of He	2 moles		3	13 moles
4	112 g of N <sub>2</sub>	0.5 moles		4	4 moles
5	35.5 g of Cl <sub>2</sub>	13 moles		5	0.5 moles

**IV. State whether True or False (If false give the correct statement)**

1. Two elements sometimes can form more than one compound.

**Ans : True**

2. Noble gases are **Diatomic**.

**Ans : False**

**Correct statement :** Noble gases are **mono atomic**.

3. The gram atomic mass of an element has no **unit**.

**Ans : False**

**Correct statement :** The gram atomic mass of an element is expressed in **grams**.

4. 1 mole of Gold and Silver contain same number of atoms.

**Ans : True**

5. Molar mass of CO<sub>2</sub> is 42g.

**Ans : False**

**Correct statement :** Molar mass of CO<sub>2</sub> is 44g.

**V. Assertion and Reason: Answer the following questions using the data given below:**

- i) A and R are correct, R explains A.  
 ii) A is correct, R is wrong.  
 iii) A is wrong, R is correct.  
 iv) A and R are correct, R doesn't explain A.

**1. Assertion :** The Relative Atomic mass of aluminium is 27.

**Reason :** An atom of aluminium is 27 times heavier than 1/12th of the mass of the C - 12 atom.

**Ans :** iv) A and R are correct, R doesn't explain A.

**2. Assertion :** The Relative Molecular Mass of Chlorine is 35.5 a.m.u. (PTA - 3)

**Reason :** The natural abundance of Chlorine isotopes are not equal.

**Ans :** iii) A is wrong, R is correct.

**VI. Short answer questions**

**1. Give any two examples for hetero diatomic molecules. (Sep.-22)**

★ CO (Carbon monoxide) and HCl (Hydrogen chloride).

**2. Define : Relative atomic mass. (PTA - 3, Sep.-22)**

★ Relative atomic mass of an element is defined as the ratio between the average mass of its isotopes to the  $\frac{1}{12}$ th part of the mass of a carbon - 12 atom.

★ It is denoted as A<sub>r</sub>.

★ It is otherwise called "Standard Atomic Weight".

$$\text{Relative Atomic Mass} = \frac{\text{Average mass of the isotopes of the element}}{\frac{1}{12} \text{th of the mass of one carbon - 12 atom}}$$

**3. Write the different types of isotopes of oxygen and its percentage abundance.**

★ Oxygen exists as a mixture of three stable isotopes in nature as shown in the following table.

Isotope	Mass (amu)	% abundance
${}_8\text{O}^{16}$	15.9949	99.757
${}_8\text{O}^{17}$	16.9991	0.038
${}_8\text{O}^{18}$	17.9992	0.205

4. Define : Atomicity. (May-22, Sep.-21,22, April-23)

★ The number of atoms present in the molecule is called atomicity.

E.g. : Hydrogen  $\rightarrow$  H<sub>2</sub> atomicity - 2

Ozone  $\rightarrow$  P<sub>3</sub> atomicity - 3

5. What is Molar volume of a gas?

★ Molar volume of a gas is the volume occupied by one mole of any gas at S.T.P. (Standard Temperature and Pressure). One mole of any gas occupies 22.4 litres or 22,400 ml at S.T.P.

6. Find the percentage of nitrogen in ammonia. (PTA - 1)

Atomic mass of Nitrogen = 14g

Atomic mass of Hydrogen = 1g

★ Molecular mass of ammonia = Mass of (1 atom of nitrogen and 3 atoms of hydrogen)

$$= 14 + (3 \times 1)$$

$$= 17\text{g}$$

$$\% \text{ of Nitrogen} = \frac{\text{Mass of nitrogen}}{\text{Molecular mass of ammonia}} \times 100$$

$$= \frac{14}{17} \times 100$$

$$= 82.35\%$$

VII. Long answer questions

1. Calculate the number of water molecule present in one drop of water which weighs 0.18 g.

$$\text{Gram molecular mass of water (H}_2\text{O)} = 2 + 16 = 18\text{g}$$

$$\text{Number of molecules} = \frac{\text{Avogadro Number} \times \text{Given mass}}{\text{Gram molecular mass}}$$

$$= \frac{6.023 \times 10^{23} \times 0.18}{18}$$

$$= 6.023 \times 10^{21} \text{ mole (or)}$$

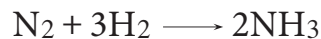
$$0.06023 \times 10^{23} \text{ molecules}$$

2.  $\text{N}_2 + 3 \text{H}_2 \rightarrow 2 \text{NH}_3$

(The atomic mass of nitrogen is 14, and that of hydrogen is 1)

1 mole of nitrogen ( \_\_\_\_\_ g) + 3 moles of hydrogen ( \_\_\_\_\_ g)  $\rightarrow$

2 moles of ammonia ( \_\_\_\_\_ g).



The atomic mass of nitrogen is 14

The atomic mass of hydrogen is 1

The molar mass of ammonia (NH<sub>3</sub>) is 17

1 mole of nitrogen (2 atoms ie.  $2 \times 14 = 28\text{g}$ )

+ 3 moles of hydrogen ( $3 \times 2$  atoms i.e.  $6 \times 1 = 6\text{g}$ )  $\longrightarrow$  2 moles of ammonia

( $2 \times 17 = 34\text{g}$ )



4. Give the salient features of "Modern atomic theory". (PTA - 5, Sep.-20,22)

The salient features of modern atomic theory are as follows :

- ★ An atom is no longer indivisible (after the discovery of the electron, proton and neutron).
- ★ Atoms of the same element may have different atomic mass (discovery of isotopes  $_{14}\text{Cl}^{35}$ ,  $_{17}\text{Cl}^{37}$ ) Atoms of different elements may have same atomic mass (discovery of isobars  $_{18}\text{Ar}^{40}$ ,  $_{20}\text{Ca}^{40}$ )
- ★ Atoms of one element can be transmuted into atoms of other elements. In other words, atom is no longer indestructible (discovery of artificial transmutation).
- ★ Atoms may not always combine in a simple whole number ratio (E.g. : Glucose  $\text{C}_6\text{H}_{12}\text{O}_6$  C : H : O = 6 : 12 : 6 or 1 : 2 : 1 and sucrose  $\text{C}_{12}\text{H}_{22}\text{O}_{11}$ , C : H : O = 12 : 22 : 11) Atom is the smallest particle that takes part in a chemical reaction.
- ★ The mass of an atom can be converted into energy ( $E = mc^2$ )

5. Derive the relationship between Relative molecular mass and Vapour density.

(Dept., PTA - 6)

- ★ The relative molecular mass of a gas or vapour is the ratio between the mass of one molecule of the gas or vapour to mass of one atom of hydrogen.

$$\text{Vapour density (V.D.)} = \frac{\text{Mass of a given volume of gas or vapour at S.T.P.}}{\text{Mass of the same volume of hydrogen}}$$

- ★ According to Avogadro's law equal volumes of all gases contain equal number of molecules at S.T.P.

- ★ Thus, let the number of molecules in one volume = n, then

$$\text{V.D. at S.T.P.} = \frac{\text{Mass of 'n' molecules of a gas or vapour at S.T.P.}}{\text{Mass of 'n' molecules of hydrogen}}$$

- ★ cancelling 'n' which is common, we get

$$\text{V.D.} = \frac{\text{Mass of 1 molecule of a gas or vapour at S.T.P.}}{\text{Mass of 1 molecule of hydrogen}}$$

- ★ since hydrogen is diatomic,

$$\text{V.D.} = \frac{\text{Mass of 1 molecule of a gas or vapour S.T.P}}{\text{Mass of 2 atoms of hydrogen}}$$

$$\text{i.e. V.D.} = \frac{\text{Mass of 1 molecule of a gas or vapour at S.T.P}}{2 \times \text{Mass of 1 atom of hydrogen}}$$

But  $\frac{\text{Mass of 1 molecule of a gas or vapour at S.T.P}}{\text{Mass of 1 atom of hydrogen}} = \text{Relative Molecular mass}$

$$\therefore \text{V.D.} = \frac{\text{Relative molecular mass}}{2}$$

(or)

Relative molecular mass = 2 × Vapour density

**6. Calculate the number of moles in**

(PTA - 5)

**i) 27g of Al**

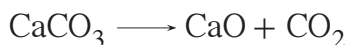
$$\begin{aligned} \text{Mass of Al} &= 27\text{g} \\ \text{Atomic mass of Al} &= 27 \\ \text{No of moles} &= \frac{\text{Mass}}{\text{Atomic mass}} = \frac{27}{27} = 1 \text{ mole.} \end{aligned}$$

**ii)  $1.51 \times 10^{23}$  molecules of  $\text{NH}_4\text{Cl}$** 

$$1 \text{ mole of } \text{NH}_4\text{Cl} = 6.023 \times 10^{23} \text{ molecules of } \text{NH}_4\text{Cl}$$

(Avogadro's number)

$$\begin{aligned} \text{No. of moles in } 1.51 \times 10^{23} \text{ molecules of } \text{NH}_4\text{Cl} &= \frac{\text{Given number of molecules}}{\text{Avogadro's number}} \\ &= \frac{1.51 \times 10^{23}}{6.023 \times 10^{23}} = \frac{1}{4} \\ &= \mathbf{0.25 \text{ moles}} \end{aligned}$$

**VIII. HOT questions.****1. Calcium carbonate is decomposed on heating in the following reaction****i. How many moles of Calcium carbonate are involved in this reaction?**

There is only one mole of calcium carbonate involved in this reaction.

**ii. Calculate the gram molecular mass of calcium carbonate involved in this reaction.**

$$\begin{aligned} \text{Gram molecular mass of calcium carbonate (CaCO}_3\text{)} &= \text{Mass of 1 Calcium} \\ &+ \text{Mass of 1 Carbon} \\ &+ \text{Mass of 3 Oxygen atoms.} \end{aligned}$$

Gram atomic masses of Ca, C and O are 40, 12 and 16g respectively.

$$\begin{aligned} \text{Gram molecular mass of calcium carbonate (CaCO}_3\text{)} &= 40 + 12 + 3(16) \\ &= 40 + 12 + 48 \\ &= \mathbf{100 \text{ g}} \end{aligned}$$

**iii. How many moles of  $\text{CO}_2$  are there in this equation?**There is only one mole of  $\text{CO}_2$  in this equation.**IX. Solve the following problems.****1. How many grams are there in the following?**

(PTA - 4)

**i. 2 moles of hydrogen molecule,  $\text{H}_2$** 

$$\begin{aligned} 2 \text{ moles of hydrogen molecule} &= 2\text{H}_2 \\ &= 4 \text{ atoms of hydrogen} \end{aligned}$$

$$\text{Gram atomic mass of hydrogen} = 1\text{g}$$

$$\begin{aligned} \text{Mass of 2 moles of hydrogen molecule} &= 4 \times 1 \\ &= \mathbf{4\text{g}} \end{aligned}$$

**ii. 3 moles of chlorine molecule, Cl<sub>2</sub>**

$$\begin{aligned} 3 \text{ moles of chlorine molecule} &= 3\text{Cl}_2 \\ &= 6 \text{ Cl atoms.} \end{aligned}$$

$$\text{Gram atomic mass of chlorine} = 35.45\text{g}$$

$$\begin{aligned} \text{Mass of 3 moles of chlorine molecule} &= \text{mass of 6 Cl atoms} \\ &= 6 \times 35.45\text{g} \\ &= \mathbf{213\text{g}} \end{aligned}$$

**iii. 5 moles of sulphur molecule, S<sub>8</sub>**

$$\begin{aligned} 5 \text{ moles of sulphur molecule} &= 5\text{S}_8 \\ &= 5 \times 8 = 40 \text{ 'S' atoms} \end{aligned}$$

$$\text{Gram atomic mass of sulphur} = 32\text{g}$$

$$\begin{aligned} \text{Mass of 5 moles of sulphur molecule} &= \text{Mass of 40 'S' atoms} \\ &= 40 \times 32 \\ &= \mathbf{1280\text{g}} \end{aligned}$$

**iv. 4 moles of phosphorous molecule, P<sub>4</sub>**

$$\begin{aligned} 4 \text{ moles of phosphorous molecule} &= 4\text{P}_4 \\ &= 4 \times 4 = 16 \text{ 'P' atoms} \end{aligned}$$

$$\text{Gram atomic mass of phosphorous} = 30\text{g}$$

$$\begin{aligned} \text{Mass of 4 moles of phosphorous} &= \text{Mass of 16 'P' atoms} \\ &= 16 \times 30 \\ &= \mathbf{480\text{g}} \end{aligned}$$

**2. Calculate the % of each element in calcium carbonate.**

(PTA - 2)

(Atomic mass: C-12, O -16, Ca - 40)

Molecular formula of calcium carbonate is CaCO<sub>3</sub>.

Gram molecular mass of Calcium Carbonate

$$\begin{aligned} &= \text{Mass of 1 Ca} + \\ &\quad (\text{Mass of 1 C} + \text{Mass of 3 'O' atoms}) \\ &= 40 + 12 + 3 (16) \\ &= 100\text{g} \end{aligned}$$

$$\begin{aligned} \% \text{ of carbon} &= \frac{\text{Mass of carbon}}{\text{Gram molecular mass of CaCO}_3} \times 100 \\ &= \frac{12}{100} \times 100 = 12\% \end{aligned}$$

$$\begin{aligned} \% \text{ of calcium} &= \frac{\text{Mass of calcium}}{\text{Gram molecular mass of CaCO}_3} \times 100 \\ &= \frac{40}{100} \times 100 = 40\% \end{aligned}$$

$$\begin{aligned} \% \text{ of oxygen} &= \frac{\text{Mass of oxygen}}{\text{Gram molecular mass of CaCO}_3} \times 100 \\ &= \frac{48}{100} \times 100 = 48\% \end{aligned}$$

3. Calculate the % of oxygen in  $\text{Al}_2(\text{SO}_4)_3$ . (PTA - 2)

(Atomic mass: Al-27, O-16, S -32)

$$\begin{aligned}\text{Gram molecular mass of } \text{Al}_2(\text{SO}_4)_3 &= \text{Mass of } 2(\text{Al}) + 3(\text{S}) + 12(\text{O}) \\ &= (2 \times 27) + (3 \times 32) + (12 \times 16) \\ &= 54 + 96 + 192 \\ &= 342\text{g}\end{aligned}$$

$$\begin{aligned}\% \text{ of oxygen} &= \frac{\text{Mass of Oxygen}}{\text{Gram molecular mass of } \text{Al}_2(\text{SO}_4)_3} \times 100 \\ &= \frac{192}{342} \times 100 \\ &= 56.14\%\end{aligned}$$

4. Calculate the % relative abundance of B -10 and B -11, if its average atomic mass is 10.804 amu.

Let the % of B - 10 be x

$\therefore$  % of B - 11 is (100 - x)

$$\begin{aligned}\text{Average atomic mass} &= \frac{x \times 10}{100} + \frac{(100-x) 11}{100} = 10.804 \\ &= 10x + 11(100 - x) = 1080.4 \\ &= 10x + 1100 - 11x = 1080.4 \\ &= -x + 1100 = 1080.4 \\ -x &= 1080.4 - 1100 \\ -x &= -19.6 \\ x &= 19.6\%\end{aligned}$$

Substitute the value of x in

$$\begin{aligned}\text{B - 11} &= (100 - x) \% \\ \therefore \text{B - 11} &= (100 - 19.6) \% \\ \% \text{ abundance of B - 10} &= 19.6 \% \\ \% \text{ abundance of B - 11} &= (100 - 19.6) \\ &= 80.4 \%\end{aligned}$$

### PTA & Exam Questions (Interior)

I. Choose the best answer

1. Analyse the following and choose the correct statement (s). (PTA - 4)
  - i) An electron has considerable mass
  - ii) A hetero atomic molecule is formed from different kinds of atoms.
  - iii) Mass number and atomic mass of an element are same

a) i, ii and iii are correct                      b) i and iii are correct  
c) only ii is correct                                d) only iii is correct

**Ans : c) only ii is correct**

2. If a molecule is made of similar kind of atoms, then it is called \_\_\_\_\_ molecule  
(PTA - 6, May-22)

- a) mono atomic molecule                      b) hetero atomic molecule  
c) homo atomic molecule                      d) poly atomic molecule

**Ans : c) homo atomic molecule**

3. The gram molecular mass of water is : (April-23)  
a) 2 g                      b) 16 g                      c) 18 g                      d) 8 g

**Ans : c) 18 g**

## VI. Short answer questions

1. Write any two application of "Avogadro's Law". (Sep.-20)

- It explain Gay -Lussac's Law.
- It helps in the determination of atomicity of gases.
- It helps to derive molecular formula of gaseous compound.
- It determines the relationship between molecular mass and vapour density.
- It helps to determine gram molar volume of all gases (22.4 litre at STP).

2. Mention any two applications of Avogadro's Law. (April -23)

- It explains Gay-Lussac's law.
- It helps in the determination of atomicity of gases.
- Molecular formula of gases can be derived using Avogadro's law

## VII. Long answer questions

1. i) Give the differences between atoms and molecules (ii) calculate the relative molecular mass of glucose. (May-22)

- i) Differences between atoms and molecules.

	<b>Atom</b>	<b>Molecule</b>
1	An atom is the smallest particle of an element.	A molecule is the smallest particle of an element or compound.
2	Atom does not exist in free state except in noble gases.	Molecule exists in free state.
3	Except some of noble gases, other atoms are highly reactive.	Molecules are less reactive.
4	Atom does not have a chemical bond. <b>E.g. :</b> Na, Zn...etc.	Atoms in a molecule are held by chemical bonds. <b>E.g. :</b> H <sub>2</sub> , CO <sub>2</sub> ... etc.

- (ii) The molecular mass of glucose (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>) = Mass of {6(C) + 12(H) + 6(O)}  
= 6(12) + 12(1) + 6(16)  
= 72 + 12 + 96  
= **180g**

## VIII. HOT questions

1. Calculate the percentage of Sulphur in
- $H_2SO_4$
- .

(April-23)

$$\begin{aligned} \text{Molecular mass of } H_2SO_4 &= (1 \times 2) + (32 \times 1) + (16 \times 4) \\ &= 2 + 32 + 64 \\ &= 98 \text{ g} \end{aligned}$$

$$\% \text{ of S in } H_2SO_4 = \frac{\text{Mass of sulphur}}{\text{Molecular mass of } H_2SO_4} \times 100$$

$$\% \text{ of S in } H_2SO_4 = \frac{32}{98} \times 100 = 32.65\%$$

2. The mass percentage of carbon is 27.28% and the mass percentage of oxygen is 72.73% calculate the molecular mass of that compound. (PTA - 4)

**Solution :**

$$\text{Mass percentage of carbon} = 27.28$$

$$\text{Atomic mass of carbon} = 12$$

$$\text{Mass percentage of oxygen} = 72.73$$

$$\text{Atomic mass of oxygen} = 16$$

$$\text{Molecular mass of the compound} = ?$$

$$\text{Mass of percentage of carbon} : \frac{\text{Mass of carbon in the compound}}{\text{Molecular mass of the compound}} \times 100$$

$$\text{Molecular mass of the compound} : \frac{\text{Mass of carbon in the compound}}{\text{Mass percentage of carbon}} \times 100$$

$$\text{Molecular mass of the compound} : \frac{12 \times x}{27.28} \times 100 \text{ (1)}$$

$$\text{Molecular mass of the compound} : \frac{\text{Mass of oxygen in the compound}}{\text{Mass percentage of oxygen}} \times 100$$

$$\text{Molecular mass of the compound} : \frac{16 \times y}{72.73} \times 100 \text{ (2)}$$

Equation (1) and (2)

$$\frac{12 \times x}{27.28} \times 100 = \frac{16 \times y}{72.73} \times 100$$

$$\frac{12 \times x}{27.28} = \frac{16 \times y}{72.73}$$

$$\frac{12x}{16y} = \frac{27.28}{72.73}$$

$$\frac{x}{y} = \frac{436.48}{872.76}$$

$$\frac{x}{y} = \frac{1}{2}$$

$$\mathbf{x : y = 1 : 2}$$

Molecular formula of the compound  $Co_2$ 

Molecular formula of the compound

$$12 \times 1 + 16 + 2 = 44$$

2. i) Calculate the mass of  $1.51 \times 10^{23}$  molecule of  $H_2O$

(Dept.)

**Solution :**

Gram mass of  $H_2O$

$$2(H) \rightarrow 2 \times 1 = 2$$

$$1(O) \rightarrow 1 \times 16 = 16$$

$$\therefore \text{G. molar mass of } H_2O = 18$$

$$\text{No. of mole} = \frac{\text{Number of molecules}}{\text{Avogadro's number}}$$

$$= \frac{1.51 \times 10^{23}}{6.023 \times 10^{23}}$$

$$= \frac{1}{4} = 0.25 \text{ mole}$$

$$\text{No. of moles} = \frac{\text{mass}}{\text{molecular mass}}$$

$$\boxed{\text{Mass} = \text{molecular mass} \times \text{No. of mole}}$$

$$= 0.25 \times 18$$

$$\text{Mass} = 4.5 \text{ g}$$

ii) Calculate the moles of 46 g sodium.

$$\text{No. of mole} = \frac{\text{Mass of the element}}{\text{Atomic mass of the element}}$$

$$= \frac{46}{23}$$

$$= 2 \text{ mole of sodium}$$

iii) Calculate the number of molecules present in the 36 g water.

$$\text{Molecular mass of the } H_2O = 18\text{g}$$

$$18\text{g of } H_2O = 1 \text{ mole of } H_2O$$

$$36 \text{ g of } H_2O = 2 \text{ moles of } H_2O$$

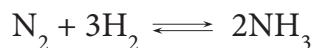
$$\therefore 1 \text{ mole of } H_2O = 6.023 \times 10^{23} \text{ molecules of } H_2O$$

$$2 \text{ moles of } H_2O = 2 \times 6.023 \times 10^{23}$$

$$= 12.046 \times 10^{23} \text{ (or)}$$

$$= 1.2046 \times 10^{24} \text{ molecules of } H_2O.$$

3. In the chemical industries the following chemical reaction is used to produce ammonia in large scale. (PTA - 3)



Based on mole concept, calculate the mass of nitrogen gas and hydrogen gas required in kilogram to produce 1000 kg of ammonia by using the above chemical equation.

**Solution :**

$$\text{Mass of NH}_3 \text{ produced} = 1000\text{kg} = 10^6\text{g}$$

Molecular mass of  $\text{NH}_3$

$$1(\text{N}) \longrightarrow 1 \times 14 = 14$$

$$3(\text{H}) \longrightarrow 3 \times 1 = 3$$

$$17 \text{ g}$$

$$\begin{aligned} \text{No. of moles of NH}_3 &= \frac{\text{Mass of NH}_3 \text{ produced}}{\text{Molecular mass of NH}_3} \\ &= \frac{10^6}{17} \text{ (1)} \end{aligned}$$

- i) 2 moles of  $\text{NH}_3$  is produced from 3 moles of  $\text{H}_2$

$$\therefore \frac{10^6}{17} \text{ moles of NH}_3 \text{ is produced } \frac{10^6}{17} \times \frac{3}{2}$$

Required mass of  $\text{H}_2 = \text{No. of mole} \times \text{molecular mass}$

$$\frac{10^6}{17} \times \frac{3}{2} \times (2 \times 1) = 176.47 \text{ kg. Hz}$$

- ii) 2 moles of  $\text{NH}_3$  produced from 1 mole of  $\text{N}_2$

$$\frac{10^6}{17} \text{ moles of NH}_3 \text{ produced } \frac{10^6}{17} \times \frac{1}{2} \text{ mass of N}_2$$

$$\text{Required mass of N}_2 = \frac{10^6}{17} \times \frac{1}{2} \times (14 \times 2)$$

$$= \frac{28}{34} \times 10^6$$

$$= 0.82353 \times 10^6$$

$$= 823.53 \text{ kg of N}_2$$

$$\therefore \text{Required mass of N}_2 = 823.53 \text{ kg}$$

$$\therefore \text{Required mass of H}_2 = \mathbf{176.47 \text{ kg.}}$$

4. Calculate the molecular mass of  $\text{CO}_2$ .

(Sep.-21)

Molecular mass of  $\text{Co}_2$

$$\text{Atomic mass of C} = 12\text{g}$$

$$\text{Atomic mass of O} = 16\text{g}$$

$$\text{Gram molecular mass of Co}_2 = 1(\text{C}) \rightarrow 1 \times 12 = 12$$

$$= 2(\text{O}) \rightarrow 2 \times 16 = \underline{32}$$

$$\underline{44}$$

$$\therefore \text{Gram molecular mass of Co}_2 = \mathbf{44 \text{ g.}}$$



## 8. Periodic Classification of Elements

### Important Formulae

1	Ionic bond	NaBr, KBr, NaCl, NaI, KI, KCl, CaCl <sub>2</sub> , K <sub>2</sub> O, MgO.
2	Covalent bond	PCl <sub>3</sub> , HCl, H <sub>2</sub> O, H <sub>2</sub> , O <sub>3</sub> , CH <sub>4</sub> , NH <sub>3</sub> , CO <sub>2</sub> , PCl <sub>5</sub> , PCl <sub>4</sub> , SH <sub>4</sub> , C <sub>2</sub> H <sub>5</sub> OH
3	Both	CaCO <sub>3</sub> , BaSO <sub>4</sub> , Na <sub>2</sub> SO <sub>4</sub> , AlBr <sub>3</sub>

### Bookback Questions & Answers

#### I. Choose the best answer

- The number of periods and groups in the periodic table are \_\_\_\_\_. (Sep.-22)  
 a) 6,16                      b) 7,17                      c) 8,18                      d) 7,18  
**Ans : d) 7,18**
- The basis of modern periodic law is \_\_\_\_\_.  
 a) atomic number                      b) atomic mass  
 c) isotopic mass                      d) number of neutrons  
**Ans : a) atomic number**
- \_\_\_\_\_ group contains the member of halogen family. (PTA - 1)  
 a) 17<sup>th</sup>                      b) 15<sup>th</sup>                      c) 18<sup>th</sup>                      d) 16<sup>th</sup>  
**Ans : a) 17<sup>th</sup>**
- \_\_\_\_\_ is a relative periodic property.  
 a) atomic radii                      b) ionic radii  
 c) electron affinity                      d) electronegativity  
**Ans : d) electronegativity**
- Chemical formula of rust is \_\_\_\_\_.  
 a) FeO.xH<sub>2</sub>O      b) FeO<sub>4</sub>.xH<sub>2</sub>O      c) Fe<sub>2</sub>O<sub>3</sub>.xH<sub>2</sub>O      d) FeO  
**Ans : c) Fe<sub>2</sub>O<sub>3</sub>.xH<sub>2</sub>O**
- In the aluminothermic process the role of Al is \_\_\_\_\_.  
 a) oxidizing agent                      b) reducing agent  
 c) hydrogenating agent                      d) sulphurising agent  
**Ans : b) reducing agent**
- The process of coating the surface of a metal with a thin layer of zinc is called \_\_\_\_\_.  
 a) painting                      b) thinning  
 c) galvanization                      d) electroplating  
**Ans : c) galvanization**
- Which of the following have inert gases 2 electrons in the outermost shell?  
 a) He                      b) Ne                      c) Ar                      d) Kr  
**Ans : a) He**

9. Neon shows zero electron affinity due to \_\_\_\_\_.  
 a) stable arrangement of neutrons      b) stable configuration of electrons  
 c) reduced size      d) increased density

**Ans : b) stable configuration of electrons**

10. \_\_\_\_\_ is an important metal to form amalgam. (Dept., Sep.-22)  
 a) Ag      b) Hg      c) Mg      d) Al

**Ans : b) Hg**

## II. Fill in the blanks

1. If the electronegativity difference between two bonded atoms in a molecule is greater than 1.7, the nature of bonding is \_\_\_\_\_. (PTA - 5)

**Ans : ionic**

2. \_\_\_\_\_ is the longest period in the periodic table.

**Ans : Sixth period**

3. \_\_\_\_\_ forms the basis of modern periodic table.

**Ans : Atomic number**

4. If the distance between two Cl atoms in  $\text{Cl}_2$  molecule is  $1.98\text{\AA}$ , then the radius of Cl atom is \_\_\_\_\_.

**Ans :  $0.99\text{\AA}$**

5. Among the given species  $\text{A}^-$ ,  $\text{A}^+$ , and A, the smallest one in size is \_\_\_\_\_.

**Ans :  $\text{A}^+$**

6. The scientist who propounded the modern periodic law is \_\_\_\_\_.

**Ans : Henry Mosley**

7. Across the period, ionic radii \_\_\_\_\_ (increases, decreases).

**Ans : decreases**

8. \_\_\_\_\_ and \_\_\_\_\_ are called inner transition elements.

**Ans : Lanthanides, Actinides**

9. The chief ore of Aluminium is \_\_\_\_\_.

**Ans : bauxite**

10. The chemical name of rust is \_\_\_\_\_.

**Ans : hydrated ferric oxide**

## III. Match the following

(PTA - 6)

1	Galvanisation	Noble gas elements
2	Calcination	Coating with Zn
3	Redox reaction	Silver-tin amalgam
4	Dental filling	Alumino thermic process
5	Group 18 elements	Heating in the absence of air

<b>Ans :</b>	1	Galvanisation	Coating with Zn
	2	Calcination	Heating in the absence of air
	3	Redox reaction	Alumino thermic process
	4	Dental filling	Silver-tin amalgam
	5	Group 18 elements	Noble gas elements

**IV. State whether True or False: (If false give the correct statement)**

1. Moseley's periodic table is based on **atomic mass**.

**Ans : False**

**Correct statement :** Mosley's periodic table is based on **atomic number**.

2. Ionic radius **increases** across the period from left to right.

**Ans : False**

**Correct statement :** Ionic radius **decreases** across the period from left to right due to increase in nuclear charge.

3. All ores are minerals; but all minerals cannot be called as ores.

**Ans : True**

4. Al wires are used as **electric cables** due to their silvery white colour.

**Ans : False**

**Correct statement :** Al wires are used as electric cables because aluminium is a **good conductor electricity** and not because of its silvery white colour.

5. An alloy is a **heterogeneous** mixture of metals.

**Ans : False**

**Correct statement :** An alloy is a **homogeneous** mixture of metals.

**V. Assertion and Reason. Answer the following questions using the data given below**

- i) A and R are correct, R explains A.  
 ii) A is correct, R is wrong.  
 iii) A is wrong, R is correct.  
 iv) A and R are correct, R doesn't explains A.

1. **Assertion :** The nature of bond in HF molecule is ionic (PTA-2)

**Reason :** The electronegativity difference between H and F is 1.9

**Ans : i) A and R are correct, R explains the A.**

2. **Assertion :** Magnesium is used to protect steel from rusting

**Reason :** Magnesium is more reactive than iron.

**Ans : i) A and R are correct, R explains A.**

3. **Assertion :** An uncleaned copper vessel is covered with greenish layer. (PTA-5)

**Reason :** copper is not attacked by alkali.

**Ans : iv) A and R are correct, R doesn't explains A.**

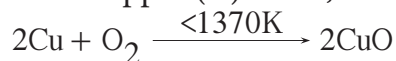
**VI. Short answer questions**

1. **A is a reddish brown metal, which combines with O<sub>2</sub> at < 1370 K gives B, a black coloured compound. At a temperature > 1370 K, A gives C which is red in colour. Find A, B and C with reaction.** (PTA -1)

'A' is copper which is a reddish brown metal.

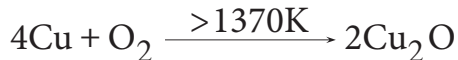
'A' with O<sub>2</sub> at <1370K gives 'B' a black coloured compound.

Thus 'B' is copper (II) oxide, CuO



'B' (black)

At a temperature  $> 1370\text{K}$  'A' gives 'C' which is red in colour. 'C' is Copper (I) Oxide,



**Result :** 'C' (red)

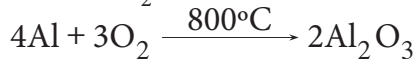
'A' is Copper, Cu 'B' is Copper (II) Oxide, CuO

'C' is Copper (I) Oxide,  $\text{Cu}_2\text{O}$

2. **A is a silvery white metal. A combines with  $\text{O}_2$  to form B at  $800^\circ\text{C}$ , the alloy of A is used in making the aircraft. Find A and B.** (PTA - 1)

★ 'A' is silvery white metal. Thus 'A' is Aluminium (Al), the alloy of which is used in making the aircraft.

'A' with  $\text{O}_2$  At  $800^\circ\text{C}$  forms 'B'



'A' is aluminium, Al 'B'

'B' is aluminium oxide,  $\text{Al}_2\text{O}_3$

3. **What is rust? Give the equation for formation of rust.** (PTA - 4, Sep.-21)

★ Rust is hydrated ferric oxide  $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ . It is formed when iron is exposed to moist air in the form of a brown layer at the surface.



4. **State two conditions necessary for rusting of iron.**

- moist air
- Oxygen ( $\text{O}_2$ )
- Presence of water

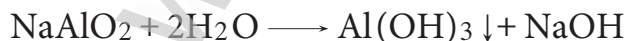
## VII. Long answer questions

1. a) **State the reason for addition of caustic alkali to bauxite ore during purification of bauxite.**

★ When the impure bauxite ore is ground and heated under pressure with a solution of concentrated caustic soda solution at  $150^\circ\text{C}$  to get sodium meta aluminate. ( $\text{NaAlO}_2$ )



★ On diluting sodium meta aluminate with water, a precipitate of aluminium hydroxide is formed.



★ The precipitate is filtered, washed, dried and ignited to  $1000^\circ\text{C}$  to get pure alumina ( $\text{Al}_2\text{O}_3$ )



b) **Along with cryolite and alumina, another substance is added to the electrolyte mixture. Name the substance and give one reason for the addition.**

★ Along with cryolite and alumina, fluorspar is also added to the electrolyte mixture. Fluorspar lowers the fusion temperature of the electrolyte.

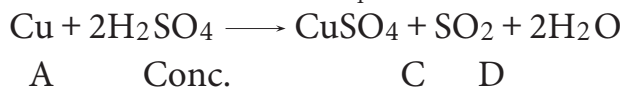
2. The electronic configuration of metal A is 2,8,18,1. (PTA - 1)

The metal A when exposed to air and moisture forms B a green layered compound. A with con.  $H_2SO_4$  forms C and D along with water. D is a gaseous compound. Find A,B,C and D.

- ★ The electronic configuration of metal A is 2, 8, 18, 1..... Metal A is copper.
- ★ A when exposed to air and moisture forms  $\therefore$  B, a green layered compound.
- ★ B is basic copper carbonate,  $CuCO_3 \cdot Cu(OH)_2$ .



- ★ A with con.  $H_2SO_4$  forms C and D along with water. D is a gaseous compound. 'C' is copper sulphate,  $CuSO_4$  and 'D' is sulphur dioxide,  $SO_2$



**Result :**

A is Copper, Cu

B is basic Copper Carbonate,  $CuCO_3 \cdot Cu(OH)_2$

C is Copper Sulphate,  $CuSO_4$

D is Sulphur dioxide,  $SO_2$

3. Explain smelting process.

Chief ore = Haematite ( $Fe_2O_3$ )

**Concentration** : Gravity separation.

**Smelting** :

**Furnace** : blast furnace

**Charge** : Roasted ore, coke and lime stone.

**Ratio** : 8 : 4 : 1

Introduced through cup and cone arrangement at the top.

Important region in the furnace = 3.

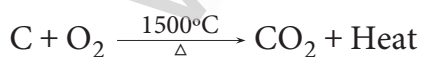
a) **Lower region : (Combustion Zone)**

Temperature =  $1500^\circ C$

Charges comes in contact with a hot blast of air.

Coke burn with oxygen to form  $CO_2$

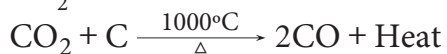
Heat is liberated, hence it is an exothermic reaction.



b) **The Middle region :**

Temperature =  $1000^\circ C$

$CO_2$  is reduced to CO



Lime stone decomposed to calcium oxide and  $CO_2$



**VIII. HOT questions**

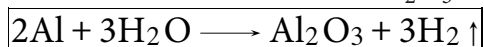
1. **Metal A belongs to period 3 and group 13. A in red hot condition reacts with steam to form B. A with strong alkali forms C. Find A,B and C with reactions** (PTA - 1)

Metal A belongs to period 3 group 13.

∴ A is Aluminium, Al

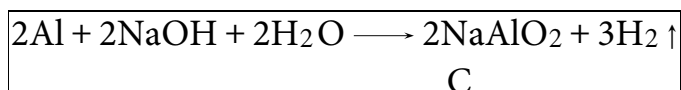
A in red hot condition reacts with steam to form B.

∴ B is Aluminium oxide,  $Al_2O_3$



A with strong alkali forms C

∴ C is sodium meta aluminate,  $NaAlO_2$

**Results :**

- i) A is Aluminium, Al
- ii) B is Aluminium oxide,  $Al_2O_3$
- iii) C is sodium meta aluminate,  $NaAlO_2$

Aluminium becomes passive due to the formation of an oxide film on its surface.

2. **Name the acid that renders aluminium passive. Why?** (PTA - 3)

★ Dilute (or) concentrated nitric acid does not attack aluminium but it renders aluminium passive due to the formation of an oxide film on its surface.

3. a) **Identify the bond between H and F in HF molecule.**

★ Covalent bond with ionic character.

- b) **What property forms the basis of identification?**

★ Electro negativity.

- c) **How does the property vary in periods and in groups?**

★ Electro negativity increases from left to right in a period

★ it decreases from top to bottom in a group.

**Test Yourself**

**Predict the nature of the bond in the following molecules.** (PTA - 2)

- (i) NaCl    (ii) NaBr    (iii) NaI    (iv) NaF    (v) NaH

★ The electronegativity values of F, Cl, Br, I, H and Na are 4, 3, 2.8, 2.5, 2.1 and 1 respectively.

★ The difference in the electronegativity values of the two atoms involved in the following molecules can be calculated as follows :

$$i) \text{ NaCl} = 3 - 1 = 2 \qquad ii) \text{ NaBr} = 2.8 - 1 = 1.8$$

$$iii) \text{ NaI} = 2.5 - 1 = 1.5 \qquad iv) \text{ NaF} = 4 - 1 = 3$$

$$v) \text{ NaH} = 2.1 - 1 = 1.1$$

★ In NaCl, NaBr and NaF the difference is found to be more than 1.7. So they are more ionic.

★ In NaI and NaH the difference is found to be less than 1.7. So they are more covalent.

## PTA & Exam Questions (Interior)

### I. Choose the best answer

- When a sodium atom loses an electron it forms  $\text{Na}^+$  ion. The radius of  $\text{Na}^+$  ion is lesser than Na atom. This is because (PTA - 3)
  - The attractive force of nucleus is more in  $\text{Na}^+$  ion than Na atom
  - The attractive force of nucleus is more in Na atom than  $\text{Na}^+$  ion
  - Number of protons present in Na atom is less than  $\text{Na}^+$  ion
  - Number of electrons present in  $\text{Na}^+$  ion is more than Na atom

**Ans : a) The attractive force of nucleus is more in  $\text{Na}^+$  ion than Na atom**

- Alloy used in the manufacturing of pressure cooker is \_\_\_\_\_. (Sep.-21)
  - Bross
  - Bronze
  - Magnalium
  - Duralumin

**Ans : d) Duralumin**

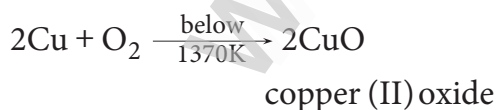
- If the electronegativity difference between two bonded atoms in a molecule is greater than 1.7, then the nature of bonding is \_\_\_\_\_. (PTA-5)
  - Ionic
  - Covalent
  - polar
  - Co-ordinate covalent

**Ans : a) Ionic**

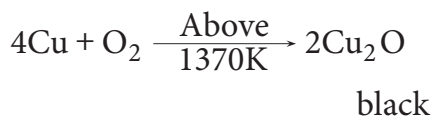
### VI. Short answer questions

- From the following clues identify the group number in the periodic table and write the names of any two elements of that group. (PTA - 1)
    - The atoms of this group have very stable electronic configuration.
    - These elements are mostly unreactive.
      - Helium (He) Neon (Ne) Argon (Ar) are the un reactive elements (or) noble gas.
      - These are the elements of the 18<sup>th</sup> group in the periodic table.
- Copper is a reddish brown metal, that reacts with  $\text{O}_2$  at less than 1370 K to give A, a black coloured compound. At a temperature greater than 1370 K, Copper reacts with  $\text{O}_2$ , to give B which is a red coloured compound. Write the balanced chemical equations for the formation of A and B. (PTA - 4)

Copper reacts with  $\text{O}_2$  below 1370K to form copper (II) oxide which is black.



Copper reacts with  $\text{O}_2$  Above 1370K to form copper (I) oxide which is red.



Compound A  $\longrightarrow$  CuO  $\longrightarrow$  copper (II) oxide

Compound B  $\longrightarrow$   $\text{Cu}_2\text{O}$   $\longrightarrow$  copper (I) oxide

3. **Copper pyrites is the prime ore of copper. It is concentrated by froth flotation method. Give the reason.** (PTA - 4)
- Copper pyrites is a sulphides ore. Sulphide ores are lighter and wetted by oil. They float on the surface along with froth flotation.
  - Gangue particle are wetted by water and settle at the bottom.
  - Hence copper pyrites ore is concentrated by froth flotation method.
4. i) **'X' is an element which belongs to 1<sup>st</sup> group of the modern periodic table 'X' is a gas and it's covalent radius value is 0.37 Å. Identify and write the chemical symbol of 'X'.** (PTA-6)
- Since the covalent radius is 0.37 Å the element is hydrogen.  
 x - is a gas and 1<sup>st</sup> group element.  
 It is hydrogen gas and its formula is H<sub>2</sub>.
- ii) **A is a metal and belongs to Boron family in modern periodic table. It acts as a good reducing agent. It reduces iron oxide into iron. It is used to make household utensils. Write the balanced chemical equation for the reduction of iron oxide by 'A'.** (PTA - 6)
- Metal A belong to boron family and used to make utensils, it is aluminium.  
 Aluminium reduces iron oxide into iron.  

$$\text{Fe}_2\text{O}_3 + 2\text{Al} \longrightarrow 2\text{Fe} + \text{Al}_2\text{O}_3 + \text{Heat}$$
5. **Mention any two uses of copper.** (April-23)
- It is extensively used in manufacturing electric cables and other electric appliances.
  - It is used for making utensils, containers, calorimeters and coins,
  - It is used in electroplating.
  - It is alloyed with gold and silver for making coins and jewels.
6. **What is an amalgam? Give an example.** (April-23)
- An amalgam is an alloy of mercury with another metal.  
 E.g. : Silver - Tin amalgam is used for dental filling

## VII. Long answer questions

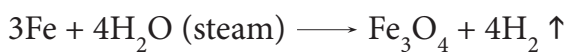
1. **Electronegativity value of hydrogen is 2 : 1 and that of sodium is 1. Find out the nature of bonding present in the compound, when hydrogen combines with fluorine and hydrogen combines with sodium. (Electronegativity value of fluorine is 4)(PTA-2)**

Compound	Element	Electro negative value	D/B in electro negative value	Nature of bond
NaH	Na	1	1 : 1	Covalent bond
	H	2 : 1		
NaF	Na	1	3	Ionic bond
	F	4		



2. **A is the second most abundant metal available next to aluminium on the earth. A forms its magnetic oxide B, when steam is passed over metal A in red hot condition. A forms an alloy C with carbon and nickel. C is used to make aircraft parts and propeller. Identify and write names of B and C. Write the balanced chemical equation for the formation of magnetic oxide.** (PTA - 2)

- Second most abundant metal A = Iron. When steam is passed over red hot iron magnetic oxide (B) is formed.



Magnetic oxide

A → Iron

B → Fe<sub>3</sub>O<sub>4</sub>

C → Nickel steel. (Fe, C, Ni)

It is used to make aircraft parts and propeller.

3. **What are the methods used for preventing corrosion?** (Dept., Sep.-20, 21)

- i) Alloying → Metal can be alloyed (Ex) Stainless steel.
- ii) Surface coating → Application of a protective coating over the metal.
  - a) Galvanisation → Coating of zinc over a metal
  - b) Electroplating → Coating one metal over the other metal by electrolysis
  - c) Anodizing / An electrochemical process which converts the metal surface into decorative, durable and corrosion resistant.
  - d) Cathodic protection → A metal surface is coated with another metal. Which is easily corrodiable.

The easily corrosive metal is called sacrificial metal (anode).

4. **Give reason for the following statements on periodic trends in modern periodic table of elements.** (PTA- 6)

- a) Along the period, from left to right, the atomic radius values of the elements decrease whereas along the groups, from the top to bottom, the atomic radius values increase.
- b) The electron affinity values increase along the period from left to right and decrease down the group.
- c) The ionization energy values increase along the period from left to right and decrease down.

No	Periodic property	Along the period from Left to Right	Down the group from top to bottom
i	Atomic radius	decreases	increases

ii	Electron affinity	increases	decreases
iii	Ionization energy	increases	decreases
iv	Reason	i) Shell number remain the same.	valence shell number increases.
		ii) Number of protons increases.	Distance between the valence shell and nucleus increases.
		iii) Atomic size decreases.	Atomic size increases.
		iv) Attraction over the electron increases.	Attraction over the electron decreases.
		v) More energy needed to remove an electron.	Less energy is needed to remove an electron.

5. a) **What is an alloy ?** (May - 22)  
 b) **Give the reasons for alloying ?**

**Alloy :** An alloy is a homogeneous mixture of two or more metals or of one or more metals with certain non - metallic elements.

**Reasons for alloys :**

- To modify appearance and colour
- To modify chemical activity.
- To lower the melting point.
- To increase hardness and tensile strength.
- To increase resistance to electricity.

9. **What are the methods preventing corrosion?** (Sep.-20,21)

**Methods of preventing corrosion :**

- i. Alloying** : The metals can be alloyed to prevent from the process of corrosion. **E.g :** Stainless Steel.
- ii. Surface Coating** : It involves application of a protective coating over the metal. It is of the following types:
- a) Galvanization** : It is the process of coating zinc on iron sheets by using electric current.
- b) Electroplating** : It is a method of coating one metal over another metal by passing electric current.
- c) Anodizing** : It is an electrochemical process that converts the metal surface into a decorative, durable and corrosion resistant. Aluminium is widely used for anodizing process.
- d) Cathodic Protection** : It is the method of controlling corrosion of a metal surface protected is coated with the metal which is easily corrodible. The easily corrodible metal is called Sacrificial metal to act as anode ensuring cathodic protection.

# BIOLOGY

## 12. Plant Anatomy and Plant Physiology

### Bookback Questions & Answers

#### I. Choose the correct answer.

1. Casparian strips are present in the \_\_\_\_\_ of the root. (Dept.)  
 a) cortex                      b) pith                      c) pericycle                      d) endodermis

**Ans : d) endodermis**

2. The endarch condition is the characteristic feature of (May-22, Sep.-22)  
 a) root                      b) stem                      c) leaves                      d) flower

**Ans : b) stem**

3. The xylem and phloem arranged side by side on same radius is called \_\_\_\_\_.  
 a) radial                      b) amphivasal                      c) conjoint                      d) None of these

**Ans : c) conjoint**

4. Which is formed during anaerobic respiration ? (Dept., Sep.-20)  
 a) Carbohydrate                      b) Ethyl alcohol                      c) Acetyl CoA                      d) Pyruvate

**Ans : b) Ethyl alcohol**

5. Kreb's cycle takes place in (PTA-3, April-23)  
 a) chloroplast                      b) mitochondrial matrix  
 c) stomata                      d) inner mitochondrial membrane

**Ans : b) mitochondrial matrix**

6. Oxygen is produced at what point during photosynthesis ? (PTA - 4)  
 a) when ATP is converted to ADP                      b) when CO<sub>2</sub> is fixed  
 c) when H<sub>2</sub>O is splitted                      d) All of these

**Ans : c) when H<sub>2</sub>O is splitted**

#### II. Fill in the blanks.

1. The innermost layer of the cortex in root is called \_\_\_\_\_.

**Ans : Endodermis**

2. Xylem and phloem are arranged in an alternate radii constitute a vascular bundle called \_\_\_\_\_.

**Ans : Radial bundle**

3. Glycolysis takes place in \_\_\_\_\_.

**Ans : cytoplasm**

4. The source of O<sub>2</sub> liberated in photosynthesis is \_\_\_\_\_.

**Ans : Water molecule (H<sub>2</sub>O)**

5. \_\_\_\_\_ is ATP factory of the cells.

**Ans : Mitochondria**

**III. State whether the statements are true or false. Correct the false statement.**

1. **Phloem** tissue is involved in the transport of water in plant.

**Ans : False**

**Correct statement :** **Xylem** tissue is involved in the transport of water in plants.

2. The waxy protective covering of a plant is called as cuticle.

**Ans : True**

3. In a monocot stem cambium is **present** in between xylem and phloem.

**Ans : False**

In a monocot stem cambium is **absent** in between xylem and phloem.

4. Palisade parenchyma cells occur below the upper epidermis in dicot **root**.

**Ans : False**

**Correct statement :** Palisade parenchyma cells occur below the upper epidermis in a dicot **leaf**.

5. Mesophyll contains chlorophyll.

**Ans : True**

6. Anaerobic respiration produces **more ATP than** aerobic respiration.

**Ans : False**

**Correct statement :** Anaerobic respiration produces **lesser ATP than** aerobic respiration.

**IV. Match the following.**

Amphicribal	Dracaena	<b>Ans:</b>	Fern
Cambium	Translocation of food		Secondary growth
Amphivasal	Fern		<i>Dracaena</i>
Xylem	Secondary growth		Conduction of water
Phloem	Conduction of water		Translocation of food

**V. Answer in a sentence.****1. What is collateral vascular bundle?**

- ★ When the vascular bundle has xylem towards the centre and phloem towards the periphery (outward), it is called the collateral vascular bundle.

**E.g.:** Monocot stem.

**2. Where does the carbon that is used in photosynthesis come from?**

- ★ It comes from carbondioxide present in the atmosphere.

**3. What is the common step in aerobic and anaerobic pathway?**

- ★ Glycolysis.

**4. Name the phenomenon by which carbohydrates are oxidized to release ethyl alcohol.**

- ★ Anaerobic respiration or Ethanol Fermentation.

**VI. Short answer questions.****1. Give an account of the vascular bundle of dicot stem.**

- ★ Conjoint - i.e. - Xylem and phloem are seen in the same radius.
- ★ Collateral - i.e. - Xylem is towards the centre and phloem is towards the periphery.
- ★ Endarch - Protoxylem lies towards the centre, metaxylem towards the periphery.
- ★ Open - Cambium is seen between the xylem and phloem.
- ★ All the vascular bundles are arranged in the form of a ring below the endodermis.

**2. Write a short note on mesophyll.****Mesophyll :**

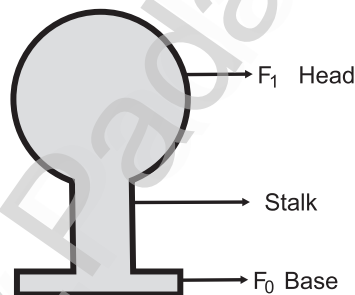
- ★ The tissue present between the upper and lower epidermis of the leaf is called mesophyll. It consists of two types of parenchyma cells.

**Palisade Parenchyma :**

- ★ lies below the upper epidermis. These are elongated cells with more chloroplasts to take part in photosynthesis. They have no intercellular spaces.

**Spongy Parenchyma :**

- ★ lies above the lower epidermis. These are irregularly arranged spherical or oval cells with more intercellular spaces meant for gaseous exchange.

**3. Draw and label the structure of oxysomes.****Structure of Oxysomes****4. Name the three basic tissue systems in flowering plants.****(April-23)****Three basic tissue systems in flowering plants are :**

- ★ Dermal tissue system.
- ★ Ground tissue system
- ★ Vascular tissue system.

**5. What is photosynthesis and where in a cell does it occur?****(PTA - 3, Sep.-21)**

- ★ It is a process in which all autotrophic organisms like green plants algae and chlorophyll containing bacteria utilize the energy from sunlight algae and chlorophyll containing bacteria utilize the energy from sunlight containing chlorophyll synthesize carbohydrates by combining water and  $\text{CO}_2$  by utilizing energy from sunlight.
- ★ Photosynthesis takes place in the thylakoid membrane and stroma of the chloroplasts.

6. What is respiratory quotient? (PTA - 1, May-22, Sep.-21,22)

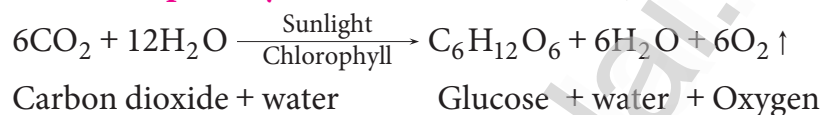
- ★ Respiratory Quotient (R.Q) is the ratio of volume of carbon dioxide liberated and the volume of oxygen consumed during respiration. It is expressed as

$$\text{R.Q.} = \frac{\text{Volume of CO}_2 \text{ liberated}}{\text{Volume of O}_2 \text{ consumed}}$$

7. Why should the light dependent reaction occur before the light independent reaction?

- ★ In light independent reaction (Dark reaction),  $\text{CO}_2$  is reduced to carbohydrate with the help of ATP and  $\text{NADPH}_2$  which are produced at the end of light reaction.
- ★ As these energy rich compounds (ATP and  $\text{NADPH}_2$ ) are produced by light dependent reaction, it should occur before light independent reactions to complete the photosynthetic process.

8. Write the reaction for photosynthesis. (May-22)



VII. Long answer questions.

1. Differentiate the following. (Dept., Sep.-20, 21)

a) Monocot root and Dicot root

	Dicot Root	Monocot Root
1	Xylem is <b>Tetrarch</b> .	Xylem is <b>Polyarch</b> .
2	Cambium is present.	Cambium is absent.
3	Secondary growth is seen.	Secondary growth is absent.
4	Pith is Absent	Pith is present.
5	Conjunctive tissue is made up of parenchyma. E.g. : Bean.	Conjunctive tissue is made up of Sclerenchyma. E.g. : Maize

b) Aerobic and Anaerobic respiration (Sep.-22)

	Aerobic respiration	Anaerobic respiration
1	It takes place with the help of oxygen.	Takes place in the absence of oxygen.
2	Glucose is completely oxidised into $\text{CO}_2$ , water and energy.	Glucose is partially converted into ethanol or lactic acid.
3	More energy is released.	Lesser amount of energy is released.
4	It occurs in all higher plants and animals.	It occurs in bacteria and yeasts.
5	Overall reaction: $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{ATP}$	$\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CO}_2 + 2\text{C}_2\text{H}_5\text{OH} + (\text{energy})\text{ATP}$

2. Describe and name the three stages of cellular respiration that aerobic organisms use to obtain energy from glucose.
- Glycolysis (Glucose splitting):**
    - ★ It is the breakdown of one molecule of glucose (6 Carbon) into two molecules of pyruvic acid (3 Carbon). Glycolysis takes place in cytoplasm of the cell.
    - ★ It is the first step of both aerobic and anerobic respiration.
  - Krebs Cycle:**
    - ★ This cycle occurs in mitochondrial matrix. At the end of glycolysis, 2 molecules of pyruvic acid enter into mitochondria.
    - ★ The oxidation of pyruvic acid into  $\text{CO}_2$  and water takes place through this cycle. It is also called **Tricarboxylic Acid Cycle (TCA)**.
  - Electron Transport Chain:**
    - ★ This is accomplished through a system of electron carrier complex called electron transport chain (ETC) located on the inner membrane of the mitochondria.
    - ★  $\text{NADH}_2$  and  $\text{FADH}_2$  molecules formed during glycolysis and Krebs cycle are oxidised to  $\text{NAD}^+$  and  $\text{FAD}^+$  to release the energy via electrons.
    - ★ The electrons, as they move through the system, release energy which is trapped by ADP to synthesize ATP. This is called **oxidative phosphorylation**.
    - ★ In this process,  $\text{O}_2$  the ultimate acceptor of electrons gets reduced to water.
3. How does the light dependent reaction differ from the light independent reaction? What are the end products and reactants in each? Where does each reaction occur within the chloroplast?

**Difference between Light dependent and light independent reactions.**

	<b>Light dependent reactions</b>	<b>Light independent reactions</b>
1	It requires sunlight for the energy source.	It does not require sunlight.
2	Photosynthetic pigments absorb sunlight energy and convert it into chemical energy as ATP and $\text{NADPH}_2$ .	$\text{CO}_2$ is reduced to carbohydrates with the help of chemical energy ATP and $\text{NADPH}_2$ produced by light reaction.
3	It is also called Hill reaction discovered by Robin Hill.	It is called dark reaction or Calvin Cycle.
<b>b) Reactants and end products :</b>		
4.	In this reactants are sunlight, water and photosynthetic pigments.	In this reactants are $\text{CO}_2$ , ATP and $\text{NADPH}_2$ .
5.	End products of light reactions are ATP and $\text{NADPH}_2$ .	End products are glucose, water and oxygen.
<b>c) Place of occurrence :</b>		
6.	Light reactions occur in the thylakoid membranes (grana) of chloroplasts.	Dark reactions occur in the stroma of chloroplasts.
7.	It occurs in grana of the chloroplasts.	It occurs in stroma of the chloroplast.

### VIII. Higher Order Thinking Skills(HOTS)

1. The reactions of photosynthesis make up a biochemical pathway. (PTA-5)

A) What are the end products of light and dark reaction of photosynthesis?

	Photosynthetic process	End products
1	Light reactions.	ATP and NADPH <sub>2</sub>
2	Dark reactions.	Glucose, water and oxygen

B) Explain how the biochemical pathway of photosynthesis recycles many of its own reactions and identify the recycled reactants.

- ★ During photosynthetic process ATP and NADPH<sub>2</sub> are recycled.
- ★ During light reaction, solar energy is absorbed by chlorophyll pigment to synthesize ATP and NADPH<sub>2</sub> from ADP and NADP<sup>+</sup> respectively.

Recycling of reactants :

Light reaction	Dark reaction
ADP + P → ATP	ATP → ADP + P
NADP <sup>+</sup> + H <sub>2</sub> → NADPH <sub>2</sub>	NADPH <sub>2</sub> → NADP <sup>+</sup> + H <sub>2</sub>

2. Where do the light dependent reaction and the Calvin cycle occur in the chloroplast?

- ★ Light dependent reactions of photosynthesis occur in the thylakoid (grana) membrane of the chloroplasts.
- ★ Calvin cycle (Dark reaction) occurs in the stroma of the chloroplasts.

### PTA & Exam Questions (Interior)

V. Answer in a sentence.

1. What is vascular bundle? (PTA - 1)

- It consists of xylem and phloem tissue.
- They are present in the form of bundles called vascular bundle.
- It consists of xylem and phloem tissue.
- Xylem → conduct water and minerals to different parts of the plant.
- Phloem → conduct food materials to different parts of the plant.

2. What is the common step in aerobic and anaerobic pathway and where does it occur in a cell? (PTA - 5)

- It takes place in cytoplasm in cell.
- It is a breakdown of one molecule of glucose into two molecules of pyruvic acid.
- It is the first step of both aerobic and anaerobic respiration.

3. What are the factors affecting photosynthesis? (Sep.-22, April-23)

**Internal factors :** Pigments, Leaf age, Accumulation of carbohydrates, Hormones.

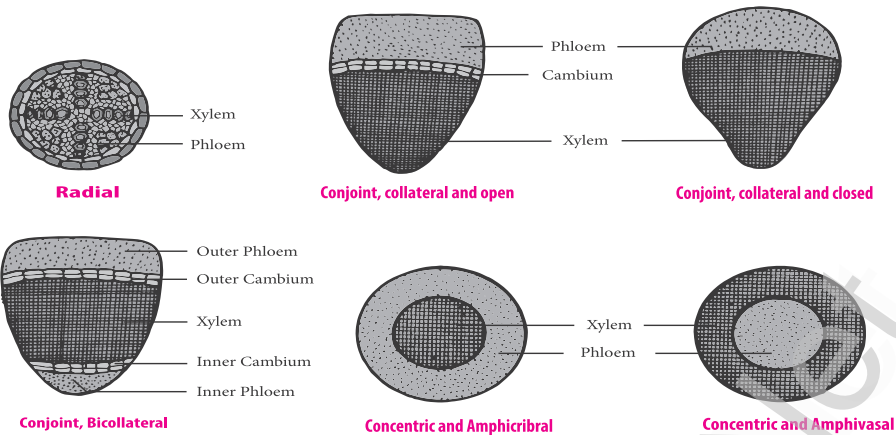
**External factors :** Light, Carbon dioxide, Temperature, Water, Mineral elements.



**VI. Short answer questions.**

**1. Draw and label the different types of Conjoint vascular bundles.**

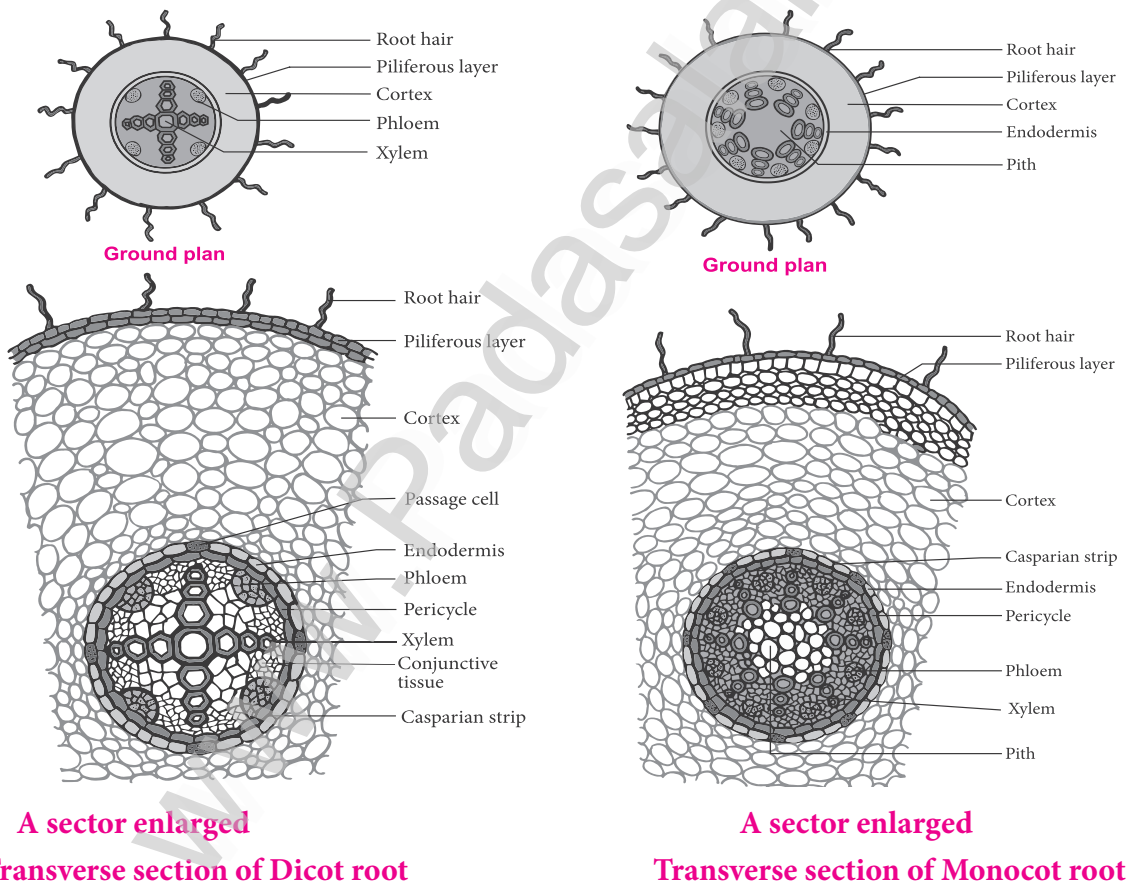
**(PTA - 4)**



**Types of vascular bundle**

**2. Draw the ground plan of dicot and monocot root.**

**(PTA - 6)**



# 13. Structural Organisation of Animals

## Bookback Questions & Answers

### I. Choose the correct answer.

- In leech locomotion is performed by
  - Anterior sucker
  - Parapodia
  - Setae
  - Contraction and relaxation of muscles

**Ans : d) Contraction and relaxation of muscles**

- The segments of leech are known as
  - Metameres (somites)
  - Proglottids
  - Strobila
  - All the above

**Ans : a) Metameres (somites)**

- Pharyngeal ganglion in leech is a part of
  - Excretory system
  - Nervous system
  - Reproductive system
  - Respiratory system

**Ans : b) Nervous system**

- The brain of leech lies above the
  - Mouth
  - Buccal Cavity
  - Pharynx
  - Crop

**Ans : c) Pharynx**

- The body of leech has
  - 23 segments
  - 33 segments
  - 38 segments
  - 30 segments

**Ans : b) 33 segments**

- Mammals are \_\_\_\_\_ animals.
  - Cold blooded
  - Warm blooded
  - Poikilothermic
  - All the above

**Ans : b) Warm blooded**

- The animals which give birth to young ones are
  - Oviparous
  - Viviparous
  - Ovoviviparous
  - All the above

**Ans : b) Viviparous**

### II. Fill in the blanks.

- The posterior sucker is formed by the fusion of the \_\_\_\_\_ segments.

**Ans : last seven**

- The existence of two sets of teeth in the life of an animal is called \_\_\_\_\_ dentition.

**Ans : diphyodont**

- The anterior end of leech has a lobe-like structure called \_\_\_\_\_.

**Ans : anterior sucker**

4. The blood sucking habit of leech is known as \_\_\_\_\_. (PTA - 5)

**Ans : sanguivorous**

5. \_\_\_\_\_ separate nitrogenous waste from the blood in rabbit.

**Ans : Nephrons (kidney)**

6. \_\_\_\_\_ of spinal nerves are present in rabbit.

**Ans : 37 pairs**

### III. Identify whether the statements are True or False. Correct the false statements.

1. An anticoagulant present in saliva of leech is called **heparin**.

**Ans : False**

**Correct statement :** An anticoagulant present in saliva of leech is called **Hirudin**.

2. The vas deferens serves to transport the ovum. (PTA-6)

**Ans : False**

**Correct statement :** The vas deferens serves to transport the **sperms**. (or) The oviduct serves to transport the ovum.

3. Diastema is the gap between **premolar and molar** teeth in rabbit.

**Ans : False**

**Correct statement :** Diastema is the gap between **incisor and premolar** teeth in the rabbit.

4. The cerebral hemispheres of the rabbit are connected by a band of nerve tissues called **corpora quadrigemina**. (PTA-6)

**Ans : False**

**Correct statement :** The cerebral hemispheres of the rabbit are connected by a band of nerve tissues called **corpus callosum**.

### IV. Match columns I, II and III correctly.

(PTA - 2)

Organs	Membranous Covering	Location
Brain	pleura	abdominal cavity
Kidney	capsule	mediastinum
Heart	meninges	enclosed in thoracic cavity
Lungs	pericardium	cranial cavity

Ans :	Organs	Membranous Covering	Location
	Brain	meninges	cranial cavity
	Kidney	capsule	abdominal cavity
	Heart	pericardium	mediastinum
	Lungs	pleura	enclosed in thoracic cavity

**V. Answer in a sentence :**

1. Give the common name of the *Hirudinaria granulosa*.

- ★ Indian Cattle Leech.

2. How does a leech respire?

(PTA - 1)

- ★ Leech respire through the skin by diffusion.

3. Write the dental formula of rabbit.

(Dept.)

- ★ Dental formula of rabbit -  $I \frac{2}{1}, C \frac{0}{0}, PM \frac{3}{2}, M \frac{3}{3}$  (or)  $\frac{2033}{1023}$

4. How many pairs of testes are present in leech?

- ★ Eleven pairs of testes are present in leech.

5. How is diastema formed in the rabbit?

(PTA - 6)

- ★ In the rabbit, diastema is a gap between the incisors and premolar teeth due to the absence of canine teeth between them.

6. What organs are attached to the two bronchi?

- ★ Lungs and trachea are attached to the two bronchi.

7. Which organ acts as suction pump in leech?

- ★ Muscular pharynx acts as sucking pump to suck the blood of animals.

8. What does CNS stand for?

- ★ CNS stand for Central Nervous System.

9. Why is the teeth of the rabbit called heterodont?

(PTA-4)

- ★ In the rabbit, teeth are of different types namely incisors, premolar and molar.
- ★ So, the dentition is called Heterodont.

10. How does leech suck blood from the host?

(PTA - 2)

- ★ Leech attaches itself to the host by posterior sucker.
- ★ Then it makes a triradiate or Y - shaped incision in the skin of the host by the jaws protruded through the mouth and sucks the blood by muscular pharynx.

**VI. Short answer questions :**

1. Why are the rings of cartilages found in trachea of the rabbit?

(PTA - 4, Sep.-20)

- ★ Tracheal walls of the rabbit are supported by rings of cartilage which help in the free passage of air.

2. List out the parasitic adaptations in leech.

(Dept., April-23)

- ★ Blood is sucked by pharynx. Anterior and posterior ends of the body are provided with suckers by which the leech attaches itself to the body of the host.
- ★ The three jaws inside the mouth cause a painless Y-shaped wound in the skin of the host.
- ★ The salivary glands produce hirudin which does not allow the blood to coagulate. Thus, a continuous supply of blood is maintained.
- ★ Parapodia and setae are completely absent. Blood is stored in the crop.

## VII. Long answer questions :

### 1. How is the circulatory system designed in leech to compensate the heart structure ?

- ★ In Leech, circulation is brought about by **haemocoelic system**. True blood vessels are absent. Instead, haemocoelic channels or canals filled with blood like fluid are present. This haemocoelic fluid contains **haemoglobin**.
- ★ There are four longitudinal channels of which dorsal one lies above the alimentary canal, ventral one lies below the alimentary canal and two lateral channels are seen on either side of the alimentary canal. Heart is absent. The lateral canals serve as heart and have inner valves. The four channels are connected together posteriorly in the 26th segments.

### 2. How does locomotion take place in leech? (PTA - 5)

#### Looping or crawling movement :

- ★ It is brought about by the contraction and relaxation of body muscles. The anterior and posterior suckers serve for attachment during looping movement on the substratum.

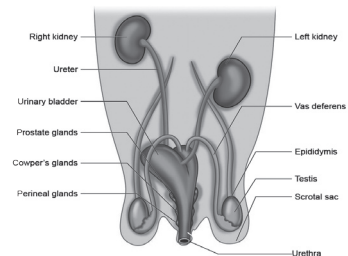
#### Swimming movement :

- ★ Leeches can swim very actively and perform undulating movements in water.

### 3. Explain the male reproductive system of the rabbit with a labelled diagram.

#### Male reproductive system of the rabbit :

- ★ The male reproductive system of rabbit consists of a pair of testes which are ovoid in shape. Testes are enclosed by scrotal sacs in the abdominal cavity.
- ★ Each testis consists of numerous fine tubules called **seminiferous tubules**. This network of tubules leads into a coiled tubule called **epididymis**, which leads into the sperm duct called **vas deferens**.
- ★ The vas deferens joins the urethra just below the urinary bladder. The urethra runs backward and passes into the penis.
- ★ There are three accessory glands namely **prostate gland**, **cowper's gland** and **perineal gland**. Their secretions are involved in reproduction.



**Male reproductive system of Rabbit**

## VIII. Higher Order Thinking Skills (HOTS)

### 1. Arjun is studying in tenth standard. He was down with fever and went to meet the doctor. As he went to the clinic he saw a patient undergoing treatment for severe leech bite. Being curious, Arjun asked the doctor why leech bite was not felt as soon as it attaches to the skin? What would have been the reply given by the doctor?

- ★ The parasitic leech makes a triradiate or Y - shaped incision in the skin of the host by the jaws protruded through the mouth to suck the blood. At that time, it injects an anaesthetic substance that prevents the host from feeling the bite.
- ★ It also secretes an anticoagulant **Hirudin** to ensure free flow of blood. Hence the bite of leech and the sucking of blood is not felt on the skin of the host.

2. Shylesh has some pet animals at his home. He has few rabbits too, one day while feeding them he observed something different with the teeth. He asked his grandfather, why is it so? What would have been the explanation of his grandfather?

- ★ Rabbit has three different types of teeth namely incisors, premolars and molars. Canine teeth are absent as it is a herbivorous animal.
- ★ So, a gap called **diastema** is formed between the incisors and premolars.
- ★ This helps in mastication and chewing of food in herbivorous animals.

### IX. Value based questions.

1. Leeches do not have an elaborate secretion of digestive juices and enzymes - Why ?

- ★ The salivary glands of Leech secrete hirudin to prevent coagulation of blood. Leeches do not have other digestive juices and enzymes. As it sucks the blood of the host, it stores a large amount of blood in the crop before it goes to the stomach.
- ★ Digestion takes place in the stomach by the action of proteolytic enzyme slowly and then absorbed by the intestine. So leeches do not have digestive juices and enzymes.

2. How is the digestive system of rabbit suited for herbivorous mode of feeding?(PTA-3)

- ★ Digestive system of rabbit is well suited for herbivorous mode of feeding. Hence canines are absent and diastema gap is formed between the incisors and premolars.
- ★ It helps the rabbit to masticate and chew the food properly. Thus teeth are suited for herbivorous life. Herbivorous rabbit mainly feeds on plant materials which contain cellulose. Caecum seen at the junction of small and large intestines contains useful bacteria that help in the digestion of cellulose.

### PTA & Exam Questions (Interior)

I. Choose the correct answer.

1. According to the dental formula \_\_\_\_\_ kind of teeth is absent in rabbit. (PTA-1)
- a) molar                      b) pre - molar                      c) incisor                      d) canine

Ans : d) canine

VI. Short answer questions :

1. What are the glands embedded in the Rabbit skin to regulate the body temperature? (PTA - 3)

- The sweat glands and sebaceous glands embedded in the skin regulate the body temperature