

Way to Success

10th-SCIENCE

STUDY MATERIAL-Quarterly syllabus

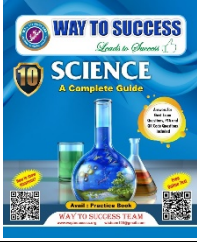
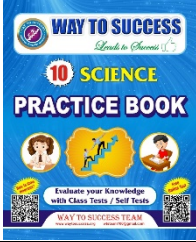
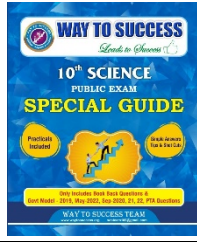
Below mentioned topics are in this material:

- **Book Back Question** - (1 Mark, 2 Marks, 5 Marks).

You can download other free materials from our website:

- [Scientists-discoveries, Important Formula, Points to remember, Important Diagrams.](#)

இந்த கையேட்டில் உள்ளவை வெறும் மாதிரிப் பக்கங்களே, கீழே உள்ள வழிகளில் எங்கள் முழுமையான புத்தகங்களை நீங்கள் வாங்கலாம்.

Main Guide	Practice Book	Special Guide
		
300/-	100/-	100/-

-----For Bulk Orders -----

Contact Our District Co-ordinators (Phone numbers in the last page)
Or **Call us on** 9787609090, 9787201010

----- For Individual orders -----

VPP Order: You can give SMS to 9787104040 to get books by VPP

Online Purchase: www.bookade.com, Amazon

PHYSICS

- Unit 1 - Laws of Motion
- Unit 2 - Optics
- Unit 3 - Thermal Physics
- Unit 4 - Electricity

UNIT - 1

LAWS OF MOTION



I. Choose the correct answer

- Inertia of a body depends on
 - weight of the object
 - mass of the object**
 - acceleration due to gravity of the planet
 - Both a & b
- Impulse is equals to (or) Impulse is the [PTA – 1]
 - rate of change of momentum
 - rate of force and time
 - change of momentum**
 - rate of change of mass
- Newton's III law is applicable
 - for a body is at rest
 - for a body in motion
 - both a & b**
 - only for bodies with equal masses
- Plotting a graph for momentum on the Y-axis and time on X-axis. Slope of momentum-time graph gives
 - Impulsive force
 - Acceleration
 - Force**
 - Rate of force
- In which of the following sport the turning of effect of force used
 - swimming
 - tennis
 - cycling**
 - hockey
- The unit of 'g' is m s^{-2} . It can be also expressed as
 - cm s^{-1}
 - N kg^{-1}**
 - $\text{N m}^2 \text{kg}^{-1}$
 - $\text{cm}^2 \text{s}^{-2}$
- One kilogram force equals to
 - 9.8 dyne
 - $9.8 \times 10^4 \text{ N}$
 - $98 \times 10^4 \text{ dyne}$**
 - 980 dyne
- 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.
 - 4 M
 - 2M
 - $\frac{M}{4}$
 - M**
- If the Earth shrinks to 50% of its real radius its mass remaining the same, the weight of a body on the Earth will
 - decrease by 50%
 - increase by 50%
 - decrease by 25%
 - increase by 300%**
- To project the rockets which of the following principle(s) is/are required? [SEP – 2021, MDL – 19]
 - Newton's third law of motion
 - Newton's law of gravitation
 - law of conservation of linear momentum
 - both a and c** [JUN – 23, AUG – 22]

Additional Questions

- 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]
 - 2F
 - $\frac{F}{2}$
 - $\frac{F}{4}$
 - 4F
- The force required to produce an acceleration of 1 cm s^{-2} on a body of mass 1 g is [PTA – 6]
 - 1 N
 - 10 N
 - 10^2 dyne
 - 1 dyne**

II. Fill in the blanks

- To produce a displacement **force** is required.
- Passengers lean forward when sudden brake is applied in a moving vehicle. This can be explained by **inertia of motion**.
- By convention, the clockwise moments are taken as **negative** and the anticlockwise moments are taken as **positive**.
- Gears** is used to change the speed of car.
- A man of mass 100 kg has a weight of **980 N** at the surface of the Earth.

Additional Questions

- Opening a door : Moment of force, Opening a water tap : **Moment of a couple** [PTA – 4]
- Pushing a bus by a group of people : Like parallel forces, Tug of war : **Unlike parallel forces** [PTA – 4]

III. True or False. If false correct it.

- The linear momentum of a system of particles is always conserved. [False]
The linear momentum of a system of particles is conserved, when **no external force is applied.*
- Apparent weight of a person is always equal to his actual weight. [False]
Apparent weight of a person is equal to his actual weight **when he is at rest.*
- Weight of a body is greater at the equator and less at the polar region. [False]
Weight of a body is **less at the equator and **greater** at the polar region.*
- Turning a nut with a spanner having a short handle is so easy than one with a long handle. [False]
Turning a nut with a spanner having a **long handle is so easy than one with a **short** handle.*
- There is no gravity in the orbiting space station around the Earth. So the astronauts feel weightlessness. [False]
**Astronauts and orbiting space station are under free fall with same acceleration. So the astronauts feel weightlessness.*

IV. Match the following

[PTA – 1]

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

V. Assertion & 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.
- Assertion:** The sum of the clockwise moments is equal to the sum of the anticlockwise 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.

Additional Question

3. **Assertion :** When a person swims he pushes the water using the hands backwards and the water pushes the person in the forward direction [PTA – 3]

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

Ans. (a)

Both the assertion and the reason are true and the reason is the correct explanation of the assertion.

VI. Answer briefly.

1. Define inertia. Give its classification.

[APR – 2023, AUG – 2022]

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

Classification of Inertia :

- ❖ Inertia of rest ❖ Inertia of motion ❖ Inertia of direction

2. Classify the types of force based on their application.

[AUG - 2022]

Types of Forces:

- (i) Like parallel force (ii) Unlike parallel force

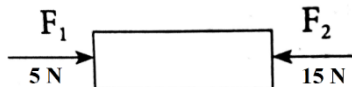
3. If a 5 N and a 15 N forces are acting opposite to one another. Find the resultant force and the direction of action of the resultant force.

Given, $F_1 = 5\text{ N}$

$F_2 = 15\text{ N}$

$$F_{\text{net}} = F_2 - F_1 = 15 - 5 = 10\text{ N.}$$

∴ Magnitude is 10 N and direction is along 15 N force.



4. Differentiate mass and weight.

[MAY - 2022]

Mass	Weight
1. It measures the quantity of matter.	1. It measures the gravitational force on a body.
2. SI unit is Kilogram (Kg).	2. SI unit is Newton (N).
3. Fundamental quantity.	3. Derived quantity.
4. Scalar quantity.	4. Vector quantity.

5. Define moment of a couple.

It is the product of any one of the forces and the perpendicular distance between the line of action of two forces. Its SI unit is Nm.

$$M = F \times S$$

6. State the principle of moments.

At equilibrium, the algebraic sum of the moments of all the individual forces at any point is equal to zero.

Moment of clockwise direction = Moment of anticlockwise direction

7. State Newton's second law.

[MDL – 19, MAY - 2022]

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.

$$F = ma$$

8. Why a spanner with a long handle is preferred to tighten screws in heavy vehicles?
- ❖ The turning effect is more when the distance between line of action and axis of rotation is more.
 - ❖ Thus, the spanner with a long handle requires less force to tighten screws in heavy vehicles.
9. While catching a cricket ball the fielder lowers his hands backwards. Why?
- ❖ To increase the time of contact.
 - ❖ To reduce the impulse and the pain.
10. How does an astronaut float in a space shuttle?
- ❖ Astronauts are not floating but falling freely around the Earth due to their huge orbital velocity.
 - ❖ Since space station and astronauts have equal acceleration, they are under free fall condition.

Additional Questions

11. Shock absorbers are used in luxury buses. Why? [PTA – 2]
Shock absorbers are used in luxury buses for the comfort purpose. Because, they absorb or damp the shocks or unwanted oscillations of the bus due to damaged roads.
12. Name the law of motion used in flying of birds. Give another example for the same law. (or) Illustrate some examples of Newton's third law of motion. [PTA – 2]
- i) **Action** : When birds fly, they push the air downwards with their wings.
Reaction : The air pushes the birds upwards.
- ii) **Action** : When a person swims, he pushes the water using the hands backwards.
Reaction : The water pushes the swimmer in the forward direction.
13. Why the apples weigh more at poles than at equator? [PTA – 3]
- ❖ Weight depends on the acceleration due to gravity of the Earth(g). The acceleration due to gravity is more at poles than at equator.
 - ❖ So, the apples weigh more at poles than at equator.

VIII. Answer in detail

1. What are the types of inertia? Give an example for each type. [AUG – 2022, PTA – 3]
- a) **Inertia of rest**: It is the resistance of a body to change its state of rest.
Eg : When we shake a tree, leaves and fruits fall down.
- b) **Inertia of motion** : It is the resistance of a body to change its state of motion.
Eg : An athlete runs some distance before jumping for a longer and higher jump.
- c) **Inertia of direction** : It is the resistance of a body to change its direction of motion.
Eg : When car turns, we lean sideways.
2. State Newton's laws of motion? [AUG – 2022, SEP – 2021]
- a) **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 some external force acts upon it.
- b) **Newton's second law** :
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. $\mathbf{F} = m\mathbf{a}$
- c) **Newton's third law** :
For every action, there is an equal and opposite reaction. $\mathbf{F}_B = -\mathbf{F}_A$

3. Deduce the equation of a force using Newton's second law of motion. [APR-23] (or) 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 ' a ' is produced. Using this data derive the relation between the force, mass and acceleration. [PTA – 5]

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.

Derivation for the equation of force:

Let, $m \rightarrow$ mass of a moving body $u \rightarrow$ initial velocity
 $F \rightarrow$ unbalanced external force $v \rightarrow$ final velocity after a time interval ' t '

Initial momentum $P_i = mu$,

Final momentum $P_f = mv$

Change in momentum, $\Delta P = P_f - P_i = mv - mu$

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

$$F = k \frac{mv - mu}{t} = m \left[\frac{v - u}{t} \right]; (\because k = 1, \text{proportionality constant})$$

$$F = ma \quad (\because a = \frac{v - u}{t})$$

Force = mass \times acceleration

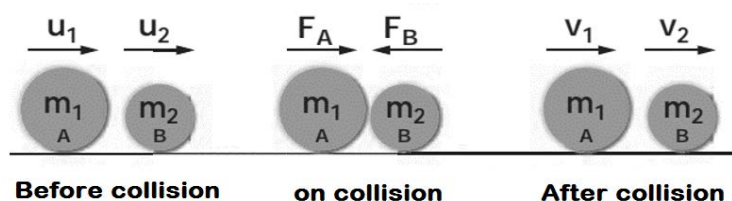
SI unit of force is Newton.

4. State and prove the law of conservation of linear momentum. [MDL – 19]

Law of Conservation of momentum:

There is no change in the linear momentum of a system of bodies as long as no net external force acts on them.

Proof:



- ❖ Let A and B with mass m_1, m_2 move in straight line with velocity u_1, u_2 such that $u_1 > u_2$.
- ❖ At ' t second', they have a collision.
- ❖ After collision, A and B move in same straight line with velocity v_1 and v_2 .

$$F_A = \frac{m_2(v_2 - u_2)}{t} \text{ ----- (1)}$$

$$F_B = \frac{m_1(v_1 - u_1)}{t} \text{ ----- (2)}$$

By Newton's third law,

$$F_B = -F_A$$

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

$$m_1(v_1 - u_1) = -m_2(v_2 - u_2)$$

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

$$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$$

Hence the law is proved.

5. Describe rocket propulsion.

[AUG – 2022, SEP – 2020, PTA – 4]

Principles Used: Law of conservation of linear momentum and Newton's III law of motion.

- ❖ When the rocket is fired, fuel in propellant tank is burnt. A hot gas is ejected with a high speed from the nozzle, producing a huge momentum.
- ❖ To balance this momentum, an equal & opposite force is produced, projecting rocket forward.
- ❖ In motion, the mass of the rocket gradually decreases, until the fuel is completely burnt out.
- ❖ There is no net external force acting on it. So linear momentum of the system is conserved.
- ❖ Mass of the rocket decreases with altitude and increases the velocity gradually and reaches a velocity, which is sufficient to just escape from the gravitational pull of Earth.
- ❖ This velocity is called escape velocity.

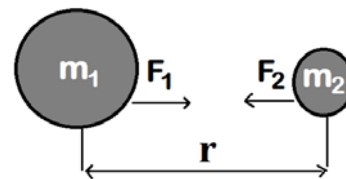
6. State the universal law of gravitation and derive its mathematical expression. [JUN – 2023]

Newton's Universal Law of gravitation :

- ❖ Gravitational force is directly proportional to the product of masses and inversely proportional to the square of the distance between the center of these masses.
- ❖ The direction of the force acts along the line joining the masses.

Mathematical Expression of Universal Law of gravitation :Let, m_1 and m_2 be the masses of two bodies A and BLet r be the distance between them.

$$F \propto \frac{m_1 m_2}{r^2} \Rightarrow F = G \frac{m_1 m_2}{r^2}$$

Where Universal gravitational constant, $G = 6.674 \times 10^{-11} \text{ Nm}^2 \text{ kg}^{-2}$

7. Give the applications of universal law of gravitation.

- i) Used to measure the dimensions of heavenly bodies like mass and radius of earth, etc.
- ii) Helps in discovering new stars and planets.
- iii) Wobble disturbs the motion of a nearby planet. Here, mass of star is calculated using law of gravitation.
- iv) It explains germination of roots (geotropism).
- v) Helps to predict the path of astronomical bodies.

Additional Question

8. Write short notes on gears.

[SEP – 2020]

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

VII. Solve the given problems1. Two bodies have a mass ratio of 3:4. The force applied on the bigger mass produces an acceleration of 12 m s^{-2} . What could be the acceleration of the other body, if the same force acts on it.**Given :** $m_1 : m_2 = 3 : 4$; $F_1 = F_2$ Let m_2 be bigger, then $a_2 = 12 \text{ ms}^{-2}$ **Solution :**

$$F_1 = F_2$$

$$m_1 a_1 = m_2 a_2$$

$$(\because F = ma)$$

$$a_1 = \frac{m_2}{m_1} a_2 = \frac{4}{3} \times 12 = 16 \text{ ms}^{-2}$$

 \therefore Acceleration, a_1 is **16 ms^{-2}**

2. A ball of mass 1 kg moving with a speed of 10 m s^{-1} rebounds after a perfect elastic collision with the floor. Calculate the change in linear momentum of the ball.
Given : $m = 1 \text{ kg}$, $u = 10 \text{ m s}^{-1}$,
Solution : It is perfect elastic collision, ball rebounds with same speed but in opposite direction $\therefore v = -10 \text{ m s}^{-1}$
 $\Delta p = mv - mu = 1 \times (-10) - 1 \times (10)$
 $= -10 - 10$
 $= -20 \text{ kg m s}^{-1}$
 \therefore Change in Linear momentum is **20 kg m s^{-1}**
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?
Given : $F_1 = 140 \text{ N}$, $d_1 = 40 \text{ cm}$;
 $F_2 = 40 \text{ N}$, $d_2 = ?$
Solution : Moment of couple is same,
 $F_1 d_1 = F_2 d_2$
 $d_2 = \frac{F_1 d_1}{F_2} = \frac{40 \times 140}{40} = 140 \text{ cm}$
 \therefore Length should be 140 cm / 1.4 m.
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.
Given : $m_1 : m_2 = 2 : 3$; $R_1 : R_2 = 4 : 7$; $g_1 : g_2 = ?$
Solution : $g_1 = \frac{GM_1}{R_1^2}$ ---- (1) $g_2 = \frac{GM_2}{R_2^2}$ ----- (2)

$$\text{Eqn (1)} \div \text{(2)} \Rightarrow \frac{g_1}{g_2} = \frac{\frac{GM_1}{R_1^2}}{\frac{GM_2}{R_2^2}} = \frac{GM_1}{R_1^2} \times \frac{R_2^2}{GM_2} = \frac{M_1}{M_2} \times \frac{R_2^2}{R_1^2}$$

$$\frac{g_1}{g_2} = \frac{2}{3} \times \frac{7^2}{4^2} = \frac{2}{3} \times \frac{49}{16} = \frac{49}{24}$$

 $\therefore g_1 : g_2 = 49 : 24$

Additional Problems

Also Practice : Text Book Example Problems Page No : 12 (Problem 3)

5. A lift is moving downwards with an acceleration of 1.8 m s^{-2} . What is apparent weight realised by a man of mass 50 kg? [PTA – 1]
Given : $a = 1.8 \text{ m s}^{-2}$ $m = 50 \text{ kg}$
Solution: Apparent weight, $R = m(g - a)$
 $= 50 (9.8 - 1.8)$
 $R = 50 \times 8$
 \therefore Apparent weight is **400 N**
6. A force of 5 N applied on a body produces and acceleration 5 cm s^{-2} . Calculate the mass of the body. [PTA–5]
Given : $F = 5 \text{ N}$, $a = 5 \text{ cm s}^{-2} = 0.05 \text{ m s}^{-2}$
Solution : $F = ma$
 $m = \frac{F}{a} = \frac{5}{0.05}$
 $m = 100 \text{ kg}$
 \therefore Mass = 100kg
7. 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 m s^{-2}) [PTA – 2]
Given : $W_e = mg_e = 686 \text{ N}$; $g_m = 1.625 \text{ m s}^{-2}$
Solution : $m = \frac{W_e}{g_e} = \frac{686}{9.8} = 70 \text{ kg}$
 $W_m = mg_m = 70 \times 1.625$
 $W_m = 113.75 \text{ N}$
 \therefore Weight on moon is 113.75 N
8. Calculate the velocity of moving body of mass 5 kg whose linear momentum is 2 kg m s^{-1} . [MDL – 19]
Given : $m = 5 \text{ kg}$; $p = 2 \text{ kg m s}^{-1}$
Solution : $p = mv$
 $v = \frac{p}{m} = \frac{2}{5} = 0.4 \text{ m s}^{-1}$
 \therefore Velocity = 0.4 m s^{-1} .

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.

Given : $m_1 = 8 \text{ kg}$, $m_2 = 2 \text{ kg}$, Force, $F = 15 \text{ N}$

Solution :

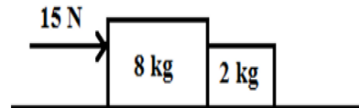
$$F = ma = (m_1 + m_2) a$$

$$a = \frac{F}{m_1 + m_2} = \frac{15}{8+2} = \frac{15}{10} = 1.5 \text{ ms}^{-2}$$

Force on 2 kg mass, $m = 2 \text{ kg}$, $a = 1.5 \text{ ms}^{-2}$

$$F = ma = 2 \times 1.5 = 3 \text{ N}$$

\therefore Force on 2kg mass is **F = 3N**



2. A heavy truck and 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)

Given : Let, Mass of bike = m_B ; Mass of truck = m_T ; $\frac{m_T}{m_B} = 4$

Solution : Kinetic Energy = $\frac{1}{2} mv^2$

K.E of truck = K.E of bike

$$\frac{1}{2} m_T v_T^2 = \frac{1}{2} m_B v_B^2$$

$$\left(\frac{v_B}{v_T}\right)^2 = \frac{m_T}{m_B} = 4$$

$$\frac{v_B}{v_T} = 2 \Rightarrow \frac{v_T}{v_B} = \frac{1}{2}$$

Ratio of their momentum is, $\frac{p_T}{p_B} = \frac{m_T v_T}{m_B v_B} = 4 \times \frac{1}{2} = 2$

\therefore Ratio of their momentum is **2 : 1**.

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

Wearing helmet is highly recommended for safe journey:

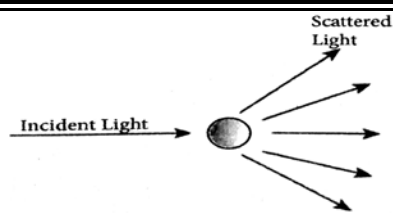
- ❖ According to Newton's second law, when you fall from a bike on the ground, you will fall with a force equal to your mass and acceleration of the bike.
- ❖ According to Newton's third law, an equal and opposite force from the ground is exerted on you.
- ❖ Wearing helmet will reduce the effect of force on you and saves us from fatal head injuries.
- ❖ So, it is important to wear helmet for the safe journey.

Fastening the seat belt is highly recommended for safe journey:

- ❖ When vehicle stops suddenly, by Newton’s first law, we will be in motion until a force act on us.
- ❖ If we don't wear a seat belt, we would get hurt during this motion.
- ❖ If we wear a seat belt, it gives us an unbalanced force that would stop us from being in motion.

UNIT - 2

OPTICS



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
- Where should an object be placed so that a real and inverted image of same size is obtained by a convex lens [MAY - 2022]
a) f b) 2f c) infinity d) between f and 2f
- 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
- Magnification of a convex lens is [APR – 2023]
a) positive b) negative c) either positive or negative d) zero
- 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
- Power of a lens is $-4D$, then its focal length is
a) 4m b) $-40m$ c) $-0.25 m$ d) $-2.5 m$
- 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
- The eye defect 'presbyopia' can be corrected by [PTA – 2, SEP - 2020]
a) convex lens b) concave lens c) convex mirror d) Bifocal lenses
- Which of the following lens 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
- 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) $V_B < V_G > V_R$

Additional Questions

- The scattered light in Raman scattering contains _____ lines. [PTA – 5]
a) stokes lines b) antistokes lines c) Rayleigh line d) all the above
- The near point of eye is (or) In common what is the value of least distance of distinct vision of a human? [PTA - 6]
a) 25 m b) 25 mm c) 25 cm d) 250 m

II. Fill in the blanks

- The path of the light is called as ray of light.
- The refractive index of a transparent medium is always greater than one.
- If the energy of incident beam and the scattered beam are same, then the scattering of light is called as elastic scattering.
- According to Rayleigh's scattering law, the amount of scattering of light is inversely proportional to the fourth power of its wavelength.
- Amount of light entering into the eye is controlled by iris.

III. True or False. If false correct it.

- Velocity of light is greater in denser medium than in rarer medium. [False]
Velocity of light is **lesser in denser medium than in rarer medium.*
- The power of lens depends on the focal length of the lens. [True]
- Increase in the converging power of eye lens cause 'hypermetropia'. [False]
Increase in the converging power of eye lens cause 'myopia**'.*
- The convex lens always gives small virtual image. [False]
The **concave lens always gives small virtual image.*

IV. Match the following.

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

V. Assertion & Reasoning type

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.

- 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.

- 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. (a) Both assertion and reason are true and reason is the correct explanation of assertion.

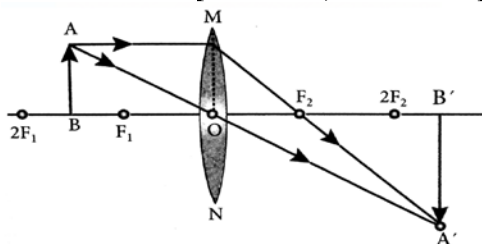
VI. Answer briefly

1. What is refractive index?

The ratio of speed of light in vacuum(c) to the speed of light in a medium(v) is refractive index(μ).

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

3. Draw a ray diagram to show the image formed by a convex lens when the object is placed between F and $2F$. [JUN –23, MDL – 19]



2. State Snell's law (or) State Second law of refraction.

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. [AUG - 2022]

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

4. Define dispersion of light.

Refraction of white light or composite light into its component colours when passed through any transparent media is called dispersion of light.

5. State Rayleigh's law of scattering. [JUN – 23, PTA-3]

The amount of scattering of light is inversely proportional to the fourth power of its wavelength.

$$S \propto \frac{1}{\lambda^4}$$

6. Differentiate convex lens and concave lens.

[JUN – 2023, PTA-3]

Convex lens	Concave lens
1. Thicker in the middle.	1. Thinner in the middle.
2. Converging lens.	2. Diverging lens.
3. Produces mostly real images.	3. Produces virtual images.
4. Used to treat Hypermetropia.	4. Used to treat myopia.

7. What is power of accommodation of eye?

It is the ability of the eye lens to focus nearby as well as the distant objects by changing the focal length of eye lens with the help of ciliary muscles.

8. What are the causes of 'Myopia'?

[MDL – 19]

- ❖ It occurs due to the lengthening of eye ball.
- ❖ The focal length of eye lens is reduced or the distance between eye lens and retina increases.
- ❖ The image of distant objects are formed before retina.

9. Why does the sky appear in blue colour?

[APR – 2023, PTA – 1]

When sunlight passes through atmosphere, blue colour with shorter wave length is scattered to more than red colour. This scattering of light causes the sky to appear in blue colour.

10. Why are traffic signals red in colour?

[PTA – 4]

- ❖ Red light having longest wavelength is scattered the least by air molecules and travels longer.
- ❖ Hence, Red light is used in traffic signals to stop the vehicle.

Additional Questions

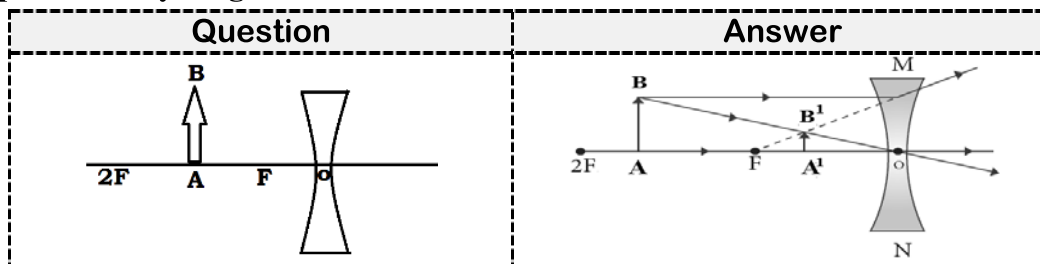
11. Write any two applications or uses of concave lens.

[SEP – 2021]

- ❖ Used as eye lens of 'Galilean Telescope'
- ❖ Used to correct the eye defect, myopia.

12. Complete the ray diagram of a concave lens.

[PTA – 6]



VII. Give the answer in detail.

1. List any five properties of light. (Write any five points)

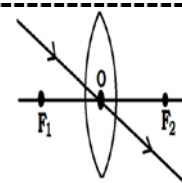
[MAY - 2022]

- ❖ 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 air (or) vacuum 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.

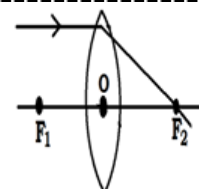
Rule - 1

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



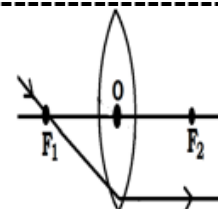
Rule - 2

When rays **parallel to the principal axis** strikes a convex lens, the refracted rays are **converged to the principal focus**.



Rule - 3

When a ray **passing through the principal focus** strikes a convex lens, the refracted ray will be **parallel to the principal axis**.



3. Differentiate the eye defects: Myopia and Hypermetropia.[APR-23, AUG-22, SEP-21, PTA-6]

Myopia (short sightedness)	Hypermetropia (long sightedness)
1. Nearby objects can be seen clearly.	1. Nearby objects cannot be seen clearly.
2. Distant objects cannot be seen clearly.	2. Distant objects can be seen clearly.
3. Due to lengthening of eye ball	3. Due to shortening of eye ball.
4. Far point comes closer.	4. Near point moves farther.
5. Image is formed before retina.	5. Image is formed behind retina.
6. Corrected using concave lens.	6. Corrected using convex lens.

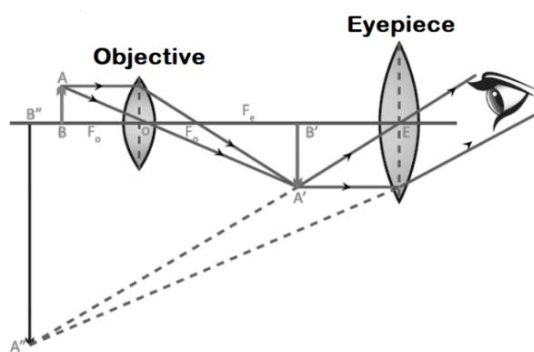
4. Explain the construction and working of a 'Compound Microscope'.

Construction :

- ❖ It consists of two convex lenses.
- ❖ Objective lens: have shorter focal length, placed near object.
- ❖ Eye lens: have larger focal length and larger aperture, placed near the observer's eye.
- ❖ Both lenses are fixed in a narrow tube with adjustable provision.

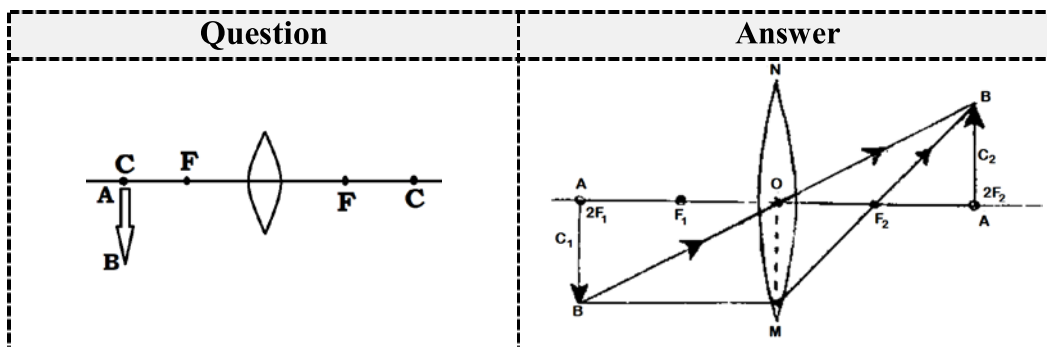
Working :

- ❖ Object AB is placed beyond the focal length of objective lens ($u > F_o$)
- ❖ A real, inverted and magnified image A'B' is formed at the other side of objective lens.
- ❖ Image A'B' acts as the object for eye lens.
- ❖ Eye lens is adjusted, so that A'B' falls within its principal focus.
- ❖ Virtual, enlarged and erect image A''B'' is formed on the same side of object.



Additional Questions

5. 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]



6. Write advantages and disadvantages of telescope.

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.
- ❖ Telescope can be viewed even with the low intensity of light.

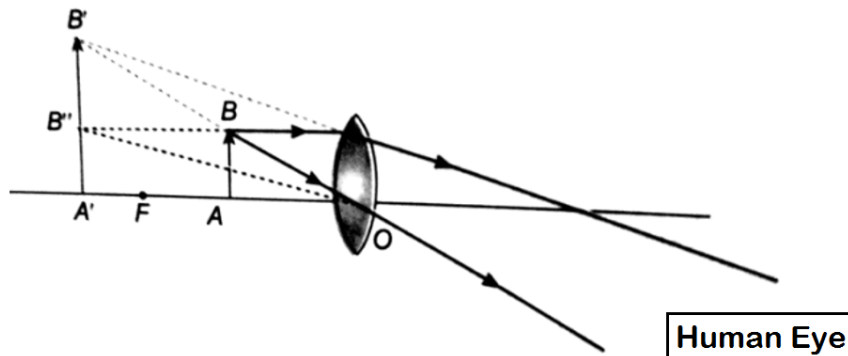
Disadvantages of Telescopes :

- ❖ Frequent maintenances needed.
- ❖ It is not easily portable one.

7. i) Draw the ray diagram of image formation in simple microscope [PTA – 2]
 ii) Find the position and write its nature and size of the image formed by Simple microscope.
 iii) Mention the uses of simple microscope.

i) Ray diagram :

- ❖ Object (AB) is placed within principal focus and observer's eye is just behind the lens.



ii) Position, nature and size of the image :

- ❖ An erect, virtual and enlarged image (A'B') is formed in the same side of the object
 ❖ Its distance is equal to the least distance of distinct vision (D).

iii) Uses of Simple microscope :

[SEP – 2020]

- ❖ Used by watch repairers and jewellers.
 ❖ Used to read small letters clearly.
 ❖ Used to observe parts of flowers, insects, etc.,
 ❖ Used to observe fingerprints in the field of forensic science.

VIII. Numerical Problems

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

Given : $f = 10$ cm, $u = -20$ cm, $v = ?$

$$\text{Solution : } \frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{10} + \frac{1}{-20}$$

$$= \frac{2-1}{20} = \frac{1}{20}$$

$$v = 20 \text{ cm}$$

Image distance is 20 cm.

Nature of image is Real and inverted image.

***Sign for f , u & v ***

For Concave lens,

f , u , $v \rightarrow -$ (All are negative.)

For Convex lens,

$f \rightarrow +$ $u \rightarrow -$

$v \rightarrow +$ (-ve only if object is between F&O)

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

Given : $f = -15$ cm, $u = -10$ cm, $h = 3$ cm, $h' = ?$

$$\text{Solution : } \frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-15} + \frac{1}{-10} = \frac{-2-3}{30}$$

$$\frac{1}{v} = -\frac{5}{30} = -\frac{1}{6}$$

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

$$\text{Magnification } m = \frac{v}{u} = \frac{-6}{-10} = 0.6$$

$$\text{Magnification } m = \frac{h'}{h} = \frac{h'}{3} = 0.6$$

$$h' = 0.6 \times 3 = 1.8 \text{ cm}$$

\therefore Height of the image h' is 1.8 cm.

Additional Problems

Also Practice : Text Book Example Problems Page No : 28 (Problem 2 & 3)

3. The power of a lens is $-2D$. Find the focal length of a lens. [PTA – 4]

Given : $P = -2D$

Solution : Power $(P) = \frac{1}{f} = -2D$

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

\therefore Focal length is 0.5 m

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]

Given : $h = 3 \text{ cm}$; $u = 10 \text{ cm}$; $v = 20 \text{ cm}$

Solution : Magnification, $m = \frac{v}{u} = \frac{20}{10} = 2$

$$\text{Magnification, } m = \frac{h'}{h}$$

$$h' = m \times h = 2 \times 3 = 6 \text{ cm}$$

\therefore Magnification is 2 and height is 6 cm.

IX. Higher order thinking (HOT) questions

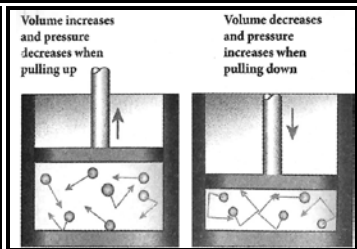
- While doing an experiment for the determination of focal length of a convex lens, Raja suddenly dropped the lens. It got broken into two halves along the axis. If he continues his experiment with the same lens, (a) can he get the image? (b) Is there any change in the focal length?
 - Yes.** He got the image. But, with less intensity.
 - No.** There is no change in the focal length, because it is cut along the axis.
- The eyes of the nocturnal birds like owl are having a large cornea and a large pupil. How does it help them? (or) How owls could see at night?
 - ❖ Nocturnal birds are the birds that are active at night. *Eg : Owl*
 - ❖ They have a large cornea and pupil. This increases the amount of light entering into its eyes.
 - ❖ This ability would enhance its night vision (i.e.) they could see clearly in dim light.

Additional Question

- A Student in a classroom can read textbook but he/ she cannot see the letters on the black board distinctly. What is his/ her eye defect? Mention its cause and suggest a remedy. [PTA–1]
 - ❖ His / Her eye defect is *Myopia or short sightedness*.
 - ❖ It occurs due to the **lengthening of eyeball**.
 - ❖ It can be corrected using a **concave lens**.

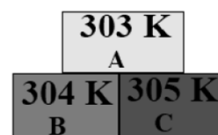
UNIT - 3

THERMAL PHYSICS



I. Choose the correct answer

- The value of universal gas constant
a) $3.81 \text{ Jmol}^{-1} \text{ K}^{-1}$ b) $8.03 \text{ Jmol}^{-1} \text{ K}^{-1}$ c) $1.38 \text{ Jmol}^{-1} \text{ K}^{-1}$ d) **$8.31 \text{ Jmol}^{-1} \text{ K}^{-1}$**
- If a substance is heated or cooled, the change in mass of that substance is [PTA – 1]
a) positive b) negative c) **zero** d) none of the above
- If a substance is heated or cooled, the linear expansion occurs along the axis of
a) X or –X b) Y or –Y c) both (a) and (b) d) **(a) or (b)**
- Temperature is the average _____ of the molecules of a substance.
a) difference in K.E and P.E b) sum of P.E and K.E
c) **difference in T.E and P.E** d) difference in K.E and T.E
- In the Given diagram, the possible direction of heat energy transformation is
a) **$A \leftarrow B, A \leftarrow C, B \leftarrow C$** b) $A \rightarrow B, A \rightarrow C, B \rightarrow C$
c) $A \rightarrow B, A \leftarrow C, B \rightarrow C$ d) $A \leftarrow B, A \rightarrow C, B \leftarrow C$



Additional Questions

- The co-efficient of linear expansion depends on _____. [PTA – 4]
a) original length b) increasing temperature c) nature of material d) **(a) and (b)**
- Variation in dimensions of any object due to rise in temperature is called as _____. [PTA – 5]
a) **thermal expansion** b) thermal variation c) thermal convection d) evaporation
- If the atoms or molecules of a gas do not interact with each other, then the gas is known as _____. [PTA – 6]
a) a real gas b) **an ideal gas** c) a noble gas d) a rare gas

II. Fill in the blanks

- The value of Avogadro number **$6.023 \times 10^{23} / \text{mole}$** . [SEP – 2020]
- The temperature and heat are **scalar** quantities. [PTA – 2]
- One calorie is the amount of heat energy required to raise the temperature of **1 g** of water through **1°C**.
- According to Boyle's law, the shape of the graph between pressure and reciprocal of volume is **straight line**.

Additional Question

- Temperature** is the average kinetic energy of the molecules of a substance. [PTA – 2]

III. True or False. If false correct it.

- For a given heat in liquid, the apparent expansion is more than that of real expansion. [False]
*For a given heat in liquid, the apparent expansion is **less than that of real expansion**.
- Thermal energy always flows from a system at higher temperature to a system at lower temperature. [True]
- According to Charles's law, at constant pressure, the temperature is inversely proportional to volume. [False]
[PTA – 2]
*According to Charles's law, at constant pressure, temperature of gas is **directly proportional to volume**.

Additional Question

4. During the process of transferring heat energy, the body at lower temperature is cooled while the body at higher temperature is heated. [PTA – 4] [False]

During the process of transferring heat energy, the body at lower temperature is **heated while the body at higher temperature is **cooled**.*

IV. Match the items in Column-I to the items in Column-II

Column I	Column II	Answer
1. Linear expansion	(a) change in volume	1-d) change in length
2. Superficial expansion	(b) hot body to cold body	2-e) change in area
3. Cubical expansion	(c) $1.381 \times 10^{-23} \text{ JK}^{-1}$	3-a) change in volume
4. Heat transformation	(d) change in length	4-b) hot body to cold body
5. Boltzmann constant	(e) change in area	5-c) $1.381 \times 10^{-23} \text{ JK}^{-1}$

V. Assertion & reason type questions

Mark the correct choice as

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

1. **Assertion :** If one end of the rod is heated, other end also is heated.

Reason : Heat always flows from a region of lower temperature to higher temperature of the rod.

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

Corrected statement: Heat always flows from a region of **higher** temperature to **lower** temperature of the rod.

2. **Assertion :** Gas is highly compressible than solid and liquid. [PTA – 2]

Reason : Interatomic or intermolecular distance in the gas is comparably high.

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

Additional Question

3. **Assertion :** Heat always flows from the body of higher temperature to the body of lower temperature.

Reason : The mass of the body is not altered when it is heated or cooled. [PTA – 5]

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

VI. Answer in briefly

1. Define one calorie.

[APR – 2023, AUG – 2022, MDL – 19]

One calories is the amount of heat energy required to rise the temperature of 1 gram of water through 1°C.

2. Distinguish between linear, areal (or) superficial expansion.

Linear Expansion	Areal / Superficial Expansion
1) When a body is heated or cooled, the length of the body changes.	1) When a body is heated or cooled, the area of the body changes.
2) Coefficient of linear expansion, $\alpha_L = \frac{\Delta L}{L_0 \Delta T}$	2) Coefficient of Areal expansion, $\alpha_A = \frac{\Delta A}{A_0 \Delta T}$

3. What is co-efficient of cubical expansion?

[PTA – 6]

It is the ratio of increase in volume of the body per degree rise in temperature to its unit volume.

$$\alpha_v = \frac{\Delta V}{V_0 \Delta T}$$

Its SI unit is K^{-1} .

4. State Boyle's law.

[JUN – 2023, MDL – 19, MAY – 2022]

When temperature is kept constant, volume of a fixed mass of gas is inversely proportional to its pressure.

$$P \propto \frac{1}{V} \quad (\text{i.e.}) \quad PV = \text{constant.}$$

5. State - the law of volume. (or) State Charles's law.

When pressure is kept constant, the volume of a gas is directly proportional to its temperature.

$$V \propto T \quad (\text{or}) \quad \frac{V}{T} = \text{constant}$$

6. Distinguish between ideal gas and real gas.

[JUN – 2023]

Ideal gas	Real gas
1. Atoms/molecules do not interact with each other.	1. Atoms/molecules interact with each other.
2. It has weaker intermolecular/interatomic force of attraction.	2. It has definite intermolecular/interatomic force of attraction.
3. Practically, no gas is ideal.	3. Practically, all gases are real gas.

7. What is co-efficient of real expansion?

[SEP – 2020]

It is the ratio of the true rise in the volume of the liquid per degree rise in temperature to its unit volume. Its SI unit is K^{-1} .

8. What is co-efficient of apparent expansion?

It is the ratio of the apparent rise in the volume of the liquid per degree rise in temperature to its unit volume. Its SI unit is K^{-1} .

Additional Questions

9. State Avogadro's Law.

[SEP – 2021]

Avogadro's law states that at constant pressure and temperature, the volume of a gas is directly proportional to number of atoms or molecules present in it.

$$V \propto n \quad (\text{or}) \quad \frac{V}{n} = \text{Constant}$$

10. Define Co-efficient of linear expansion.

[PTA – 1]

It is the ratio of increase in length of the body per degree rise in temperature to its unit length.

VIII. Answer in detail

1. Derive the ideal gas equation.

According to Boyle's law

$$PV = \text{Constant} \dots\dots\dots(1)$$

According to Charles's law

$$\frac{V}{T} = \text{Constant} \dots\dots\dots(2)$$

According to Avogadro's law

$$\frac{V}{n} = \text{Constant} \dots\dots\dots(3)$$

Combine (1), (2) & (3)

$$\frac{PV}{nT} = \text{Constant} \dots\dots\dots(4)$$

This is called a combined law of gases.

For a gas of μ moles, the number of atoms (n) = μN_A (5)

Equation (5) in (4), $\frac{PV}{\mu N_A T} = \text{Constant}$

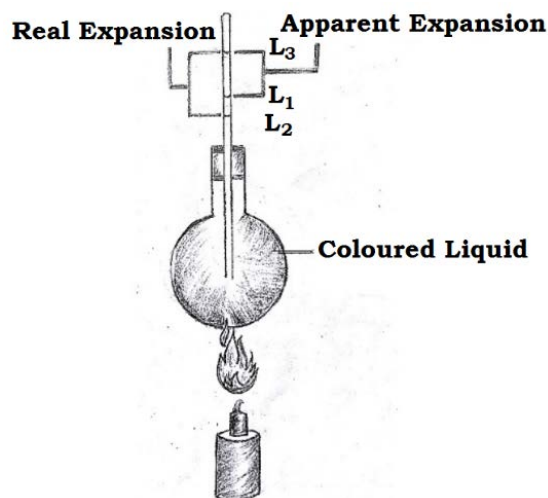
$$\frac{PV}{\mu N_A T} = k_B \quad (k_B = \text{Boltzmann constant} = 1.38 \times 10^{-23} \text{J K}^{-1})$$

$$PV = \mu N_A k_B T$$

Considering $\mu N_A k_B = R = 8.31 \text{ J mol}^{-1} \text{K}^{-1}$ R is Universal gas constant.Thus ideal gas equation (or) equation of state is $PV = RT$.

2. Explain the experiment of measuring the real and apparent expansion of a liquid with a neat diagram. [MDL – 19]

- ❖ The liquid whose real and apparent expansion is to be determined is poured in a container up to a level. Mark this level as L_1 .
- ❖ Now, heat the container and the liquid using a burner.
- ❖ Initially container expands. Hence, volume of liquid is reduced. Mark this level as L_2 .
- ❖ On further heating, the liquid expands and the level of liquid rises to L_3 .
- ❖ Difference between L_1 and L_3 is called apparent expansion.
- ❖ Difference between L_2 and L_3 is called real expansion.
- ❖ Real expansion is always more than apparent expansion.



$$\text{Real expansion} = L_3 - L_2$$

$$\text{Apparent expansion} = L_3 - L_1$$

VII. Numerical problems

1. Find the final temperature of a copper rod. Whose area of cross section changes from 10 m^2 to 11 m^2 due to heating. The copper rod is initially kept at 90 K . (Coefficient of superficial expansion is $0.0021/\text{K}$)

Given : $A_o = 10 \text{ m}^2$, $A = 11 \text{ m}^2$, $\Delta A = 11 - 10 = 1 \text{ m}^2$
 $T_o = 90 \text{ K}$, $T = ?$ $\Delta T = T - T_o = T - 90$, $\alpha_A = 0.0021 \text{ K}^{-1}$

Solution : $\frac{\Delta A}{A_o} = \alpha_A \Delta T \Rightarrow \Delta T = \frac{\Delta A}{A_o \alpha_A} = \frac{1}{10 \times 0.0021}$
 $T - 90 = \frac{1}{0.021} = 47.61$
 $T = 47.61 + 90 = 137.6 \text{ K}$
 \therefore Final temperature is **137.6 K**

2. Calculate the coefficient of cubical expansion of a zinc bar. Whose volume is increased from 0.25 m^3 to 0.3 m^3 due to the change in its temperature of 50 K .

Given : $V = 0.3 \text{ m}^3$ $V_o = 0.25 \text{ m}^3$ $\Delta T = 50 \text{ K}$

Solution : $\alpha_v = \frac{\Delta V}{V_o \Delta T} = \frac{V - V_o}{V_o \Delta T}$
 $\alpha_v = \frac{0.3 - 0.25}{0.25 \times 50} = \frac{0.05}{12.5} = 0.004 \text{ K}^{-1}$

\therefore The coefficient of cubical expansion is **0.004 K^{-1}** .

Additional Problems

Also Practice : Text Book Example Problems Page No : 38, 39 (Problem 1 & 2)

3. The length of an aluminium rod at the temperature 303 K is 50 m . What would be its increase in length when it is heated to 323 K ? (The linear co-efficient of Aluminium is $23 \times 10^{-6} \text{ K}^{-1}$) [PTA – 1]

Given : ΔL = Increase in length, $\Delta T = 323 \text{ K} - 303 \text{ K} = 20 \text{ K}$; $L_o = 50 \text{ m}$, $\alpha_L = 23 \times 10^{-6} \text{ K}^{-1}$

Solution : $\frac{\Delta L}{L_o} = \alpha_L \Delta T \Rightarrow \Delta L = \alpha_L \Delta T \times L_o$
 $\Delta L = (23 \times 10^{-6}) \times 20 \times 50 = 0.023$
 \therefore Increase in length is **0.023 m**

4. Convert 80°F temperature into kelvin scale.

[PTA – 6]

Given : Temperature = 80°F

Solution: Fahrenheit to Kelvin, $K = (F + 460) \times \frac{5}{9} = (80 + 460) \times \frac{5}{9} = 300 \text{ K}$

IX. HOT Question

1. If you keep ice at 0°C and water at 0°C in either of your hands, in which hand you will feel more chillness? Why?

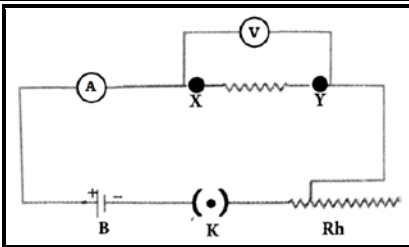
When water and ice are kept in either of our hand at 0°C , we feel more chillness in the hand of *ice*.

Reason: Ice requires additional latent heat energy to melt down compared to water.

\therefore Ice absorbs more heat when compared to water and we feel more chillness.

UNIT – 4

ELECTRICITY



I. Choose the best answer

- Which of the following is correct?
 a) Rate of change of charge is electrical power. b) Rate of change of charge is current.
 c) Rate of change of energy is current. d) Rate of change of current is charge.
- SI unit of resistance is [SEP – 2021]
 a) mho b) joule c) ohm d) ohm meter
- In a simple circuit, why does the bulb glow when you close the switch?
 a) The switch produces electricity b) Closing the switch completes the circuit
 c) Closing the switch breaks the circuit d) The bulb is getting charged
- Kilowatt hour is the unit of [JUN – 2023, AUG – 2022, MDL – 19]
 a) resistivity b) conductivity c) electrical energy d) electrical power

Additional Questions

- The effective resistance of three resistors of resistances $5\ \Omega$, $3\ \Omega$ and $2\ \Omega$ are connected in series is _____.
 a) $1.03\ \Omega$ b) $10\ \Omega$ c) $0.97\ \Omega$ d) $2.5\ \Omega$ [PTA – 2]
- Nichrome is used as heating element in electric heater, because it has [PTA – 3]
 a) high resistivity b) high melting point c) not easily oxidised d) all the above
- SI unit of specific resistance is _____. [PTA – 4]
 a) mho b) ohm/ metre c) ohm d) ohm metre

II. Fill in the blanks

- When a circuit is open, **current** cannot pass through it.
- The ratio of the potential difference to the current is known as **resistance**.
- The wiring in a house consists of **parallel** circuits.
- The power of an electric device is a product of **current** and **potential difference**.
- LED stands for **Light Emitting Diode**.

III. True or False. If false correct it.

- Ohm's law states the relationship between power and voltage. [False]
 *Ohm's law states the relationship between **current** and **potential difference**.
- MCB is used to protect household electrical appliances. [True]
- The SI unit for electric current is coulomb. [False]
 *The SI unit for electric current is **ampere**.
- One unit of electrical energy consumed is equal to 1000 kilowatt hour. [False]
 *One unit of electrical energy consumed is equal to **1** kilowatt hour.
- The effective resistance of three resistors connected in series is lesser than the lowest of the individual resistances. [False]
 *Effective resistance of three resistors in series is **greater** than **highest** of individual resistances.





IV. Match the items in Column-I to the items in Column-II

[PTA – 5]

Column I	Column II	Answer
(i) Electric current	(a) volt	i - (e) ampere
(ii) Potential difference	(b) ohm metre	ii - (a) volt
(iii) Specific resistance	(c) watt	iii - (b) ohm metre
(iv) Electrical power	(d) joule	iv - (c) watt
(v) Electrical energy	(e) ampere	v - (d) joule

Additional Question

[PTA – 2]

Column I	Column II	Answer
(a) Ammeter	(i) 	a - (iii)
(b) Diode	(ii) 	b - (i)
(c) Galvanometer	(iii) 	c - (iv)
(d) Resistor	(iv) 	d - (ii)

V. Assertion and Reason type questions

Mark the correct choice as

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

1. **Assertion:** Electric appliances with a metallic body have three wire connections.**Reason :** Three pin connections reduce heating of the connecting wires.**Ans. (c)***The assertion is true, but the reason is false.*2. **Assertion:** In a simple battery circuit the point of highest potential is the positive terminal of the battery.**Reason :** The current flows towards the point of the highest potential.**Ans. (c)***The assertion is true, but the reason is false.*3. **Assertion:** LED bulbs are far better than incandescent bulbs.**Reason :** LED bulbs consume less power than incandescent bulbs.**Ans. (a)***Both the assertion and the reason are true and the reason is the correct explanation of the assertion.*

VI. Very short answer questions

1. Define the unit of current.

[JUN – 2023]

- ❖ SI unit of current is ampere (A). Current through a conductor is one ampere, when a charge of one coulomb flows across its cross-section, in one second.

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

2. What happens to the resistance, as the conductor is made thicker?

Resistance decreases. Because resistance is inversely proportional to area of cross section. ($R \propto \frac{1}{A}$).

3. Why is tungsten metal used in bulbs, but not in fuse wires?

Tungsten have high melting point.

- ❖ It cannot melt easily and so it is not be used in fuse wire.
- ❖ It can bear high heat for glowing and so it is used in bulbs.

4. Name any two devices, which are working on the heating effect of the electric current.

- ❖ Fuse wire, Filament in bulbs, electric iron, toaster, oven, etc.,

Additional Questions

5. Electric power lines in electrical post, hang very low in hot summer, why? [PTA – 4]

The power lines expands on heating during hot summer, this makes the lines to hang low.

6. Which instrument is used to measure the potential difference? How will you connect it in a circuit? [PTA – 5]

Voltmeter. It is connected in parallel.

VII. Short answer questions

1. Define electric potential and potential difference.

Electric potential: It is the amount of work done in moving a unit positive charge from infinity to that point against the electric force.

Potential difference: It is the amount of work done in moving a unit positive charge from one point to another point against the electric force.

$$\text{Potential Difference (V)} = \frac{\text{Work done (W)}}{\text{Charge (Q)}}$$

2. What is the role of the earth wire in domestic circuits?

- ❖ Earth wire acts as protective conductor and saves us from electric shocks.
- ❖ When a live wire accidentally touches the metallic body of the electric appliances, earth wire provides a low resistance path to the current and sends it from the body to the earth.

3. State Ohm's law.

At a constant temperature, the steady current 'I' flowing through a conductor is directly proportional to the potential difference 'V' between the two ends of the conductor.

$$I \propto V \Rightarrow V = IR$$

Where R → Resistance of the material.

4. Distinguish between the resistivity and conductivity of a conductor.

Resistivity (ρ)	Conductivity (σ)
i) It is the resistance of a conductor of unit length and unit area of cross section. ($\rho = \frac{RA}{L}$)	i) It is the reciprocal of electrical resistivity. ($\sigma = \frac{1}{\rho}$)
ii) Its unit is ohm metre (Ωm).	ii) Its unit is mho metre⁻¹ .
iii) It is the measure of resisting power.	iii) It is the measure of ability to pass the current.

5. What connection is used in domestic appliances and why?

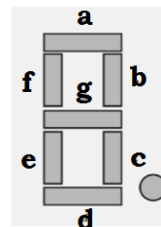
Domestic appliances are connected in parallel.

Reason: ❖ Disconnection of one circuit does not affect other circuit

❖ Each appliance gets an equal voltage.

Additional Questions**6. Define the unit of electrical energy consumption.**

- ❖ Electrical energy consumed is the product of electric power and time of usage. [PTA – 5]
- ❖ Its SI unit is watt second. But, consumption of electrical energy is expressed in watt hour.
- ❖ One kilowatt hour is one unit of electrical energy.
- ❖ $1 \text{ kWh} = 1000 \text{ watt hour} = 3.6 \times 10^6 \text{ J}$.

7. Draw the picture of seven segment display for an alpha numeric number.[PTA–3]**VIII. Long answer questions****1. With the help of a circuit diagram derive the formula for the resultant resistance of three resistances connected: a) in series and b) in parallel****a) Resistance in Series :**

R_1, R_2 and R_3 are the resistors in series, R_s = resultant resistance,

V_1, V_2 and V_3 are potential differences. Current is same and let it be I .

According to ohm's law,

$$V_1 = IR_1 \rightarrow (1)$$

$$V_2 = IR_2 \rightarrow (2)$$

$$V_3 = IR_3 \rightarrow (3)$$

$$V = IR_s \rightarrow (4)$$

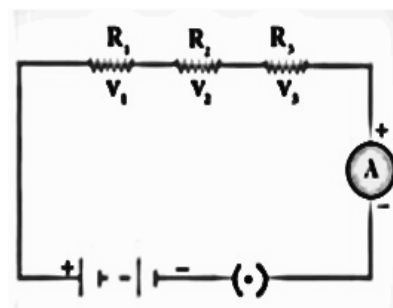
The sum of the potential differences of each resistor is

$$V = V_1 + V_2 + V_3 \rightarrow (5)$$

$$IR_s = IR_1 + IR_2 + IR_3$$

$$\boxed{R_s = R_1 + R_2 + R_3}$$

\therefore When resistors are in series, resultant resistance is the sum of individual resistances.

**b) Resistance in parallel :**

[PTA – 4]

R_1, R_2 and R_3 are the resistors in parallel, R_p = resultant resistance.

Potential difference is same for all resistors.

Current I at A divides into I_1, I_2 and I_3 .

According to ohm's law,

$$I_1 = \frac{V}{R_1} \dots\dots\dots (1)$$

$$I_2 = \frac{V}{R_2} \dots\dots\dots (2)$$

$$I_3 = \frac{V}{R_3} \dots\dots\dots (3)$$

$$I = \frac{V}{R_p} \dots\dots\dots (4)$$

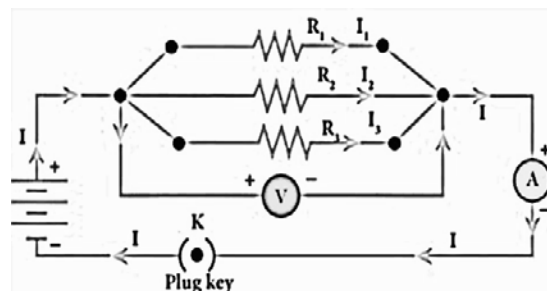
Total current is

$$I = I_1 + I_2 + I_3 \dots\dots\dots (5)$$

$$\Rightarrow \frac{V}{R_p} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\boxed{\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

\therefore When resistors are in parallel, the sum of the reciprocals of individual resistance is equal to the reciprocal of resultant resistance.



2. a) What is meant by electric current?

[MAY - 2022, PTA – 1]

It is the rate of flow of charges in a conductor. (or) It is the amount of charges flowing in any cross section of a conductor in unit time.

$$I = \frac{Q}{t}$$

b) Name and define its unit. (or) Define the unit of electric current. [MAY - 2022, PTA– 1]

- ❖ SI unit of electric current is ampere (A).
- ❖ Current flowing through a conductor is said to be one ampere, when a charge of one coulomb flows across any cross-section of a conductor, in one second.

$$1 \text{ ampere} = \frac{1 \text{ coulomb}}{1 \text{ second}}$$

c) Which instrument is used to measure the electric current? How should it be connected in a circuit? [MAY - 2022, PTA– 1]

Ammeter. It should be **connected in series** in a circuit.

3. a) State Joule's law of heating. (Or) Write two properties of the heat produced in any resistor, according to the Joules Law of heating. [APR – 2023]

Joules' law of heating states that the heat produced in any resistor is

- ❖ directly proportional to the square of the current.
- ❖ directly proportional to the resistance.
- ❖ directly proportional to the time.

$$H = I^2 R t$$

b) An alloy of nickel and chromium is used as the heating element. Why?

- Because,
- (i) It has high resistivity and high melting point.
 - (ii) It is not easily oxidized.

c) How does a fuse wire protect electrical appliances?

- ❖ When a large current passes, the fuse wire melts due to Joule's heating effect. Hence, the circuit gets disconnected. Thus, electric appliances are saved from any damage.

4. Explain about domestic electric circuits. (circuit diagram not required) [SEP – 2020]**Source :**

Electricity produced in power stations is distributed to domestic circuits through overhead and underground cables. Power supply is brought to main-box from a distribution panel.

Main-box :

Meter : Used to record the consumption of electrical energy.

Fuse box : Contains fuse wire or miniature circuit breaker (MCB). Used to protect appliances.

Types of wires :

* **Live wire** has red insulation.

* **Neutral wire** has black insulation.

Domestic electric circuit :

- ❖ Alternating current with electric potential of 220 V is supplied.
- ❖ Live wire connected via main fuse and neutral wire enter into electricity meter.
- ❖ These wires then enter into main switch.
- ❖ **There are two separate circuits :**
 - ☞ **5 A rating** – for low power rating appliances. **Eg :** Tube lights, Bulbs, Fans
 - ☞ **15 A rating** – for high power rating appliances. **Eg :** AC, Fridge, Heaters
- ❖ Circuits are in parallel. Disconnection of one will not affect the other. Each get equal voltage.

5. a) What are the advantages of LED TV over the normal TV? [PTA – 6]





- ❖ It has brighter picture quality.
- ❖ It is thinner in size.
- ❖ It uses less power
- ❖ It consumes less energy.
- ❖ Its life span is more.
- ❖ It is more reliable.

5. b) List the merits of LED bulb. [PTA – 1]

- ❖ There is no loss of energy in the form of heat.
- ❖ It requires low power.
- ❖ It is not harmful to environment.
- ❖ It is cost efficient and energy efficient.
- ❖ Many colours are available.
- ❖ Mercury and other toxic materials are not required.

Additional Question

6. Write the symbols and uses of the components commonly used in a circuit. [SEP – 2021]

Component	Symbol used	Component	Symbol used
Resistor		A diode	
Ground connection		Light Emitting Diode (LED)	

IX. Numerical problems

1. An electric iron consumes energy at the rate of 420 W when heating is at the maximum rate and 180 W when heating is at the minimum rate. The applied voltage is 220 V. What is the current in each case?

Given : $V = 220 \text{ V}$, $P_{\max} = 420 \text{ W}$, $P_{\min} = 180 \text{ W}$

Solution : $P = VI$

$$I = \frac{P}{V}$$

$$I_{\max} = \frac{P_{\max}}{V} = \frac{420}{220} = \frac{21}{11} = 1.909 \text{ A}$$

$$I_{\min} = \frac{P_{\min}}{V} = \frac{180}{220} = \frac{9}{11} = 0.818 \text{ A}$$

2. A 100 watt electric bulb is used for 5 hours daily and four 60 watt bulbs are used for 5 hours daily. Calculate the energy consumed (in kWh) in the month of January.

Solution : No. of days in January month = 31 days

$$\begin{aligned} \text{Energy consumed by one 100 W bulb} &= P \times t \times \text{no. of days used} \times \text{no. of bulbs} \\ &= 100 \times 5 \times 31 \times 1 = 15500 \\ &= 15.5 \text{ kWh.} \end{aligned}$$

$$\begin{aligned} \text{Energy consumed by four 60 W bulb} &= P \times t \times \text{no. of days used} \times \text{no. of bulbs} \\ &= 60 \times 5 \times 31 \times 4 = 37.2 \text{ kWh} \end{aligned}$$

$$\therefore \text{Total energy consumed} = 15.5 + 37.2 = 52.7 \text{ kWh}$$

3. A torch bulb is rated at 3 V and 600 mA. Calculate it's

- a) power b) resistance c) energy consumed if it is used for 4 hour.

Given : $V = 3 \text{ V}$; $I = 600 \text{ mA} = 0.6 \text{ A}$

Solution : a) **Power :** $P = VI = 3 \times 0.6 = 1.8 \text{ watt}$

b) **Resistance :** $R = \frac{V}{I} = \frac{3}{0.6} = 5 \Omega$

c) **Energy consumed if it used for 4 hour.**

$$E = \text{power} \times \text{time} = 1.8 \times 4 = 7.2 \text{ watt hour}$$

4. A piece of wire having a resistance R is cut into five equal parts.

a) How will the resistance of each part of the wire change compared with the original resistance?

b) If the five parts of the wire are placed in parallel, how will the resistance of the combination change?

c) What will be the ratio of the effective resistance in series connection to that of the parallel connection?

Solution :

a) length of each part $L' = \frac{L}{5}$ & Resistance of each part, $R' = \frac{\rho L'}{A} = \frac{\rho L}{5A} = \frac{R}{5}$

\therefore Resistance of each part is reduced to one-fifth of the original resistance.

b) If the five parts are placed in parallel

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4} + \frac{1}{R_5}$$

$$\frac{1}{R_P} = \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} + \frac{5}{R} = \frac{25}{R}$$

$$\Rightarrow R_P = \frac{R}{25}$$

\therefore Resistance of each part is reduced to one-twenty-fifth of the original resistance.

c) If the five parts are connected in series, Resistance $R_S = R$

$$\frac{R_S}{R_P} = \frac{R}{\frac{R}{25}} = \frac{R \times 25}{R} = \frac{25}{1}$$

\therefore Ratio is $R_S : R_P = 25 : 1$

Additional Problems

Also Practice : Text Book Example Problems Page No : 43, 46 & 51 (Problem 1, 3 & 6)

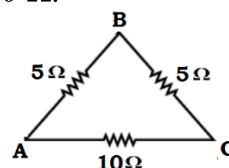
5. Calculate the effective resistance of given circuit across terminals AC. [PTA – 2]

Given : $R_1 = 5 \Omega$, $R_2 = 5 \Omega$ are connected in series which is parallel to $R_3 = 10 \Omega$.

Solution: $R_s = R_1 + R_2 = 5 + 5 = 10 \Omega$

$$\frac{1}{R_P} = \frac{1}{10} + \frac{1}{10} = \frac{2}{10} = \frac{1}{5} \Rightarrow R_P = 5 \Omega$$

\therefore Effective resistance across AC, $R_P = 5 \Omega$



6. A piece of wire having a resistance of 5 ohm cut into five equal parts. If the five parts of the wire are connected in parallel, then find the effective resistance of the combination?

Given: $R = 5 \Omega$, Length of single part $L' = \frac{L}{5}$

[PTA – 3]

Solution: $R' = \frac{\rho L'}{A} = \frac{\rho L}{5A} = \frac{R}{5} = \frac{5}{5} = 1 \Omega$

($\because R = \frac{\rho L}{A}$)

Effective resistance, $R_P = \frac{R'}{5} = \frac{1}{5} = 0.2 \Omega$

7. An electric lamp of resistance 20 ohm and a resistance of 4 ohm are connected in series to a 6 v battery as shown in the figure. [PTA – 6]

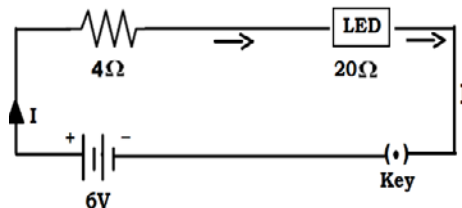
- Find the total resistance of the circuit.
- Find the current flowing through the circuit.
- Find the potential difference across the resistor.

Given : $R_1 = 20 \Omega$, $R_2 = 4 \Omega$ $V = 6 \text{ V}$

Solution: a) Total Resistance $R_s = R_1 + R_2 = 20 \Omega + 4 \Omega \Rightarrow R_s = 24 \Omega$

b) Current, $I = \frac{V}{R} = \frac{6}{24} = 0.25 \text{ A}$

c) Potential difference $V = IR = 0.25 \times 4 = 1 \text{ V}$



8. A charge of 10 coulomb flows through a bulb for 5 seconds. What is the current through the bulb? [MDL – 19]

Given : $Q = 10 \text{ C}$, $t = 5 \text{ s}$

Solution : $I = \frac{Q}{t} = \frac{10}{5} = 2 \text{ A}$ \therefore The current through the bulb, $I = 2 \text{ A}$

X. HOTS questions

1. Two resistors when connected in parallel give the resultant resistance of 2 ohm; but when connected in series the effective resistance becomes 9 ohm. Calculate the value of each resistance.

Given: $R_p = 2 \Omega$ $R_s = 9 \Omega$

Solution :

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{2} \quad \dots\dots\dots (1)$$

$$R_s = R_1 + R_2 = 9 \Omega \quad \dots\dots\dots (2)$$

$$R_2 = 9 - R_1 \quad \dots\dots\dots (3)$$

Substitute (3) in (1)

$$\frac{1}{R_1} + \frac{1}{9 - R_1} = \frac{1}{2}$$

$$\frac{9 - R_1 + R_1}{R_1 (9 - R_1)} = \frac{1}{2}$$

$$\frac{9}{R_1 (9 - R_1)} = \frac{1}{2}$$

$$18 = 9 R_1 - R_1^2$$

$$R_1^2 - 9 R_1 + 18 = 0$$

$$(R_1 - 3) (R_1 - 6) = 0$$

$$R_1 = 3 \Omega \quad (\text{or}) \quad R_1 = 6 \Omega$$

$$R_2 = 9 - 3 = 6 \Omega \quad (\text{or}) \quad R_2 = 9 - 6 = 3 \Omega$$

\therefore Resistance of the two resistors are **3 Ω and 6 Ω .**

2. How many electrons are passing per second in a circuit in which there is a current of 5 A?

Given : $I = 5 \text{ A}$; Time, $t = 1 \text{ s}$; $e = 1.6 \times 10^{-19} \text{ C}$

[MDL – 19]

Solution : $I = \frac{Q}{t} = \frac{ne}{t}$ [$\because Q = ne$]

$$n = \frac{It}{e} = \frac{5 \times 1}{1.6 \times 10^{-19}} \Rightarrow n = 3.125 \times 10^{19} \text{ electrons}$$

$\therefore 3.125 \times 10^{19}$ electrons are passing per second.

3. A piece of wire of resistance 10 ohm is drawn out so that its length is increased to three times its original length. Calculate the new resistance.

Given : $R = 10 \Omega$; Original length = L ; Increased length = $3 L$

Solution : If length is increased to 3 times the original length at constant volume,

area of cross section is decreased to 3 times the original area. $\therefore A' = \frac{A}{3}$

$$\text{New Resistance, } R' = \frac{\rho L'}{A'} = \frac{\rho 3L}{\frac{A}{3}} = 9 \frac{\rho L}{A} = 9 R = 9 \times 10 = 90 \Omega$$

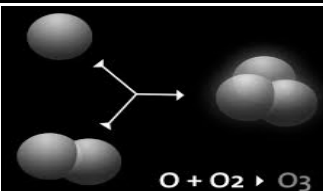
\therefore The new resistance is **90 Ω .**

CHEMISTRY

- Unit 7 - Atoms and Molecules
- Unit 8 - Periodic Classification of Elements
- Unit 9 - Solutions

UNIT – 7

ATOMS AND MOLECULES



I. Choose the best answer

- Which of the following has the smallest mass?
a) 6.023×10^{23} atoms of He **b) 1 atom of He** c) 2 g of He d) 1 mole atoms of He
- Which of the following is a triatomic molecule? [MDL – 19, PTA – 1]
a) Glucose b) Helium **c) Carbon dioxide** d) Hydrogen
- The volume occupied by 4.4 g of CO_2 at S.T.P
a) 22.4 litre **b) 2.24 litre** c) 0.24 litre d) 0.1 litre
- Mass of 1 mole of Nitrogen atom is
a) 28 amu b) 14 amu c) 28 g **d) 14 g**
- Which of the following represents 1 amu?
a) Mass of a C – 12 atom b) Mass of a hydrogen atom
c) $\frac{1}{12}$ th of the mass of a C – 12 atom d) Mass of O – 16 atom
- Which of the following statement 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 6.023×10^{23} electrons.
- 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
- In the nucleus of ${}_{20}Ca^{40}$, 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
- The gram molecular mass of oxygen molecule is [AUG - 2022]
a) 16 g b) 18 g **c) 32 g** d) 17 g
- 1 mole of any substance contains _____ molecules.
a) 6.023×10^{23} b) 6.023×10^{-23} c) 3.0115×10^{23} d) 12.046×10^{23}

Additional Questions

- The gram molecular mass of water is: [APR – 2023]
a) 2 g b) 16 g **c) 18 g** d) 8 g
- 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
- If a molecule is made of similar kind of atoms, then it is called _____. [MAY -22, PTA-6]
a) mono atomic molecule b) hetero atomic molecule
c) homo atomic molecule d) poly atomic molecule

II. Fill in the blanks

- Atoms of different elements having same mass number, but different atomic numbers are called isobars.
- Atoms of one element can be transmuted into atoms of other element by artificial transmutation.
- The sum of the numbers of protons and neutrons of an atom is called its mass number.
- Relative atomic mass is otherwise known as standard atomic weight.
- The average atomic mass of hydrogen is 1.008 amu.
- If a molecule is made of similar kind of atoms, then it is called homo atomic molecule.
- The number of atoms present in a molecule is called its atomicity. [PTA – 4]
- One mole of any gas occupies 22400 ml at S.T.P.
- Atomicity of phosphorous is 4.

Additional Question

- Atoms of different elements having same number of neutrons are called isotones. [PTA – 4]

III. Match the following

Column I	Column II	Answer	Hint : No. of moles = $\frac{\text{Mass}}{\text{Atomic/molecular mass}}$
1. 8g of O ₂	4 moles	1) 0.25 moles	1) $8\text{g of O}_2 = \frac{8}{32} = 0.25 \text{ moles}$
2. 4g of H ₂	0.25 moles	2) 2 moles	2) $4\text{g of H}_2 = \frac{4}{2} = 2 \text{ moles}$
3. 52 g of He	2 moles	3) 13 moles	3) $52 \text{ g of He} = \frac{52}{4} = 13 \text{ moles}$
4. 112 g of N ₂	0.5 moles	4) 4 moles	4) $112 \text{ g of N}_2 = \frac{112}{28} = 4 \text{ moles}$
5. 35.5 g of Cl ₂	13 moles	5) 0.5 mole	5) $35.5 \text{ g of Cl}_2 = \frac{35.5}{71} = 0.5 \text{ moles}$

IV. True or False: (if false give the correct statement)

- Two elements sometimes can form more than one compound. [True]
- Noble gases are diatomic. [False]
*Noble gases are **monoatomic**.
- The gram atomic mass of an element has no unit. [False]
* The **relative** atomic mass of an element has no unit.
- 1 mole of Gold and Silver contain same number of atoms. [True]
- Molar mass of CO₂ is 42g. [False]
* Molar mass of CO₂ = $12 + (16 \times 2) = 44 \text{ g}$.

V. Assertion & Reason

Answer the following questions using the data given below:

- i) A and R are correct, R explains the 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.

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

Reason : An atom of aluminium is 27 times heavier than $\frac{1}{12}$ th of the mass of the C – 12 atom.

Ans. (iv)

A and R are correct, R does not explain A.

- 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. Define: Relative atomic mass (or) Define Standard atomic weight.

Relative Atomic mass of an element is the ratio between average mass of its isotope to $\frac{1}{12}$ th part of the mass of a carbon-12 atom. [JUN – 23, AUG – 22, PTA – 3]

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

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

Isotope	Atomic 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

3. Define: Atomicity. Give an example. [APR – 2023, AUG – 2022, MAY-2022, SEP – 2021]

❖ Number of atoms present in molecule is called its atomicity.

❖ **Eg :** Atomicity of Phosphorous(P_4) is 4.

4. Give any two examples for heterodiatomic molecules.

[AUG - 2022]

Hydrogen Chloride (HCl), Hydrogen Fluoride (HF)

5. What is Molar volume of a gas?

It is the volume occupied by one mole of a gas at STP. Its value is 22.4 litre / 22400 ml

6. Find the percentage of nitrogen in ammonia.

[PTA – 1]

$$\% \text{ of Nitrogen in } \text{NH}_3 = \frac{\text{Mass of element}}{\text{Molecular mass}} \times 100 = \frac{14}{17} \times 100 = 82.35 \%$$

VII. Long answer questions

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

Molecular mass of $\text{H}_2\text{O} = (1 \times 2) + 16 = 18 \text{ g}$

$$\begin{aligned} \text{Number of molecules} &= \frac{\text{Mass of water}}{\text{Molecular mass}} \times \text{Avogadro number} \\ &= \frac{0.18}{18} \times 6.023 \times 10^{23} \end{aligned}$$

$$\therefore \text{The No. of water molecules} = 6.023 \times 10^{21}$$

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)

Mass = No. of moles \times Molecular mass

$$\text{Mass of } \text{N}_2 = 1 \times (14 \times 2) = 28$$

$$\text{Mass of } \text{H}_2 = 3 \times (1 \times 2) = 6$$

$$\text{Mass of } \text{NH}_3 = 2 \times (14 + (3 \times 1)) = 34$$

1 mole of nitrogen (28 g) + 3 moles of hydrogen (6 g) \rightarrow 2 moles of ammonia (34 g)

3. Calculate the number of moles in i) 27g of Al ii) 1.51×10^{23} molecules of NH_4Cl . [PTA – 5]

i) 27g of Al :

$$\begin{aligned} \text{Number of moles} &= \frac{\text{Mass of Molecule}}{\text{Atomic mass of Molecule}} \\ &= \frac{27}{27} = 1 \text{ mole} \end{aligned}$$

ii) 1.51×10^{23} molecules of NH_4Cl :

$$\begin{aligned} \text{Number of moles} &= \frac{\text{Number of Molecules}}{\text{Avogadro number}} \\ &= \frac{1.51 \times 10^{23}}{6.023 \times 10^{23}} = 0.25 \text{ moles} \end{aligned}$$

4. Give the salient features of “Modern atomic theory”. [AUG – 2022, SEP – 2020, PTA – 5]

- ❖ Atom is no longer indivisible. It is divided into electron, proton and neutron.
- ❖ **Isotope** : Atoms of the same element having different atomic mass. *Eg* : ${}_{17}\text{Cl}^{35}$, ${}_{17}\text{Cl}^{37}$
- ❖ **Isobars** : Atoms of different elements having same atomic masses. *Eg* : ${}_{18}\text{Ar}^{40}$, ${}_{20}\text{Ca}^{40}$
- ❖ **Artificial transmutation** : Atom is no longer indestructible.
- ❖ Atoms may not always combine in a simple whole number ratio.
Eg : Glucose $\text{C}_6\text{H}_{12}\text{O}_6$ C:H:O = 6:12:6 or 1:2:1
- ❖ 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. [PTA-6, MDL-19]

$$\text{Relative Molecular Mass (RMM)} = \frac{\text{Mass of 1 molecule of gas (or) vapour at STP}}{\text{mass of 1 atom of hydrogen}} \dots\dots\dots (1)$$

$$\text{Vapour Density (V.D)} = \frac{\text{Mass of a given volume of gas (or) Vapour at STP}}{\text{Mass of the same volume of Hydrogen}} \dots\dots\dots (2)$$

According to Avogadro's law, Equal volumes of all gases contain equal number of molecules.

Let, number of molecules in the considered volume = n

$$\therefore \text{Vapour Density (at STP)} = \frac{\text{Mass of 'n' molecules of a gas (or) Vapour at STP}}{\text{mass of 'n' molecules of hydrogen}}$$

$$\text{Let } n = 1, \text{ then } \text{VD} = \frac{\text{Mass of 1 molecule of a gas (or) Vapour at STP}}{\text{mass of 1 molecule of hydrogen}}$$

Hydrogen is diatomic molecule so,

$$\text{Vapour Density} = \frac{\text{Mass of 1 molecule of gas (or) Vapour at STP}}{2 \times \text{Mass of 1 atom of hydrogen}}$$

$$2 \times \text{Vapour density} = \frac{\text{Mass of 1 molecule of gas (or) Vapour at STP}}{\text{Mass of 1 atom of hydrogen}}$$

$$2 \times \text{Vapour density} = \text{Relative Molecular Mass} [\because \text{By Eqn (1)}]$$

$$\boxed{\text{Relative Molecular Mass} = 2 \times \text{Vapour Density}}$$

Additional Questions

6. Distinguish between atoms and molecules.

[MAY - 2022]

Atom	Molecule
1. Smallest particle of an element.	1. Smallest particle of an element / compound.
2. Does not exist in free state except noble gas.	2. Exists in free state.
3. Except some noble gas, others are highly reactive.	3. Less reactive.
4. Does not have a chemical bond.	4. Atoms are held by chemical bonds.

7. What is Avogadro's Hypothesis? State its application.

Avogadro's law / Hypothesis: “Equal volumes of all gases under similar conditions of temperature and pressure contain equal number of molecules”.

Applications of Avogadro's law:

[APR – 2023, SEP – 2020]

- i) Explains Gay-Lussac's law.
- ii) Helps in determining atomicity.
- iii) Molecular formula can be derived.
- iv) Determines the relation between molecular mass and vapour density.
- v) Helps to determine gram molar volume.

8. In chemical industries, the following chemical reaction is used to produce ammonia in large scale. $\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3$ [PTA – 3]

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

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

$$\text{Molecular mass of NH}_3 = 14 + (3 \times 1) = 17 \text{ g}$$

$$\text{No. of moles of NH}_3 = \frac{\text{mass of NH}_3 \text{ produced}}{\text{molecular mass of NH}_3} = \frac{10^6}{17}$$

$$\begin{aligned} \text{Required Mass of H}_2 &= \text{No. of moles of H}_2 \times \text{Molecular mass} \\ &= \frac{10^6}{17} \times \frac{3}{2} \times (2 \times 1) = 176.47 \text{ kg of H}_2 \end{aligned}$$

$$\begin{aligned} \text{Required Mass of N}_2 &= \text{No. of moles of N}_2 \times \text{Molecular mass} \\ &= \frac{10^6}{17} \times \frac{1}{2} \times (14 \times 2) = 823.53 \text{ kg of N}_2 \end{aligned}$$

$$\therefore \text{Required mass of Nitrogen gas} = 823.53 \text{ kg}$$

$$\text{Required mass of Hydrogen gas} = 176.47 \text{ kg}$$

VIII. HOT Question

1. Calcium carbonate is decomposed on heating in the following reaction.



- i) How many moles of Calcium carbonate are involved in this reaction?

One mole of CaCO_3 .

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

$$\begin{aligned} \text{Gram Molecular Mass of CaCO}_3 &= (40 \times 1) + (12 \times 1) + (16 \times 3) \\ &= 40 + 12 + 48 = 100 \text{ g} \end{aligned}$$

- iii) How many moles of CO_2 are there in this equation?

One mole of CO_2 .

IX. Solve the following problems.

1. How many grams are there in the following?

[PTA – 4]

- i) 2 moles of hydrogen molecule, H_2

$$\text{Molecular mass of H}_2 = 1 \times 2 = 2$$

$$\text{Mass} = \text{No. of moles} \times \text{Molecular mass} = 2 \times 2 = 4 \text{ g}$$

- ii) 3 moles of chlorine molecule, Cl_2

$$\text{Molecular mass of Cl}_2 = 35.5 \times 2 = 71$$

$$\text{Mass} = \text{No. of moles} \times \text{Molecular mass} = 3 \times 71 = 213$$

- iii) 5 moles of sulphur molecule, S_8

$$\text{Molecular mass of S}_8 = 32 \times 8 = 256$$

$$\text{Mass} = \text{No. of moles} \times \text{Molecular mass} = 5 \times 256 = 1280 \text{ g}$$

- iv) 4 moles of phosphorous molecule, P_4

$$\text{Molecular mass of P}_4 = 30 \times 4 = 120$$

$$\text{Mass} = \text{No. of moles} \times \text{Molecular mass} = 4 \times 120 = 480 \text{ g}$$

Note : In Text Book solved problems (Pg. no. 100, Q.No. I-3), atomic mass of Phosphorus is given as 30. But, correct approximate value is 31.

2. Calculate the (mass) % of each element in calcium carbonate. (Atomic mass: C -12, O -16, Ca - 40)

Molecular mass of $\text{CaCO}_3 = 40 + 12 + (16 \times 3) = 100 \text{ g}$ [JUN – 2023, PTA – 2]

Elements	Mass of Individual element	$\frac{\text{Mass of element}}{\text{Molecular mass}} \times 100$	Mass percentage of each element
Ca	40	$\frac{40}{100} \times 100$	40%
C	12	$\frac{12}{100} \times 100$	12%
O	$3 \times 16 = 48$	$\frac{48}{100} \times 100$	48%

3. Calculate the % of oxygen in $\text{Al}_2(\text{SO}_4)_3$. (Atomic mass: Al -27, O -16, S - 32). [PTA – 2]

Molecular mass of $\text{Al}_2(\text{SO}_4)_3 = (2 \times 27) + (3 \times (32 + (4 \times 16))) = 342 \text{ g}$

$$\% \text{ of O in } \text{Al}_2(\text{SO}_4)_3 = \frac{3 \times 4 \times 16}{342} \times 100 = \frac{192}{342} \times 100 = 56.14\%$$

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

Let a_1, a_2 be the % abundance of B-10 and B-11 respectively. $m_1 = 10, m_2 = 11$

$$a_1 + a_2 = 100 \Rightarrow a_1 = 100 - a_2$$

$$\begin{aligned} \text{Average Atomic Mass} &= m_1 \times \frac{a_1}{100} + m_2 \times \frac{a_2}{100} \\ &= 10 \times \frac{(100 - a_2)}{100} + 11 \times \frac{a_2}{100} \\ &= 10 \times \left(1 - \frac{a_2}{100}\right) + \frac{11a_2}{100} \\ &= 10 - \frac{10a_2}{100} + \frac{11a_2}{100} \end{aligned}$$

$$10.804 = 10 + \frac{a_2}{100} \quad (\because \text{Average Atomic Mass of B} = 10.804 \text{ amu})$$

$$\frac{a_2}{100} = 10.804 - 10 = 0.804$$

$$a_2 = 0.804 \times 100 = 80.4 \%$$

$$a_1 = 100 - 80.4 = 19.6 \%$$

\therefore % abundance of B-10 = 19.6 % & % abundance of B-11 = 80.4%

Additional Problems

Also Practice : Text Book Example Problems Page No : 100 (Problem I – 2 & II – 1)

5. Calculate the number of molecules present in the 36 g water. [MDL – 19]

$$\begin{aligned} \text{Number of molecules of water} &= \frac{\text{Given mass}}{\text{Gram Molecular Mass}} \times \text{Avogadro number} \\ &= \frac{36}{18} \times 6.023 \times 10^{23} \\ &= 12.046 \times 10^{23} \end{aligned}$$

6. 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]

$$\text{No. of moles of C} = \frac{\text{Mass \% of Carbon}}{\text{Atomic mass of Carbon}} = \frac{27.28}{12} = 2.27 \cong 2$$

$$\text{No. of moles of O} = \frac{\text{Mass \% of Oxygen}}{\text{Atomic mass of Oxygen}} = \frac{72.73}{16} = 4.54 \cong 4$$

Molecular formula : C_2O_4 (or) 2 CO_2

Molecular mass = $(2 \times 12) + (4 \times 16) = 88 \text{ g}$

UNIT – 8

PERIODIC CLASSIFICATION OF ELEMENTS

I. Choose the best answer

- The number of periods and groups in the periodic table are _____. [AUG - 2022]
a) 6, 16 b) 7, 17 c) 8, 18 d) 7, 18
- The basis of modern periodic law is _____.
a) **atomic number** b) atomic mass c) isotopic mass d) number of neutrons
- _____ group contains the member of halogen family. [PTA – 1]
a) **17th** b) 15th c) 18th d) 16th
- _____ is a relative periodic property
a) atomic radii b) ionic radii c) electron affinity d) **electronegativity**
- Chemical formula of rust is _____.
a) $\text{FeO} \cdot x\text{H}_2\text{O}$ b) $\text{FeO}_4 \cdot x\text{H}_2\text{O}$ c) **$\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$** d) FeO
- In the aluminothermic process the role of Al is _____.
a) oxidizing agent b) **reducing agent** c) hydrogenating agent d) sulphurising agent
- The process of coating the surface of metal with a thin layer of zinc is called _____.
a) Painting b) thinning c) **galvanization** d) electroplating
- Which of the following inert gases have 2 electrons in the outermost shell.
a) **He** b) Ne c) Ar d) Kr
- Neon shows zero electron affinity due to _____.
a) stable arrangement of neutrons b) **stable configuration of electrons**
c) reduced size d) increased density
- _____ is an important metal to form amalgam. [JUN – 2023, AUG – 2022, MDL – 19]
a) Ag b) **Hg** c) Mg d) Al

Additional Questions

- Alloy used in the manufacturing of pressure cooker is _____. [SEP – 2021]
a) Brass b) Bronze c) Magnalium d) **Duralumin**
- When a sodium atom loses an electron it forms Na^+ ion. The radius of Na^+ ion is lesser than Na atom. This is because, [PTA – 3]
a) **The attractive force of nucleus is more in Na^+ ion than Na atom**
b) The attractive force of nucleus is more in Na atom than Na^+ ion
c) Number of protons present in Na atom is less than Na^+ ion
d) Number of electrons present in Na^+ ion is more than Na atom

II. Fill in the blanks

- If the electronegativity difference between two bonded atoms in a molecule is greater than 1.7, the nature of bonding is **ionic**. [PTA – 5]
- Sixth period** is the longest period in the periodical table.
- Atomic number** forms the basis of modern periodic table.
- If the distance between two Cl atoms in Cl_2 molecule is 1.98\AA , then the radius of Cl atom is **0.99\AA** .
- Among the given species A^- , A^+ , and A , the smallest one in size is **A^+** .
- The scientist who propounded the modern periodic law is **Henry Moseley**.
- Across the period, ionic radii **decreases**. (increases, decreases).
- Lanthanides** and **actinides** are called inner transition elements.
- The chief ore of Aluminium is **bauxite**.
- The chemical name of rust is **hydrated ferric oxide ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$)**.

III. Match the following

[PTA – 6]

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

IV. True or False: (if false give the correct statement)

- Moseley's periodic table is based on atomic mass. [False]
*Moseley's periodic table is based on **Atomic number**.
- Ionic radius increases across the period from left to right. [False]
*Ionic radius **decreases** across the period from left to right.
- All ores are minerals; but all minerals cannot be called as ores. [True]
- Al wires are used as electric cables due to their silvery white colour. [False]
*Al wires are used as electric cables due to their **electrical conductivity**.
- An alloy is a heterogenous mixture of metals. [False]
*An alloy is a **homogeneous** mixture of metals.

V. Assertion & Reason

Answer the following questions using the data given below:

- i) A and R are correct, R explains the 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.

- Assertion (A)** : The nature of bond in HF molecule is ionic. [PTA – 2]
Reason (R) : The electronegativity difference between H and F is 1.9.

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

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

Reason (R) : Magnesium is more reactive than iron.

Ans. (i)

A and R are correct, R explains the A.

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

[PTA – 5]

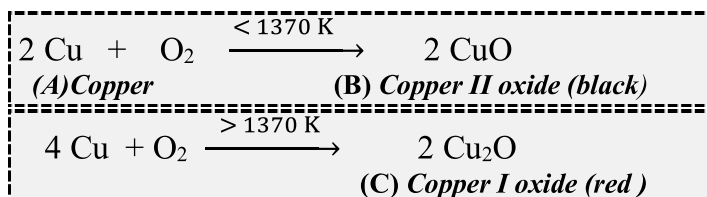
Reason (R) : copper is not attacked by alkali.

Ans. (iv)

A and R are correct, R doesn't explain A.

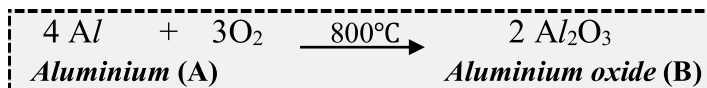
VI. Short answer questions

1. A is a reddish brown metal, which combines with O₂ 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 the reaction. [PTA – 4]



A → Copper (Cu); B → Copper II oxide (CuO) ; C → Copper I oxide (Cu₂O)

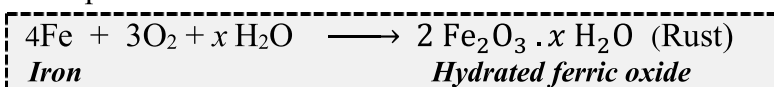
2. A is a silvery white metal. A combines with O₂ to form B at 800°C, the alloy of A is used in making the aircraft. Find A and B. [PTA – 1]



A → Aluminium (Al); B → Aluminium oxide (Al₂O₃)

3. What is rust? Give the (chemical) equation for formation of rust. [JUN–23, SEP–21, PTA – 4]

When iron is exposed to moist air, it forms a layer of brown hydrated ferric oxide on its surface. This compound is known as rust.



4. State two conditions necessary for rusting of iron.

[JUN – 2023]

The two necessary conditions for rusting of iron are *Air * Moisture

Additional Questions

5. Define Amalgam. Give an example.

[APR – 2023]

An amalgam is an alloy of mercury with another metal. These alloys are formed through metallic bonding with the electrostatic force of attraction between the electrons and metal ions. *Eg* : Silver tin amalgam is used for dental filling.

6. Mention any two uses of copper.

[APR – 2023]

Uses of Copper :

- ❖ It is used in electro plating.
- ❖ It is alloyed with gold and silver for making coins and jewels.
- ❖ It is used in manufacturing of electric cables and other electrical appliances.
- ❖ It is used for making utensils, containers, calorimeters and coins.

7. 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]

a) The atoms of this group have very stable electronic configuration.

b) These elements are mostly unreactive.

Group Number: 18 (or) Zero group (or) Noble gas **Eg :** Helium(He), Neon(Ne), Argon(Ar).

8. Copper pyrites is the prime ore of copper. It is concentrated by froth floatation method. (OR) Lighter / sulphide ores can be concentrated by froth floatation method. Give the reason.

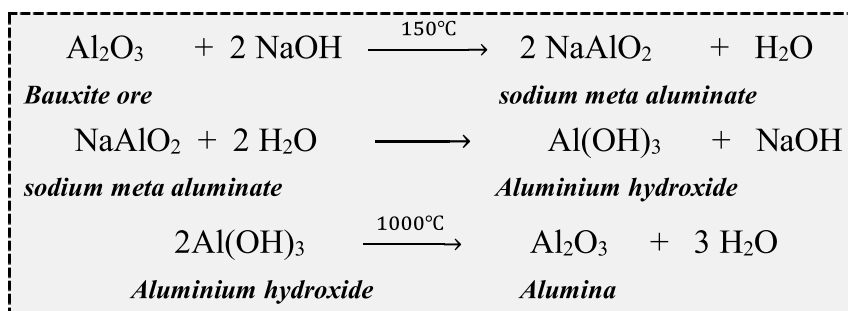
Froth floatation depends on preferential wettability of ore with oil and the gangue particles by water. This means that impurity should be heavier than ore. Thus, Lighter ore like sulphide ores(Zinc blende(ZnS)) (OR) Copper pyrites (CuFeS₂) are concentrated by froth floatation method. [PTA – 4]

VII. Long answer questions

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

Caustic alkali dissolves Al₂O₃ forming soluble sodium meta aluminate while the impurities remain insoluble. The filtered solution processed to get back its pure form.

Thus, caustic alkali is added to bauxite ore during its purification.

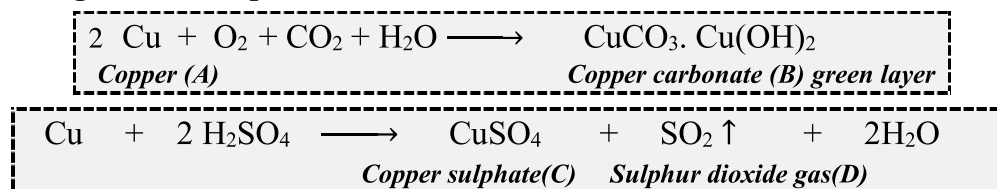


b) Along with cryolite and alumina, another substance is added to the electrolyte mixture. Name the substance and give one reason for the addition.

❖ **Fluorspar** is the another substance.

Reason : It lowers the fusion temperature of electrolyte.

2. The electronic configuration of metal A is 2, 8, 18, 1. The metal A when exposed to air and moisture forms B, a green layered compound. A with con. H₂SO₄ forms C and D along with water. D is a gaseous compound. Find A, B, C and D. [PTA – 1]



A → Copper (Cu)
B → Copper carbonate (CuCO₃ . Cu(OH)₂)
C → Copper sulphate (CuSO₄)
D → Sulphur dioxide(SO₂) gas

3. Explain Smelting Process.

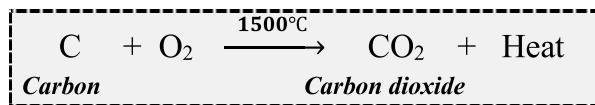
Smelting Process: It is the process of reducing roasted metallic oxide into molten metal.

Smelting of iron: Charge consisting of roasted ore, coke and limestone in the ratio 8:4:1 is smelted in a blast furnace.

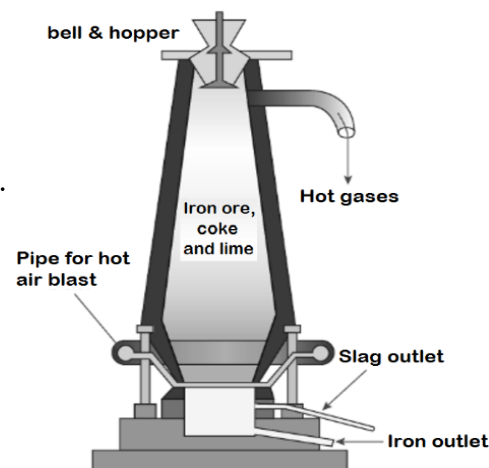
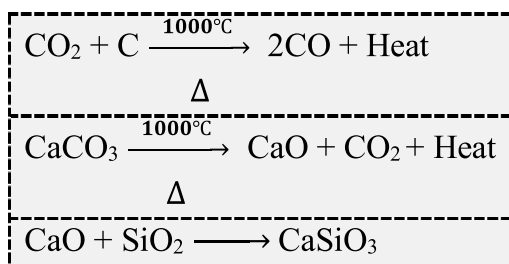
(a) Lower Region (Combustion Zone) :

❖ Temperature is at 1500°C.

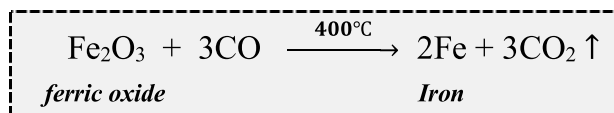
❖ In this region, coke burns with O₂ to form CO₂



(b) Middle Region (Fusion Zone) – Temperature is 1000°C.



(c) Upper Region (Reduction Zone) – Temperature is 400°C.



Molten iron collected at the bottom after removing slag is called **pig iron**.

It is remelted and casted into different moulds called **cast iron**.

Additional Questions

4. Give reason for the following statements on periodic trends in modern periodic table of elements. [PTA - 6]

- 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.
- The electron affinity values increase along the period from left to right and decrease down the group.
- The ionization energy values increase along the period from left to right and decrease down the group.
 - * Along the period, with same valence shell, protons and its attraction over electrons increases. Thus, atom shrinks and atomic radius increases.
 - * Along the group, valence shell number increases. Thus, atomic radius decreases.
 - * Along the period, as atomic radius decreases, electrons become closer. Electron affinity increases.
 - * Along the group, as atomic radius increases, electrons are loosely bound. Electron affinity decreases.
 - * Along the period, with closer electrons more energy is required to remove it. Ionisation energy increases.
 - * Along the group, with loose electrons, less energy is required to remove it. Ionisation energy decreases.

5. What is an alloy? Write the reasons for alloying.

[MAY - 2022]

Alloy is a homogeneous mixture of two or more metals.

Reasons for alloying:

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

6. What is Metal Corrosion? Write the methods to prevent corrosion. [SEP – 2021, MDL – 19]

Corrosion: Gradual destruction of metals by chemical / electrochemical reaction with the environment.

Methods to Prevent Metal Corrosion.

(i) **Alloying** : Metals can be alloyed to prevent corrosion. *Eg:* Stainless steel.

(ii) **Surface Coating**: Protective coating over the metal.

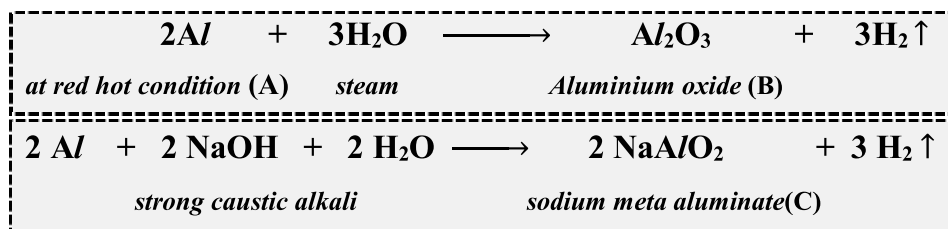
- **Galvanization** - Coating zinc on iron sheets by using electric current.
- **Electroplating** - Coating one metal over another metal by passing electric current.
- **Anodizing** is an electrochemical process that converts metal surface into a decorative, durable and corrosion resistant. *Eg:* Aluminium. [SEP – 2020]
- **Cathodic Protection** - Metal to be protected is coated with a corrodible sacrificial metal.

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 – 3]



A → Aluminium (Al)

B → Aluminium oxide (Al_2O_3)

C → Sodium meta aluminate ($NaAlO_2$)

2. Name the acid that renders aluminium passive. Why?

[PTA – 3]

- ❖ Dilute or Concentrated nitric acid renders aluminium passive.
- ❖ It is due to formation of oxide film on its surface.

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

Electronegativity of H = 2.1 and F = 4.0

Difference in electronegativity = $4.0 - 2.1 = 1.9$ which is >1.7

∴ The bond between H and F in HF molecule is **ionic**.

b) What property forms the basis of identification?

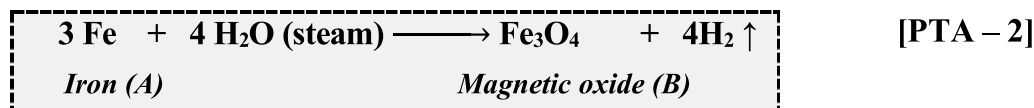
Electronegativity

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

- ❖ Across the *period*, from left to right, electronegativity *increases*.
- ❖ Down a *group*, from top to bottom, electronegativity *decreases*.

Additional Questions

4. 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.



Nickel steel (C) (Fe, C, Ni) is used to make aircraft parts and propeller.

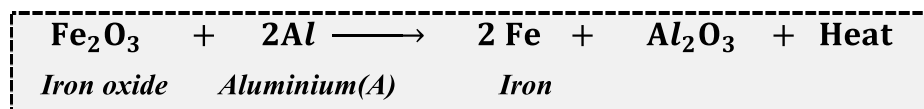
A → Iron (Fe)
 B → Magnetic oxide (Fe₃O₄)
 C → Nickel steel (Fe, C, Ni)

5. 'X' is an element that belongs to 1st group of the modern periodic table. 'X' is a gas and its covalent radius value is 0.37 Å. Identify and write the chemical symbol of 'X'. [PTA – 6]

❖ Element X is *Hydrogen*, Chemical symbol is **H / H₂**.

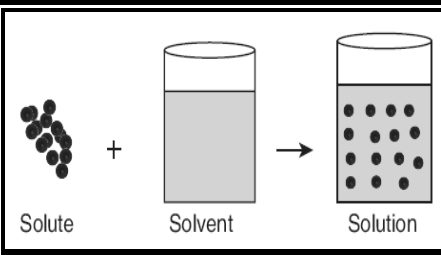
6. A is a metal and belongs to Boron family in modern periodic table acts as a good reducing agent. It reduces iron oxide into iron. It is used to make household utensils. Write the balanced chemical equation for the reduction of iron oxide by 'A'. [PTA – 6]

❖ A → **Aluminium**. This process is *aluminothermic process*.



UNIT - 9

SOLUTIONS



I. Choose the correct answer

- A solution is a _____ mixture.
a) **homogeneous** b) heterogeneous c) homogeneous & heterogeneous d) nonhomogeneous
- The number of components in a binary solution is _____. [MAY - 2022]
a) **2** b) 3 c) 4 d) 5
- Which of the following is the universal solvent? [APR - 2023]
a) Acetone b) Benzene c) **Water** d) Alcohol
- A solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature is called _____.
a) **Saturated solution** b) Unsaturated solution
c) Super saturated solution d) Dilute solution
- Identify the non aqueous solution. [SEP - 2020]
a) sodium chloride in water b) glucose in water
c) copper sulphate in water d) **sulphur in carbon-di-sulphide**
- When pressure is increased at constant temperature, the solubility of gases in liquid _____.
a) No change b) **increases** c) decreases d) no reaction
- Solubility of $NaCl$ in 100 ml water is 36 g. If 25 g of salt is dissolved in 100 ml of water how much more salt is required for saturation _____.
a) 12 g b) **11 g** c) 16 g d) 20 g
- A 25% alcohol solution means [PTA - 4]
a) 25 ml alcohol in 100 ml of water b) 25 ml alcohol in 25 ml of water
c) **25 ml alcohol in 75 ml of water** d) 75 ml alcohol in 25 ml of water
- Deliquescence is due to _____. [PTA - 5]
a) **Strong affinity to water** b) Less affinity to water
c) Strong hatred to water d) Inertness to water
- Which of the following is hygroscopic in nature? [JUN - 2023]
a) ferric chloride b) copper sulphate penta hydrate
c) **silica gel** d) none of the above

Additional Questions

- While doing a science practical experiment, a student left a bottle opened after usage, which contained solid sodium hydroxide. When the student visited the laboratory again after few days, he found only liquid sodium hydroxide in the bottle. This is due to _____ property of sodium hydroxide.
a) hygroscopic b) **deliquescence** c) dehydration d) dissociation [PTA - 1]
- Volume percentage of solutions decreases with the increase in temperature due to [PTA - 2]
a) **thermal expansion of liquids** b) cooling effect of liquids
c) increase in concentration of solution d) decrease in concentration of solution

II. Fill in the blanks

1. The component present in lesser amount, in a solution is called **solute**. [MDL – 19]
2. Example for liquid in solid type solution is **mercury with sodium (amalgam)**.
3. Solubility is the amount of solute dissolved in **100 g** of solvent.
4. Polar compounds are soluble in **polar** solvents.
5. Volume percentage decreases with increase in temperature because of **thermal expansion of liquid**.

III. Match the following

Column I	Column II	Answer
1. Blue vitriol	$\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$	1) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
2. Gypsum	CaO	2) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
3. Deliquescence	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	3) NaOH
4. Hygroscopic	NaOH	4) CaO

IV. True or False: (if false give the correct statement)

1. Solutions which contain three components are called binary solution. [False]
Solutions which contain **two components are called binary solution.*
2. In a solution, the component which is present in lesser amount is called solvent. [False]
In a solution, the component which is present in lesser amount is called **solute. [PTA – 4]*
3. Sodium chloride dissolved in water forms a non - aqueous solution. [PTA – 4] [False]
Sodium chloride dissolved in water forms an **aqueous solution.*
4. The molecular formula of green vitriol is $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ [False]
The molecular formula of green vitriol is **$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ (or) The molecular formula of **epsom salt** is $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.*
5. When Silica gel is kept open, it absorbs moisture from the air, because it is hygroscopic in nature. [True] [PTA – 4]

Additional Questions

6. In our daily life such as a solution of syrups, mouth wash, antiseptic solution, household disinfectants etc., the concentration of the ingredients is expressed as w/w. [False]
In our daily life such as a solution of syrups, mouth wash, antiseptic solution, household disinfectants etc., the concentration of the ingredients is expressed as **v/v. [SEP- 2020]*
7. In ointments, antacids, soaps, etc., concentration of solution is expressed as v/v. [False]
In ointments, antacid, soaps, etc., concentration of solution is expressed as **w/w. [SEP- 2020]*

V. Short answer questions**1. Define the term - Solution.**

- ❖ It is a homogeneous mixture of two or more substances. **Eg** : Sea water
- ❖ Components: Solute (lesser amount) and Solvent (larger amount)

2. What is mean by binary solution?

Binary solution consists of two components - one solute and one solvent.

Eg: Copper sulphate crystals in water

3. Give an example each i) gas in liquid ii) solid in liquid iii) solid in solid iv) gas in gas
i) Gas in liquid - Soda water ii) Solid in liquid - NaCl in water [PTA – 1]
iii) Solid in solid - Copper in gold iv) Gas in gas - Mixture of Helium and oxygen

4. What is aqueous and non-aqueous solution? Give an example.

Aqueous solution : It is the solution in which water acts as a solvent. *Eg: Sugar in water.*

Non - Aqueous solution : It is the solution in which any liquid other than water acts as solvent.
Eg: Sulphur dissolved in carbon - disulphide.

5. Define Volume percentage.

It is the percentage by volume of solute (in ml) present in the given volume of the solution.

$$\text{Volume percentage} = \frac{\text{Volume of the solute}}{\text{Volume of the solute} + \text{Volume of the solvent}} \times 100$$

6. The aquatic animals live more in cold region. Why? [PTA – 5]

- ❖ The solubility of gas in liquid is more at lower temperature.
- ❖ Hence, more oxygen is dissolved in water making aquatic animals live more in cold regions.

7. Define Hydrated salt.

It is the ionic substances, which contain water of crystallization. *Eg : Blue vitriol ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)*

8. A hot saturated solution of copper sulphate forms crystals as it cools. Why?

- ❖ When hot saturated solution of copper sulphate is cooled, the excess copper sulphate present in the solution will be crystallized.
- ❖ This is because solubility decreases with decrease in temperature.

9. Classify the following substances into deliquescent, hygroscopic. [AUG - 2022]

(Conc. Sulphuric acid, Copper sulphate penta hydrate, Silica gel, Calcium chloride and Gypsum salt)

❖ **Deliquescent substances :** Calcium chloride

❖ **Hygroscopic substances :** Conc. Sulphuric acid, Silica gel, Gypsum salt, Copper sulphate penta hydrate

Additional Questions

10. Analyse the following statement about the formation of solutions and explain with an example. “Like solvents dissolve Like solutes” [PTA – 1]

This statement means dissolving occurs when similarities exist between solvent and solute.

❖ **Polar Compounds are soluble in polar solvents.** *Eg: Common salt dissolves in water.*

11. What will be the impact of temperature & pressure while dissolving carbon dioxide in water? [PTA–5]

- ❖ **Impact of Temperature :** Solubility of CO_2 in water decreases with the increase in temperature.
- ❖ **Impact of Pressure :** Solubility of CO_2 in water increases with the increase in pressure.

VI. Long answer questions

1. Write notes on i) saturated solution ii) unsaturated solution [JUN – 2023]

i) **Saturated solution :** It is the solution in which no more solute can be dissolved in a definite amount of solvent at a given temperature.

Eg : 36 g of sodium chloride in 100g of water at 25°C

ii) **Unsaturated solution :** It is the solution that contains less solute than that of saturated solution at a given temperature. *Eg : 10 g of sodium chloride in 100g of water at 25°C*

2. Write notes on various factors affecting solubility.

[JUN – 2023, MDL – 19]

i) Nature of the solute and solvent:

- ❖ “Like dissolves Like”.
- ❖ This means that dissolving occurs only when similarities exist between solvent and solute.
- ❖ Polar compounds are soluble in polar solvents only. *Eg: Common salt dissolves in water.*
- ❖ Non-polar compounds are soluble in non-polar solvents only. *Eg: Fat dissolved in ether.*

ii) Temperature:

a) Solubility of solid in liquid:

- ❖ Solubility increases with increase in temperature.
Eg: More sugar will dissolve in warm water than in cold water.
- ❖ In endothermic process, solubility increases with increase in temperature.
- ❖ In exothermic process, solubility decreases with increase in temperature.

b) Solubility of gases in liquid:

- ❖ Solubility decreases with increase in temperature. *Eg: Oxygen escapes as bubbles in boiling water.*
- ❖ Solubility is more at low temperatures. *Eg: Aquatic animal live more in cold regions.*

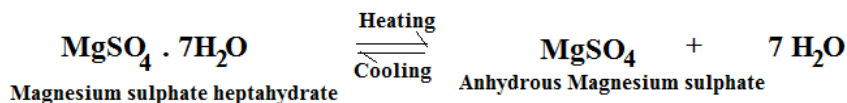
iii) Pressure:

When pressure is increased, solubility is also increased. *Eg: Soft drinks*

3. a) What happens when $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ is heated? Write the appropriate equation.

[AUG – 2022, SEP – 2021, PTA – 4]

When $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ is heated, it loses its water and become anhydrous magnesium sulphate.



b) Define solubility.

- ❖ It is the number of grams of solute that can be dissolved in 100 g of solvent to form its saturated solution at a given temperature and pressure.
- ❖ *Eg: At 25°C, 36 g of sodium chloride has to be dissolved in 100g of water to form saturated solution.*

4. In what way hygroscopic substances differ from deliquescent substances.

[JUN – 2023, APR – 2023, SEP – 2021, PTA – 2]

Hygroscopic substances	Deliquescence substances
1. When exposed to atmosphere, they absorb moisture and <i>do not dissolve</i> .	1. When exposed to atmosphere, they absorb moisture and <i>dissolve</i> .
2. <i>Do not change its physical state</i> .	2. <i>Change its physical state</i> on exposure to air.
3. <i>Amorphous</i> solids or liquids.	3. <i>Crystalline</i> solids.
4. <i>Do not form saturated solutions</i> .	4. <i>Form saturated solutions</i> .
5. <i>Eg: Quick lime, Silica gel.</i>	5. <i>Eg: Caustic soda, Caustic potash.</i>

5. A solution is prepared by dissolving 45 g of sugar in 180 g of water. Calculate the mass percentage of solute.

$$\text{Mass percentage of solute} = \frac{\text{Mass of solute}}{\text{Mass of solvent} + \text{mass of solute}} \times 100 = \frac{45}{180+45} \times 100 = \frac{4500}{225} = 20\%$$

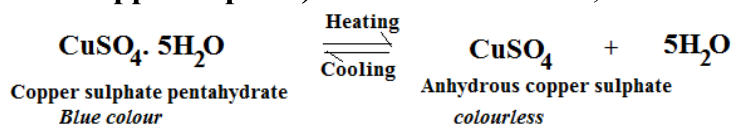
6. 3.5 litres of ethanol is present in 15 litres of aqueous solution of ethanol. Calculate volume percent of ethanol solution.

[PTA – 2]

$$\text{Volume percentage} = \frac{\text{Volume of solute}}{\text{volume of solution}} \times 100 = \frac{3.5}{15} \times 100 = 23.33\%$$

VII. HOT Questions

- Vinu dissolves 50 g of sugar in 250 ml of hot water, Sarath dissolves 50 g of same sugar in 250 ml of cold water. Who will get faster dissolution of sugar? and Why? [PTA – 6]
Dissolution is faster for Vinu than Sarath because solubility increases with increase in temperature.
- 'A' is a blue coloured crystalline salt. On heating it loses blue colour and to give 'B'. When water is added, 'B' gives back to 'A'. Identify A and B, write the equation. [MAY - 2022]
❖ When blue vitriol (A) is heated, it loses its five water molecules and becomes colourless CuSO_4 (Anhydrous copper sulphate) 'B'. If water is added, it returns back to blue vitriol (A).



A → Blue vitriol - Copper sulphate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$)
 B → Anhydrous copper sulphate (CuSO_4)

- Will the cool drinks give more fizz at top of the hills or at the foot? Explain.
 ❖ Pressure is reduced when we move from foot to top of the hill.
 ❖ When pressure is decreased, solubility is decreased and more will be the fizzes.
 ❖ Thus, cool drinks fizzes more at top than at the foot of hills.

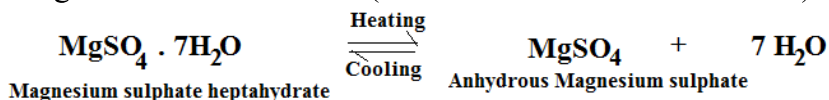
Additional Question

- Compound A is a colourless, crystalline, hydrated salt of magnesium. On heating it becomes an anhydrous salt. The number of water molecules lost by compound A is equal to number of water molecules present in green vitriol on heating. [PTA – 2]
 i) Identify compound A.

A → Magnesium sulphate heptahydrate ($\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$)
 Colourless, crystalline, hydrated salt of magnesium

- Give the Chemical equation for this heating reaction.

When Magnesium sulphate heptahydrate(A) is heated, anhydrous magnesium sulphate(MgSO_4) is formed losing seven water molecules(as in Green vitriol - $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$)



Solve the given problems

Additional Problems

Also Practice : Text Book Example Problems Page No : 132 (Problem II – 1)

- Calculate the mass of water required in grams to dissolve 10 g of sucrose to produce the mass percentage of 10% solution. [PTA – 3]

Let, Mass of water = x So, Mass of solution = $x + 10$

$$\text{Mass \%} = \frac{\text{Mass of the solute}}{\text{Mass of the solution}} \times 100$$

$$10 = \frac{10}{x + 10} \times 100$$

$$x + 10 = 100 \text{ g} \Rightarrow x = 100 \text{ g} - 10 \text{ g} = 90 \text{ g}$$

- Calculate the solubility of a solute at 300 K by dissolving 10 g of solute in 50 g of solvent.

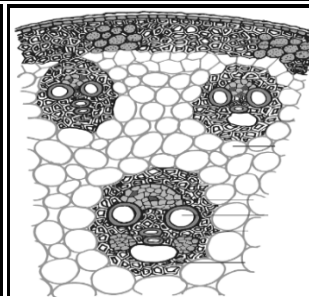
$$\text{Solubility} = \frac{\text{Mass of the solute}}{\text{Mass of the solvent}} \times 100 = \frac{10}{50} \times 100 = 20 \text{ g} \quad [\text{PTA} - 5]$$

BIOLOGY

- Unit 12 - Plant Anatomy and Plant Physiology
- Unit 13 – Structural Organisation of Animals
- Unit 14 – Transportation in Plants and Circulation in Animals
- Unit 15 – Nervous System
- Unit 16 – Plant and Animal Hormones
- Unit 17 – Reproduction in Plants and Animals
- Unit 18 - Genetics

UNIT - 12

PLANT ANATOMY AND PLANT PHYSIOLOGY



I. Choose the correct answer

- Casparian strips are present in the _____ of the root. [JUN – 2023, MDL – 19]
a) Cortex b) Pith c) Pericycle d) endodermis
- The endarch condition is the characteristic feature of [AUG – 2022, MAY - 2022]
a) root b) stem c) leaves d) flower
- The xylem and phloem arranged side by side on same radius is called
a) radial b) amphivasal c) conjoint d) None of these
- Which is formed during anaerobic respiration [SEP – 2020, MDL – 19]
a) Carbohydrate b) Ethyl alcohol c) Acetyl CoA d) Pyruvate
- Krebs cycle takes place in [APR – 2023, PTA – 3]
a) chloroplast b) mitochondrial matrix c) stomata d) inner mitochondrial membrane
- Oxygen is produced at what point during photosynthesis (or) During photosynthesis at which of the following state, oxygen is produced. [PTA – 4]
a) when ATP is converted to ADP b) when CO₂ is fixed
c) when H₂O is splitted d) all of these

II. Fill in the blanks

- The innermost layer of cortex in root is called endodermis.
- Xylem and phloem are arranged in an alternate radii constitute a vascular bundle called radial bundles.
- Glycolysis takes place in cytoplasm.
- The source of O₂ liberated in photosynthesis is water.
- Mitochondria is ATP factory of the cells.

III. True or false. Correct the statement if it is false.

- Phloem tissue is involved in the transport of water in plant. [False]
* Xylem tissue is involved in the transport of water in plant.
- The waxy protective covering of a plant is called as cuticle. [True]
- In monocot stem, cambium is present in between xylem and phloem. [False]
* In dicot stem, cambium is present in between xylem and phloem.
- Palisade parenchyma cells occur below upper epidermis in dicot root. [False]
* Palisade parenchyma cells occur below upper epidermis in dicot leaf.
- Mesophyll contains chlorophyll. [True]
- Anaerobic respiration produces more ATP than aerobic respiration. [False]
* Anaerobic respiration produces less ATP than aerobic respiration.

IV. Match the following

Column I	Column II	Answer
1. Amphicribal	<i>Dracaena</i>	1. Fern
2. Cambium	Translocation of food	2. Secondary growth
3. Amphivasal	Fern	3. <i>Dracaena</i>
4. Xylem	Secondary growth	4. Conduction of water
5. Phloem	Conduction of water	5. Translocation of food

V. Answer in a sentence

1. What is collateral vascular bundle?

In collateral vascular bundle, xylem lies towards centre, phloem lies towards periphery.

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

Carbon comes from atmosphere in the form of CO₂.

3. What is the common step in aerobic and anaerobic pathway and where is it occur in a cell?

Common Step - Glycolysis. It takes place in cytoplasm of the cell. [PTA – 5]

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

Fermentation (Anaerobic respiration).

VI. Short answer Questions

1. Give an account on vascular bundle of dicot stem.

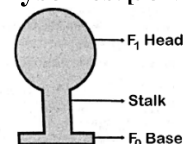
- ❖ Vascular bundles of dicot stem are conjoint collateral, endarch and open.
- ❖ They are arranged as ring around the pith.

2. Write a short note on mesophyll.

Tissue between upper and lower epidermis of leaf is called mesophyll. It is differentiated into,

- ❖ **Palisade parenchyma:** It is found below upper epidermis. These are elongated cells with more chloroplasts. Helps in photosynthesis.
- ❖ **Spongy parenchyma:** It is found below palisade parenchyma. These are spherical/oval cells with intercellular spaces. Helps in gaseous exchange.

3. Draw and label the structure of oxysomes. [JUN-23]



4. Name the three basic tissue system in flowering plants.

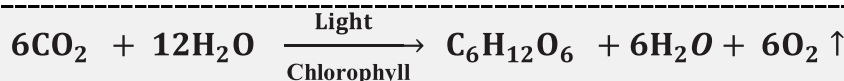
[APR – 2023]

* Dermal/Epidermal tissue system * Ground tissue system * Vascular tissue system

5. What is photosynthesis and where in a cell does it occur?

[SEP – 2021, PTA – 3]

It is a process by which organisms utilize energy from sunlight to synthesize their own food.



- ❖ It occurs in the chloroplast.

6. What is Respiratory quotient?

[AUG – 2022, MAY - 2022, SEP – 2021, PTA – 1]

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

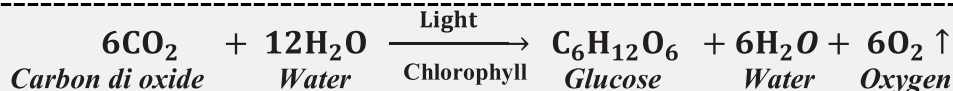
$$\text{R.Q.} = \frac{\text{volume of CO}_2 \text{ liberated}}{\text{volume of O}_2 \text{ consumed}}$$

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

- ❖ During light independent reactions, CO₂ is reduced into carbohydrates with the help of ATP and NADPH₂ which is generated during light dependent reaction.
- ❖ So, light dependent reaction should occur before the light independent reaction.

8. Write the reaction for photosynthesis.

[MAY - 2022]



Additional Questions

9. What are the factors affecting photosynthesis?

[APR – 2023, AUG – 2022]

- ❖ Internal factors → Pigments, leaf age, accumulation of carbohydrates and hormones.
- ❖ External factors → Light, Carbon dioxide, temperature, water and mineral elements.

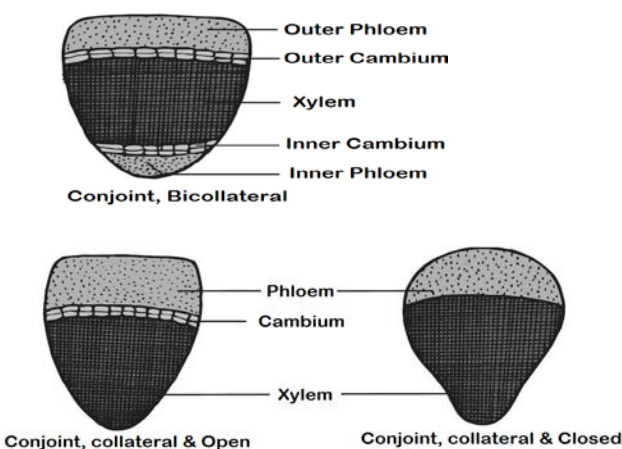
10. What is vascular bundle?

[PTA – 1]

- ❖ Xylem and phloem tissues are present in the form of bundles called vascular bundles.
- ❖ Xylem conducts water and minerals to different parts of the plant.
- ❖ Phloem conducts food materials to different parts of the plant.

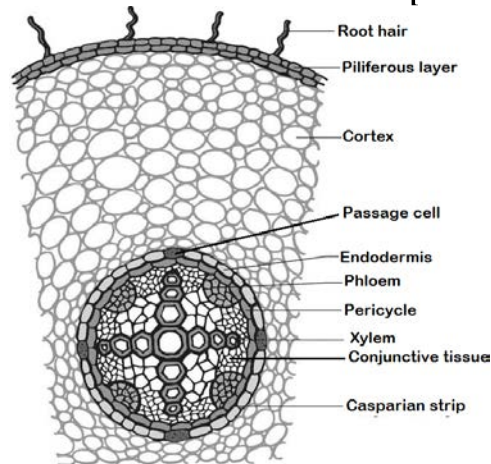
11. Draw and label the different types of conjoint vascular bundles.

[PTA – 4]



12. Draw and label the internal structure of a Dicot / Bean root.

[PTA – 6]



VII. Long Answer Questions

1. Differentiate the following.

[MDL – 19]

a) Monocot root and Dicot root:

[SEP – 2020]

S.No	Tissues	Dicot Root (Bean)	Monocot Root (Maize)
1.	Number of xylem	Tetrarch	Polyarch
2.	Cambium	Present	Absent
3.	Secondary growth	Present	Absent
4.	Pith	Absent	Present
5.	Conjunctive tissue	Parenchyma	Sclerenchyma
6.	Example	Bean	Maize

b) Aerobic and Anaerobic respiration:

[AUG – 2022, SEP – 2021]

Aerobic respiration	Anaerobic respiration
1) Takes place in presence of oxygen.	1) Takes place in absence of oxygen.
2) Occurs in most plants and animals	2) Occurs in some bacteria.
3) Carbohydrate is completely oxidized into carbon dioxide, water and energy.	3) Glucose is converted into ethanol (in plants) or lactic acid (fermentation by bacteria).
4) $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{ATP}$	4) $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2\text{CO}_2 + 2\text{C}_2\text{H}_5\text{OH} + \text{Energy (ATP)}$

2. Describe and name three stages of cellular respiration that aerobic organisms use to obtain energy from glucose.

Cellular Respiration : It is a cell process where the food is oxidized to obtain energy.



Stages of Aerobic Cellular Respiration :

Glycolysis :

- ❖ One glucose molecule breakdown into two molecules of pyruvic acid in cytoplasm.
- ❖ It is the first step of both aerobic and anaerobic respiration.

Krebs cycle (or) Tricarboxylic Acid cycle (TCA) :

- ❖ After glycolysis, pyruvic acid is oxidized to CO_2 and water in mitochondrial matrix.

Electron Transport chain (ETC) :

- ❖ It occurs through electron carrier complex in the inner membrane of mitochondria.
- ❖ NADH_2 & FADH_2 are oxidized to NAD^+ & FAD^+ to release energy via electrons.
- ❖ The electrons release energy, which is trapped by ADP to synthesize ATP.
- ❖ This is called oxidative phosphorylation. Here O_2 is 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?

Light dependent (Light) Reaction	Light independent (Dark) Reaction
Takes place in the presence of light energy.	Takes place in the absence of light.
Photosynthetic pigments absorb light energy and convert it into ATP & NADPH_2	CO_2 is reduced into carbohydrates with the help of ATP & NADPH_2
Occurs in <i>thylakoid membrane</i> of chloroplast.	Occurs in <i>Stroma</i> of chloroplast.

VIII. Higher Order Thinking Skills (HOTS)

1. The reactions of photosynthesis make up a biochemical pathway.

A) What are the reactants and end products of light & dark reaction of photosynthesis? [PTA-5]

	Light Reaction	Dark Reaction
Reactants	Chlorophyll, Sunlight, H_2O , NADP^+ , ADP	CO_2 , ATP and NADPH_2
Products	ATP, NADPH_2 and O_2	Carbohydrate/Glucose

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

- ❖ Steps of photosynthesis are Light reactions and Dark reactions (or) Calvin cycle.
- ❖ ATP and NADPH_2 are formed during light reactions using sunlight.
- ❖ They are used by Calvin cycle to produce glucose and oxidized to NADP^+ & ADP.
- ❖ They are used again by light reaction and reduced to NADPH_2 & ATP with the help of water molecule.
- ❖ In this way, photosynthesis recycles its own reaction in a series.

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

- ❖ Light dependent reaction takes place in *thylakoid membrane* of chloroplast.
- ❖ Calvin cycle takes place in *stroma* of chloroplast.

UNIT – 13

STRUCTURAL ORGANISATION OF ANIMALS



I. Choose the correct answer

- In leech locomotion is performed by
a) Anterior sucker b) Parapodia c) Setae **d) Contraction and relaxation of muscles**
- The segments of leech are known as
a) Metameres (somites) b) Proglottids c) Strobila d) All the above
- Pharyngeal ganglion in leech is a part of
a) Excretory system **b) Nervous system** c) Reproductive system d) Respiratory system
- The brain of leech lies above the
a) Mouth b) Buccal Cavity **c) Pharynx** d) Crop
- The body of leech has
a) 23 segments **b) 33 segments** c) 38 segments d) 30 segments
- Mammals are _____ animals.
a) cold blooded **b) warm blooded** c) poikilothermic d) all the above

Additional Question

- According to the dental formula _____ kind of teeth is absent in rabbit. **[PTA – 1]**
a) molar b) per-molar c) incisor **d) canine**

II. Fill in the blanks

- The posterior sucker is formed by the fusion of the **last seven** segments.
- The existence of two sets of teeth in the life of an animal is called **diphyodont** dentition.
- The anterior end of leech has a lobe-like structure called **anterior sucker**.
- The blood sucking habit of leech is known as **sanguivorous**. **[PTA – 5]**
- Kidney** separate nitrogenous waste from the blood in rabbit.
- 37 pairs** spinal nerves are present in rabbit.

III. True or False. (If false give the correct statement)

- An anticoagulant present in saliva of leech is called heparin. **[False]**
* An anticoagulant present in saliva of leech is called **hirudin**.
- The vas deferens serves to transport the ovum. **[PTA – 6] [False]**
* The vas deferens serves to transport the **sperm**.
- Diastema is a gap between premolar and molar teeth in rabbit. **[False]**
* Diastema is a gap between **incisors** and **premolar** teeth in rabbit.
- The cerebral hemispheres of rabbit are connected by band of nerve tissue called corpora quadrigemina. **[PTA – 6] [False]**
* The cerebral hemispheres of rabbit are connected by band of nerve tissue called **corpus callosum**.

IV. Match columns I, II and III correctly

[PTA – 2]

Answer :

Organs	Membranous Covering	Location
1. Brain	<i>meninges</i>	<i>cranial cavity</i>
2. Kidney	<i>capsule</i>	<i>abdominal cavity</i>
3. Heart	<i>pericardium</i>	<i>mediastinum</i>
4. Lungs	<i>pleura</i>	<i>enclosed in thoracic cavity</i>

V. Answer in a sentence

1. Give the common name of the <i>Hirudinaria granulosa</i> .	Leech
2. How does leech respire? [PTA – 1]	Through skin
3. Write the dental formula of rabbit. [MDL – 19]	$(I \frac{2}{1}, C \frac{0}{0}, PM \frac{3}{2}, M \frac{3}{3}); \frac{2033}{1023}$
4. How many pairs of testes are present in leech?	11 pairs
5. How is diastema formed in rabbit? [PTA – 6]	Canines are absent. This gap forms diastema.
6. What organs are attached to the two bronchi?	Two lungs
7. Which organ acts as suction pump in leech?	Pharynx
8. What does CNS stand for? [JUN – 2023]	Central Nervous System.
9. Why is the teeth of rabbit called heterodont? [PTA– 4]	Because of its four different types of teeth.
10. How does leech suck blood from the host? [PTA – 2]	Suckers attaches to the host. It makes Y shaped incision and sucks blood by muscular pharynx.

VI. Short answer questions

- Why are the rings of cartilages found in trachea of rabbit? [PTA – 4, SEP – 2020]
The rings of cartilages are found in trachea of rabbit to help in free passage of air.
- List out the parasitic adaptations in leech. [APR – 2023, MDL – 19]
 - ❖ Blood is sucked by muscular pharynx and stored in crop.
 - ❖ Three jaws inside the mouth, causes a painless Y-shaped incision in the skin of host.
 - ❖ Suckers in anterior and posterior ends attaches to the host.
 - ❖ The salivary glands produce hirudin. It does not allow the blood to coagulate.

Additional Question

- What are the glands embedded in the Rabbit skin to regulate the body temperature?
Sweat glands and sebaceous glands. [PTA – 3]

VII. Long answer questions

- How is the circulatory system designed in leech to compensate the heart structure?
 - ❖ Circulation happens by haemocoelic system.
 - ❖ Blood vessels are replaced by haemocoelic canals filled with blood like fluid.
 - ❖ Coelomic fluid contains haemoglobin.
 - ❖ There are four longitudinal channels
 - One above (dorsal) and one below (ventral) the alimentary canal.
 - Other two on either (lateral) side of alimentary canal. This serves as heart.
 - ❖ Channels are connected posteriorly in 26th segment.

2. How does locomotion take place in leech?

[PTA – 5]

Locomotion in leech takes place by,

Looping or crawling movement :

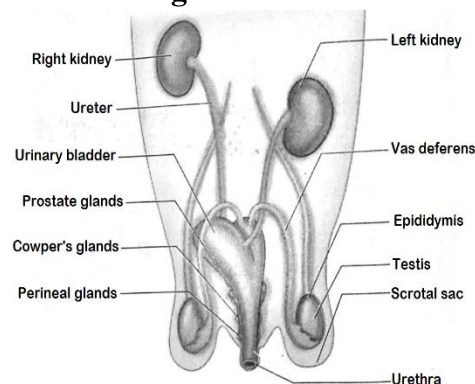
- ❖ It occurs by contraction and relaxation of muscles.
- ❖ The two suckers are used for attachment during movement.

Swimming movement :

- ❖ Leeches swim very actively and perform undulating movements in water.

3. Explain the male reproductive system of rabbit with a labelled diagram.

- ❖ It consists of a pair of testes, ovoid in shape.
- ❖ Testes are enclosed by scrotal sacs.
- ❖ Each testis consists of seminiferous tubules.
- ❖ This forms epididymis, which leads into vas deferens.
- ❖ Vas deferens join in the urethra just below the urinary bladder and then into penis.
- ❖ **Accessory glands:** Prostate, Cowper's and Perineal gland. Its secretion helps in reproduction.



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? (or) Why do the host doesn't feel bite of a leech.

When leeches bite they inject an anesthetic substance that prevent the host from feeling its bite. Thus, the host doesn't feel the bite of a leech.

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? (OR) Explain the dentition of rabbit.

- ❖ Rabbits' teeth are hard bone - like structure.
- ❖ It has diphyodont dentition (ie) milk teeth and permanent teeth.
- ❖ It has heterodont dentition for of its four teeth types.
- ❖ Gap between incisors & premolar is called diastema and it helps in mastication and chewing of food.

IX. Value based questions

1. Leeches do not have an elaborate secretion of digestive juices and enzymes - Why?

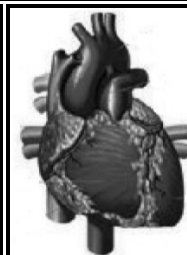
In leeches, blood is stored in crop. It gives nourishment for several months. Thus, they do not have an elaborate secretion of digestive juices and enzymes.

2. How is the digestive system of rabbit suited for herbivorous mode of feeding? [PTA –3]

- ❖ Herbivorous animals like rabbit eat grass in large quantities. Therefore, it requires specialized digestive system that suits this herbivorous mode of feeding.
- ❖ Rabbits' teeth are hard bone-like structure used to cut, tear and grind the food material.
- ❖ Gap between incisors & premolar called diastema helps in mastication and chewing of food.
- ❖ Bacteria in small and large intestine helps in digestion of cellulose.

UNIT – 14

TRANSPORTATION IN PLANTS AND CIRCULATION IN ANIMALS

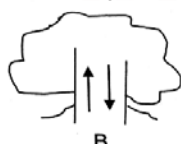
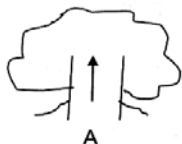


I. Choose the correct answer

1. Active transport involves
 - a) movement of molecules from lower to higher concentration
 - b) expenditure of energy
 - c) it is an uphill task
 - d) all of the above
2. Water which is absorbed by roots is transported to aerial parts of the plant through
 - a) cortex
 - b) epidermis
 - c) Phloem
 - d) xylem
3. During transpiration there is loss of
 - a) carbon dioxide
 - b) oxygen
 - c) water
 - d) none of the above[AUG – 2022]
4. Root hairs are
 - a) cortical cell
 - b) projection of epidermal cell
 - c) unicellular
 - d) both b and c[PTA – 4]
5. Which of the following process requires energy?
 - a) active transport
 - b) diffusion
 - c) osmosis
 - d) all of them[PTA – 3]
6. The wall of human heart is made of
 - a) Endocardium
 - b) Epicardium
 - c) Myocardium
 - d) All of the above
7. Which is the correct sequence of blood flow
 - a) ventricle → atrium → vein → arteries
 - b) atrium → ventricle → veins → arteries
 - c) atrium → ventricle → arteries → vein
 - d) ventricles → vein → atrium → arteries
8. A patient with blood group O was injured in an accident and has blood loss. Which group of blood should be used by doctor for transfusion?
 - a) O group
 - b) AB group
 - c) A or B group
 - d) all blood group[JUN – 2023, MDL – 19]
9. 'Heart of heart' is called
 - a) SA node
 - b) AV node
 - c) Purkinje fibres
 - d) Bundle of His
10. Which one of the following shows correct composition of blood
 - a) Plasma - Blood + Lymphocyte
 - b) Serum - Blood + Fibrinogen
 - c) Lymph - Plasma + RBC + WBC
 - d) Blood - Plasma + RBC + WBC + Platelets

Additional Questions

11. The heart of amphibians possess _____ chambers.
 - a) 3
 - b) 4
 - c) 2
 - d) 5[APR – 2023]
12. The heart of fishes possess _____ chambers.
 - a) 3
 - b) 4
 - c) 2
 - d) 5[AUG - 2022, MAY-2022]
13. The concept of blood group is derived by _____.
 - a) Wiener
 - b) Karl Landsteiner
 - c) William Harvey
 - d) His[SEP - 2021]
14. Identify the conducting tissues by using the arrow marks,
 - a) A is phloem, B is xylem
 - b) A is xylem, B is phloem
 - c) Both A and B are xylem
 - d) Both A and B are phloem[PTA – 2]



II. Fill in the blanks

- Transpiration** involves evaporative loss of water from aerial parts.
- Water enters into the root hair cell through **plasma (or) semi permeable** membrane.
- Parts of the root (or) structures in root that absorbs water from the soil is **root hair**. [PTA – 6]
- Normal blood pressure is **120 mm Hg / 80 mm Hg**.
- The normal human heartbeat rate is about **72 – 75** time per minute.

Additional Question

- William Harvey** is the father of modern physiology. [SEP – 2020]

III. Match the following

Section - I	Column I	Column II	Answer
	1. Symplastic pathway	Leaf	1. Plasmodesmata
	2. Transpiration	Plasmodesmata	2. Leaf
	3. Osmosis	Pressure in xylem	3. Pressure gradient
	4. Root Pressure	Pressure gradient	4. Pressure in xylem

Section - II	Column I	Column II	Answer
	1. Leukemia	Thrombocytes	1. Blood Cancer
	2. Platelets	Phagocyte	2. Thrombocytes
	3. Monocytes	Decrease in leucocytes	3. Phagocyte
	4. Leucopenia	Blood Cancer	4. Decrease in leucocytes
	5. AB blood group	Allergic condition	5. Absence of antibody
	6. O blood group	Inflammation	6. Absence of antigen
	7. Eosinophil	Absence of antigen	7. Allergic condition
	8. Neutrophils	Absence of antibody	8. Inflammation

IV. State whether True or False. If false write the correct statement

- The phloem is responsible for the translocation of food. [True]
- Plants lose water by the process of transpiration. [True]
- The form of sugar transported through the phloem is glucose. [False]
The form of sugar transported through the phloem is **sucrose.*
- In apoplastic movement the water travels through the cell membrane and enter the cell. [False]
In **symplastic movement the water travels through the cell membrane and enter the cell.*
- When guard cells lose water the stoma opens. [False]
** When guard cells lose water the stoma **closes**.*
- Initiation and stimulation of heart beat take place by nerves. [False]
Initiation and stimulation of heartbeat take place by **heart muscles(i.e) sino-atrial node.*
- All veins carry deoxygenated blood. [False]
** All veins **except pulmonary vein** carry deoxygenated blood.*
- WBC defend the body from bacterial and viral infections. [True]
- The closure of the mitral and tricuspid valves at the start of the ventricular systole produces the first sound 'LUBB'. [True]

V. Answer in a word or sentence

1. Name two layered protective covering of human heart. Pericardium.
2. What is the shape of RBC in human blood? Biconcave and disc shaped.
3. Why is the colour of the blood red? [AUG – 2022] Due to respiratory pigment haemoglobin.
4. Which kind of cells are found in the lymph? WBC Cells.
5. Name the heart valve associated with the major arteries leaving the ventricles. Semilunar valves.
6. Mention the artery, which supplies blood to the heart muscle. Coronary arteries.

VI. Short answer questions

1. What causes the opening and closing of guard cells of stomata during transpiration?

Change in turgidity of guard cells causes opening and closing of stomata.

2. What is cohesion?

The force of attraction between water molecules is called cohesion.

3. Trace the pathway followed by water molecules from the time it enters a plant root to the time it escapes into the atmosphere from a leaf.

- ❖ Root hair absorbs water by osmosis.
- ❖ Root pressure conducts water to stem through xylem & then to leaf.
- ❖ In sunlight, excess water is evaporated through stomata by transpiration.

Root hair → Root → Xylem → Stem → Leaf → Stomata → Water is evaporated

4. What would happen to leaves of a plant that transpires more water than its absorption in roots?

- ❖ Plant dehydrates and losses moisture resulting in wilting or drying of leaves.
- ❖ It affects plant growth, photosynthesis and may lead to death.

5. Describe the structure and working of the human heart.

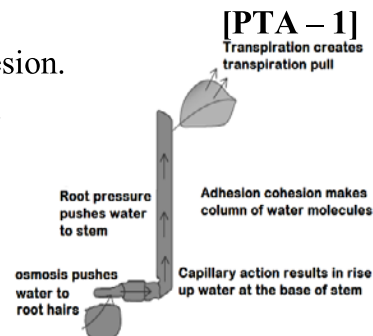
Heart is a muscular pumping organ that pumps blood into blood vessels.

Structure:

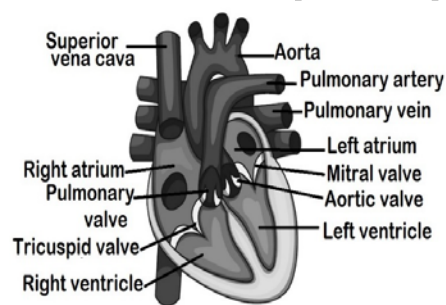
- ❖ Heart is situated between lungs, slightly tilted toward left and above diaphragm.
- ❖ It is enclosed by pericardium. It is four chambered.
Auricle - Two upper thin walled chambers
Ventricle - Two lower thick walled chambers
- ❖ These chambers are separated by septum.

Working of human heart :

- ❖ Right atrium receives deoxygenated blood from body parts through main veins.
- ❖ Left atrium receives oxygenated blood from lungs through pulmonary veins.
- ❖ Right and left auricles pump blood into right and left ventricles respectively.
- ❖ Right ventricle supplies deoxygenated blood to lungs by pulmonary arteries.
- ❖ Left ventricle supplies oxygenated blood to body parts by aorta.
- ❖ Coronary arteries supply blood to heart.

**Additional Question**

16. Draw external structure of human heart. [SEP – 20]



6. Why is the circulation in man referred to as double circulation?

[PTA – 1]

In man, blood circulates twice through heart in one complete cycle. So, it is called double circulation.

7. What are heart sounds? How are they produced?

- ❖ Rhythmic closure and opening of heart valves is called heart sounds.
- ❖ LUBB sound is produced by closure of tricuspid & bicuspid valves.
- ❖ DUPP sound is produced by closure of semilunar valves.

8. What is the importance of valves in the heart?

[MAY - 2022, PTA – 2]

- ❖ Valves regulate blood flow in single direction.
- ❖ It prevents backward flow of blood into ventricles.

9. Who discovered Rh factor? Why was it named so?

[PTA – 6]

- ❖ Landsteiner and Wiener discovered Rh factor.
- ❖ It was discovered in the blood of Rhesus monkey. So, it was named as Rh factor.

10. How are arteries and veins structurally different from one another?

[PTA – 5]

S.No	Artery	Vein
1.	It have a strong, thick and elastic wall.	It have a weak, thin and non-elastic wall.
2.	Internal valves are absent.	Internal valves are present.
3.	Deep in location.	Superficial in location.
4.	It is pink in colour.	It is red in colour.

11. Why is the sinoatrial node called the pacemaker of heart?

[MDL – 19, PTA – 5]

Sinoatrial node initiates an impulse, which simulates heart muscles to contract. SA node plays an important role in the initiation of heartbeat. Hence, it is called as pacemaker of heart.

12. Differentiate between systemic circulation and pulmonary circulation.

[PTA – 2]

Systemic circulation	Pulmonary circulation
1. Oxygenated blood is pumped from heart to body.	1. Deoxygenated blood is pumped from heart to lungs.
2. Deoxygenated blood is returned to heart.	2. Oxygenated blood is returned to heart.
3. Occurs between heart and body via arteries and veins.	3. Occurs between heart and lungs via pulmonary arteries and pulmonary veins.

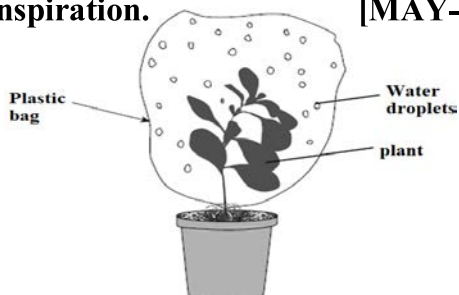
13. The complete events of cardiac cycle last for 0.8 sec. What is the timing for each event?

Each Event of cardiac cycle involves:

✱ *Atrial systole:* 0.1 sec ✱ *Ventricular systole:* 0.3 seconds ✱ *Ventricular diastole:* 0.4 seconds

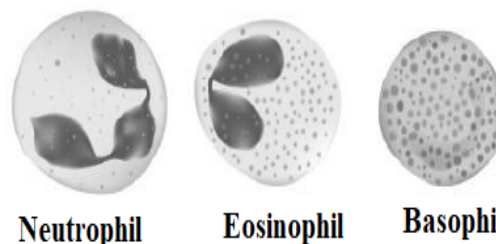
Additional Questions

14. Draw and label the parts of process of transpiration. [MAY-2022]



15. Draw pictures of Granulocytes.

[AUG – 2022, MAY – 2022]



VII. Give reasons for the following statements

1. Minerals cannot be passively absorbed by the roots.

- ❖ Minerals in soil are ions. They cannot move across cell membrane.
- ❖ Concentration of minerals in soil is lower than the concentration of minerals in root.
- ❖ Thus, minerals cannot be passively absorbed by roots.

2. Guard cells are responsible for opening and closing of stomata.

[SEP – 2021]

- ❖ Change in turgidity of guard cells causes opening and closing of stomata.
- ❖ When water enters, guard cells become turgid and stoma open.
- ❖ When guard cells lose water, it shrinks and stoma closes.

3. The movement of substances in the phloem can be in any (or) all direction.

[PTA – 4]

- ❖ Function of Phloem is to transport food from source to sink.
- ❖ Normally, Phloem transports food in downward direction (i.e) from leaves to root, stem etc.,
- ❖ Based on plant's need, Phloem transports in upward direction from root to all parts.
- ❖ Thus, movement of substances in phloem can be in any direction.

4. Minerals in the plants are not lost when the leaf falls.

[PTA – 2]

Reason: Minerals are remobilised from older dying leaves to younger leaves.
So, minerals in plants are not lost, when leaf falls.

5. The walls of the right ventricle are thicker than the right auricle.

Reason: Right ventricle has to pump out blood with force away from heart.
Thus, the walls of ventricles are thicker than auricles.

6. Mature RBC in mammals do not have cell organelles.

[PTA – 4]

Reasons:

- ❖ Lack of nucleus makes the cells biconcave and increases the surface area for oxygen binding.
- ❖ Lack of mitochondria allows RBC to transport all the oxygen to tissues.
- ❖ Lack of endoplasmic reticulum gives flexibility for RBC to move through narrow capillaries.

VIII. Long answer questions

1. How do plants absorb water? Explain.

Water absorbing unit - Root Hair:

- ❖ Root hairs absorb water and minerals by diffusion.
- ❖ They are thin walled, extension of epidermal cell.
- ❖ They increase the area of absorption.

Pathway of Water absorbed by Roots:

- ❖ Water enters root hairs, concentration of water in root hairs become more than in cortex.
- ❖ Thus, water from root hair move to the cortical cells by osmosis and reaches xylem.
- ❖ Then water is transported to stem and leaves.

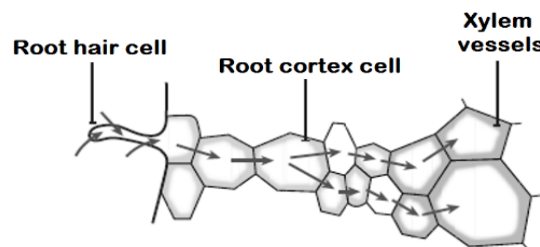
Types of movement of water into root cells:

1. Apoplast pathway

- ❖ Movement of water is through the intercellular spaces and the cell walls.
- ❖ It does not involve crossing the cell membrane. It is dependent on the gradient.

2. Symplast pathway

- ❖ Movement of water is through plasma membrane, cytoplasm and plasmodesmata.
- ❖ It is dependent on concentration gradient.
- ❖ It is slower as water moves through plasma membrane.



2. What is transpiration? Give the importance of transpiration.

[AUG – 2022]

Transpiration: It is the evaporation of water from aerial plant-parts through stomata in leaves.

Importance of transpiration:

- ❖ It creates transpiration pull.
- ❖ It supplies water for photosynthesis.
- ❖ It transports minerals from soil.
- ❖ It cools the leaf surface.
- ❖ It keeps the cells turgid, hence maintain their shape.

3. Why are leucocytes classified as granulocytes and agranulocytes? Name each cell and mention its functions.

1) Granulocytes: They contain granules in cytoplasm. Its nucleus is irregular (or) lobed.

i) <i>Neutrophils</i>	They increase during infection and inflammation.
ii) <i>Eosinophils</i>	<ul style="list-style-type: none"> • They increase during allergy & parasitic infections. • It brings detoxification of toxins.
iii) <i>Basophils</i>	They release chemicals during inflammation.

2) Agranulocytes: Granules are not found in cytoplasm. Its nucleus is not lobed.

i) <i>Lymphocytes</i>	They produce antibodies during bacterial and viral infections.
ii) <i>Monocytes</i>	They are phagocytic and can engulf bacteria.

4. Differentiate between systole and diastole. Explain the conduction of heart beat.

Systole	Diastole
1. Contraction of auricles & ventricles of heart.	1. Relaxation of auricles & ventricles of heart.
2. Normal systolic pressure is 120mm.	2. Normal diastolic pressure is 80mm.

Conduction of heart beat:

- ❖ Sino – atrial node acts as the pacemaker of heart.
- ❖ SA node initiates an impulse. It stimulates the heart muscles to contract.
- ❖ This impulse spreads as a wave of contraction over right and left atrial wall.
- ❖ It pushes blood through atrioventricular valves into ventricles.
- ❖ This wave of contraction from SA node reaches the atrioventricular (AV) node.
- ❖ AV node emits an impulse of contraction and spreads to ventricular muscles via atrioventricular bundle and Purkinje fibres.

5. Enumerate the functions of blood.

[APR – 2023, AUG – 2022, SEP – 2021]

Functions of blood:

- ❖ It transports respiratory gases (O_2 & CO_2).
- ❖ It transports digested food to body parts.
- ❖ It transports hormones & excretory products.
- ❖ It protects body & defense against diseases.
- ❖ It helps in regulation of pH and body temperature.
- ❖ It maintains water balance.

IX. Assertion and Reasoning

Direction: In each of the following questions, a statement of assertion (A) is given and a corresponding statement of reason (R) is given just below it. Mark the correct statement as.

- a) If both A and R are true and R is correct explanation of A.
- b) If both A and R are true but R is not the correct explanation of A.
- c) A is true but R is false.
- d) Both A and R are false.

1. **Assertion (A):** RBC plays an important role in the transport of respiratory gases.

Reason (R) : RBC do not have cell organelles and nucleus.

Ans. (a) *Both A and R are true and R is correct explanation of A.*

2. **Assertion (A) :** Persons with AB blood group are called an universal recipients, because they can receive blood from all groups.

Reason (R) : Antibodies are absent in persons with AB blood group.

Ans. (a) *Both A and R are true and R is correct explanation of A.*

X. Higher Order Thinking Skills (HOTS)

1. **When any dry plant material is kept in water, they swell up. Name and define the phenomenon involved in this change.**

- ❖ **Phenomenon** is Imbibition.
- ❖ Imbibition is a type of diffusion in which a solid absorbs water and gets swelled up.
- ❖ **Eg:** Absorption of water by seeds and dry grapes.

2. **Why are the walls of the left ventricle thicker than the other chambers of the heart?**

Left ventricle pumps blood with great pressure into aorta that supplies blood to whole body. Whereas other chambers pump blood with comparatively lesser pressure. Thus, it is thicker.

3. **Doctors use stethoscope to hear the sound of the heart. Why?**

Stethoscope is a diagnostic tool to identify and localize health problems and diagnose disease.

4. **How does the pulmonary artery and pulmonary vein differ in their function when compared to a normal artery and vein?**

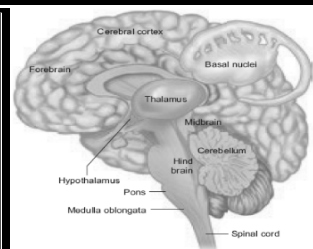
- ❖ All arteries carry oxygenated blood except pulmonary arteries, which carry deoxygenated blood.
- ❖ All veins carry deoxygenated blood except pulmonary veins, which carry oxygenated blood.

5. **Transpiration is a necessary evil in plants. Explain.** **[PTA – 3]**

- ❖ During transpiration 95% of water is evaporated. But, it is an inevitable process for photosynthesis.
- ❖ Therefore, it is a necessary evil in plants.

UNIT – 15

NERVOUS SYSTEM



I. Choose the correct answer

- Bipolar neurons are found in [APR – 2023]
a) retina of eye b) cerebral cortex c) embryo d) respiratory epithelium
- Site for processing of vision, hearing, memory, speech, intelligence and thought is
a) kidney b) ear c) brain d) lungs
- In reflex action, the reflex arc is formed by
a) brain, spinal cord, muscle b) receptor, muscle, spinal cord
c) muscle, receptor, brain d) receptor, spinal cord, muscle
- Dendrites transmit impulse _____ cell body and axon transmit impulse _____ cell body.
a) away from, away from b) towards, away from c) towards, towards d) away from, towards
- The outer most of the three cranial meninges is
a) arachnoid membrane b) pia mater c) duramater d) myelin sheath
- There are _____ pairs of cranial nerves and _____ pairs of spinal nerves. [JUN – 2023]
a) 12, 31 b) 31, 12 c) 12, 13 d) 12, 21
- The neurons which carries impulse from the central nervous system to the muscle fibre.
a) afferent neurons b) association neuron c) efferent neuron d) unipolar neuron
- Which nervous band connects the two cerebral hemispheres of brain? [PTA – 5]
a) thalamus b) hypothalamus c) corpus callosum d) pons
- Node of Ranvier is found in [SEP – 2020]
a) muscles b) axons c) dendrites d) cyton
- Vomiting centre is located in
a) medulla oblongata b) stomach c) cerebrum d) hypothalamus
- Nerve cells do not possess a) neurilemma b) sarcolemma c) axon d) dendrites
- A person who met with an accident lost control of body temperature, water balance and hunger. Which of the following part of brain is supposed to be damaged?
a) Medulla oblongata b) cerebrum c) pons d) hypothalamus

II. Fill in the blanks

- Neurons** is the longest cell in our body.
- Impulses travels rapidly in **myelinated multipolar** neurons.
- A change in the environment that causes an animal to react is called **stimulus**.
- Dendrites** carries the impulse towards the cell body.
- The two antagonistic component of autonomic nervous system are **sympathetic** and **parasympathetic**.
- A neuron contains all cell organelles except **centrioles**.
- Cerebrospinal fluid** maintains the constant pressure inside the cranium.
- Gyri** and **sulci** increases the surface area of cerebrum.
- The part of human brain, which acts as relay centre is **thalamus**. [PTA – 1]

III. State whether true or false, if false write the correct statement

- Dendrons are the longest fibres that conducts impulses away from the cell body. [False]
*Axons are the longest fibres that conducts impulses away from the cell body.
- Sympathetic nervous system is a part of central nervous system. [PTA – 3] [False]
*Sympathetic nervous system is a part of **autonomic nervous system**.
- Hypothalamus is the thermoregulatory centre of human body. [True]
- Cerebrum controls the voluntary actions of our body. [False]
***Cerebellum** controls the voluntary actions of our body.
- In the central nervous system myelinated fibres form the white matter. [True]
- All the nerves in the body are covered and protected by meninges. [PTA – 3] [False]
***Brain and Spinal cord** is covered and protected by meninges.
- Cerebrospinal fluid provides nutrition to brain. [True]
- Reflex arc allows the rapid response of the body to a stimulus. [True]
Note: Reflex Action allows the rapid response of the body to a stimulus.
- Pons helps in regulating respiration. [True]

IV. Match the following

Column I	Column II	Answer
A) Nissl's granules	Forebrain	A) Cyton B) Forebrain C) Hindbrain D) Peripheral Nervous system
B) Hypothalamus	Peripheral Nervous system	
C) Cerebellum	Cyton	
D) Schwann cell	Hindbrain	

V. Assertion and Reason

Understand the assertion statement. Justify the reason given and choose the correct choice.

- (a) Assertion is correct and reason is wrong (b) Reason is correct and the assertion is wrong
(c) Both assertion and reason are correct (d) Both assertion and reason are wrong.

- Assertion :** Cerebrospinal fluid is present throughout the central nervous system.
Reason : Cerebrospinal fluid has no such functions.
Ans. (a) Assertion is correct and reason is wrong.
- Assertion :** Corpus callosum is present in space between the duramater and piamater.
Reason : It serves to maintain the constant intracranial pressure.
Ans. (d) Both assertion and reason are wrong.

VI. Short answer questions

- Define stimulus.**
Stimulus is the changes in environmental condition, detected by receptors present in the body.
- Name the parts of the hind brain.** [PTA – 2]
❖ Cerebellum ❖ Pons ❖ Medulla oblongata
- What are the structures involved in the protection of brain?** [APR – 2023, PTA – 4]
❖ **Duramater, arachnoid membrane, piamater** protects brain from mechanical injury.
❖ **Cerebrospinal fluid** protects brain from sudden shock.
- Give an example for conditioned reflexes.**
Playing harmonium by striking a particular key on seeing a music note.

5. Which acts as a link between the nervous system and endocrine system?

Hypothalamus acts as a link between the nervous system and endocrine system.

6. Define reflex arc.

[PTA – 4]

Reflex arc is the pathway taken by nerve impulse to accomplish reflex action.

Additional Questions

7. Classify neurons based on its function.

[PTA – 3]

Sensory / Afferent neurons: They carry impulses from sense organ to central nervous system.

Motor / Efferent neurons: They carry impulses from central nervous system to effector organ.

Association neurons: They conduct impulses between sensory and motor neurons.

8. Write the functions of cerebellum.

[PTA – 6]

Cerebellum coordinates voluntary movements and maintains body balance.

VII. Differentiate between

1. Voluntary and involuntary actions.

[PTA – 5]

S.No	Voluntary action	Involuntary action
1.	Controlled by brain. <i>Eg:</i> eating	Controlled by spinal cord. <i>Eg:</i> sneezing
2.	With our conscience.	Without our conscience.
3.	Under the control of will.	Not under the control of will.
4.	It results in muscular action.	It results in muscular action or secretions.

2. Medullated and non-medullated nerve fibre (or) Myelinated & non-myelinated nerve fibre.

S.No	Medullated (Myelinated) Nerve Fibres	Non-medullated (Nonmyelinated) Nerve Fibres
1.	It has myelin sheath.	It do not have myelin sheath. [PTA – 3]
2.	It forms the white matter.	It forms the grey matter of the brain.
3.	It has Nodes of Ranvier.	It do not have Nodes of Ranvier.
4.	It carry impulses faster.	It carry impulses slower.

VIII. Long answer questions

1. With a neat labelled diagram explain the structure of a neuron.

[MDL – 19]

(i) Cyton / Cell body / Perikaryon :

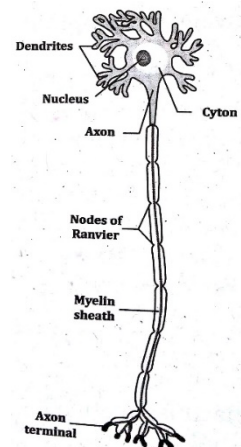
- ❖ It has nucleus with cytoplasm called neuroplasm.
- ❖ Cytoplasm has Nissl's granules and other cell organelles.
- ❖ Neurofibrils help in transmission of nerve impulse.

(ii) Dendrites:

- ❖ They are branched cytoplasmic processes.
- ❖ They project from surface of the cell body.
- ❖ They conduct nerve impulses towards cyton.
- ❖ Branched projections increase surface area for receiving signals.

(iii) Axon: It is a single, elongated, slender projection.

- ❖ Axon end has **Synaptic knobs**.
- ❖ Its plasma membrane is called **axolemma**.
- ❖ Its cytoplasm is called **axoplasm**.
- ❖ **Myelin sheath** acts as insulator and ensures rapid transmission of nerve impulses. It is covered by **neurilemma**.
- ❖ **Nodes of Ranvier** - Depressions in Myelin sheath
- ❖ **Synapse / synaptic junction** - Between synaptic knob of one neuron and dendron of next neuron.
- ❖ Information from one neuron is passed to another through synapse with the release of chemicals called **Neurotransmitters** from the synaptic knob.



2. Illustrate the structure and functions of brain.

[PTA – 1]

Brain is the controlling centre of all body activities. It is covered by 3 connective membranes called Duramater, Arachnoid Membrane, Piamater. Three main parts of brain are,

i) Forebrain :

* **Cerebrum:** Largest portion. Divided into right & left cerebral hemispheres by median cleft.

- **Corpus Callosum:** Connects 2 Cerebral hemisphere.
- **Cerebral Cortex:** Grey outer portion - **Gyri** and **Sulci**
- **Cerebral Medulla:** White inner portion
- **Cerebral Lobes:** Frontal lobe, Parietal lobe, temporal lobe, occipital lobe.

Functions: Responsible for intelligence, memory, imagination, willpower, etc.,

* **Thalamus:** Present in cerebral medulla. Functions: Acts as relay centre.

* **Hypothalamus:** At the base of thalamus. Functions: Controls involuntary functions, Link between nervous & endocrine system.

ii) **Midbrain:** Between thalamus and hindbrain. Functions: Controls visual & auditory reflexes.

iii) Hindbrain:

* **Cerebellum:** Second largest portion. Has two large sized hemispheres & middle vermis.

Functions: Coordinates voluntary movements, maintains body balance.

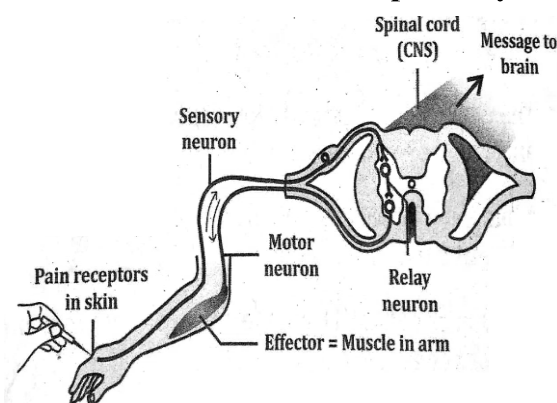
* **Pons:** It connects lobes of cerebellum. It relay signals between cerebellum, spinal cord, midbrain and cerebrum. Functions: Controls respiration and sleep cycle.

* **Medulla oblongata:** Connects spinal cord and various parts of brain.

Functions: cardiac, respiratory and vasomotor centre. Regulates vomiting & salivation.

3. What will you do if someone pricks your hand with a needle? Elucidate the pathway of response with a neat-labelled diagram.

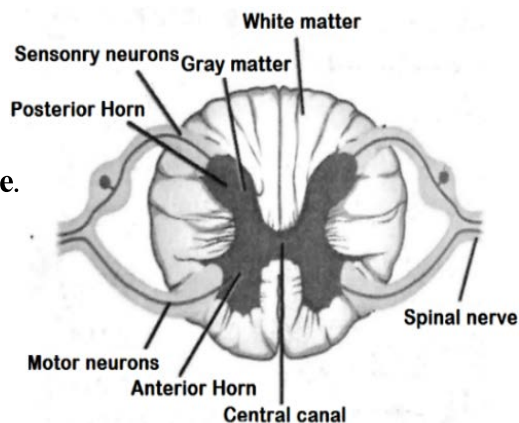
- ❖ When someone pricks, pain is the stimulus.
- ❖ Stimulus is sensed by **pain receptors**.
- ❖ Stimulus triggers impulse in **sensory neuron**.
- ❖ It transmits the impulse to **spinal cord**.
- ❖ **Spinal cord** interprets the stimulus and passed onto **relay neuron**.
- ❖ It then transmits to **motor neuron**.
- ❖ It commands the muscle in our arm.
- ❖ Thus, we withdraw our hand immediately.



4. Describe the structure of spinal cord.

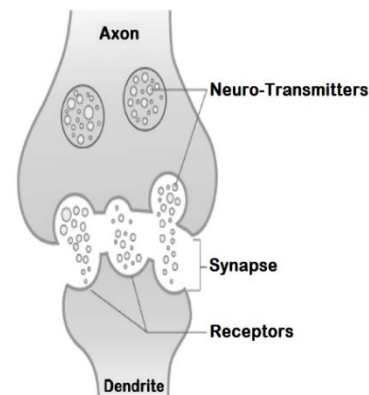
Structure of spinal cord :

- ❖ It is a cylindrical structure in vertebral column.
- ❖ It is from medulla oblongata to first lumbar vertebra.
- ❖ It is covered by meninges.
- ❖ Thin fibrous thread like posterior end is **filum terminale**.
- ❖ **Central canal** - Cerebrospinal fluid filled cavity.
- ❖ It has 'H' shaped **Grey matter**.
 - * Posterior horns (upper end). Fibres pass inward & form Dorsal/Afferent root.
 - * Anterior horns (lower end). Fibres pass outward & form Ventral/efferent root.
- ❖ Two roots join to form **Spinal nerves**.
- ❖ **White matter** is external and has bundle of nerve tracts.



5. How nerve impulses are transferred from one neuron to next neuron?

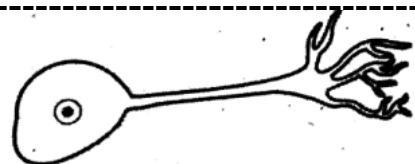
- ❖ Information from environment is detected by receptors in our sense organs like eyes, nose, skin etc.
- ❖ It is transmitted as electrical impulse to dendrites of neuron.
- ❖ Impulse travels to its terminal end along cell body & axon.
- ❖ On axonal end, nerve impulse releases neurotransmitter.
- ❖ It diffuses across synapse and starts similar process in the next neuron.
- ❖ Thus, electrical signal reaches brain or spinal cord.
- ❖ From there it is passed similarly onto the effector organs.



6. Classify neurons based on its structure. [JUN – 2023, SEP – 2020]

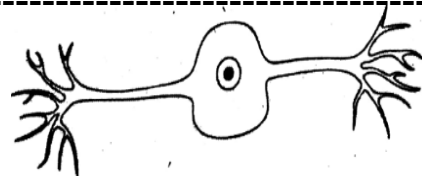
i) Unipolar Neurons :

- Only one nerve process arises from cyton,
- It acts as both axon and dendron.
- **Eg:** Early embryos.



ii) Bipolar Neurons :

- Two-nerve process arises from the cyton,
- One acts as axon while another as dendron.
- **Eg:** Retina of eye.



iii) Multipolar Neurons :

- Cyton gives rise to many dendrons and one axon.
- **Eg:** Cerebral cortex of brain.



IX. Higher Order Thinking Skills (HOTS)

1. 'A' is a cylindrical structure that begins from the lower end of medulla and extend downwards. It is enclosed in bony cage 'B' and covered by membranes 'C'. As many as 'D' pairs of nerves arise from the structure 'A'.

(i) What is A?

(ii) Name (a) bony cage 'B' and (b) membranes 'C'

(iii) How much is D?

A → Spinal cord

B → Vertebrae (or) Vertebral column

C → Meninges - Duramater, Arachnoid membrane, Piamater

D → 31 Pairs

[PTA – 6]

2. Our body contains a large number of cells 'L', which are the longest cells in the body. L has long and short branch called as 'M' and 'N' respectively. There is a gap 'O' between two 'L' cells, through which nerve impulse transfer by release of chemical substance 'P'.

(i) Name the cells L.

(ii) What are M and N?

(iii) What is the gap O?

(iv) Name the chemical substance P.

L → Neuron ;

M → Axon ;

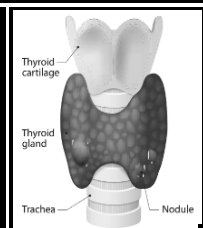
N → Dendron

O → Synaptic junction (or) Synapse;

P → Neurotransmitter

UNIT –16

PLANT AND ANIMAL HORMONES



I. Choose the correct answer

- Gibberellins cause: a) Shortening of genetically tall plants b) **Elongation of dwarf plants**
c) Promotion of rooting d) Yellowing of young leaves
- The hormone which has positive effect on apical dominance is:
a) Cytokinin b) **Auxin** c) Gibberellin d) Ethylene
- Which one of the following hormones is naturally not found in plants: [AUG – 2022]
a) **2, 4-D** b) GA 3 c) Gibberellin d) IAA
- Avena coleoptile test was conducted by
a) Darwin b) N. Smit c) Paal d) **F.W. Went**
- LH is secreted by
a) Adrenal gland b) Thyroid gland c) **Anterior pituitary** d) Hypothalamus
- Identify the exocrine gland [AUG – 2022]
a) Pituitary gland b) Adrenal gland c) **Salivary gland** d) Thyroid gland
- Which organ acts as both exocrine gland as well as endocrine gland
a) **Pancreas** b) Kidney c) Liver d) Lungs
- Which one is referred as “Master Gland”? [JUN – 2023, MAY - 2022, PTA – 2]
a) Pineal gland b) **Pituitary gland** c) Thyroid gland d) Adrenal gland

Additional Questions

- Pancreas acts as _____ gland. [PTA – 3]
a) exocrine b) endocrine c) **both a and b** d) flying
- _____ is found abundantly in liquid endosperm of coconut. [SEP – 2020]
a) Auxin b) **Cytokinin** c) Gibberellins d) Ethylene

II. Fill in the blanks

- Auxins** causes cell elongation, apical dominance and prevents abscission.
- Ethylene** is a gaseous hormone involved in abscission of organs and acceleration of fruit ripening.
- Abscisic acid** causes stomatal closure.
- Gibberellins induce stem elongation in **rosette** plants.
- The hormone which has negative effect on apical dominance is **cytokinin**.
- Calcium metabolism of the body is controlled by **parathormone**.
- In the islets of Langerhans, beta cells secrete **insulin**. [PTA – 6]
- The growth and functions of thyroid gland is controlled by **thyroid stimulating hormone**.
- Decreased secretion of thyroid hormones in the children leads to **cretinism**.

III. a) Match Column I with columns II and III

Answer:

Column I	Column II	Column III
1. Auxin	<i>Coleoptile tip</i>	<i>Apical dominance</i>
2. Ethylene	<i>Fruits</i>	<i>Ripening</i>
3. Abscissic acid	<i>Chloroplast</i>	<i>Abscission</i>
4. Cytokinin	<i>Coconut milk</i>	<i>Cell division</i>
5. Gibberellins	<i>Gibberella fujikuroi</i>	<i>Internodal elongation</i>

III. b) Match the following hormones with their deficiency states

Hormones	Disorders	Answer
1. Thyroxine	Acromegaly	1. Simple goitre
2. Insulin	Tetany	2. Diabetes mellitus
3. Parathormone	Simple goitre	3. Tetany
4. Growth hormone	Diabetes insipidus	4. Acromegaly
5. ADH	Diabetes mellitus	5. Diabetes insipidus

IV. True or False: (if false give the correct statement)

- A plant hormone concerned with stimulation of cell division and promotion of nutrient mobilization is cytokinin. [True]
- Gibberellins cause parthenocarp in tomato. [True]
- Ethylene retards senescence of leaves, flowers and fruits. [False]
**Ethylene hastens senescence of leaves, flowers and fruits.*
- Exophthalmic goitre is due to the over secretion of thyroxine. [True]
- Pituitary gland is divided into four lobes. [False]
**Pituitary gland is divided into two lobes.*
- Estrogen is secreted by corpus luteum. [False]
Estrogen is secreted by **graafian follicle (OR) **Progesterone** is secreted by corpus luteum.*

V. Assertion and Reasoning

Direction: In each of the following questions, a statement of assertion (A) is given and a corresponding statement of reason (R) is given just below it. Mark the correct statement as.

- a) If both A and R are true and R is correct explanation of A c) A is true but R is false
b) If both A and R are true but R is not the correct explanation of A d) Both A and R are false

- Assertion (A):** Application of cytokinin to marketed vegetables can keep them fresh for several days.
Reason (R): Cytokinins delay senescence of leaves and other organs by mobilisation of nutrients.

Ans. (a) Both A and R are true but R is correct explanation of A.

- Assertion (A):** Pituitary gland is referred as “Master gland”.
Reason (R): It controls the functioning of other endocrine glands.

Ans. (a) Both A and R are true and R is correct explanation of A.

3. **Assertion (A):** Diabetes mellitus increases the blood sugar levels.

Reason (R): Insulin decreases the blood sugar levels.

Ans. (b)

Both A and R are true but R is not the correct explanation of A.

VI. Answer in a word or sentence

1. Which hormone promotes the production of male flowers in cucurbits?	Gibberellin
2. Write the name of a synthetic auxin.	2,4 D (2,4 Dichlorophenoxy acetic acid)
3. Which hormone induces parthenocarp in tomatoes? [APR-23]	Gibberellin
4. What is the hormone responsible for the secretion of milk in female after childbirth?	Prolactin
5. Name the hormones, which regulates water and mineral metabolism in man. [PTA – 5]	Vasopressin, Aldosterone & Parathyroid
6. Which hormone is secreted during emergency situation in man?	Adrenaline & Noradrenaline
7. Which gland secretes digestive enzymes and hormones?	Pancreas
8. Name the endocrine glands associated with kidneys.	Adrenal gland

VII. Short answer questions

1. What are synthetic auxins? Give examples.

[MAY - 2022, PTA – 4]

These are artificially synthesized auxins that have properties like auxins.

Example: 2,4 D (2,4 Dichlorophenoxy acetic acid), Indole 3 Butyric Acid (IBA).

2. What is bolting? How can it be induced artificially?

[MDL – 19]

Treatment of rosette plants with gibberellin artificially induces sudden shoot elongation followed by flowering. This is called bolting.

3. Bring out any two physiological activities of abscisic acid.

❖ It promotes abscission process. ❖ It promotes senescence in leaves.

4. What will you do to prevent leaf fall and fruit drop in plants? Support your answer with reason.

❖ Spraying auxins can prevent leaf fall and fruit drop.
❖ Because auxin prevents the formation of abscission layer.

5. What are chemical messengers?

❖ Hormones produced by Endocrine Glands are called Chemical Messengers.
❖ **Eg:** Growth hormone.

6. Write the differences between endocrine and exocrine gland.

S.No	Endocrine glands	Exocrine glands
1.	They do not have ducts. Secretions diffuse directly into blood.	They have ducts to carry secretions.
2.	Secrete hormones.	Secrete enzymes.
3.	Eg : Thyroid gland	Eg : Salivary gland

7. What is the role of parathormone?

❖ Parathormone regulates calcium and phosphorus metabolism.
❖ They maintain blood calcium levels.

8. What are the hormones secreted by posterior lobe of the pituitary gland? Mention the tissues on which they exert their effect. [PTA – 2]

Hormone	Tissues on which they exert their effect
Vasopressin or Antidiuretic hormone(ADH)	Kidney tubules
Oxytocin	Muscles of uterus and mammary gland.

9. Why are thyroid hormones referred as personality hormones? [APR-23, AUG-22, MDL-19]
Thyroid hormones are essential for normal physical, mental and personality development. Hence, it is also known as personality hormone.

10. Which hormone requires iodine for its formation? What will happen if intake of iodine in our diet is low?

❖ Thyroid hormone requires iodine for its formation. ❖ If intake of iodine is low, it causes goiter.

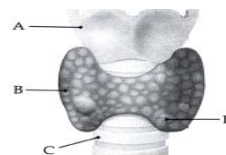
Additional Questions

11. Identify the parts A, B, C, D in the given figure. [MAY-2022]



A – Capsule	B – Cortex
C – Medulla	D – Blood vessels

12. Identify the parts of A, B, C and D in the given figure. [SEP – 2020]



A – Thyroid Cartilage	C – Trachea
B – Thyroid gland	D – Nodule

13. Explain the disorder with which the person shown in the figure is suffering. [PTA – 1]



- ❖ The person is suffering from **goitre**.
❖ It is caused due to inadequate supply of iodine in our diet.

14. How is Corpus luteum formed? Name the hormones secreted by corpus luteum. [PTA – 2]

- ❖ Corpus Luteum is formed in ovary from the ruptured follicle during ovulation.
❖ Progesterone is the hormones secreted by corpus luteum.

15. What is parthenocarpic fruit? Give an example. [PTA – 6]

These are Seedless fruits developed without fertilization. Induced by auxins or Gibberellin. *Eg : Tomato.*

VIII. long answer question

1. (a) Name the gaseous plant hormone. Describe its three different actions (physiological effects) in plants. [SEP – 2021, PTA – 3]

Gaseous plant hormone - **Ethylene**

- ❖ It promotes the **ripening of fruits**.
❖ It **inhibits the elongation** of stem and root in dicots.
❖ It **hastens senescence**.

- (b) Which hormone is known as stress hormone in plants? Why?

Stress hormone - **Abscisic acid**. Because it increases tolerance of plants to various stress.

2. Describe an experiment which demonstrates that growth stimulating hormone is produced at the tip of coleoptile.

Frits Warmolt Went demonstrated that auxin is produced at the tip of coleoptile.

In his first experiment,

- ❖ He removed the tips. The cut tips did not grow.
❖ Indicate that the tips produced something essential for growth.

In his second experiment,

- ❖ He placed agar blocks on the removed tips. There is no response.

In his next experiment,

- ❖ He placed cut tips on agar blocks. After an hour, he removed the tips and placed this agar block on the cut plant. It grew straight up.
❖ Indicates that some chemical had diffused from the cut tips into agar block.

Conclusion: This Chemical was responsible for growth and Went named it as “**Auxin**”.

3. Write the physiological effects of gibberellins.

- ❖ Gibberellin stimulates extraordinary *elongation of internode*. *Eg* : Pea.
- ❖ *Bolting* is achieved by gibberellin.
- ❖ It promote the *production of male flowers*. *Eg* : Cucurbits.
- ❖ It *break dormancy* of potato tubers.
- ❖ It induces *parthenocarpic fruits*.

4. Where are estrogens produced? What is the role of estrogens in the human body?

Estrogen is produced in *graafian follicles* of ovary.

Functions of estrogens:

- ❖ It brings changes during puberty.
- ❖ It initiates oogenesis.
- ❖ It stimulates the maturation of ovarian follicles.
- ❖ It helps in development of secondary sexual characters.

5. What are the conditions, which occur due to lack of ADH and insulin? How are the conditions different from one another?

S.No	Deficiency of ADH causes Diabetes Insipidus	Deficiency of insulin causes Diabetes Mellitus
1.	Increases water loss through urine.	Glycosuria - Excretion of excess glucose in urine.
2.	Causes Polyuria	Causes Polyuria, Polydipsia, Polyphagia
3.	Reduces reabsorption of water.	Hyperglycemia - Increased blood sugar level.

IX. Higher Order Thinking Skills (HOTS)

1. What would be expected to happen if,

a) Gibberellin is applied to rice seedlings.	Internodal elongation and increase in height.
b) A rotten fruit gets mixed with unripe fruits.	Ethylene from ripe fruits will hasten the ripening.
c) When cytokinin is not added to culture medium?	Culture tissue will not show any growth.

2. A plant hormone was first discovered in Japan when rice plants were suffering from Baka disease caused by *Gibberella fujikuroi*. Based on this information answer the following questions:

a) Identify the hormone involved in this process.	Gibberellin.
b) Which property of this hormone causes the disease?	Internodal elongation.

c) Give two functions of this hormone.

- ❖ *Bolting* is achieved by gibberellin.
- ❖ It induces *parthenocarpic fruits*.

3. Senthil has high blood pressure, protruded eyeball and an increased body temperature. Name the endocrine gland involved and hormone secretion responsible for this condition.

- ❖ Thyroid gland is responsible for this condition.
- ❖ It occurs due to the excess secretion of the thyroid hormones.

4. Sanjay is sitting in the exam hall. Before the start of the exam, he sweats a lot, with increased rate of heartbeat. Why does this condition occur?

- ❖ It is due to the secretion of emergency hormones during stress and emotion.

5. Susan's father feels very tired and frequently urinates. After clinical diagnosis, he was advised to take an injection daily to maintain his blood glucose level. What would be the possible cause for this? Suggest preventive measures.

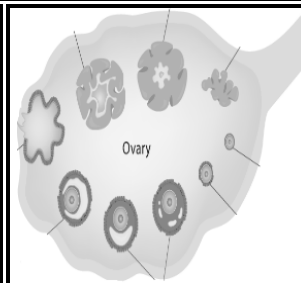
It is due to deficiency of insulin, which leads to Diabetes mellitus.

Preventive measures:

- ❖ Eat healthy foods
- ❖ Exercise regularly
- ❖ Avoid smoking

UNIT - 17

REPRODUCTION IN PLANTS AND ANIMALS



I. Choose the correct answer

- The plant which propagates with the help of its leaves is _____.
a) Onion b) Neem c) Ginger d) **Bryophyllum**
- Asexual reproduction takes place through budding in _____.
a) Amoeba b) **Yeast** c) Plasmodium d) Bacteria
- Syngamy results in the formation of _____. [APR – 2023, SEP – 2021]
a) Zoospores b) Conidia c) **Zygote** d) Chlamydospores
- The essential parts of a flower are _____.
a) Calyx and Corolla b) Calyx and Androecium
c) Corolla and Gynoecium d) **Androecium and Gynoecium**
- Anemophilous flowers have _____.
a) Sessile stigma b) Small smooth stigma
c) Colored flower d) **Large feathery stigma**
- Male gametes in angiosperms are formed by the division of _____. [MAY - 2022]
a) **Generative cell** b) Vegetative cell c) Microspore mother cell d) Microspore
- What is true of gametes?
a) They are diploid b) They give rise to gonads
c) They produce hormones d) **They are formed from gonads**
- A single highly coiled tube where sperms are stored, get concentrated and mature is known as
a) **Epididymis** b) Vasa efferentia
c) Vas deferens d) Seminiferous tubules
- The large elongated cells that provide nutrition to developing sperms are [SEP – 2021]
a) Primary germ cells b) **Sertoli cells**
c) Leydig cells d) Spermatogonia
- Estrogen is secreted by
a) Anterior pituitary b) Primary follicle
c) **Graffian follicle** d) Corpus luteum
- Which one of the following is an IUCD?
a) **Copper – T** b) Oral pills c) Diaphragm d) Tubectomy

Additional Questions

- _____ type of cell division occurs in generative cell of mature pollen grain [PTA – 1]
a) **Mitosis** b) Meiosis c) Amitosis d) both b and c
- In humans, a male and a female gamete fuse and form the zygote. The condition of zygote is [PTA – 4]
a) haploid b) **diploid** c) triploid d) tetraploid

II. Fill in the blanks

1. The embryo sac in a typical dicot at the time of fertilization is seven cells and eighth nuclei.
2. After fertilization the ovary develops into fruit.
3. *Planaria* reproduces asexually by regeneration.
4. Fertilization is internal in humans.
5. The implantation of the embryo occurs at about 6th to 7th day of fertilization.
6. Colostrum is the first secretion from the mammary gland after childbirth.
7. Prolactin is a hormone produced by anterior pituitary gland.

III. (a) Match the following

Column 1	Column 2	Answer
1. Fission	Spirogyra	1. Amoeba
2. Budding	Amoeba	2. Yeast
3. Fragmentation	Yeast	3. Spirogyra

III. (b) Match the following terms with their respective meanings

Column 1	Column 2	Answer
a) Parturition	Duration between pregnancy and birth.	a) Delivery of baby from uterus
b) Gestation	Attachment of zygote to endometrium.	b) Duration between pregnancy and birth
c) Ovulation	Delivery of baby from uterus.	c) Release of egg from Graafian follicle
d) Implantation	Release of egg from Graafian follicle.	d) Attachment of zygote to endometrium

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

1. Stalk of the ovule is called pedicle. [False]
*Stalk of the ovule is called **funiculus**.
2. Seeds are the product of asexual reproduction. [False]
*Seeds are the product of **sexual** reproduction.
3. Yeast reproduces asexually by means of multiple fission. [False]
*Yeast reproduces **vegetatively** by means of **budding**.
4. The part of the pistil which serves as a receptive structure for the pollen is called as style. [False]
*The part of the pistil which serves as a receptive structure for the pollen is called as **stigma**.
5. Insect pollinated flowers are characterized by dry and smooth pollen. [False]
***Wind** pollinated flowers are characterized by dry and smooth pollen.
6. Sex organs produce gametes which are diploid. [False]
*Sex organs produce gametes which are **haploid**.
7. LH is secreted by the posterior pituitary. [False]
*LH is secreted by the **anterior** pituitary.
8. Menstrual cycle ceases during pregnancy. [True]
9. Surgical methods of contraception prevent gamete formation. [False]
*Surgical methods of contraception prevent **the release of gamete**.
10. The increased level of estrogen and progesterone is responsible for menstruation. [False]
*The **decreased** level of estrogen and progesterone is responsible for menstruation.

V. Answer in a word or sentence

1. If one pollen grain produces two male gametes, how many pollen grains are needed to fertilize 10 ovules?	10 pollen grains
2. In which part of the flower germination of pollen grains takes place?	Stigma
3. Name two organisms which reproduces through budding.	Yeast, Hydra
4. Mention the function of endosperm.	It provides food to embryos.
5. Name the hormone responsible for the vigorous contractions of the uterine muscles.	Oxytocin
6. What is the enzyme present in acrosome of sperm?	Hyaluronidase
7. When is World Menstrual Hygiene Day observed?	May 28 th
8. What is the need for contraception?	It reduces population explosion.
9. Name the part of the human female reproductive system where the following occurs.	
a) Fertilization : Ampulla	b) Implantation : Uterine wall

VI. Short answer questions

- 1. What will happen if you cut planaria into small fragments?**
Each fragments of the cut planaria will give rise to new individual.
- 2. Why is vegetative propagation practiced for growing some type of plants? [PTA – 1]**
Vegetative propagation is practiced, because
 - ❖ It is useful for plants that do not produce viable seeds or produce less seeds.
 - ❖ It helps to retain and preserve the character of parent plant.
 - ❖ This is the only reproduction method for some seedless plants like Rose, Jasmine, etc.
- 3. How does binary fission differ from multiple fission?**

S.No.	Binary Fission	Multiple Fission
1.	Two new organisms are formed.	Many new organisms are formed.
2.	Occurs during favourable environmental conditions.	Occurs during unfavourable environmental conditions.
3.	Eg : Amoeba	Eg : Algae

- 4. Define triple fusion.** [JUN – 2023, MAY - 2022, MDL – 19]
One sperm fuses with egg and forms a diploid Zygote. Other sperm fuses with secondary nucleus to form triploid primary endosperm nucleus. This is called triple fusion.
- 5. Write the characteristics of insect pollinated flowers.** [PTA – 6]
 - ❖ Insect pollinated flowers are brightly coloured, have smell and nectar.
 - ❖ The pollen grains are larger, exine is pitted, spiny, etc., and firmly adhere to stigma.
- 6. Name the secondary sex organs in male.** [MAY - 2022]
Vas deferens, epididymis, seminal vesicle, prostate gland and penis.
- 7. What is colostrum? How is milk production hormonally regulated?** [PTA – 2]
Colostrum is the milk produced during the first 2 to 3 days after child birth.
 - ❖ Milk production is stimulated by prolactin.
 - ❖ Ejection of milk is stimulated by oxytocin.

8. How can menstrual hygiene be maintained during menstrual days? [PTA – 4]

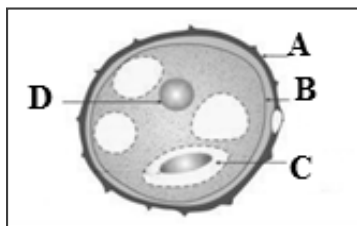
- ❖ Sanitary pads should be changed regularly.
- ❖ Use warm water to clean genitals.
- ❖ Wearing loose clothing.

9. How does developing embryo gets its nourishment inside the mother's body? [PTA – 6]

Developing embryo gets its nourishment inside the mother's body and excretes the wastes through placenta (umbilical cord).

10. Identify the parts A, B, C and D.

[APR – 2023, AUG – 2022, MDL – 19]



Pollen grain

- A** – Exine
B – Intine
C – Generative cell
D – Vegetative nucleus

11. Write the events involved in the sexual reproduction of a flowering plant. [JUN – 2023]

- 1) Pollination 2) Fertilization

a) Discuss the first event and write the types. (or) What is pollination? [SEP - 2021]

First event is pollination. It is the transfer of pollen grains from anther to stigma.

Types: ❖ Self-pollination ❖ Cross pollination

b) Mention the advantages and the disadvantages of that event. [JUN – 2023]

Self-pollination	Cross-pollination
<p>Advantages :</p> <ul style="list-style-type: none"> ❖ It is possible in bisexual flowers. ❖ Do not depend on agents. ❖ No wastage of pollen grains. <p>Disadvantages :</p> <ul style="list-style-type: none"> ❖ Seeds are less in numbers. ❖ Seeds produce weak plants. ❖ New varieties cannot be produced. 	<p>Advantages :</p> <ul style="list-style-type: none"> ❖ It leads to production of new varieties. ❖ More viable seeds are produced. <p>Disadvantages :</p> <ul style="list-style-type: none"> ❖ Pollination may fail due to distance barrier. ❖ More wastage of pollen grains. ❖ It may introduce some unwanted characters. ❖ Depend on the external agencies.

12. Why are the human testes located outside the abdominal cavity? Name the pouch in which they are present.

Human testes is outside the abdominal cavity, because sperm formation requires a lower temperature than our body temperature. Pouch in which they are present is scrotum.

13. Luteal phase of the menstrual cycle is also called the secretory phase. Give reason.

progesterone (as well as estrogen) is secreted during luteal phase. It maintains pregnancy and prevents contraction of uterus. Thus, this phase is called secretory phase.

14. Why are family planning methods not adopted by all the people of our country?

- ❖ Poverty
- ❖ Illiteracy
- ❖ Religious Opposition
- ❖ Lack of Cheap and Effective Methods

Additional Questions

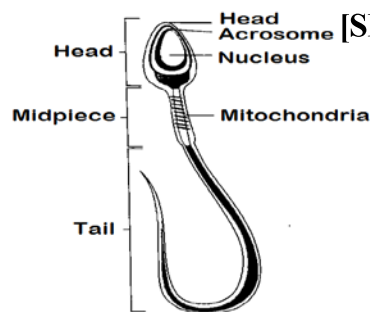
15. State the importance of pollination. [SEP-2021]

- ❖ Pollination results in fertilization, which leads to fruits and seeds.
- ❖ New varieties of plants are formed in case of cross-pollination.

16. Write the significance of fertilization in plants.

- ❖ It stimulates ovary to develop into fruit. [PTA-2]
- ❖ It helps in development of new characters.

17. Draw and label the parts of a sperm. [SEP-2021]

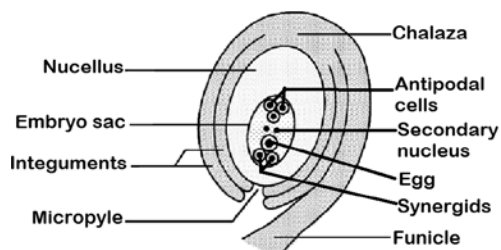


VII. Long answer questions

1. With a neat labelled diagram describe the parts of a typical angiospermic ovule. [PTA-5]

Structure of the Ovule:

1. The main part is nucellus.
2. It is enclosed by two integuments
3. It has an opening called micropyle.
4. It is attached to ovary wall - funiculus.
5. Chalaza is the basal part.
6. Embryo sac contains seven cells and eighth nuclei within nucellus.
 - Egg apparatus: 3 cells at micropylar end.
 - Antipodal cells: 3 cells at chalaza end.
 - Polar nuclei in the centre.



2. What are the phases of menstrual cycle? Indicate the changes in the ovary and uterus. [PTA-3]

❖ **Menstrual or Destructive Phase (4 – 5 days) :**

- **Changes in Ovary :** Development of primary follicles.
- **Changes in Uterus :** Breakdown of endometrial lining leads to bleeding.
- **Hormonal Changes :** Decrease in progesterone and oestrogen.

❖ **Follicular or Proliferative Phase (6th – 13th day) :**

- **Changes in Ovary :** Primary follicles grow to Graafian follicle.
- **Changes in Uterus :** Endometrium regenerates through proliferation.
- **Hormonal Changes :** FSH and oestrogen increase.

❖ **Ovulatory Phase (14th day) :**

- **Changes in Ovary :** Graafian follicle ruptures & releases ovum (egg).
- **Changes in Uterus :** Increase in endometrial thickness.
- **Hormonal Changes :** LH peak.

❖ **Luteal or Secretory Phase (15th – 28th day) :**

- **Changes in Ovary :** Emptied Graafian follicle develops into corpus luteum.
- **Changes in Uterus :** If fertilization occurs, endometrium is prepared for implantation. If fertilization does not occur, uterine wall ruptures, bleeding starts and egg is expelled.
- **Hormones:** LH & FSH decrease. Progesterone increases. It declines, if bleeding occurs.

Additional Question**3. Write short notes on UTIs.****[SEP – 2020]**

- ❖ Urinary Tract Infection (UTI) affect both women & men.
- ❖ Woman are more susceptible from the bacteria on skin, rectum or vagina. This will enter urethra, before moving upwards.
- ❖ Types of UTI are:
 - i) **Cystitis/Bladder infection:** Bacteria lodged in urinary bladder multiply leading to inflammation. It is common in age group 20 to 50.
 - ii) **Kidney Infection:** Bacteria travel from bladder to ureter and affect one or both kidneys. It also infects blood stream leading to life-threatening complications.
 - iii) **Asymptomatic Bacteriuria:** Bacteria in urinary bladder may not show any symptoms.

VIII. Higher Order Thinking Skills (HOTS)**1. In angiosperms the pollen germinates to produce pollen tube that carries two gametes.****What is the purpose of carrying two gametes when single gamete can fertilize the egg?**

In angiosperms, double fertilization takes place. The purpose of two gametes are

- i) Endosperm thus formed provides food to developing embryo.
- ii) It increases the viability of seeds.
- iii) Plant has better chances of survival.

2. Why menstrual cycle does not take place before puberty and during pregnancy?

- ❖ Before puberty, progesterone & estrogen secretion is absent. So, there is no menstrual cycle.
- ❖ After fertilization, corpus luteum persists. So progesterone continues to secrete to protect the embedded embryo. So, there is no menstrual cycle during pregnancy.

3. Read the following passage and answer the questions that follow.

Rahini and her parents were watching a television programme. An advertisement flashed on the screen, which was promoting use of sanitary napkins. Rahini's parents suddenly changed the channel, but she objected to her parents and explained the need and importance of such advertisement.

a) What is first menstruation called? When does it occur?

First menstruation is called Menarche. It occurs between 11 to 13 years of age.

b) List out the napkin hygiene measures taken during menstruation.

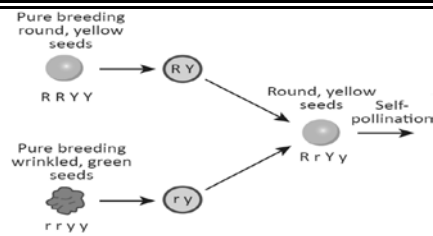
- ❖ Sanitary pad should be wrapped and discarded properly.
- ❖ Sanitary pad should not be flushed in toilet.
- ❖ Napkin incinerators should be used properly.

c) Do you think that Rahini's objection towards her parents was correct? If so, Why?

Yes, she was correct. Because, maintaining menstrual hygiene is important for woman's health. It is not a shame to discuss about such topics at home.

UNIT – 18

GENETICS



I. Choose the correct answer

- According to Mendel alleles have the following character
 - Pair of genes
 - Responsible for character**
 - Production of gametes
 - Recessive factors
- 9 : 3 : 3 : 1 ratio is due to [APR – 2023]
 - Segregation
 - Crossing over
 - Independent assortment**
 - Recessiveness
- The region of the chromosome where the spindle fibres get attached during cell division
 - Chromomere
 - Centrosome
 - Centromere**
 - Chromonema
- The centromere is found at the centre of the _____ chromosome.
 - Telocentric
 - Metacentric**
 - Sub-metacentric
 - Acrocentric
- The _____ units form the backbone of the DNA.
 - 5 carbon sugar
 - Phosphate
 - Nitrogenous bases
 - Sugar phosphate**
- Okasaki fragments are joined together by _____.
 - Helicase
 - DNA polymerase
 - RNA primer
 - DNA ligase**
- The number of chromosomes found in human beings are _____.
 - 22 pairs of autosomes and 1 pair of allosomes**
 - 22 autosomes and 1 allosome
 - 46 autosomes
 - 46 pairs autosomes and 1 pair of allosomes
- The loss of one or more chromosome in a ploidy is called _____.
 - Tetraploidy
 - Aneuploidy**
 - Euploidy
 - polyploidy

Additional Questions

- The term chromosome was first coined by [MAY-2022]
 - Mendel
 - Waldeyer**
 - Reginald punnet
 - T.H.Morgan
- The formation of nucleolus in the nucleus is by [PTA – 2]
 - secondary constriction**
 - primary constriction
 - telomere
 - locus
- Identify Dihybrid Phenotypic ratio [PTA – 3]
 - 9 : 3 : 3 : 1**
 - 9 : 1 : 3 : 1
 - 9 : 1 : 3 : 3
 - 1 : 2 : 1
- In metacentric chromosome, the position of centromere is [PTA – 5]
 - the proximal end
 - distal end
 - the centre**
 - near the end
- Find the correct pair. [SEP – 2020]
 - Acrocentric
 - The centromere is found near the centre of the chromosome with two unequal arms.
 - Submetacentric
 - The centromere is found on the proximal end.
 - Metacentric**
 - **The centromere occurs in the centre of the chromosome and forms two equal arms.**
 - Telocentric
 - The centromere is found at one end with a short arm and a long arm.

II. Fill in the blanks

- The pairs of contrasting character (traits) of Mendel are called alleles (or) allelomorphs.
- Physical expression of a gene is called phenotype.
- The thin thread like structures found in the nucleus of each cell are called chromosomes.
- DNA consists of two polynucleotide chains.
- An inheritable change in the amount or the structure of a gene or a chromosome is called mutation.

Additional Questions

- In DNA replication, the enzyme that separates the two strands of DNA is helicase. [PTA – 1]
- Enzyme that removes the twists formed during the unwinding process of DNA is topoisomerase. [PTA – 1]
- Nucleotides are added with the help of an enzyme called DNA Polymerase. [PTA – 1]
- The DNA fragments are joined together by the enzyme DNA ligases. [PTA – 1]
- The replication stops when the replication fork of the two sides meet at a site called terminus. [PTA – 1]

III. True or False: (if false give the correct statement)

- A typical Mendelian dihybrid ratio of F₂ generation is 3:1. [False]
A typical Mendelian **monohybrid ratio of F₂ generation is 3:1.*
- A recessive factor is altered by the presence of a dominant factor. [False]
A recessive factor is **masked by the presence of a dominant factor.*
- Each gamete has only one allele of a gene. [True]
- Hybrid is an offspring from a cross between genetically different parent. [True]
- Some of the chromosomes have an elongated knob-like appendages known as telomere. [False]
Some of the chromosomes have an elongated knob-like appendages known as **satellite.*
- New nucleotides are added and new complementary strand of DNA is formed with the help of enzyme DNA polymerase. [True]
- Down's syndrome is the genetic condition with 45 chromosomes. [False]
Down's syndrome is the genetic condition with **47 chromosomes (23 pairs(46) +1 extra chromosome)*

IV. Match the following

Column I	Column II	Answer
1. Autosomes	Trisomy 21	1. 22 pair of chromosome
2. Diploid condition	9:3:3:1	2. 2n
3. Allosome	22 pair of chromosome	3. 23 rd pair of chromosome
4. Down's syndrome	2n	4. Trisomy 21
5. Dihybrid ratio	23 rd pair of chromosome	5. 9:3:3:1

V. Answer in a sentence

1. What is a cross in which inheritance of two pairs of contrasting characters are studied?	Dihybrid cross
2. Name the condition when both the alleles are identical.	Homozygous condition.
3. A garden pea plant produces axial white flowers. Another of the same species produced terminal violet flowers. Identify the dominant trait.	axial white flowers
4. What is the name given to the segments of DNA, which are responsible for the inheritance of a particular character?	Genes
5. Name the bond which binds the nucleotides in a DNA.	Phosphodiester bonds

VI. Short answer questions

- Why did Mendel select pea plant for his experiments? [MAY - 2022]
 - ❖ It is naturally self pollinating and easy to cross-pollinate
 - ❖ It has short life span. We can follow several generations.
 - ❖ It has deeply defined contrasting characters.
 - ❖ Flowers are bisexual.
- What do you understand by the term phenotype and genotype? [APR-2023, AUG – 2022]
 - ❖ Phenotype – It is the external expression of a particular trait.
 - ❖ Genotype – It is the genetic expression of an organisms.
- What are allosomes? (or) Define Sex-chromosomes. [APR-2023, PTA – 2]
 - ❖ Chromosomes which are responsible for determining the sex of an individual are called Allosomes (or) sex chromosomes (or) hetero-chromosomes.
 - ❖ Human male have XY chromosomes. Human female have XX chromosomes.
- What are Okazaki fragments? [PTA – 4]

Short segments of DNA synthesised during replication of DNA are called Okazaki fragments. This strand is called lagging strand.
- Why is euploidy considered to be advantageous to both plants and animals? [PTA – 1]
 - ❖ Euploidy is advantageous to plants, as they give increased fruit and flower size.
 - ❖ It is not advantageous in animals. It creates diseases and abnormalities.
- A pure tall plant (TT) is crossed with pure dwarf plant (tt), what would be the F₁ and F₂ generations? Explain. [PTA – 5]

F₁ generation

	<i>T</i>	<i>T</i>
<i>t</i>	<i>Tt</i>	<i>Tt</i>
<i>t</i>	<i>Tt</i>	<i>Tt</i>

Phenotypes : All are tall plants
Genotypic ratio = All are *Tt*

F₂ generation

	<i>T</i>	<i>t</i>
<i>T</i>	<i>TT</i>	<i>Tt</i>
<i>t</i>	<i>Tt</i>	<i>tt</i>

Phenotypes : 3 tall and 1 dwarf plant = 3 : 1
Genotypic ratio = *TT* : *Tt* : *tt* = 1 : 2 : 1

7. Explain the structure of a chromosome. [SEP – 2021, PTA – 6]

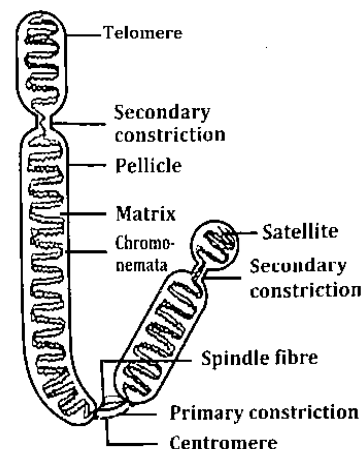
- ❖ Chromosomes are thin, long, thread like structures.
- ❖ It consists of two identical strands called sister chromatids.
- ❖ They are held together by centromere.
- ❖ Each chromatid has spirally coiled thin structure, chromonema.
- ❖ It has many bead-like structures called chromomeres along its length.
- ❖ They are made up of DNA, RNA, chromosomal proteins, etc.,
- ❖ Proteins provide structural support to the chromosome.
- ❖ A chromosome consists of the following regions.

i) **Primary constriction / centromere:** Two arms meet at this point. It is where spindle fibres attach to the chromosomes during cell division.

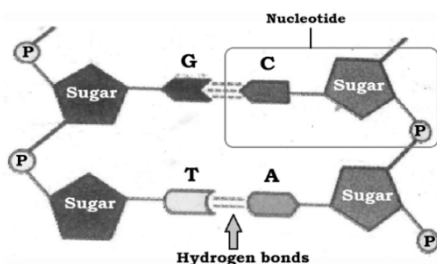
ii) **Secondary constriction:** It occurs at any point of some chromosome.

iii) **Telomere:** End of the chromosome. Provides stability.

iv) **Satellite:** It is an elongated knob-like appendage at one end of some chromosomes.



8. Label the parts of the DNA in the diagram given below. Explain the structure briefly.



A = Adenine
T = Thymine
C = Cytosine
G = Guanine

The given figure is **Nucleotides in DNA**

- ❖ Each nucleotide consists of three components.
 - a) A sugar molecule - Deoxyribose sugar
 - b) A nitrogenous base - Its two types are,
 - Purines (Adenine and Guanine)
 - Pyrimidines (Cytosine and Thymine)
 - c) A Phosphate group
- ❖ Nucleotide = Nucleoside + Phosphate;
- ❖ Nucleoside = Nitrogenous base + Sugar;
- ❖ Nucleotides are joined by phosphodiester bonds.

Additional Questions

9. If we cross two different parents with the genotype of $Tt \times tt$, what would be the genotype ratio in its F_1 generation? [PTA – 3]

F_1 generation

	T	t
t	Tt	tt
t	Tt	tt

$$\text{Genotypic ratio} = Tt : tt = 2 : 2 = 1 : 1$$

10. Differentiate phenotype and genotype. [PTA – 4]

Genotype	Phenotype
1. Genetic expression of an organism.	1. External appearance/ expression of a trait.
2. Determined by scientific methods.	2. Determined by observing the organism.
3. Monohybrid Genotype $TT:Tt:tt = 1:2:1$	3. Monohybrid Phenotype - Tall: Short - 3:1

VII. Long answer questions

1. Explain with an example the inheritance of dihybrid cross. How is it different from monohybrid cross?

Dihybrid cross : It involves the inheritance of two pairs of contrasting traits at the same time.

Experiment : Mendel crossed round yellow seeded pea plants and wrinkled green seeded pea plants.

First generation (F₁): When pure seeds are crossed.

* **Observation:** All seeds are Round and yellow.

Dominant traits - Round shape & yellow colour

Recessive traits - Wrinkled shape & green colour

Second generation (F₂): When hybrids of F₁ generation were cross-bred by self-pollination.

* **Observation:** Four types of plants are obtained.

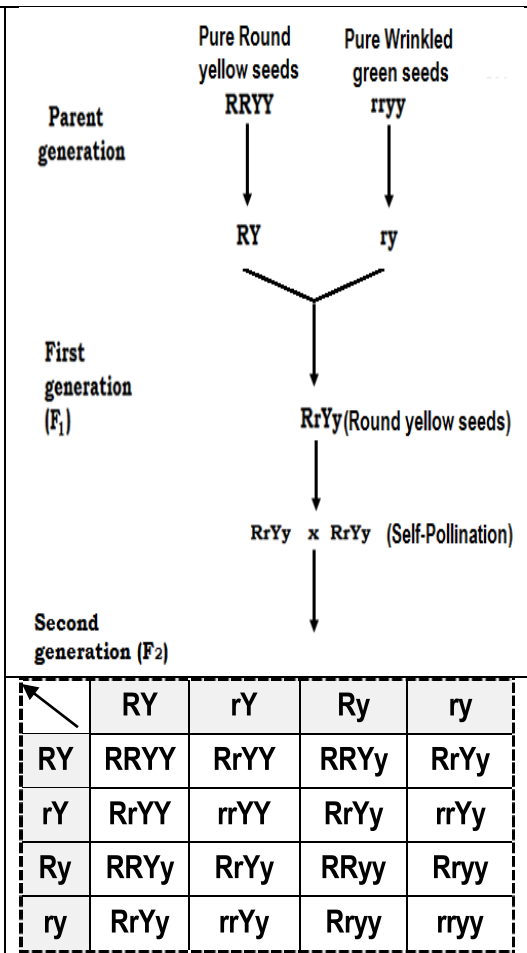
- Round yellow – 9 plants – 2 Dominant traits
 - Round green – 3 plants
 - Wrinkled yellow – 3 plants
 - Wrinkled green – 1 Plant – 2 Recessive Traits
- } 1 Dominant &
} 1 Recessive

New Combinations : Round green & Wrinkled yellow

Phenotypic ratio – 9 : 3 : 3 : 1

Conclusion :

- ❖ Factors for each character or trait remain independent and maintain their identity in the gametes.
- ❖ Factors are independent to each other and pass to the offsprings (through gametes).



Monohybrid cross	Dihybrid cross
1. Inheritance of one pair of contrasting characters	Inheritance of two pairs of contrasting characters
2. <i>Eg</i> : Tall Plant × Dwarf plant	<i>Eg</i> : Round yellow × Wrinkled green
3. F ₂ phenotypic ratio is 3:1	F ₂ phenotypic ratio is 9:3:3:1

2. How is the structure of DNA organised? What is the biological significance of DNA?

Structure of DNA – Watson and Crick Model:

[JUN – 2023]

- i) DNA molecule consists of two polynucleotide chains.
- ii) These chains form double helix structure with two anti-parallel strands.
- iii) Nitrogenous bases in the centre are linked to sugar-phosphate units.
- iv) Nitrogenous bases possess complementary base pairing.
 - Adenine links Thymine with two hydrogen bonds (A = T)
 - Cytosine links Guanine with three hydrogen bonds (C ≡ G)
- v) These hydrogen bonds make DNA molecule stable.
- vi) Each turn of double helix is 34 Å°. There are ten base pairs in a turn.
- vii) Nucleotides in a helix are joined by phosphodiester bonds.

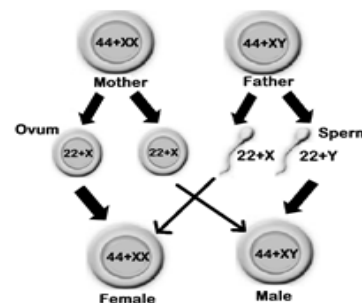
Significance of DNA:

[SEP – 2020]

- ❖ It transmits hereditary information from one generation to the next.
- ❖ It contains information for the formation of proteins.
- ❖ It controls developmental process and life activities.

3. The sex of the new born child is a matter of chance and neither of the parents may be considered responsible for it. What would be the possible fusion of gametes to determine the sex of the child?

- ❖ Human have 22 pairs of autosomes & one pair of allosomes.
- ❖ Female gametes are homogametic (22+XX).
- ❖ Male gametes are heterogametic (22+XY).
 - Sperm bearing (22 + X) chromosomes.
 - Sperm bearing (22 + Y) chromosomes.
- ❖ If egg is fused with X - bearing sperm (22+X) it produces a female child (44+XX).
- ❖ If egg is fused with Y - bearing sperm (22+Y) it produces a male child (44+XY).
- ❖ Thus, the sperm produced by the father, determines the sex of the child. Mother does not involved in the determination of the sex of the child. Hence, it is a matter of chance.

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

1. Flowers of the garden pea are bisexual and self-pollinated. Therefore, it is difficult to perform hybridization experiment by crossing a particular pistil with the specific pollen grains. How Mendel made it possible in his monohybrid and dihybrid crosses?

Mendel made this possible by following techniques

- **Emasculation:** Anthers are removed.
- **Bagging :** Female flower is covered by polythene bag.

Pollen grains are collected from desired plant and dusted on the stigma in consideration.

2. Pure-bred tall pea plants are first crossed with pure-bred dwarf pea plants. The pea plants obtained in F₁ generation are then selfed to produce F₂ generation of pea plants. [MDL – 19]

a) What do the plants of F ₁ generation look like?	All are tall plants.
b) What is the ratio of tall plants to dwarf plants in F ₂ generation?	3:1
c) Which type of plants were missing in F ₁ generation but reappeared in F ₂ generation?	Dwarf plants

3. Kavitha gave birth to a female baby. Her family members say that she can give birth to only female babies because of her family history. Is the statement given by her family members true. Justify your answer.

- ❖ No, Kavitha is not responsible for the gender of her child. Father determines the sex.
- ❖ If egg is fused with X - bearing sperm (22+X) it produces a female child (44+XX).
- ❖ If egg is fused with Y - bearing sperm (22+Y) it produces a male child (44+XY).
- ❖ Thus, sperm of father, determines the sex. So, Kavitha and her family is not responsible.

IX. Value based question

1. Under which conditions does the law of independent assortment hold good and why?

The law of independent assortment holds goods only if different genes lie in different chromosomes, because chromosomes are the one which get segregated and not the genes.

Ariyalur: 7094441952, 9843427724 Chennai: 7094441953, 7868911969 Chengalpet: 7397774505, 9600526295 Coimbatore: 7397774501, 8973711777 Cuddalore: 7397774502, 9003557799 Dharmapuri: 7397774503, 9787144519 Dindigul: 7094441954, 9150078022 Erode: 7397774504, 9788831237 Kallakuruchi: 7094441965, 9943153202 Kanchipuram: 7397774505, 9600526295 Kanniyakumari: 7397774506, 9486679747 Karur: 7094441955, 9842964646 Krishnagiri: 7094441956, 9543811011 Madurai: 7094441957, 9843349892 Mayiladuthurai: 8680810626, 9789175104 Nagapattinam: 7094441966, 7598868760 Namakkal: 7094441958, 7418176317 Perambalur: 7397774509, 9003557799 Pudukottai: 7397774510, 9597402010	Ramanathapuram: 7094441959, 9150854043 Ranipet: 7094441964, 9994311090 Salem: 7397774511, 9952499928 Sivaganga: 7397774512, 7708672601 Tenkasi: 7397774515, 9500806359 Thanjavur: 7094441960, 9940333073 Theni: 7397774513, 7904657547 Thirupathur: 7094441961, 9786315453 Thiruvallur: 7397774514, 8667604216 Thiruvavarur: 7094441962, 7598868760 Thoothukudi: 7397774507, 9487771682 Tiruchirappalli: 9626053030, 9787609090 Thuraiyur: 9994595695, 9965894470 Tirunelveli: 7397774515, 9500806359 Tiruppur: 7397774524, 9788776767 Tiruvannamalai: 7094441963, 9952782495 Vellore: 7094441964, 9994311090 Villuppuram: 7094441965, 9943153202 Virudhunagar: 7397774516, 8189844465
You can also buy our books in Book Shops and Stationaries near you.	