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SCIENCE

10

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Compiled by

Dr. S.A. RAJKUMAR MBBS., MS(EM)

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SCIENCE

10th Standard

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PREFACE

Don Science Companion for the X Std. students is entirely based on the new syllabus and latest Question Paper pattern.

In this book, all the text book questions are answered. Additional questions are given as per the blue print of new syllabus. In Section B, all types of questions are dealt in detail. Also for every chapter an unit test question paper is given.

Along with this book a free practice book to all important questions is issued. And a Q book with Govt. Model question papers in all chapters is given free.

It is our robust optimism that our companion would provide an impetus to the students growth potential and serve as an useful guidance to the teachers.

All the best in all your endeavours.

S.A. Suresh Kumar, MCA., MBA.,
for Don Publications (P) Ltd.

Authors

1. Mrs. **S.Revathi,** M.Sc., M.phil., Ph.d., B.Ed.,
2. Mrs. **M.A.Maria Rosaline,** M.Sc., M.phil., B.Ed (Zoology)
3. Mr. **I.Jeyaprakash,** M.Sc (Phy)., B.Ed.,
4. Mr. **V.Arumuga Selvam,** M.Sc (Phy)., B.Ed.,

Reviewed by

1. Mrs. **L.Seetha Lakshmi,** M.Sc.,(Che) B.Ed.,
2. Mr. **D.V.Thangaraj,** M.Sc., M.Ed

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X Std. State Board Syllabus
Based on New Question Paper Pattern
Design of the Question Paper & Time Management

MODEL QUESTION PAPER

Time : 15 mins + 3 hours **Marks: 75**

Section	Question Number	Question Type	No. of Questions	Question to write	Total Marks	Writing Time (Average)	Revision Time
I.	1 – 12	Choose the correct answer	12	12	12	12 × 2 = 24	6
II.	13 – 22	2 Mark Questions (Question No.22 is compulsory)	10	7	14	7 × 5 = 35	6
III.	23 – 32	4 Mark Questions (Question No.32 is compulsory)	10	7	28	7 × 6 = 42	6
IV.	33 – 35	7 Mark Questions (Either or Type)	6	3	21	3 × 16 = 48	13
		Total	38	29	75	149	31

NOTE

▲ Science paper is for 75 marks only. Remaining 25 marks is for internal assessment and practicals.

▲ Around 40 % questions will be from inside book (created questions.)

▲ Students should write the answers in either BLUE or BLACK colour pen only (Do not use both the colours - even for highlighting or underlining or heading).
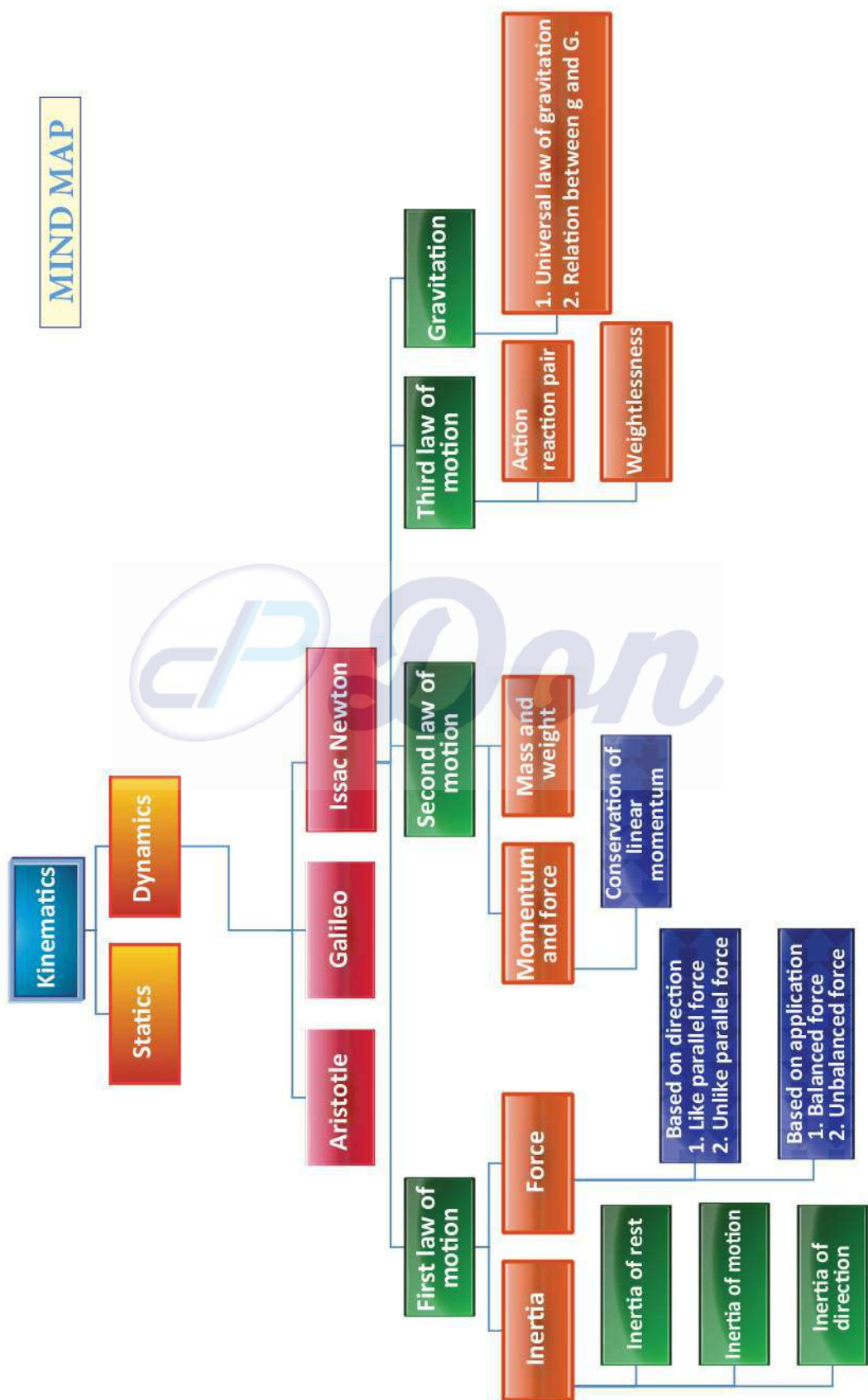
Laws of Motion

Mechanics	: The branch of physics that deals with the effect of force on bodies.
Statics	: It deals with the bodies which are at rest under the action of forces.
Force	: It is an external effort in the form of push or pull.
Inertia	: The inherent property of a body to resist any change in its state of rest or the state of uniform motion, unless it is influenced upon by an external unbalanced force.
Linear momentum	: The product of mass and velocity
Like parallel forces	: Two are more forces of equal or unequal magnitude acting along the same direction parallel to each other;
Unlike parallel forces	: Two are more equal forces or unequal forces act along opposite directions parallel to each other.
Resultant forces	: When several forces act simultaneously on the same body, then the combined effect of multiple forces can be represented by a single force termed resultant force.
Moment of the force	: The rotating or turning effect of a force about a fixed point or fixed axis is called moment of the force.
Torque	: Moment of the force is otherwise called as Torque.
Couple	: Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple.
Moment of a couple	: Rotating effect of a couple is known as moment of a couple.
1 newton	: The amount of force required for a body of mass 1 kg produces an acceleration of $1m\ s^{-2}$.
Impulsive force	: A large force acting for a very short interval of time.
Mass	: Mass is the quantity of matter contained in a body.
Inertial mass	: If mass is defined in association with force and inertia, it is termed as "inertial mass".
Gravitational mass	: When the mass of the body is defined in association with the gravitational field, it is termed as gravitational mass.
Weight	: Weight is the gravitational force exerted on it due to the earth's gravity alone
Apparent weight	: It is the weight of the body acquired due to the action of gravity and other external forces acting on the body.
Weightlessness	: Whenever a body or a person falls freely under the action of Earth's gravitational force alone, it appears to have zero weight. This state is referred to as weightlessness.

MIND MAP

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Kinematics

Dynamics **Statics**

Aristotle **Galileo** **Issac Newton**

First law of motion
- **Inertia**
  - Inertia of rest
  - Inertia of motion
  - Inertia of direction
- **Force**
  - Based on direction
    1. Like parallel force
    2. Unlike parallel force
  - Based on application
    1. Balanced force
    2. Unbalanced force

Second law of motion
- Momentum and force
- Mass and weight
- Conservation of linear momentum

Third law of motion
- Action reaction pair
- Weightlessness

Gravitation
1. Universal law of gravitation
2. Relation between g and G.

Formulae	
Linear Momentum	$P = mv$
Parallel forces are acting in the same direction	$F_{net} = F_1 + F_2$
Parallel unequal forces are acting in the opposite direction	$F_{net} = F_1 - F_2$ (if $F_1 > F_2$) $F_{net} = F_2 - F_1$ (if $F_2 > F_1$)
Torque	$\tau = F \times d$
Principle of moments	$F_1 \times d_1 = F_2 \times d_2$
Moment of couple	$M = F \times S$
Force	$F = m \times a$
Impulse	$J = \Delta P$ (or) $F \times t$
Law of conservation of linear momentum	$m_1v_1 + m_2v_2 = m_1u_1 + m_2u_2$
Newton's Universal law of gravitation	$F = \dfrac{GMm}{R^2}$ $[G = 6.674 \times 10^{-11}\ Nm^2kg^{-2}]$
Acceleration due to gravity	$g = \dfrac{GM}{R^2}$
Weight	$W = mg$
Mass of the Earth	$M = \dfrac{gR^2}{G}$
Acceleration	$a = \dfrac{v-u}{t}$
Apparent weight i. When lift is moving upwards	$R = m(g + a)$ Where ($R \rightarrow$ apparent weight of the person)
ii. When lift moving downards	$R = m(g - a)$ $a \rightarrow$ acceleration $m \rightarrow$ mass of the person
iii. When lift is at rest	$R = mg,$ $g \rightarrow$ acceleration due to gravity
iv. when lift is falling down	$R = 0$

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

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

2. Impulse is equal to ✦ ✦
   a) rate of change of momentum
   b) rate of force and time
   c) change of momentum
   d) rate of change of mass

3. Newton's III law is applicable
   a) for a body at rest   b)   for a body in motion
   c) both a & b
   d) only for bodies with equal masses

4. Plotting a graph for momentum on the X-axis and time on Y-axis. Slope of momentum-time graph gives ✦ ✦
   a) Impulsive force
   b) Acceleration
   c) Force
   d) Rate of force

5. In which of the following sport is the turning of effect of force used
   a) swimming   b) tennis   c) cycling   d) hockey

6. The unit of 'g' is m s^{-2}. It can be also expressed as
   a) cm s^{-1} b) N kg^{-1} c) N m^{2}kg^{-1} d) cm^{2}s^{-2}

7. One kilogram force equals to ✦
   a) 9.8 dyne   b) 9.8×10^4 N   c) 98×10^4 dyne   d) 980 dyne

8. The mass of a body is measured on planet Earth as M kg. When it is taken to a planet of radius half that of the Earth then its value will be _____ kg.
   a) 4 M   b) 2M   c) M/4   d) M

9. If the Earth shrinks to 50% of its real radius and its mass remains the same, the weight of a body on the Earth will be ✦ ✦
   a) decrease by 50%
   b) increase by 50%
   c) decrease by 25%
   d) increase by 300%

10. To project the rockets which of the following principle(s) is /(are) required?
   a) Newton's third law of motion
   b) Newton's law of gravitation
   c) law of conservation of linear momentum
   d) both a and c

Ans:

1)	c)	Mass of the object	6)	b)	Nkg^{-1}
2)	c)	Change of momentum	7)	c)	98×10^4 dyne
3)	c)	both a & b	8)	d)	M
4)	c)	force	9)	d)	increases by 300%
5)	c)	cycling	10)	d)	both a and c

II. Fill in the blanks:

1. To produce a displacement _____ is required

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

3. By convention, the clockwise moments are taken as _____ and the anticlockwise moments are taken as_____

4. _____ is used to change the speed of a car.

5. A man of mass 100 kg has a weight of _____ at the surface of the Earth. ✹ ✹

Ans:

1.	Force	4.	A gear
2.	inertia of motion	5.	980 N
3.	negative, positive		

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

1. The linear momentum of a system of particles is always conserved. **False**
   The linear momentum of a system of particle is conserved only if no external force acts on the system.

2. Apparent weight of a person is always equal to his actual weight. ✹ ✹ **False**
   Apparent weight of a person may be the same, greater or lesser than his actual weight.

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

4. 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.

5. There is no gravity in the orbiting space station around the Earth. So the astronauts feel weightlessness. ✹ ✹ **False**
   Since spacestation and astronauts have equal acceleration, they are under free fall condition. So, the astronaut feels weightlessness.

IV. Match the following

1. **Column I**

   1) Newton's I law
   2) Newton's II law
   3) Newton's III law
   4) Law of conservation of linear momentum

   Column II

   a) propulsion of a rocket   (b)
   b) Stable equilibrium of a body   (c)
   c) Law of force   (d)
   d) Flying nature of bird   (a)

V. Assertion & Reasoning

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.

b) If both the assertion and the reason are true, the reason is not the correct explanation of the assertion.

c) Assertion is true, but the reason is false.

d) Assertion is false, but the reason is true.

1. **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) If both the assertion and the reason are true, the reason is not the correct explanation of the assertion.

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

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

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

VI. Answer briefly.

1. Define inertia. Give its classification. ✷ ✷

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

Types :

• Inertia of rest

• Inertia of motion

• Inertia of direction

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

Based on the direction in which the force acts, they can be classified as

• Like Parallel forces

• Unlike Parallel forces.

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

Let, $F_1 = 5 \, N$

$F_2 = 15 \, N$

$F_{net} = F_2 - F_1 \qquad [\because F_2 > F_1]$

$= 15 - 5 = 10 \, N$

F_{net} i.e, the resultant force acts along the direction of the greater force 15 N.

4. Differentiate mass and weight. ✲✲

Mass	Weight
Fundamental quantity	Derived quantity
It is the amount of **matter** containing in a body	It is the **gravitational pull** acting on the body
Its unit is **kilogram**	Its unit is **newton**
Remains the **same**	**Varies** from place to place.
It is a **scalar** quantity	It is a **vector** quantity

5. Define moment of a couple. ✲✲

- The **rotating effect** of a couple is known as moment of a couple
- **Eg:** Turning a tap, winding or unwinding a screw.
- Moment of a couple = Force × perpendicular distance between the line of action of force.
- $\boxed{M = F \times S}$

6. State the principle of moments.

- When a number of like or unlike parallel forces act on a rigid body and the body is in equilibrium, then the algebraic sum of the moments in the clock wise direction is equal to the algebraic sum of the moments in the anti-clockwise direction.
- Moment in clockwise direction = Moment in anticlockwise direction.
- $\boxed{F_1 \times d_1 = F_2 \times d_2}$

7. State 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".
- Force = mass × acceleration
- $\boxed{F = ma}$

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

- A spanner has a long handle to produce a larger moment of force by a small force applied normally at the end of its handle.
- **Moment of force =** $\boxed{\vec{F} \times \vec{d}}$

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

- If he stops his hands soon after catching the ball, the ball comes to rest very quickly.
- It means that the momentum of the ball is brought to rest very quickly.
- So the average force acting on the body will be large.
- Due to this large average force, the hands will get hurt.
- To avoid getting hurt, the player brings the ball to rest slowly.

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

- Since space station and astronauts have equal acceleration, they are under **free fall condition.**
- Both the astronauts and the space station are in the state of weightlessness.
- They are not actually floating but falling freely around the earth due to the **huge orbital velocity.**

VII. Solve the given problems: (Numerical Problems)

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

Given $m_1 : m_2 = 3 : 4$

           $a_2 = 12$ m s^{-2}

           $a_1 = ?$

> **Formula used:**
> Newton's second law
> $F = ma$

Using Newton's second law

         $F = ma$

         $F = m_1 a_1 = 3a_1$

         $F = m_2 a_2 = 4 \times 12 = 48$ N

      $3a_1 = 48$

        $a_1 = 48 / 3 = 16$ m s^{-2}

      $a_1 = 16$ ms^{-2}

The acceleration produced on the other body is **16 m s^{-2}**

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

Given $m = 1$ kg , $v = 10$ m s^{-1}

     When a ball bounces back with the same speed, the momentum changes from mv to – mv. So the change in momentum is –2 mv.

        $\Delta P = -2mv = -2 \times 1 \times 10$

        $\Delta P = -20$ 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 $F_1 = 140$ N

           $d_1 = 40$ cm $= 40 \times 10^{-2}$ m

           $F_2 = 40$ N

           $d_2 = ?$

> **Formula used:**
> Moment of force
> $= F_1 d_1$

The moment of force on the nut

         $= F_1 d_1 = 140 \times 40 \times 10^{-2}$

         $= 56$ Nm

The same moment of force is required to unscrew the nut so,

        $56 = F_2 d_2$

        $56 = 40 \times d_2$

        $d_2 = \dfrac{56}{40} = 1.4$ m

      $d_2 = 1.4$ m

The spanner with the longer handle requires very less force to unscrew the same nut.

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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, the ratio of masses of two planets $M_1 : M_2$ is $2 : 3$

The ratio of their radii $R_1 : R_2$ is $4 : 7$

$g_1 : g_2 = ?$

$$g = \frac{GM}{R^2} ; \qquad g_1 = \frac{GM_1}{R_1^2} ; \qquad g_2 = \frac{GM_2}{R_2^2}$$

> **Formula used:**
> $$g = \frac{GM}{R^2}$$

$$\frac{g_1}{g_2} = \frac{\dfrac{GM_1}{R_1^2}}{\dfrac{GM_2}{R_2^2}} ; \qquad \frac{g_1}{g_2} = \frac{M_1}{R_1^2} \times \frac{R_2^2}{M_2} = \frac{2 \times 7 \times 7}{4 \times 4 \times 3} = \frac{49}{24}$$

So **$g_1 : g_2 = 49 : 24$**

VIII. Answer in detail.

1. What are the types of inertia? Give an example for each type.

Definition:

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

Types of Inertia:

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

I. Inertia of rest:

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

Example: When you vigorously shake the branches of a tree some of the leaves and fruits are detached and they fall down. (Inertia of rest)

II. Inertia of motion:

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

Example: An athlete runs some distance before jumping. Because, this will help him jump longer and higher. (Inertia of motion).

III. Inertia of direction:

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

Example: When we make a sharp turn while driving a car we tend to lean sideways due to inertia of direction

2. State Newton's laws of motion. ✶ ✶ ✶

Newton's first law

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

Newton's second law

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

Newton's third law

For every action there is an equal and opposite reaction. They always act on two different bodies.

3. Deduce the equation of a force using Newton's second law of motion. ✶ ✶

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

- Let, 'm' be the mass of a moving body, moving along a straight line with an initial speed 'u'.

- After a time interval of 't', the velocity of the body changes to 'v' due to the impact of an unbalanced external force F.

Initial momentum of the body $P_i = mu$

Final momentum of the body $P_f = mv$

Change in momentum $\Delta p = P_f - P_i$

$$= mv - mu$$

By Newton's second law of motion,

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

F $\propto$ change in momentum / time

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

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

Here, k is the proportionality constant.

k = 1 in all systems of units. Hence,

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

Since, acceleration = change in velocity/ time, a = (v – u) / t. Hence, we have
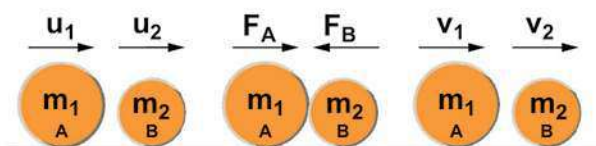
$$\boxed{F = m \times a}$$

Force = mass × acceleration

4. State and prove the law of conservation of linear momentum. ✶✶

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

Proof:

- Let us prove the law of conservation of linear momentum with the following illustration:

Conservation of linear momentum

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

    Force on body B due to A, $F_B = m_2 (v_2 - u_2) / t$

    Force on body A due to B, $F_A = m_1 (v_1 - u_1) / t$

By Newton's III law of motion,

    Action force = Reaction force

    $F_A = - F_B$

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

$$\boxed{m_1 v_1 + m_2 v_2 = m_1 u_1 + m_2 u_2}$$

The above equation confirms **in the absence of an external force, the algebraic sum of the momentum after collision is numerically equal to the algebraic sum of the momentum before collision.**

Hence the law of conservation of linear momentum is proved.

5. Describe rocket propulsion. ✶✶

- Propulsion of rockets is based on the **law of conservation of linear momentum** as well as **Newton's III law** of motion.
- Rockets are filled with a fuel (either liquid or solid) in the propellant tank
- When the rocket is fired, this **fuel** is burnt and a **hot gas is ejected** with a high speed from the nozzle of the rocket, producing a huge momentum.
- To balance this momentum, an **equal and opposite reaction** force is produced in the **combustion chamber,** which makes the rocket project forward.
- While in motion, the **mass** of the rocket gradually decreases, until the fuel is completely burnt out.
- Since, there is **no net external force** acting on it, the linear momentum of the system is conserved.
- The mass of the rocket **decreases with altitude**, which results in the gradual **increase in velocity** of the rocket.
- At one stage, it reaches a velocity, which is sufficient to just escape from the gravitational pull of the Earth. This velocity is called **escape velocity.**

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

This law states that every particle of matter in this universe attracts every other particle with a force. This force is directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of these masses. The direction of the force acts along the line joining the masses.

Derivation:

- Force between the masses is always attractive and it does not depend on the medium where they are placed.
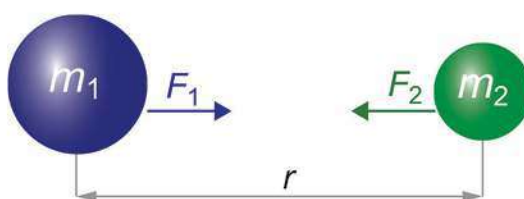
Gravitational force between two masses

- Let, m_1 and m_2 be the masses of two bodies A and B placed r metre apart in space

  Force $F \propto m_1 \times m_2$

  $F \propto 1/r^2$

- On combining the above two expressions

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

  $$\boxed{F = \dfrac{Gm_1m_2}{r^2}}$$

  Where G is the universal gravitational constant.

- Its value in SI unit is 6.674×10^{-11} N m^2 kg^{-2}.

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

- **Dimensions of the heavenly bodies** can be measured using the law of gravitation. Mass of the Earth, radius of the Earth, acceleration due to gravity, etc. can be calculated with a higher accuracy.

- Helps in **discovering new stars** and **planets**.

- One of the irregularities in the motion of stars is called **'Wobble'** that leads to the disturbance in the motion of a planet nearby. In this condition the **mass of the star** can be calculated using the law of gravitation.

- Helps to explain **germination of roots** due to the property of geotropism which is the property of a root responding to the gravity.

- Helps to predict the **path of the astronomical bodies**.

IX. Higher Order Thinking Skills (HOTS)

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.**

   Consider both the masses as a unit system as they will move with common acceleration,

   $\vec{F_1} = M\vec{a}$, Let $m_1 = 8$ kg, $m_2 = 2$ kg, $\vec{F_1} = 15$ N

   $\vec{F_1} = (m_1 m_2)\vec{a}$

   $15 = (8 + 2)\vec{a}$

   $15 = 10\,a$

   $a = 15/10 = 1.5$ ms^{-2}

   Formula used:

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

Let F_2 be the force exerted on 2 kg mass then

$$\vec{F_2} = m\vec{a}$$

$$\vec{F_2} = 2 \times 1.5 = 3\,N$$

So, the force exerted on 2 kg mass is 3 N.

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 = 1:2**

The kinetic energy of the truck $= \dfrac{1}{2} m_1 v_1^2$

The kinetic energy of the bike $= \dfrac{1}{2} m_2 v_2^2$

Given that both are equal

$$\dfrac{1}{2} m_1 v_1^2 = \dfrac{1}{2} m_2 v_2^2 = k$$

$$v_1 = \sqrt{\dfrac{2k}{m_1}}, \qquad v_2 = \sqrt{\dfrac{2k}{m_2}}$$

> **Formula used:**
> Kinetic energy
> $= \dfrac{1}{2} mv^2$

$\therefore$ momentum of the two bodies are given by,

$$P_1 = \sqrt{2m_1 k}, \quad P_2 = \sqrt{2m_2 k}$$

Given that $m_1 = 4m_2$; $\quad \dfrac{P_1}{P_2} = \dfrac{\sqrt{2(4)(m_2)k}}{\sqrt{2m_2 k}} = \dfrac{\sqrt{4}}{\sqrt{1}}$

Ratio of momenta = 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.**

- The second law tells us that applying a force on an object produces an acceleration proportional to the object's mass.
- When **you're wearing your seat belt**, it supplies the force to decelerate you in the event of a crash so that you don't hit the wind shield.
- According to **Newton's first law** an object in motion continues in motion with the same speed and in same direction, unless acted upon by a force.
- If the motor cycle were to abruptly stop, then the rider in motion would continue in motion.
- The rider would likely be propelled from the motor cycle, the rider becomes a projectile.
- If the person is not wearing the helmet, the injury would be severe.
- Thus wearing helmet and fastening the seat belt is highly recommended for safe journey.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. When a force is applied on bodies, they resist any change in their state. This property is called
   a) momentum
   b) inertia
   c) torque
   d) impulse

2. Force is vector quantity that has
   a) magnitude only
   b) direction only
   c) both magnitude and direction
   d) None of these

3. Which of the Newton's laws give the definition of force as well as inertia?
   a) Newton's I law
   b) Newton's II law
   c) Newton's III law
   d) zeroth law of Thermodynamics

4. Drawing water from a well is an example of
   a) balanced forces
   b) unbalanced forces
   c) parallel forces
   d) axial forces

5. Moment of force is also termed as
   a) torque
   b) inertia
   c) impulse
   d) None

6. Which of the following is an example for moment of couple? ✴
   a) turning a tap
   b) winding a screw
   c) spinning of a top
   d) All the above

7. Newton's second law is also called as ✴
   a) law of force
   b) law of inertia
   c) law of impulse
   d) law of conservation of momentum

8. Which of the following statements are true about Newton's second law of motion?
   a) Force is directly proportional to the rate of change of momentum
   b) This law helps to measure the amount of force
   c) Force is required to produce the acceleration of a body
   d) All the above statements are true.

9. 1 kg f is equal to
   a) 980 N
   b) 98 N
   c) 9.8 N
   d) 9.8 dyne

10. Impulse is product of
    a) force and time
    b) mass and velocity
    c) mass and acceleration
    d) force and velocity

11. Force between the masses is
    a) Always attractive
    b) Always repulsive
    c) either attractive or repulsive
    d) cannot be predicted

12. Force between the masses
    a) depends on the medium where they are placed
    b) does not depend on the medium
    c) may or may not depend on the medium
    d) None of the above

13. SI unit of G is
  a) Nm^2kg^{-2}　　b) Nm^2kg^2　　c) $Nm^{-2}kg^2$　　d) $Nm^{-2}kg^{-2}$

14. When we move to a higher altitude from the surface of the earth, the value of 'g'
  a) increases　　b) reduces　　c) becomes zero　　d) becomes infinity

15. When we move deep below the surface of the earth, the value of 'g'
  a) increases　　b) reduces　　c) becomes zero　　d) becomes infinity

16. Direction of weight is
  a) always towards the centre of the earth
  b) always away from the centre of the earth
  c) cannot be predicted
  d) either towards or away from the centre of the earth

17. A person whose mass is 60 kg on the surface of earth would weigh ✴
  a) 97.5 N　　b) 60 N　　c) 588 N　　d) 65 N

18. Apparent weight is the
  a) actual weight of the body
  b) weight of the body acquired by gravity
  c) weight of the body due to other external forces acting on the body
  d) both b and c

Ans:

1)	b)	inertia	10)	a)	force and time
2)	c)	both magnitude and direction	11)	a)	Always attractive
3)	a)	Newton's I law	12)	b)	does not depend on the medium
4)	b)	unbalanced forces	13)	a)	$Nm^2\,kg^{-2}$
5)	a)	Torque	14)	b)	reduces
6)	d)	All the above	15)	b)	reduces
7)	a)	law of force	16)	a)	always towards the centre of the earth
8)	d)	All the above statements are true	17)	c)	588 N
9)	c)	9.8 N	18)	d)	both (b) and (c)

II. Fill in the blanks:

1. _____ measures the impact of force on a body

2. Unit of momentum in C.G.S system is _____

3. A force which is equal to the resultant force in magnitude but opposite in direction is called as _____ ✴

4. Moment of force is also called as _____

5. Newton's second law of motion is also called as _____ ✴

6. _____ is required to produce the acceleration of a body

7. Impulse is also equal to the magnitude of _____

8. Propulsion of rockets is based on the _____ and _____

9. The value of g is maximum in _____ region and minimum at the _____ region

10. Value of g is _____ at the centre of the earth

11. The weight of a body is more at the _____ than at the _____ region

12. Ability of a body to maintain its state of rest or motion is called _____ ✳

Ans:

1.	linear momentum	7.	change in momentum
2.	g cm s^{-1}	8.	law of conservation of momentum and Newton's third law of motion
3.	Equilibrant	9.	polar region, equatorial
4.	Torque	10.	zero
5.	law of force	11.	poles, equatorial
6.	Force	12.	inertia

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

1. Kinematics deals with the motion of bodies considering the cause of motion

   False

   Kinetics deals with the motion of bodies considering the cause of motion

2. In presence of air when two different mass bodies are dropped from a height, the heavier body falls faster than the lighter one.   **True**

3. The impact of force is more if the velocity and the mass of the body is less. ✳

   False

   The impact of force is more if the velocity and the mass of the body is more.

4. Newton's second law gives the definition of force as well as inertia. ✳   **False**
   Newton's first law gives the definition of fore as well as inertia.

5. Change in momentum can be achieved when a large force acting for a longer period of time   **False**
   Change in momentum can be achieved when a large fore acting for a short period of time.

6. Force between the masses is always attractive and it does not depend on the medium where they are placed.   **True**

IV. Match the following

1.

Column I	Column II	
1) Linear momentum	- a) F = ma	(d)
2) Force	- b) M = F × s	(a)
3) Moment of couple	- c) J = F × t	(b)
4) Impulse	- d) P = mV	(c)

Don

2. **Column I**   **Column II**

	Column I		Column II	
1)	Force	-	a) Nm	(c)
2)	Torque	-	b) kg ms^{-1}	(a)
3)	Impulse	-	c) Newton	(d)
4)	Momentum	-	d) Ns	(b)

3. **Column I**   **Column II** ✳

	Column I		Column II	
1)	Like parallel forces	-	a) Action of a lever	(b)
2)	Unlike parallel forces	-	b) A kick on the moving soccer ball.	(c)
3)	Balanced forces	-	c) Tug of war	(d)
4)	Unbalanced forces	-	d) A book lying on a table	(a)

V. Assertion & Reasoning

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.

b) If both the assertion and the reason are true, the reason is not the correct explanation of the assertion.

c) Assertion is true, but the reason is false.

d) Assertion is false, but the reason is true.

1. **Assertion:** When you make a sharp turn while driving a car you tend to lean sideways.

   Reason: It is due to inertia of direction

   Ans : a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.

2. **Assertion:** In balanced forces the resultant force of all the forces acting as a body is equal to zero.

   Reason: The body will be in equilibrium. ✳

   Ans : a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.

3. **Assertion:** In C.G.S system unit of force is dyne

   Reason: A large force acting for a very short interval of time is called impulsive force.

   Ans : b) If both the assertion and the reason are true, the reason is not the correct explanation of the assertion.

VI. Answer briefly.

1. What do you mean by inertia of rest? Give example.

- The resistance of a body to **change** its **state of rest** is called inertia of rest.
- When you vigorously shake the branches of a tree, some of the leaves and fruits are detached and they fall down.

2. What is inertia of motion? Give example.

- The resistance of a body to **change its state of motion** is called inertia of motion.
- An athlete runs some distance before jumping, because this will help him jump longer and higher.

3. What do you mean by inertia of direction? Give example.

- The resistance of a body to **change its direction of motion** is called inertia of direction.
- When we make a sharp turn while driving a car we tend to lean sideways due to inertia of direction.

4. Define Linear momentum. Give its SI unit.

- The **product of mass and velocity** of a moving body gives the magnitude of linear momentum.
- Linear momentum is a **vector** quantity
- Its unit is **kg m s⁻¹**

5. What are like parallel forces?

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

6. What are unlike parallel forces?

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

7. What is a resultant force?

When several forces act simultaneously on the same body, then the combined effect of the **multiple forces can be represented by a single force** which is termed as 'resultant force'.

8. What are balanced forces?

If the **resultant force** of all the forces acting **on a body is equal to zero,** then the body will be in equilibrium. Such forces are called balanced forces.

9. What causes unbalanced forces?

If the **resultant force is not equal to zero,** then it causes the motion of the body due to unbalanced forces.

10. What is Equilibrant?

A system can be brought to equilibrium by applying another force which is equal to the resultant force in magnitude but opposite in direction. Such force is called 'Equilibrant'.

11. What is moment of force? (or) Define torque. Give its SI unit. ✶ ✶

- The rotating or turning effect of a force about a fixed point or fixed axis is called moment of the force about that point or torque (τ)
- It is measured by the product of the force and the perpendicular distance is between the fixed point or the fixed axis and the line of action of the force.
- $$\boxed{\tau = F \times d}$$
- Its SI unit is **Nm**.

12. What is a couple? ✦

Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple.

13. State the principle of moments.

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

14. Define the CGS unit of force.

The CGS unit of force is dyne. One dyne is the amount of force required for a **body of mass 1 gram** produces an **acceleration of 1 cms^{-2}.**

15. Define unit force.

The amount of force required to produce an **acceleration of 1 ms^{-2} in a body of mass 1 kg** is called unit force.

16. What is an impulsive force?

A large force acting for a very short interval of time is called an Impulsive force.

17. What is impulse? ✦

- Impulse is the product of force and time.
- Impulse = Force × Time
- $\boxed{J = F \times t}$

18. How can change in momentum be achieved?

- A large force acting for a short period of time.
- a smaller force acting for a longer period of time produce the change in momentum.

19. State principle of conservation of linear momentum.

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

20. What is acceleration due to gravity? ✦

The acceleration of a body due to **Earth's gravitational force** is called as acceleration due to gravity.

21. Define weight. Give its unit.

Weight of a body is defined as the **gravitational force exerted** on it due to the **Earth's gravity** alone.

22. What do you mean by apparent weight?

Apparent weight is the weight of the body acquired due to the **action of gravity** and other external forces acting on the body.

23. What is the meaning of weightlessness?

Whenever a body or a person falls freely under the **action of Earth's gravitational force** alone, it appears to have **zero weight**. This weight is referred to as "weightlessness".

VII. Solve the given problems: (Numerical Problems)

1. A cricket ball of mass 0.20 kg is moving with a velocity of 1.2 ms⁻¹. Find the impulse on the ball and average force applied by the player if he is able to stop the ball in 0.1s. ✴ ✴

Impulse = change in momentum = m × v

= 0.20 × 1.2 = 0.24 kg ms⁻¹

Impulse = F × t

$$F = \frac{0.24}{0.10} = 2.4 \, N$$

F = 2.4 N

Formula used:

Impulse = F × t

2.4 N force is required to stop the ball.

2. A vehicle accelerate at the rate of 10 ms⁻² after applying a force equal to 50, 000 N. Find the mass of the vehicle.

Given : F = 50, 000 N; a = 10 ms⁻²

$$m = \frac{F}{a} = \frac{50,000}{10} = 5000 \, kg$$

m = 5000 kg

Formula used:

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

3. The moment of force of 5 N about a point P is 2 Nm. Calculate the distance of point of application of the force from the point P. ✴

Given, moment of force = 2 Nm

F = 5 N

Moment of force = Force × distance

2 = 5 × r

$$r = \frac{2}{5} = 0.4 \, m$$

r = 0.4 m

Formula used:

Moment of force = F×r

4. Calculate the force of gravity between the earth (m = 5.98 × 10²⁴ kg) and a 70 kg person, if the person is standing at sea level, a distance of 6.38 × 10⁶ m from earth's centre. ✴

Given , m_1 = 5.98 × 10²⁴ kg m_2 = 70 kg

r = 6.38 × 10⁶ m

$$F = \frac{Gm_1m_2}{r^2} = \frac{6.67 \times 10^{-11} \times 5.98 \times 10^{24} \times 70}{\left(6.38 \times 10^6\right)^2}$$

F = 686 N.

Formula used:

$$F = \frac{m_1m_2}{r^2}$$

5. **An object of mass 1 kg travels at a constant 10 m/s speed. Calculate the linear momentum of the object.**

$$m = 1 \text{ kg}$$
$$v = 10 \text{ ms}^{-1}$$

Linear momentum $\quad p = mv$

$$= 1 \times 10 = 10 \text{ kg m s}^{-1}$$

$$\mathbf{p = 10 \text{ kg m s}^{-1}}$$

Formula used:

$$P = mv$$

VIII. Answer in detail.

1. **Give a detailed account on Galileo's concepts about force, motion and inertia of bodies.**

   Galileo proposed the following concepts about force, motion and inertia of bodies:

   - The natural state of all earthly bodies is either the state of rest or the state of uniform motion.
   - A body in motion will continue to be in the same state of motion as long as no external force is applied.
   - When a force is applied on bodies, they resist any change in their state. This property of bodies is called 'inertia'.
   - When dropped from a height in vacuum, bodies of different size, shape and mass fall at the same rate and reach the ground at the same time.

2. **Write any three applications of torque.**

   Gears:

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

   Seasaw

   - Most of you have played on the seasaw. Since there is a difference in the weight of the persons sitting on it, the heavier person lifts the lighter person.
   - When the heavier person comes closer to the pivot point (fulcrum) the **distance of the line of action of the force decreases.**
   - It causes less amount of torque to act on it. This enables the lighter person to lift the heavier person.

   Steering Wheel

   A small steering wheel enables you to turn a car easily by **transferring a torque to the wheels** with less effort.

3. **Write a detailed note on moment of the force.**

   - The rotating or **turning effect of a force** about a fixed point or fixed axis is called moment of the force about that point or **torque (τ).**
   - It is measured by the product of the force (F) and the perpendicular distance (d) between the fixed point or the fixed axis and the line of action of the force.

   $$\boxed{\tau = F \times d}$$

   - Torque is a **vector** quantity. It is acting along the direction, perpendicular to the plane containing the line of action of force and the distance.
   - Its SI unit is N m.

Couple:

- Two equal and unlike parallel forces applied simultaneously at two distinct points constitute a couple.
- The line of action of the two forces does not coincide
- It does not produce any translatory motion since the resultant is zero.
- But, a couple results in of the rotation of the body.
- Rotating effect of a couple is known as **moment of a couple**.

Examples: Turning a tap, winding or unwinding a screw, spinning of a top, etc.

- Moment of a couple is measured by the product of any one of the forces and the perpendicular distance between the line of action of two forces.
- The turning effect of a couple is measured by the magnitude of its moment.
- Moment of a couple = Force × perpendicular distance between the line of action of forces

$$\boxed{M = F \times S}$$

- The unit of moment of a couple is newton metre (N m) in SI system and dyne cm in CGS system.
- By convention, the direction of moment of a force or couple is taken as positive if the body is rotated in the anti-clockwise direction and negative if it is rotate in the clockwise direction.
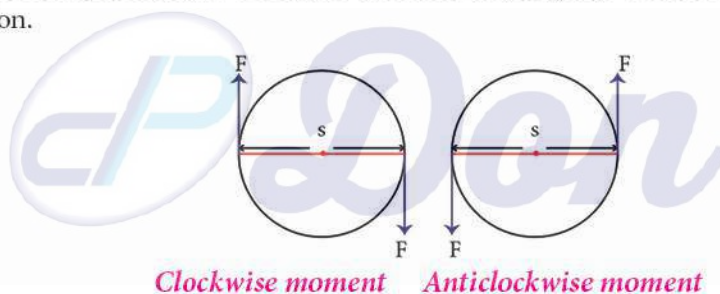
Clockwise moment   *Anticlockwise moment*

4. Deduce the relation between g and G. ★ ★

- When a body is at rest on the surface of the Earth, it is acted upon by the gravitational force of the Earth.
- Let us compute the magnitude of this force in two ways.
- Let, M be the mass of the Earth and m be the mass of the body.
- The entire mass of the Earth is assumed to be concentrated at its centre.
- The radius of the Earth is R = 6378 km (= 6400 km approximately).
- By Newton's law of gravitation, the force acting on the body is given by

$$F = \frac{GMm}{R^2} \quad ....(1)$$
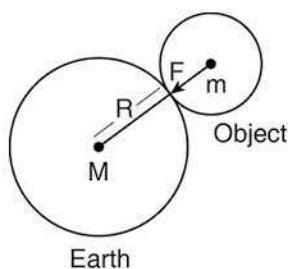
Earth

Relation between g and G

- Here, the radius of the body considered is negligible when compared with the Earth's radius.
- Now, the same force can be obtained from Newton's second law of motion.
- According to this law, the force acting on the body is given by the product of its mass and acceleration (called as weight).
- Here, acceleration of the body is under the action of gravity hence a = g

$$F = m\,a = m\,g$$

$$F = weight = mg \quad \ldots\ldots\ldots\ldots (2)$$

Comparing equation (1) and (2) we get,

$$mg = \frac{GMm}{R^2}$$

Acceleration due to gravity

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

IX. Higher Order Thinking Skills (HOTS)

1. **Suppose that two objects attract each other with a gravitational force of 16 N. If the distance between the two objects is doubled, what is the new force of attraction between the two objects?**

   If the distance is increased by a factor of 2, then force will be decreased by a factor of 4. Then the new force is

   $$\frac{16\,N}{4} = 4$$

   $$F_1 = \frac{Gm_1m_2}{d_1^{\,2}} = 16N$$

   $$F_2 = \frac{Gm_1m_2}{d_2^{\,2}} = ?$$

   $$d_2 = 2d_1$$

   $$\frac{F_2}{F_1} = \frac{d_1^{\,2}}{d_2^{\,2}} = \frac{d_1^{\,2}}{4d_1^{\,2}} = \frac{1}{4}$$

   $$F_2 = \frac{1}{4} \times 16N = 4N$$

   $F_2 = 4N$

   > **Formula used:**
   > $$F = \frac{Gm_1m_2}{d_1^{\,2}}$$

2. **A small ball of mass 0.2 kg is thrown horizontally with a constant speed of 10 m/s. The ball hits the wall and reflected with the same speed. What is the change in linear momentum of the ball?**

   The change in momentum = $mv_f - mv_i = m\,(v_f - v_i)$

   $$= 0.2\,(-10 - 10) = -\,(0.2)\,(+20)$$

   $$= -\,4\ kgms^{-1}$$

   magnitude of change in momentum is **$4\ kgms^{-1}$**

   > **Formula used:**
   > $$mv_f - mv_i$$

3. A boy of 50 kg mass is running with a velocity of 2 m/s. He jumps over a stationary cart of 2 kg while running. Find the velocity of cart after jumping of boy.

Given $m_1 = 50$ kg

initial velocity of the boy   ; $v_1 = 2$ m/s

$m_2 = 2$ kg

initial velocity of the cart $u_2 = 0$

Final velocity of cart $v_2 = ?$

Since the boy jumped over the car, the final velocity of boy will be equal to that of the cart.

$v_1 = v_2$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$= 50 \times 2 + 2 \times 0 = 50 \times v_1 + 2 \times v_2$

$= 100 = 50\,v_2 + 2\,v_2\ (v_1 = v_2)$

$= 100 = 52\,v_2$

$v_2 = \dfrac{100}{52} = 1.92$ ms^{-1}

$\mathbf{v_2 = 1.92\ ms^{-1}}$

Formula used:

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Unit Test - 1
Laws of Motion

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. Impulse is equals to
   a) rate of change of momentum   b) rate of force and time
   c) change of momentum   d) rate of change of mass

2. Newton's III law is applicable
   a) for a body is at rest   b) for a body in motion
   c) both a & b   d) only for bodies with equal masses

3. Plotting a graph for momentum on the X-axis and time on Y-axis. Slope of momentum-time graph gives
   a) Impulsive force   b) Acceleration   c) Force   d) Rate of force

4. A person whose mass is 60 kg on the surface of earth would weigh
   a) 97.5 N   b) 60 N   c) 588 N   d) 65 N

5. **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.

   a) If both the assertion and the reason are true and the reason is the correct explanation of assertion.
   b) If 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.

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. 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.

2. Define moment of a couple.

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

4. Give an example for inertia of direction.

5. State the principle of moments.

III. Answer the following questions in brief: 2 × 4 = 8

1. Deduce the equation of a force using Newton's second law of motion.

2. Write any three applications of torque.

IV. Answer the following questions in detail: 1 × 7 = 7

1. i) Deduce the relation between g and G.
   ii) Classify the types of force based on their direction.

Optics

Speed of light	: $c = 3 \times 10^8$ ms^{-1}.
Refraction	: When light ray travels from one medium to another if deviates its path.
First law of refraction	: The incident ray ,the refracted ray of light and the normal to the refracting surface all lie in the same plane.
Refractive index	: The ratio of speed of light in vaccum to the speed of light in a medium.
Snell's law	: The ratio of the sine of the angle of incidence and sine of the angle of refraction is equal to ratio of refractive indices of the two media.

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

Dispersion of light	: When a beam of white light is refracted through any transparent media, it is split into its component colours.
VIBGYOR	: Violet, Indigo, Blue, Green, Yellow, Orange, Red.
Red	: Angle of refraction is the smallest.
Violet	: Angle of refraction is the highest.
Types of scattering	: Elastic, Inelastic.
Scatterer	: "Scattering is the phenomenon by which a beam of light is redirected in many different directions when it interacts with a constitutent particle of the atmosphere. The interacting particle of the atmosphere is called scatterer.
Elastic Scattering	: If the energy of incident beam of light and scattered light beam are the same.
Inelastic Scattering	: If the energy of incident beam of light and scattered light beam are not the same.

MIND MAP

LIGHT

- **Refraction**
  - Law of refraction
- **Dispersion**
  - VIBGYOR
- **Scattering**
  - Inelastic
  - Elastic
    - Rayleigh Scattering
    - Mie scattering
    - Tyndall scattering
    - Raman Scattering
- **Properties**
  - Lenses
    - Convex
    - Concave
- **Optical Instruments**
  - Telescope
    - Terrestrial
    - Astronomical
  - Microscope
    - Simple
    - Compound
  - Human eye
    - Structure
    - Defect
      - Myopia
        - Concave lens
      - Hypermetropia
        - Convex lens
      - Presbyopia
        - Bifocal lenses

Don

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Rayleigh scattering law	: The amount of scattering of light is inversely proportional to the fourth power of the wavelength.
Mie scattering	: It takes place when the diameter of the scatterer is similar to or larger than the wavelength of the incident light .It is also an elastic scattering.
Tyndall scattering	: The scattering of light rays by the colloidal particles in the colloidal solution.
Raman scattering	: The interaction of light ray with the particles of pure liquids or transparent solids, which leads to a change in wavelength or frequency.
Convex lens	: It is thicker at the centre than at the edge.
Concave lens	: It is thinner at the centre than at the edge.
Cornea	: Maximum refracting surface of eye.
Iris	: It controls amount of light entering into the pupil.
Retina	: It is a screen. Image is formed this screen.
Myopia	: Short sightedness – corrected using concave lens.
Hypermetropia	: Long sightedness – corrected using convex lens.
Presbyopia	: Both long and short sightedness corrected by bifocal lenses.
Microscope	: Help to see tiny objects.
Telescope	: Optical instrument to see the distant objects.

Formulae

Velocity of light	$C = v\lambda$
Snell's law	$\dfrac{\sin i}{\sin r} = \dfrac{\mu_2}{\mu_1}$
Rayleigh's Scattering Law	$S \, \alpha \, \dfrac{1}{\lambda^4}$
Lens formula	$\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$
Magnification	$m = \dfrac{h'}{h} = \dfrac{v}{u} = \dfrac{\text{distance of the image}}{\text{distance of the object}}$
Power of lens	$P = \dfrac{1}{f}$ (f in meter)

Len's makers formula	$\dfrac{1}{f} = (\mu - 1)\left(\dfrac{1}{R_1} - \dfrac{1}{R_2}\right)$
Focal length of required concave lens for myopia	$f = \dfrac{xy}{x - y}$
Focal length of the required convex lens for hypermeteropia	$f = \dfrac{dD}{d - D}$
Visual angle, $(\tan\theta)$	$\dfrac{\text{height}}{\text{distance}}$
Angular magnification $M = \dfrac{\alpha}{\beta}$	α - angle subtended by the final image at the eye. β - angle substended by the object at the naked eye.
In simple microscope,	$M = 1 + \dfrac{D}{f}$ $D \rightarrow$ Least distance of distinct vision from the lens of eye
Compound microscope magnification	$M = \left(\dfrac{v}{f_0} - 1\right)\left(1 + \dfrac{D}{f_e}\right)$ $M = M_0 \times M_e$
Astronomical telescope	Magnification $M = \dfrac{f_0}{f_e}$

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. 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

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

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

4. Magnification of a convex lens is
   a) positive
   b) negative
   c) either positive or negative
   d) zero

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

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

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

8. The eye defect 'presbyopia' can be corrected by
   a) convex lens
   b) concave lens
   c) convex mirror
   d) Bi focal lenses

9. 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

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

Ans:

1.	a)	A	6.	c)	– 0.25 m
2.	b)	2f	7.	c)	infront of the retina
3.	c)	a parallel beam of light	8.	d)	Bifocal lenses
4.	c)	either positive or negative	9.	a)	A convex lens of focal length 5 cm
5.	b)	infinity	10.	b)	$V_B < V_G < V_R$

II. Fill in the blanks:

1. The path of the light is called as _____.

2. The refractive index of a transparent medium is always greater than _____. ✱

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

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

5. Amount of light entering into the eye is controlled by _____. ✱ ✱

Ans:

1.	Ray	4.	wavelength
2.	One	5.	Iris
3.	Elastic		

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

1. **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.

2. **The power of lens depends on the focal length of the lens** — **True**

3. **Increase in the converging power of eye lens cause 'hypermetropia'** ✹ ✹ — **True**

4. **The convex lens always gives small virtual image.** — **False**
   The concave lens always gives small virtual image.

IV. Match the following:

1. 1) Retina   –   a) Pathway of light   (d)
   2) Pupil   –   b) Far point comes closer (a)
   3) Ciliary muscles –   c) Near point moves away   (e)
   4) Myopia   –   d) Screen of the eye   (b)
   5) Hypermetropia   –   e) Power of accommodation (c)

V. Assertion & Reasoning

Mark the correct choice as

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Assertion is false but reason is true.

1. **Assertion (A)** : If the refractive index of the medium is high (denser medium) the velocity of the light in that medium will be small

   Reason(R) : Refractive index of the medium is inversely proportional to the velocity of the light

   Ans: (a) If both assertion and reason are true and reason is the correct explanation of assertion

2. **Assertion (A)** : Myopia is due to the increase in the converging power of eye lens.
   Reason (R) : Myopia can be corrected with the help of concave lens.

   Ans: (a) If 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** to the **speed of light in a medium** is defined as refractive index (μ) of the medium.

$$\mu = \frac{\sin i}{\sin r}$$

2. State Snell's law. ✴ ✴

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. This law is also known as Snell's law.

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

3. Draw a ray diagram to show the image formed by a convex lens when the object is placed between F and 2F.
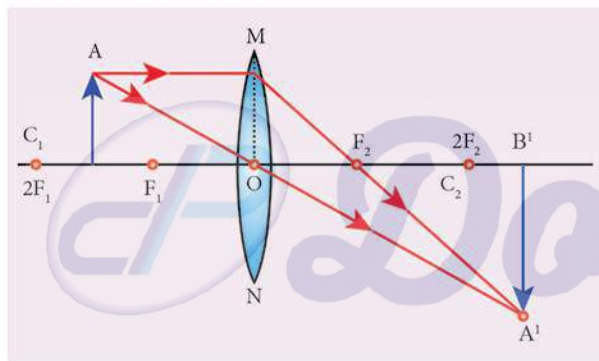
4. Define dispersion of light.

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

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

Rayleigh's **scattering law** states that "The amount of **scattering of light** is inversely proportional to the **fourth power** of its **wavelength**.

Amount of scattering $\text{'s'} \propto \dfrac{1}{\lambda^4}$

6. Differentiate convex lens and concave lens. ✴ ✴

S.No	Convex lens	Concave lens
1.	A convex lens is **thicker** in the **middle** than at edges.	A concave lens is **thinner** in the **middle** than at edges.
2.	It is a **converging** lens.	It is a **diverging** lens.
3.	It produces mostly **real** images.	It produces **virtual** images.
4.	It is used to treat **hypermeteropia**.	It is used to treat **myopia**.

7. What is power of accommodation of eye?

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

8. What are the causes of 'Myopia'?

- The focal length of eye lens is **reduced** or the distance between **eye lens** and **retina increases**.

- Hence the far point will not be infinity for such eyes and the far point has come closer, with this defect, **nearby object** can be **seen clearly** but distant objects cannot be seen clearly.

9. Why does the sky appear in blue colour?

- When sunlight passes through the atmosphere the blue colour (Shorter wavelength) is **scattered** to a **greater** extent than the red colour (larger wavelength).

- This scattering causes the sky to appear in blue colour.

10. Why are traffic signals red in colour? ✳

- The red colour has longer wavelength.

- So it can travel for longer distance and will be seen clearly. So red colour is used in traffic signals.

VII. Give the answer in detail:

1. List any five properties of light ✳ ✳

Properties of light:

- 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 vacuum or air is, **c = 3 × 10⁸ m/s**.

- Since, light is in the form of waves, it is characterized by **a wavelength** (λ) and a **frequency** (v), which are related by the following equation: $c = v \lambda$ (c - velocity of light).

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

Rules for obtaining images:

- When an object is placed infront of a lens, the light rays from the object fall on the lens.

- The position, size and nature of the image formed can be understood only if we know certain basic rules.

Rule-1:

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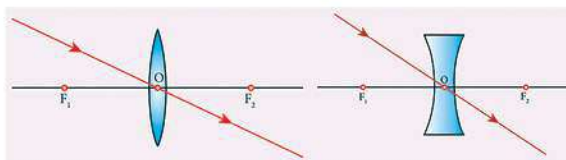
Rays passing through the optical centre

Rule-2:

• When rays **parallel** to the **principal axis** strikes a convex lens, the **refracted rays** are **converged** to (convex lens) the **principal focus.**
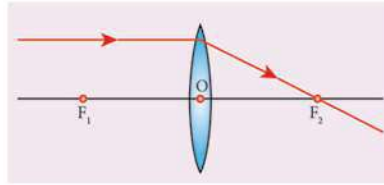
Rays passing parallel to the optic axis

Rule-3:

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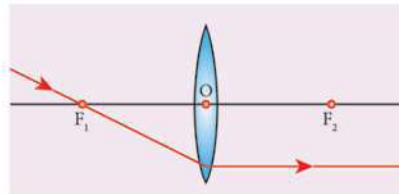
Rays passing through or directed towards the principal focus

3. Differentiate the eye defects: Myopia and Hypermetropia ✳

S.No	Myopia	Hypermetropia
1.	**Short** sightedness	**Long** sightedness
2.	Occurs due to **lengthening** of eye ball	Occurs due to **shortening** of eye ball.
3.	Nearby objects can be seen clearly	Nearby objects cannot be seen clearly
4.	Distant objects **cannot be seen** clearly	Distant objects **can be seen** clearly
5.	The focal length of eye lens is **reduced**	The focal length of eye lens is **increased**
6.	The **far points will not be infinity** for such eyes and the far points have come closer	The **near points will not be at 25 cm** for such eyes and the near point have moved farther
7.	The image of distant objects are formed **before the retina**	The image of nearby objects are formed **behind the retina**
8.	The defect can be corrected using **concave lens of negative power**	The defect can be corrected using **convex lens of positive power**

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

Compound microscope:

Construction:

• A compound microscope is used to see the **tiny objects** has **better magnification power** than simple microscope.

• A compound microscope consists of **two convex lenses.**

- The lens with the **shorter focal length** is placed **near the object**, and is called as 'objective lens' or 'objective piece'.
- The lens with **larger focal length** and larger aperture placed **near** the **observer's eye** is called as 'eye lens' or 'eye piece'.
- Both the lenses are fixed in a **narrow tube** with adjustable provision.

Working:

- The **object** (AB) is placed at a distance **slightly greater** than the **focal length** of objective lens ($u > f_o$).
- A **real, inverted** and **magnified** image (A' B') is formed at the other side of the objective lens.
- This image **behaves** as the **object** for the eye lens.
- The position of the eye lens is adjusted in such a way, that the **image** (A' B') falls **within** the **principal focus** of the eye piece.
- This eye piece forms a **virtual, enlarged** and **erect** image (A" B") on the **same side** of the object.
- Compound microscope has 50 to 200 times more magnification power than simple microscope.
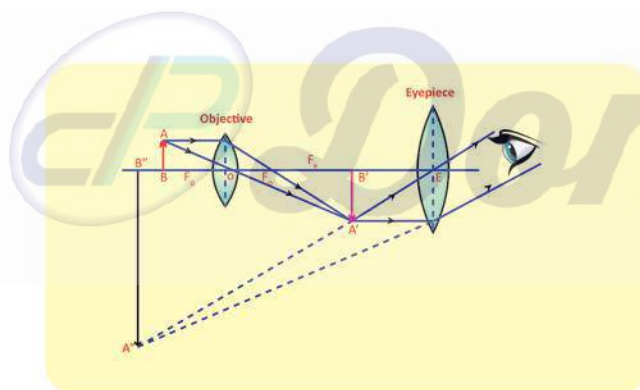
Image formation in compound microscope

VIII. Numerical Problems:

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

    Solution:

    Given:

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

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

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

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

Formula used:

Image distance

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

$$\frac{1}{v} = \frac{1}{10} + \frac{1}{-20} = \frac{1}{10} - \frac{1}{20}$$

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

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

Image distance = 20 cm

Nature of image:

Real inverted is formed at the centre of curvature. The size of the image is same

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

   Solution:

   Given:

   f = –15 cm, u = –10 cm, v = ?, h = 3 cm

Formula used:
Image distance
$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

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

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

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

   $$= \frac{1}{15} + \frac{1}{-10} - \left(\frac{1}{15} + \frac{1}{10}\right)$$

   $$\frac{1}{v} = \frac{-(2+3)}{30} = \frac{-5}{30} = -\frac{1}{6}$$

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

Size of the image

$$\text{Magnification} = \frac{+v}{u} \quad \left(m = \frac{h'}{h}\right)$$

Formula used:
$\text{Magnification} = \frac{+v}{u}$

$$\frac{h'}{h} = \frac{-v}{u}$$

$$\frac{h'}{3} = \frac{-6}{-10} = 0.6$$

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

Size of the image = 1.8 cm

IX. Higher Order Thinking Skills (HOTS)

1. 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?

    a) Yes he got the image. But the image is not clear.

    b) No change in the focal length. Because no change in radius of curvature.

2. The eyes of the nocturnal birds like owl are having a large cornea and a large pupil. How does it help them?

    The eyes of the nocturnal birds like owl have a large cornea and a large pupil. These features increase their field of vision and also shows an increase in retinal surface and help them to collect more ambient light during night.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Speed of light in vacuum or air is _____. ★
    a) 3×10^8 m/s   **b)** 3×10^8 cm/s
    c) 3×10^8 m/hr   **d)** 3×10^8 cm/hr

2. The angle of refraction is smallest in _____ colour.
    a) green   **b)** blue
    c) red   **d)** violet

3. _____ lens is thicker at the centre than at the edge.
    a) Concave   **b)** Convex
    c) Spherical   **d)** Bifocal

4. When an object is placed in _____ the collected image size is bigger than that of an object. ★
    a) at infinity
    b) behind centre of curvature
    c) at the centre of curvature
    d) between the centre of curvature and principal focus

5. _____ lenses are used as camera lenses.
    a) Convex   **b)** Concave
    c) Bifocal   **d)** None of these

6. _____ lenses are used to correct the defect of myopia.
    a) Convex   **b)** Concave
    c) Bifocal   **d)** None of these

7. _____ is the correct lens formula for spherical lenses.

a) $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$ b) $\dfrac{1}{f} = \dfrac{1}{u} - \dfrac{1}{v}$

c) $\dfrac{1}{u} = \dfrac{1}{f} - \dfrac{1}{v}$ d) $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u}$

8. Among the following _____ is the coloured part of eye.

   a) cornea   b) pupil   c) Iris   d) Redina

9. _____ helps to change the focal length of the eye lens

   a) Retina   b) Ciliary muscle

   c) Pupil   d) Eye lens

10. A normal human eye can clearly see all the object placed between _____ and infinity.

   a) 25 cm   b) 25 mm   c) 25 m   d) 30 cm

11. _____ can be corrected by bifocal lenses.

   a) Myopia   b) Hypermetropia

   c) Presbyopia   d) Astigmatism

12. An _____ telescope is used to view heavenly bodies like stars and planets. ★

   a) refracting   b) astronomical

   c) terrestrial   d) galilean

Ans:

1.	a)	3×10^{8} m/s	7.	a)	$\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$
2.	c)	Red	8.	c)	Iris
3.	b)	Convex	9.	b)	Ciliary muscle
4.	d)	between the centre of curvature and principal focus	10.	a)	25 cm
5.	a)	Convex	11.	c)	Presbyopia
6.	b)	Concave	12.	b)	astronomical

II. Fill in the blanks:

1. Light does not need any medium for its _____.

2. The band of colours is termed as _____.

3. Angle of refraction is the highest for _____ colour.

4. _____ scattering is responsible for the white appearance of the clouds. ★

5. _____ lens is thinner at the centre than at the edges.

6. Convex lenses are used as _____ lenses.

7. Convex lenses are _____ lenses.

8. _____ is the most sensitive part of human eye.

9. _____ lens is made of a flexible, jelly like material.

10. Astigmatism can be corrected by using _____ lenses.

11. Travelling microscope is work based on the principle of _____.

12. _____ is an optical instrument to see the distant objects. ✳

13. The SI unit of power of lens is _____.

Ans:

1.	propagation	8.	Retina
2.	spectrum	9.	Eye
3.	violet	10.	Torrid
4.	Mie	11.	Vernier
5.	Concave	12.	Telescope
6.	magnifying	13.	dioptre
7.	converging		

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

1. **Different coloured lights have different wavelength and frequency.** **True**

2. **A convex lens is thinner at the centre than at the edge.** ✳ **False**

   A concave lens is thinner at the centre than at the edge.

   (OR)

   A convex lens is thicker at the centre than at the edge.

3. **When an object is placed at the focus, a real image is formed at the centre of curvature.** **False**

   When an object is placed at the focus, a real image is formed at infinity.

4. **Concave lenses are used as eye lens of Galilean Telescope.** **True**

5. **According to Cartesian sign convention the distances measured against the direction of incident light are taken as positive.** **False**

   According to Cartesian sign convention the distances measured against the direction of incident light are taken as negative.

6. **In human eye, a tough membrane called Iris protects the internal parts of the eye.** **False**

   In human eye, a tough membrane called sclera protects the internal parts of the eye.

7. **Hypermetropia occurs due to lengthening of eye ball.** ✳ **False**

   Hypermetropia occurs due to shortening of eye ball.

   (OR)

   Myopia occurs due to lengthening of eye ball.

8. **Compound microscope is an optical instrument to see the distant objects.** **False**

   Telescope is an optical instrument to see the distant objects.

IV. Match the following:

1.
1) Velocity of light	–	a) Violet	(d)
2) Law of refraction	–	b) Snell's law	(b)
3) Spectrum	–	c) Red	(e)
4) Angle of refraction is smallest	–	d) 3×10^8 m/s	(c)
5) Angle of refraction is highest	–	e) VIBGYOR	(a)

2
1) Diverging lens	–	a) Optical nerves ✶ ✶	(d)
2) Converging lens	–	b) Enlarged image	(c)
3) Sign Convention	–	c) Convex lens	(e)
4) Image to brain	–	d) Concave lens	(a)
5) Microscope	–	e) Cartesian	(b)

3.
Object Placed		Image Formed ✶	
1) At infinity	–	a) Centre of curvature	(d)
2) Beyond C (>2F)	–	b) At infinity	(e)
3) At C	–	c) Behind centre of curvature	(a)
4) Between F and C	–	d) Principal focus	(c)
5) At the principal Focus (F)	–	e) Between C and F	(b)

4.
1) Myopia	–	a) Torrid lens	(c)
2) Hypermetropia	–	b) Bifocal lens	(d)
3) Presbyopia	–	c) Concave lens	(b)
4) Astigmatism	–	d) Convex lens	(a)

V. Assertion & Reasoning

Mark the correct choice as

a) If both assertion and reason are true and reason is the correct explanation of assertion.

b) If both assertion and reason are true but reason is not the correct explanation of assertion.

c) Assertion is true but reason is false.

d) Assertion is false but reason is true.

1. **Assertion (A)** : When light travels from one medium into another medium it deviates in both.

   Reason(R) : It takes place due to the difference in the velocity of light in different mediums.

   Ans: a) Both A and R are correct.

2. **Assertion (A)** : Sunlight is a composite light which consists of various colours or wavelengths.

   Reason (R) : The amount of scattering is independent of wavelength.

   Ans: c) Assertion is true but reason is false.

3. **Assertion (A)** : Convex lenses are used in slide projectors.
   Reason (R) : The image is formed between optical centre and principal focus

   Ans: c) Assertion is true but reason is false.

4. **Assertion (A)** : Concave lenses are used on the main door of houses.
   Reason (R) : They are used in wide angle spy hole in doors.

   Ans: a) If both assertion and reason are true and reason is the correct explanation of assertion.

5. **Assertion (A)** : Power of lens is numerically defined as the reciprocal of its focal length.

   Reason (R) : The power of concave lens is taken as positive ✷

   Ans: c) Assertion is true but reason is false.

6. **Assertion (A)** : Myopia is also known as long sightedness
   Reason (R) : The images of distant objects are formed before retina in myopia eyes.

   Ans: d) Assertion is false but reason is true.

VI. Answer briefly

1. Define refraction. ✷

When a ray of light **travels from one medium to another** if path of light undergoes deviation. This deviation of ray of light is called refraction.

2. Write the first law of refraction.

The incident ray, the refracted ray of light and the normal to the refracting surface **all lie in the same plane.**

3. List the types of scattering

According to the initial and final energy of the light beam.

They are classified into two types.

- Elastic Scattering
- Inelastic Scattering

The nature and size of scatter results they are divided into,

- Rayleigh scattering
- Mie scattering
- Tyndall scattering
- Raman Scattering

4. Define Elastic scattering.

If the energy of the **incident beam of light and the scattered beam of light are same.** Then it is called elastic scattering.

5. Define Tyndall effect. ✳

The **scattering of light rays by the colloidal particles** in the colloidal solution is called Tyndall scattering or Tyndall effect.

6. Define Raman scattering.

Raman scattering is defined as ''The **interaction of light ray with the particles of pure liquids** or transparent solids which leads to a change in wavelength or frequency".

7. Differentiate Rayleigh lines and Raman lines.

Rayleigh lines	Raman lines
The spectral lines having **frequency equal to the incident ray frequency**	The spectral lines which are having **frequencies other than the incident ray frequency**

8. Define Plano-convex lens and Plano-concave lens.

Plano-convex lens

- One of the faces of a **biconvex lens** is plane

Plane-concave lens

- If one of the faces of a **biconcave lens** is plane

9. Define-magnification of a lens. ✳ ✳

It is defined as the ratio of the height of the image to the height of an object

$$m = \frac{\text{height of the image}}{\text{height of the object}} = \frac{h'}{h}$$

10. Write the lens makers equation. ✳

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

μ = Refractive index of the material

R_1, R_2 = Radii of the curvature of the two faces of the lens.

11. Define power of lens. Give its unit.

The power of a lens can be defined as the **degree of convergence or divergence** of light rays. It is numerically defined as the reciprocal of the focal length.

$$p = \frac{1}{f}$$

The SI unit of power of lens is dioptre

12. Differentiate far points and near points of human eye.

Far points	Near points
Minimum distance is required to see the objects distinctly without strain.	The **maximum distance** upto which the eye can see objects clearly.
The **near point is 25 cm** for normal human eye.	Its **far point is infinity** for normal eye.

13. What are the causes of presbyopia?

Due to ageing, ciliary muscles become weak and the eye lens become rigid and so the eye loses its power of accommodation.

14. What is the purpose of bifocal lenses? Why?

- Lenses are used for the upright of eye sight.
- The eye loses its power due to many reasons including ageing.
- Hence their vision becomes defective, to correct these defects bifocal lenses are used.

15. What is Astigmatism?

- In this defect, the eye **cannot see parallel and horizontal lines** clearly.
- It may be inherited or acquired.
- It is due to the **imperfect structure of eye lens** due to the **development of cataract** on the lens, ulceration of cornea, injury to the refracting surfaces, etc.
- It is **corrected by cylindrical lenses** (Torrid lenses).

16. List the uses of simple microscope.

It is used

- by watch repairers and jewellers
- to read small letters clearly
- to observe parts of flowers, insects, etc.
- to observe finger prints in the field of forensic sciences.

17. Give the types of Telescope.

According to optical property two types of telescopes are used:

- Refracting Telescope
- Reflecting telescope

According to the things which one observes

- Astronomical telescope
- Terrestrial telescope

VII. Give the answer in detail:

1. Draw the ray diagram for following object placed at i) At infinity ii) beyond C iii) placed at 'C' iv) between C and F v) at the principle focus (F) then write the position, nature and size of the image ✶ ✶

i) Object at infinity:

- When an object is placed at infinity, a **real image is formed at the principal focus.**
- The size of the image is much smaller than that of the object.
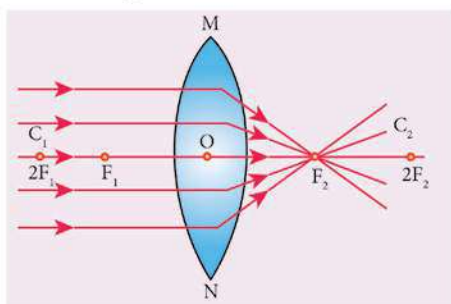
ii) Object placed beyond C (>2F)

- When an object is placed behind the center of curvature (beyond C), a **real and inverted image is formed between the center of curvature** and the principal focus.
- The size of the image is the same as that of the object.
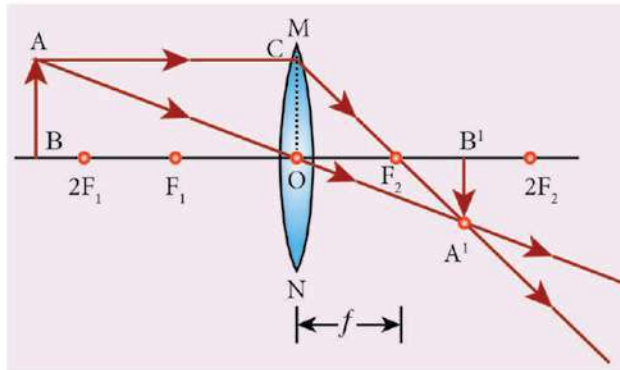
iii) Object placed at C

- When an object is placed at the center of curvature, **a real and inverted image is formed at the other center of curvature.**
- The size of the image is the same as that of the object.
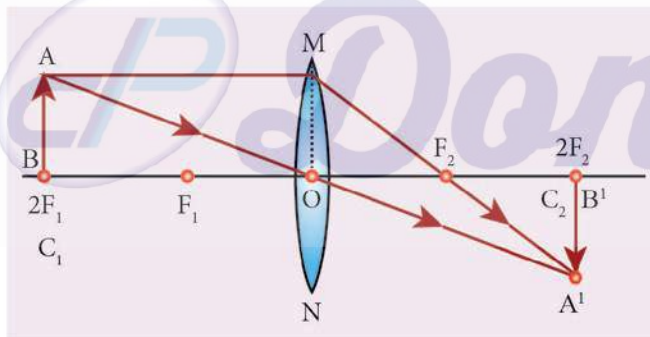
iv) Object placed between F and C

- When an object is placed in between the center of curvature and principal focus, **a real and inverted image is formed behind the center of curvature.**
- The size of the image is bigger than that of the object.
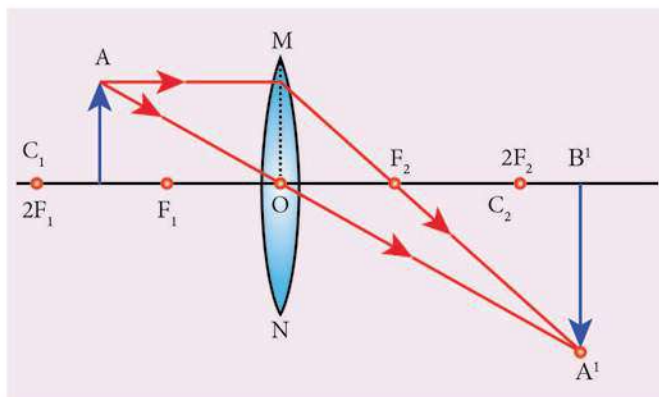
v) Object placed at the principal focus F

- When an object is placed at the focus, **a real image is formed at infinity.**
- The size of the image is much larger than that of the object.
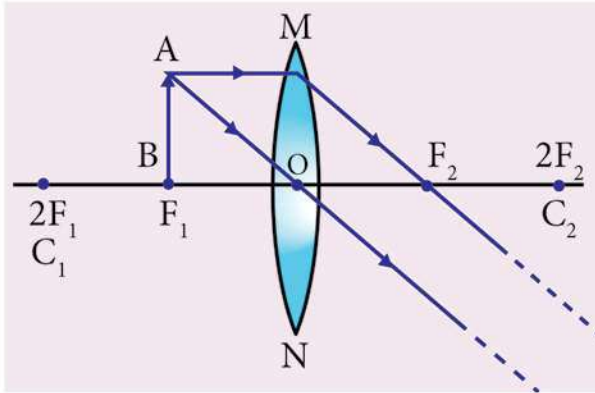
2. Write about Cartesian sign conventions.

Cartesian sign conventions are used for measuring the various distances in the ray diagrams of spherical lenses. According to Cartesian sign convention:

- The object is always placed on the left side of the lens.
- All the distances are measured from the optical centre of the lens.
- The distances measured in the same direction as that of incident light are taken as positive.
- The distances measured against the direction of incident light are taken as negative.
- The distances measured upward and perpendicular to the principal axis is taken as positive.
- The distances measured downward and perpendicular to the principal axis is taken as negative.

3. Describe the structure of eye and working of human eye. ✴ ✴ ✴

Structure of the eye

- The eye ball is approximately spherical in shape with a diameter of about 2.3 cm.
- It consists of a tough membrane called sclera, which protects the internal parts of the eye.

Important parts of human eye are as follows:

Cornea:

- This is the thin and transparent layer on the front surface of the eyeball.
- It is the main refracting surface.
- When light enters through the cornea, it refracts or bends the light on to the lens.

Iris:

- It is the coloured part of the eye.
- It may be blue, brown or green in colour.
- Every person has a unique colour, pattern and texture.
- Iris controls amount of light entering into the pupil like camera aperture.

Pupil:

- It is the centre part of the Iris.
- It is the pathway for the light to retina.

Retina:

- This is the back surface of the eye.
- It is the most sensitive part of human eye, on which real and inverted images of objects is formed.

Ciliary muscles:

- Eye lens is fixed between the ciliary muscles.
- It helps to change the focal length of the eye lens according to the position of the object.

Eye Lens:

- It is the important part of the human eye. It is convex in nature.
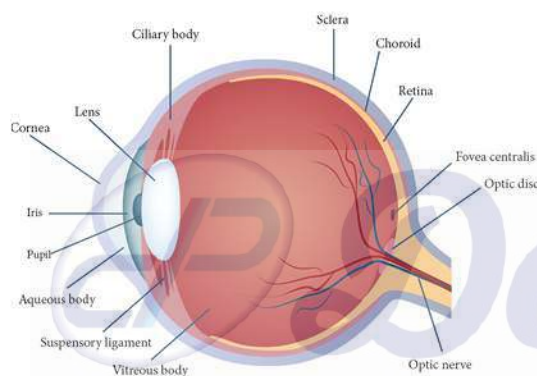
Working of the eye:

- The transparent layer cornea bends the light rays through the pupil located at the centre part of the Iris.
- The adjusted light passes through the eye lens. Eye lens is convex in nature.
- So, the light rays from the objects are converged and a real and inverted image is formed on the retina.
- Then, the retina passes the received real and inverted image to the brain through optical nerves. Finally, the brain senses it as an erect image.

4. Describe the following i) Myopia, ii) Hypermeteropia �֍ ✖

Myopia:

- Myopia, also known as **short sightedness**, occurs due to the **lengthening of eye ball.**
- With this defect, **nearby objects can be seen clearly** but distant objects cannot be seen clearly.
- The **focal length of eye lens is reduced** or the distance between eye lens and retina increases.
- Hence, the **far point will not be at infinity** for such eyes and the far point has come closer.
- Due to this, the **image of distant objects** are formed **before the retina**.
- This defect can be **corrected using a concave lens.**

(a) Myopia

(b) Myopia corrected eye
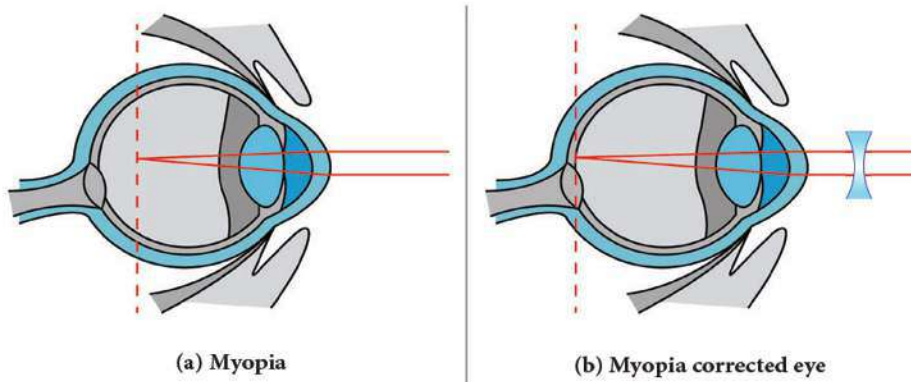
Hypermeteropia:

- Hypermeteropia, also known as **long sightedness**, occurs due to the **shortening of eye ball.**
- With this defect, **distant objects can be seen clearly** but nearby objects cannot be seen clearly.
- The **focal length of eye lens is increased** or the distance between eye lens and retina decreases.
- Hence, the **near point will not be at 25cm** for such eyes and the near point has moved farther.
- Due to this, the **image of nearby objects** are formed **behind the retina.**
- This defect can be **corrected using a convex lens.**

(a) Hypermeteropia

(b) Hypermeteropia corrected eye
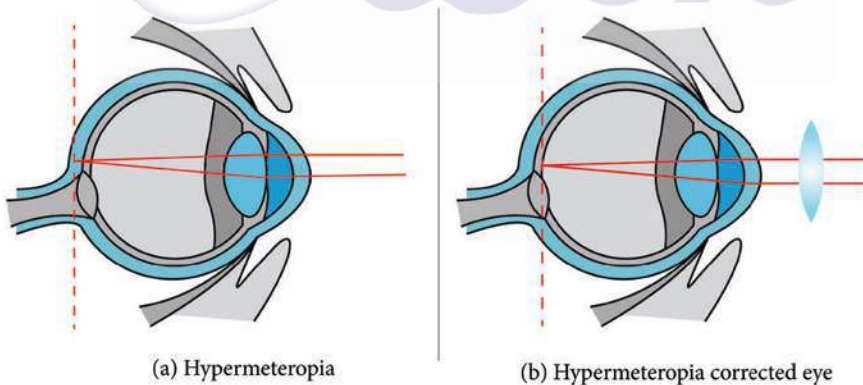
VIII. Numerical Problems:

1. **The focal length of the concave lens is 7 m. Calculate the power of lens.**

   Solution:

   Given: $f = -7 \text{ m}$

   $$\text{Power of lens} = \frac{1}{f} = \frac{1}{-7}$$

   $$P = -0.14 \text{ dioptre}$$

> **Formula used:**
>
> Power of lens $= \dfrac{1}{f}$

2. **A light ray enter into the medium 'A' its angle of incident is 45° then enters into medium 'B' angle of refraction is 30°. Find the refraction index.** ✦

Solution:

Given: Incident ray (i) = 45°

Refraction ray (r) = 30°

According to snells law

$$\mu = \frac{\sin i}{\sin r}$$

$$= \frac{\sin 45°}{\sin 30°} = \frac{1/\sqrt{2}}{1/2} = \frac{1}{\sqrt{2}} \times \frac{2}{1} = \sqrt{2}$$

$$\mu = 1.414$$

Refractive index = 1.414

> **Formula used:**
> snell's law
> $$\mu = \frac{\sin i}{\sin r}$$

3. **A person with hypermeteropia eye can see object beyond the distance 20 m. suppose he went to see the closer object at 1.5 m. Find the focal length and power of the convex lens he must wear.**

Solution:

Given: d = 20 m, D = 1.5 m

According to the formula $f = \dfrac{dD}{d-D}$

$$f = \frac{20 \times 1.5}{20 - 1.5} = \frac{30}{18.5} = 23.2$$

Power of correction lens $= \dfrac{1}{f} = \dfrac{1}{23.2} = $ **0.04 dioptre**

> **Formula used:**
> focal length $f = \dfrac{dD}{d-D}$
> Power of lens $= \dfrac{1}{f}$

◄◄◄◄◄◄ ◉ ►►►►►►

Unit Test - 2
Optics

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

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

2. In a myopic eye, the image of the object is formed
   a) behind the retina   b) on the retina
   c) infront of the retina   d) on the blind spot

3. When an object is placed in _____ the collected image size is bigger than that of an object.
   a) at infinity   b) behind centre of curvature
   c) at the centre of curvature
   d) between the centre of curvature and principal focus

4. _____ can be corrected by bifocal lenses.
   a) Myopia   b) Hypermetropia
   c) Presbyopia   d) Astigmatism

5. An _____ telescope is used to view heavenly bodies like stars and planets.
   a) refracting   b) astronomical
   c) terrestrial   d) galilean

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. State Snell's law.
2. Define power of lens. Give its unit.
3. What is Astigmatism?
4. List the uses of simple microscope.
5. Define refraction.

III. Answer the flowing questions in brief: 2 × 4 = 8

1. Differentiate convex lens and concave lens.
2. i) What is Astigmatism?
   ii) State Rayleigh's law of scattering.

IV. Answer the flowing questions in detail: 1 × 7 = 7

1. i) Explain the construction and working of a 'Compound Microscope'.
   ii) An object is placed at a distance 20cm from a convex lens of focal length 10cm. Find the image distance and nature of the image.

POINTS TO REMEMBER

Thermal energy	: It is a form of energy which is transferred between any two bodies due to the difference in their temperatures.
Temperature	: It is the degree of hotness or coldness of a body
Absolute temperature	: The temperature is measured in relation to absolute zero using the Kelvin scale.
Linear expansion	: When a body is heated or cooled, the length of the body changes due to change in its temperature.
Areal expansion	: There is an increase in the area of a solid object due to heating.
Superficial expansion	: If there is an increase in the area of a solid object due to heating, then the expansion is called superficial expansion.
Cubical expansion	: If there is an increase in the volume of a solid body due to heating, then the expansion is called as cubical expansion.
Real expansion	: If a liquid is heated directly without using any container then the expansion is real expansion.
Apparent expansion	: The expansion of a liquid is apparently observed without considering the expansion of the container.
Coefficient of linear expansion	: It is the ratio of increase in the length of the body per degree rise in temperature to its unit length.
Coefficient of superficial expansion	: It is the ratio of increase in the area of the body per degree rise in temperature to its unit volume.
Coefficient of real expansion	: It is the ratio of true rise in the volume of the liquid per degree rise in temperature to its unit volume. The SI unit of coefficient of real expansion is K^{-1}.

MIND MAP

Thermal Physics

- **Thermal Energy**
  - **Units of Thermal energy**
    - 1. Calorie
    - 2. Kilo calorie
  - **Characteristics of Energy transfer**
  - **Effects of Thermal Energy**
    - **Expansion of Gases**
      - **Fundamental laws of gases**
        - **Boyle's Law**
        - **Charles's Law**
        - **Avogadro's Law**
    - **Expansion of Liquids**
      - **Real Expansion**
      - **Apparent Expansion**
    - **Expansion of solids**
      - **Linear Expansion**
      - **Superficial Expansion**
      - **Cubical Expansion**

- **Temperature**
  - **Kelvin scale**
  - **Thermal Equilibrium**

Don

Boyle's law	: When the temperature of a gas is kept constant , the volume of a fixed mass of gas is inversely proportional to its pressure. $P \propto 1/V$ or PV = constant of a gas.
Charles's law	: When the pressure of a gas is kept constant , the volume of a gas is directly proportional to the temperature of the gas. $V \propto T$ or V/T = constant
Avogadro's law	: It states that at constant pressure and temperature , the volume of a gas is directly proportional to the number of atoms or molecules present in it. i.e. $V \propto n$ or V/n = constant.
Real gases	: If the molecules or atoms of a gases interact with each other with a definite amount of intermolecular or inter atomic force of attraction, then the gases are real gases.
Ideal gases	: Ideal gases obey Boyle's law, Charles's law and Avogadro's law.

Formulae

Relation between Celsius & Kelvin	$K = {}^{\circ}C + 273$
Relation between Fahrenheit and kelvin	$[K] = ({}^{\circ}F + 460) \times \dfrac{5}{9}$
Coefficient of cubical expansion	$\dfrac{\Delta V}{V_0} = \alpha_v \Delta T$
Coefficient of linear expansion	$\dfrac{\Delta L}{L_0} = \alpha_L \Delta T$
Coefficient of areal expansion	$\dfrac{\Delta A}{A_0} = \alpha_A \Delta T$ (or) $2 \times \alpha_L$
Coefficient of cubical expansion	$\alpha_v = 3 \times \alpha_L$
Boyle's law	$P \propto \dfrac{1}{V}$ (or) PV = constant
Charles's law	$V \propto T$ (or) $\dfrac{V}{T}$ = constant
Avogadro's law	$V \propto n$ (or) $\dfrac{V}{n}$ = constant
Ideal gas equation	$PV = nRT$; n–No. of moles R – Universal gas constant ($8.314J\ mol^{-1}\ K^{-1}$)

Don

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The value of universal gas constant ✴✴
   a) 3.81 mol^{-1} K^{-1}
   b) 8.03 mol^{-1} K^{-1}
   c) 1.38 mol^{-1} K^{-1}
   d) 8.31 J mol^{-1} K^{-1}

2. If a substance is heated or cooled, the change in mass of that substance is
   a) positive
   b) negative
   c) zero
   d) none of the above

3. 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

4. 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

5. In the Given diagram, the possible direction of heat energy transformation is

303 K	
A	
304 K	305 K
B	**C**
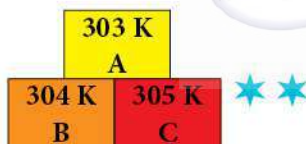
   ✴✴
   a) A ← B, A ← C, B ← C
   b) A→B, A→C, B→C
   c) A→B, A←C, B→C
   d) A←B, A→C, B←C

Ans:

1.	d)	8.31 J mol^{-1} K^{-1}	4.	c)	difference in T.E and P.E
2.	c)	Zero	5.	a)	A ← B, A ← C, B ← C
3.	d)	a or b			

II. Fill in the blanks

1. The value of Avogadro number _____. ✴✴

2. The temperature and heat are _____ quantities.

3. One calorie is the amount of heat energy required to raise the temperature of _____ of water through_____. ✴

4. According to Boyle's law, the shape of the graph between pressure and reciprocal of volume is _____.

Ans:

1.	6.023×10^{23}	3.	1 gram, 1° C
2.	Scalar	4.	Straight line

III. State whether the following statements are true or false, if false explain why.

1. For a given heat in liquid, the apparent expansion is more than that of real expansion. ✶ ✶ **False**

   For a given heat in liquid, the real expansion is more than that of apparent expansion.

2. Thermal energy always flows from a system at higher temperature to a system at lower temperature. **True**

3. According to Charle's law, at constant pressure, the temperature is inversely proportional to volume. **False**

   According to Charle's law at constant pressure, the temperature is directly proportional to volume.

IV. Match the Following

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

V. Assertion and 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 the assertion.

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

c) Both assertion and reason false.

d) Assertion is false but the reason is true.

1. **Assertion:** There is no effect on other end when one end of the rod is only heated.

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

   Ans : (c) Both assertion and reason false

2. **Assertion:** Gas is highly compressible than solid and liquid

   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 the assertion.

VI. Answer in briefly

1. Define one calorie. ✳✳

One calorie is defined as the amount of heat energy required to raise the temperature of **1 gram** of water through **1° C.**

2. Distinguish between linear, superficial and cubical expansion. ✳

Linear Expansion	Superficial Expansion	Cubical Expansion
When a body is heated or cooled, the **length** of the body changed due to change in its temperature, then the expansion is called as linear expansion.	If there is an increase in the **area** of a solid object due to heating, then the expansion is called as superficial expansion.	If there is an increase in the **volume** of a solid due to heating, then the expansion is called as cubical expansion.
The **ratio** of increase in **length** of the body per **degree** rise in temperature is called as the co-efficient of linear expansion.	The **ratio** of the increase in ratio of the body per **degree rise in temperature** to its unit area is called as co-efficient of superficial expansion.	The **ratio** of the increase in **volume** of the water of the body per **degree** rise in temperature to its unit volume is called as co-efficient of cubical expansion.
This is otherwise called as **longitudinal** expansion.	This is otherwise called as **Areal** expansion.	This is otherwise called as **volumetric** expansion.

3. What is co-efficient of cubical expansion?

- The **ratio** of the increase in **volume** of the body per **degree** rise in temperature to its **unit volume** is called as co-efficient of cubical expansion.
- SI unit – K^{-1}.
- Co - efficient of cubical expansion can be expressed as $\boxed{\dfrac{\Delta V}{V_p} = \alpha_v \Delta T}$

4. State Boyle's law

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

$$\boxed{P \, \alpha \, \frac{1}{V}}$$

5. State-the law of volume

Charles's law is otherwise called as the law of volume. It states that when the **pressure** of gas is kept **constant**, the **volume** of the gas is **directly** proportional to the **temperature** of the gas.

$$\boxed{V \propto T}$$

6. Distinguish between ideal gas and real gas. ✳✳

Ideal gas	Real gas
If the atoms or molecules of a gas **do not interact with each other**, then the gas is said to be ideal gas.	If the molecules or atoms of a gases **interact with each other** with a definite amount of intermolecular or interatomic force of attraction, then the gases are said to be real gases.

7. What is co-efficient of real expansion?

- Co-efficient of real-expansion is defined as 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?

- Co-efficient of **apparent** expansion is defined as the ratio of the **apparent rise** in the **volume** of the liquid per degree rise in **temperature** to its volume.
- Its SI unit is K^{-1}

VII. Numerical problems:

1. Find the final temperature of a copper rod. Whose area of cross section changes from 10 m² to 11 m² due to heating. The copper rod is initially kept at 90 K. (Co-efficient of superficial expansion is 0.0021 /K) ✳

Solution:

Given:

$$\Delta A = 11\,m^2 - 10\,m^2 = 1\,m^2$$

$$T_1 = 90\,K$$

$$\alpha_A = 0.0021/\,K$$

$$T_2 = ?$$

Formula used:
$$\frac{\Delta A}{A_0} = \alpha_A \Delta T$$

$$\frac{\Delta A}{A_0} = \alpha_A \Delta T$$

$$\frac{1m^2}{10m^2} = 0.0021\,[T_2 - 90]$$

$$0.1 = 0.0021\,[T_2 - 90] = \frac{0.1}{0.0021} + 90 = T_2$$

$$T_2 = 137.61\,K$$

So the final temperature of a copper rod is **137.61 K**

2. Calculate the co-efficient of cubical expansion of a zinc bar. Whose volume is increased 0.25 m³ from 0.3 m³ due to the change in its temperature of 50 K.

Solution:

Given:

Change in volume $(\Delta V) = 0.25\,m^3$

Original volume $(V_0) = 0.3\,m^3$

Change in Temperature $\Delta T = 50\,K$

$$\alpha_V = ?$$

Formula used:
Co-efficient of cubical expansion
$$\alpha_V = \frac{\Delta V}{V_0} \times \Delta T$$

$$\frac{\Delta V}{V_0} = \alpha_V \Delta T = \frac{0.25}{0.3} = \alpha_V \times 50$$

$$\alpha_V = \frac{0.05}{0.25 \times 50} = 0.0167 K^{-1}$$

Co-efficient of cubical expansion of Zinc bar **0.0167 K**

VIII. Answer in detail

1. Derive the ideal gas equation. ✷ ✷ ✷

- The ideal gas equation is an equation, which relates to **all the properties** of an ideal gas.

- An ideal gas obeys **Boyle's law** and **Charles' law** and **Avogadro's law**.

- According to Boyle's law,

$$PV = constant \quad -----(1)$$

- According to Charles's law,

$$V/T = constant \quad -----(2)$$

- According to Avogadro's law,

$$V/n = constant \quad -----(3)$$

After combining equations (1), (2) and (3), you can get the following equation.

$$PV/nT = constant \quad -----(4)$$

The above relation is called the combined law of gases.

- If you consider a gas, which contains μ moles of the gas, the number of atoms contained will be equal to μ times the Avogadro number, N_A.

$$i.e. \quad n = \mu N_A. \quad -----(5)$$

Using equation (5), equation (4) can be written as

$$PV/\mu N_A T = constant$$

The value of the constant in the above equation is taken to be k_B, which is called as **Boltzmann constant (1.38×10^{-23} JK^{-1})**. Hence, we have the following equation:

$$PV/\mu N_A T = k_B$$

$$PV = \mu N_A k_B T$$

Here, $\mu N_A k_B = R$, which is termed as universal gas constant whose value is 8.31 J mol^{-1} K^{-1}.

$$PV = RT \quad -------(6)$$

Ideal gas equation is also called as *equation of state* because it gives the relation between the state variables and it is used to describe the state of any gas.

2. Explain the experiment of measuring the real and apparent expansion of a liquid with a neat diagram. ✷ ✷

Aim:

To measure real and aparent expansion of liquid.

Apparatus Required:

Round bottomed flask, a narrow glass tube with a scale, burner.

Procedure:

- 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, the container receives the thermal energy and it **expands**.
- As a result, the **volume** of the liquid appears to have **reduced**.
- Mark this reduced level of liquid as L_2.
- On further **heating**, the thermal energy supplied to the liquid through the container results in the **expansion** of the liquid.
- Hence, the level of liquid rises to L_3.
- Now, the difference between the levels L_1 and L_3 is called as **apparent expansion**.
  Apparent expansion = $L_3 - L_1$.
- The difference between the levels L_2 and L_3 is called **real expansion**.
  Real expansion = $L_3 - L_2$.

Result:

- The real expansion is always more than that of apparent expansion.
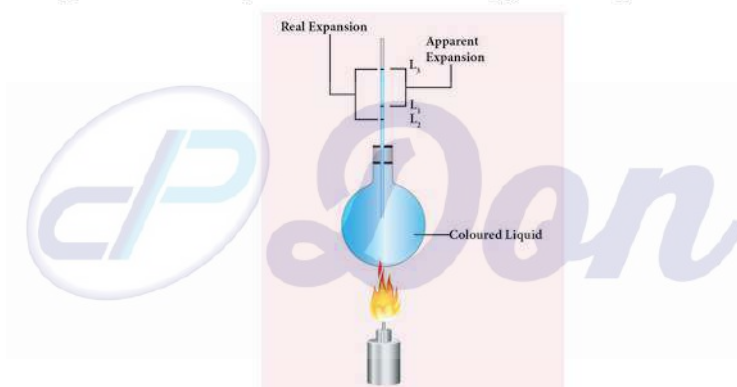
Real and apparent expansion of liquid

IX. Higher Order Thinking Skills (HOTS)

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?

- 0°C ice is colder than water.
- This can be explained in terms of the latent heat of fusion (336 kJ) which is required to convert ice at 0°C to water at 0°C.
- In simpler terms water at 0°C has higher heat content than ice at the same temperature.
- Thus we conclude ice at 0°C is colder.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Temperature is the
   a) average kinetic energy of the molecules
   b) average potential energy of the molecules.
   c) total energy of the molecules.
   d) none of the above

2. The absolute scale of temperature of a body is ✴
   a) 1K
   b) 0 K
   c) 100 K
   d) None

3. Two or more physical system or bodies are said to be in equilibrium
   a) if there is a flow of thermal energy between the systems.
   b) if there is no net flow of thermal energy between the systems
   c) if there may or may not be a flow of thermal energy between the systems.
   d) None of the above

4. Unit of heat energy is
   a) Kelvin
   b) Calorie
   c) Celsius
   d) Fahrenheit

5. When a body is heated or cooled
   a) the mass of the system is also altered
   b) the mass of the system is not altered
   c) the mass of the system may or may not be altered
   d) none of the above

6. For any exchange of heat
   a) heat gained by the cold system is equal to the heat lost by the hot system.
   b) heat gained by the cold system is more than the heat lost by the system.
   c) heat gained by the cold system is lesser than the heat lost by the system.
   d) none of the above.

7. One kilo calorie is defined as the amount of heat energy required to rise the temperature of ✴
   a) 1 kg through 1°C
   b) 1 g through 1°C
   c) 1 kg through 100°C
   d) 1 g through 100°C

8. When a certain amount of heat energy is given to the substance
   a) Temperature of the substance rises
   b) The substance may change its state
   c) The substance will expand
   d) All the above

9. **Rise in temperature depends on the**
   a) nature and mass of the substance
   b) nature of the substance only
   c) mass of the substance only
   d) none of the above

10. **The SI unit of co-efficient of linear expansion is**
    a) K^{-1}
    b) K
    c) mK
    d) $m^{-1}K^{-1}$

11. **The co-efficient of linear expansion is**
    a) different for different material
    b) same for all the metals
    c) independent on the nature of the metals
    d) different for same metals under different conditions

12. **SI unit of co-efficient of real expansion is**
    a) K^{-1}
    b) K
    c) K^2
    c) mK

13. **Which of the statements given below is true?**
    a) The real expansion is always more than that of apparent expansion
    b) The real expansion and apparent expansion are equal
    c) The real expansion is always lesser than that of apparent expansion
    d) None of the above

14. **Charles's law is otherwise called as** ✳
    a) law of mass
    b) law of temperature
    c) law of pressure
    d) law of volume

15. **According to Avogadro's law**
    a) $\dfrac{V}{T}$ is constant
    b) $PV =$ a constant
    c) $\dfrac{V}{n} =$ a constant
    d) $Vn =$ a constant

16. **Practically in an ideal gas**
    a) there is no interaction of molecules
    b) the interaction of molecules are weaker
    c) the interaction of molecules are stronger
    d) the interaction of molecules are either weaker or stronger

17. **An ideal gas obeys**
    a) Boyle's law
    b) Avogadro's law
    c) Charles's law
    d) All the above

18. **The value of Boltzmann's constant is** ✳ ✳
    a) 1.38×10^{-23} JK^{-1}
    b) 13.8×10^{-23} JK^{-1}
    c) 1.38×10^{-21} JK^{-1}
    d) 1.38×10^{-22} JK^{-1}

Ans:

1.	a)	average kinetic energy theory of the molecules	10.	a)	K^{-1}
2.	b)	0 K	11.	a)	different for different material
3.	b)	if there is no net flow of thermal energy between the systems	12.	a)	K^{-1}
4.	b)	calorie	13.	a)	the real expansion is always more than that of apparent expansion
5.	b)	the mass of the system is not altered	14.	d)	law of volume
6.	a)	heat gained by the cold system is equal to the heat lost by the hot system	15.	c)	$\dfrac{V}{n}$ = a constant
7.	a)	1 kg through 1°C	16.	b)	the interaction of molecules are weaker
8.	d)	All the above	17.	d)	All the above
9.	a)	nature and mass of the substance	18.	a)	$1.38 \times 10^{-23}\ JK^{-1}$

II. Fill in the blanks

1. Temperature is the average _____ of the molecules.

2. Absolute temperature is also known as _____.

3. Heat is a _____ quantity.

4. The _____of a system is not altered when it is heated or cooled. ✴

5. The change in dimension due to rise in temperature is called _____ of the object.

6. Co-efficient of superficial expansion is _____ for different metals.

7. The Co-efficient of cubical expansion of liquid is independent of _____.

8. The SI unit of co-efficient of real expansion is _____.

9. The real expansion is always _____ than that of apparent expansion. ✴

10. Ideal gas equation is also called as _____ ✴

Ans:

1.	Kinetic energy	6.	different
2.	thermodynamic temperature	7.	Temperature
3.	scalar	8.	K^{-1}
4.	mass	9.	more
5.	Thermal expression	10.	Equation of state

III. State whether the following statements are true or false, if false explain why.

1. For any exchange of heat, the heat gained by the cold system is equal to heat lost by the hot system.   **True**

2. One calorie is defined as the amount of heat energy required to rise the temperature of 1 kg of water to 1° C. ✴   **False**

   One calorie is defined as the amount of heat energy required to rise the temperature of 1 gram of water to 1°C.

3. At constant temperature and pressure the volume of the gas is directly proportional to number of atoms or molecules present in it.   **True**

4. Ideal gases do not obey Boyle's law and Charle's law.   **False**

   Ideal gases obey Boyle's law and charle's law.

5. SI unit of temperature is joule. ✴   **False**

   SI unit of temperature is kelvin.

6. The expansion of the liquid apparently observed without considering the expansion of the container is called as real expansion.   **False:**

   The expansion of a liquid apparently observed without considering the expansion of the container is called apparent expansion.

7. All forms of matter undergo expansion on heating.   **True**

8. In the ideal gas equation PV = RT; R is known as Boltzmann's constant. ✴ **False**

   In the ideal gas equation PV = RT; R is known as Universal gas constant.

IV. Match the Following

I. 1) Boltzmann's constant   - a) −273° C ✴   (d)
    2) Universal gas constant   - b) 6.023×10^{23} (c)
    3) Avogadro number   - c) $8.315 \; J \; mol^{-1} K^{-1}$ (b)
    4) Zero kelvin   - d) $1.38 \times 10^{-23} \; JK^{-1}$ (a)

II. 1) Heat energy   - a) kelvin   (c)
    2) Temperature   - b) $J \; mol^{-1} \; K^{-1}$ (a)
    3) Co-efficient of linear expansion - c) joule   (d)
    4) Universal gas constant   - d) K^{-1} (b)

III. 1) Thermodynamic temperature   - a) longitudinal expansion   (b)
     2) Linear expansion   - b) absolute temperature   (a)
     3) Cubical expansion   - c) arial expansion   (d)
     4) Superficial expansion   - d) volumetric expansion   (c)

V. Assertion and reason type questions

1. **Assertion:** Solids undergo expansion on heating.

   Reason: When a solid is heated, the atoms gain energy and vibrate more vigorously.

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

2. **Assertion:** Ideal gas equation is called as equation of state.

   Reason: An ideal gas obeys Boyle's law and Charles's law and Avogadro's law.

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

3. **Assertion:** If two bodies are said to be in thermal equilibrium, then they will be at the same temperature.

   Reason: There will be a transfer of heat energy from the hot body to the cold body until a thermal equilibrium is established between them

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

VI. Answer in briefly

1. Define temperature. ✸

Temperature is defined as the **degree of hotness** of a body. It is also defined as the property which determines whether a body is in **equilibrium or not** with the surroundings.

2. Define absolute scale of temperature. (or) Define thermodynamic temperature.

The temperature measured in relation to **absolute zero using** the kelvin scale is known as absolute temperature.

3. Define thermal equilibrium.

Two or more physical systems or bodies are said to be in thermal equilibrium if there is **no net flow of thermal energy** between the systems.

4. Define thermal energy.

Thermal energy is a form of energy which is transferred between any two bodies due to the **difference** in their **temperatures**.

5. What is meant by heating?

The process in which **heat energy flows** from a body at a higher temperature to another object at lower temperature is known as heating.

6. Define kilo calorie. ✸

One kilo calorie is defined as the amount of heat energy required to rise the temperature of **1 kilogram** of water through **1°C.**

7. What are the effects of heat energy? ✸

- The temperature of the substance rises.
- The substance may change its state from solid to liquid or from liquid to gas.
- The substance will expand when heated.

8. What do you mean by thermal expansion of the object?

The **change in dimension** due to **rise in temperature** is called thermal expansion of the object.

9. Define co-efficient of linear expansion. Give its unit. ✸

- The **ratio** of increase in **length** of the body per **degree** rise in temperature to its **length** is called as the co-efficient of liner expansion.

- It's unit is K^{-1}.

- It can be expressed as, $$\frac{\Delta L}{L_o} = \alpha_L \Delta T$$

10. Define co-efficient of superficial expansion. Give its unit.

- The **ratio** of increase in **area** of the body per **degree** rise in temperature to its **unit area** is called as the co-efficient of superficial expansion.

- It's unit is K^{-1}.

- It can be expressed as, $$\frac{\Delta A}{A_o} = \alpha_A \Delta T$$

11. What do you mean by real expansion of the liquid?

If a liquid is heated directly **without using any container,** then the expansion that you observe is termed as real expansion of the liquid.

12. What do you mean by apparent expansion of the liquid?

The expansion of a liquid apparently observed **without considering the expansion** of the container is called the apparent expansion of the liquid.

13. What are the three fundamental laws of gases?

- Boyle's law
- Charles's law
- Avogadro's law.

14. State Avogadro's law. ✸ ✸

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.

15. What do you mean by Avogadro's number?

- It is the **total number of atoms per mole** of the substance.
- It is equal to 6.023×10^{23}/**mole.**

VII. Numerical problems:

1. A steel is 40 cm long at 20°C. The co-efficient of linear expansion for steel is 12×10^{-6} / °C. find the increase in length and the final length of the steel at 70° C

Solution:

Given

Original length = 40 cm (L_1)

Change in temperature (ΔT) = 70° – 20° C = 50° C

Co-efficient of linear Expansion α_L = 12×10^{-6}. C^{-1}

ΔL = ?

L_2 = ?

> **Formula used:**
> Increase in length
> $\Delta L = L_1 \alpha_L \Delta T$

$$\frac{\Delta L}{L} = \alpha_L \, \Delta T$$

Increase in length $(\Delta L) = L_1 \, \alpha_L \Delta T$

$$= 40 \times 12 \times 10^{-6} \times 50$$

$$= 240 \times 10^2 \times 10^{-6} = 24 \times 10^{-3} \text{ cm}$$

$$\Delta L = 0.024 \text{ cm}$$

Final length $L_2 = L_1 + \Delta L = 40 + 0.024 = 40.024 \text{ cm}$

$$\mathbf{L_2 = 40.024 \text{ cm}}$$

2. **An iron rod heated from 30° C to 80° C. The final length of iron is 115 cm and the co-efficient of linear expansion is $3 \times 10^{-3}\,°C^{-1}$. What is the original length and the change in length of the iron?** ✶

Solution

Given:

Formula used:
Change in length
$\Delta L = L_2 - L_1$

$$\Delta T = 80° - 30° \text{ C} = 50° \text{ C}$$

$$L_2 = 115 \times 10^{-2} \text{ m}$$

$$\alpha_L = 3 \times 10^{-3}\ {}^0C^{-1}$$

$$L_1 = ?$$

$$L_2 = \Delta L + L_1$$

$$= L_1 \alpha \, \Delta T + L_1$$

$$= L_1 \, (\alpha \, \Delta T + 1)$$

$$115 = L_1 \, (1 + 3 \times 10^{-3} \times 50)$$

$$115 = L_1 \, (1 + 0.15)$$

$$115 = L_1 \, (1.15)$$

$$L_1 = \frac{115}{1.15} = 100 \text{ cm}$$

$$\mathbf{L_1 = 100 \text{ cm}}$$

So the original length was 100 cm

3. **At 30° C the volume of an Aluminium sphere is 30 cm³. The co-efficient of linear expansion is $24 \times 10^{-6}\ °C^{-1}$. If the final volume is 30.5 cm³. What is the final temperature of the aluminium sphere?**

Solution:

Given:

Formula used:
Volume change
$\Delta V = \beta \, (V_1) \, (T_2 - T_1)$

$$\alpha = 24 \times 10^{-6}\ °C^{-1}$$

$$\alpha_V = 3\alpha_A = 3 \times 24 \times 10^{-6} = 72 \times 10^{-6}$$

$$T_1 = 30°C, \ V_1 = 30 \text{cm}^3, \ V_2 = 30.5 \text{ cm}^3$$

$$\Delta V = 30.5 - 30 = 0.5 \text{ cm}^3$$

$$T_2 = ?$$

$$\frac{\Delta V}{V} = \alpha_V \Delta T$$

$$\Delta V = \beta (V_1)(T_2 - T_1)$$

$$0.5 = 72 \times 10^{-6} \times 30 \times (T_2 - 30)$$

$$0.5 = 2160 \times 10^{-6} (T_2 - 30)$$

$$(T_2 - 30) = \frac{2160}{0.5} \times 10^{-6}$$

$$T_2 = 230 + 30 = 260° C$$

$$\mathbf{T_2 = 260°C}$$

4. At 30° C, the area of a sheet of aluminium is 40 cm² and the co-efficient of linear expansion is 24× 10⁻⁶ /°C. Determine the final temperature if the final area is 40.2 cm² ✴

Solution:
Given:

Formula used:

Temperature change
$$\Delta T = \alpha_A A_1 (T_2 - T_1)$$

$$T_1 = 30°, \ \alpha_L = 24 \times 10^{-6} \ °C^{-1}$$

$$\alpha_A = 2a = 2 \times 24 \times 10^{-6} = 48 \times 10^{-6} \ °C^{-1}$$

$$A_1 = 40 \ cm^2, \ A_2 = 40.2 \ cm^2, \ \Delta A = 0.2 \ cm^2$$

$$\Delta A = \alpha_A A_1$$

$$\Delta T = \alpha_A A_1 (T_2 - T_1)$$

$$0.2 = 48 \times 10^{-6} \times 40 \times (T_2 - 30)$$

$$0.2 = 1920 \times 10^{-6} (T_2 - 30)$$

$$T_2 - 30 = \frac{1920}{0.2} = 10^{-6}, \ T_2 = 100 + 30 = 130° C$$

The final temperature = 130° C

5. A gas occupies 1.56L at 1.00 atm. What will be the volume of this gas if the pressure becomes 3.00 atm

Solution
Given:

$$\text{Volume} = 1.56 \ \text{Litre}$$

$$(1.56L)(1 \ atm) = 3 \ atm \times x$$

$$x = \frac{1.56}{3} = 0.52 \ L$$

$$\mathbf{x = 0.52 \ L}$$

6. 600 mL of air is at 20° C. What is the volume at 60° C ?

Solution
Given:

$$\frac{V_1}{T_1} = \frac{V_2}{T_2} \qquad \begin{bmatrix} 20°C = 293K \\ 60°C = 333K \end{bmatrix}$$

Don

$$\frac{600\,mL}{293\,K} = \frac{X}{333\,K}$$

$$X = 682 \text{ mL}$$

VIII. Answer in detail

1. What is meant by heat energy? What are the characteristics features of heat energy transfer?

Heat energy:

- When a hot object is in contact with another cold object, a form of **energy flows** from **the hot object to the cold object,** which is known as thermal energy.
- Thus, thermal energy is a form of energy which is **transferred between any two bodies** due to the difference in their temperatures.
- Thermal energy is also known as 'heat energy' or simply 'heat'.

Characteristics features of heat energy transfer:

- Heat always flows from a system at **higher** temperature to a system at **lower** temperature.
- The mass of a system is **not altered** when it is heated or cooled.
- For any exchange of heat, the **heat gained** by the cold system is equal to **heat lost** by the hot system.
- **Heat gained = Heat lost**

2. Explain the different types of expansion in solids. ★

The different types of expansion of solid are listed and explained below

- Linear expansion
- Superficial expansion
- Cubical expansion

Linear expansion:

- When a body is heated or cooled, the **length of the body changes** due to change in its temperature.
- Then the expansion is said to be linear or longitudinal expansion.
- The **ratio** of increase in **length** of the body per **degree** rise in temperature to its **unit length** is called as the co-efficient of linear expansion.
- The SI unit of Co-efficient of Linear expansion is **K^{-1}**.
- The value of co-efficient of linear expansion is different for different materials.
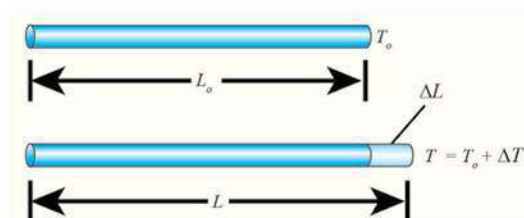
Linear expansion

- The equation relating to the change in length and the change in temperature of a body is given below:

$$\frac{\Delta L}{L_o} = \alpha_L \Delta T$$

ΔL - Change in length (Final length- Original length)

L_0 - Original length

ΔT - Change in temperature (Final temperature - Initial temperature)

α_L - Co-efficient of linear expansion.

Superficial expansion:

- If there is an **increase in the area of a solid object** due to heating, then the expansion is called superficial or a real expansion.

- Superficial expansion is determined in terms of co-efficient of superficial expansion.

- The **ratio** of increase in **area** of the body per degree rise in temperature to its **unit area** is called as co-efficient of superficial expansion.

- Co-efficient of superficial expansion is different for different materials.

- The SI unit of Co-efficient of superficial expansion is **K^{-1}.**
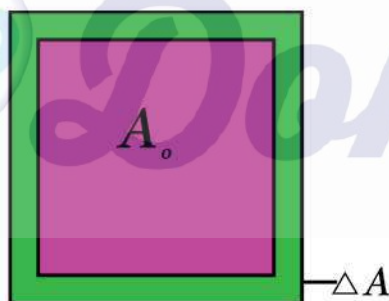
Superficial expansion

- The equation relating to the change in area and the change in temperature is given below:

$$\frac{\Delta A}{A_o} = \alpha_A \Delta T$$

ΔA - Change in area (Final area - Initial area)

A_o - Original area

ΔT - Change in temperature (Final temperature - Initial temperature)

α_A - Co-efficient of superficial expansion.

Cubical expansion:

- If there is an **increase in the volume** of a solid body due to heating, then the expansion is called cubical or volumetric expansion.

- As in the cases of linear and areal expansion, cubical expansion is also expressed in terms of co-efficient of cubical expansion.

- The **ratio** of increase in **volume** of the body per **degree** rise in temperature to its **unit volume** is called as co-efficient of cubical expansion.

- This is also measured in K^{-1}.
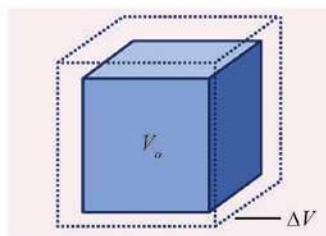
Cubical expansion

- The equation relating to the change in volume and the change in temperature is given below:

$$\frac{\Delta V}{V_o} = \alpha_V \Delta T$$

ΔV - Change in volume(Final volume - Initial volume)

V_o - Original volume

ΔT - Change in temperature (Final temperature - Initial temperature)

α_V - Co-efficient of cubical expansion.

- Different materials possess different co-efficient of cubical expansion.

3. Explain three fundamental laws of gases. ✦✦

The three fundamental laws which connect the relation between pressure, volume and temperature are as follows

- Boyle's Law
- Charles's law
- Avogadro's law

Boyle's law:

When the **temperature** of a gas is kept **constant**, the **volume** of a fixed mass of gas is **inversely** proportional to its **pressure**. This is shown in Figure

$$P \propto 1 / V$$

Volume increases and pressure decreases when pulling up

Volume decreases and pressure increases when pulling down
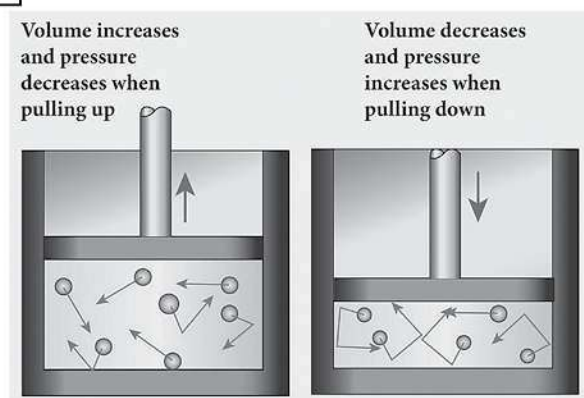
Variation of volume with pressure

- In other words, for an invariable mass of a perfect gas, at constant temperature, the product of its pressure and volume is a constant.

(i.e) **PV = constant**

Charle's law (The law of volume)

Charle's law was formulated by a **French scientist Jacques Charles**. According to this law, When the **pressure** of gas is kept **constant**, the **volume** of a gas is **directly** proportional to the **temperature** of the gas.

$$\boxed{V \propto T}$$

or $\dfrac{V}{T}$ = constant

Avogadro's law:

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

i.e. $\boxed{V \propto n}$

(or) $\dfrac{V}{n}$ = constant

- Avogadro's number (N_A) is the total number of atoms per mole of the substance.

- It is equal to **6.023×10^{23} /mol.**

IX. Higher Order Thinking Skills (HOTS)

1. An iron ball at 40° C is transferred to a mug containing water at a temperature of 40° C, in which direction will the heat flow?

Heat will not flow. Because, the iron ball and water are at same temperature.

2. Wet clothes dry in summer faster. Why?

Transfer of heat energy from environment to wet clothes till thermal equillibrium is established.

◄◄◄◄◄◄ ● ▶▶▶▶▶▶

Unit Test - 3
Thermal Physics

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. The value of universal gas constant
   a) 3.81 mol^{-1} K^{-1} b) 8.03 mol^{-1} K^{-1} c) 1.38 mol^{-1} K^{-1} d) 8.31 J mol^{-1} K^{-1}

2. 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

3. Charles's law is otherwise called as
   a) law of mass   b) law of temperature
   c) law of pressure   d) law of volume

4. The value of Boltzmann's constant is
   a) 1.38× 10^{-23} JK^{-1} b) 13.8× 10^{-23} JK^{-1}
   c) 1.38× 10^{-21} JK^{-1} d) 1.38× 10^{-22} JK^{-1}

5. a) Both the assertion and the reason are true and the reason is the correct explanation of the assertion.
   b) Both the assertion and the reason are true 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.

   Assertion: There is no effects on other end when one end of the rod is only heated.

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

II. Answer the following questions in one or two lines.   5 × 2 = 10
1. Define one calorie.
2. State Boyle's law.
3. What are the effects of heat energy?
4. State Avogadro's law.
5. Why do the substance expand?

III. Answer the fllowing questions in brief: 2 × 4 = 8
1. Distinguish between linear, areal and cubical expansion.
2. i) State Avogadro's law.
   ii) What do you mean by real expansion of the liquid?

IV. Answer the fllowing questions in detail: 1 × 7 = 7
1. i) Derive the ideal gas equation?
   ii) Define kilo calorie.

POINTS TO REMEMBER

- Electricity deals with the flow of electric charges through a conductor.
- The motion of electric charges through a conductor will constitute through an electric current.
- SI unit of current is ampere.
- By convention, the direction of current is taken as the direction of flow of positive charge.
- The SI unit of electric potential or potential difference is volt.
- Potential difference V is proportional to the current.
- The SI unit of resistance is ohm.
- Electrical resistivity of a conductor is a constant for a given material.
- The reciprocal of electrical resistivity of a material is called its electrical conductivity.
- Conductivity is more for conductor than for insulators.
- Specific resistivity is the resistance of a conductor of unit length and unit area of cross section.
- Electrical resistance is the ratio between the potential difference across the ends of a conductor and the current flowing through it.
- Electrical conductance is the reciprocal of resistance.
- Electrical conductivity is the reciprocal of electrical resistivity of a material.
- If resistors are connected in series same current passes through each of them.
- The heating effect of current is used in devices like electric heater, electric iron etc.
- The electric power is the product of the electric current and the potential difference.
- One watt is the power consumed when an electric device is operated at a potential difference of one volt and it carries a current of one ampere.
- Ohm's law is defined as the relation between the potential difference and current.
- Electrical potential difference is defined as the amount of work done in moving a unit positive charge from one point to another against the electric force.
- Earth wire serves as a protective conductor, which saves us from electric shocks.
- An LED bulb is a semiconductor device that emits visible light when an electric current passes through it.

MIND MAP

★ ELECTRICITY ★

LED Bulbs

LED TV

Heating effect of current

Joule's law of heating

Electric power

Electrical potential

Electrical potential difference

Electric circuits

Resistances in series

Resistances in parallel

Domestic electric Circuits

Electric Current $I = Q/T$

Ohm's law $V = IR$

Resistance $R = V/I$

Resistivity

Conductivity
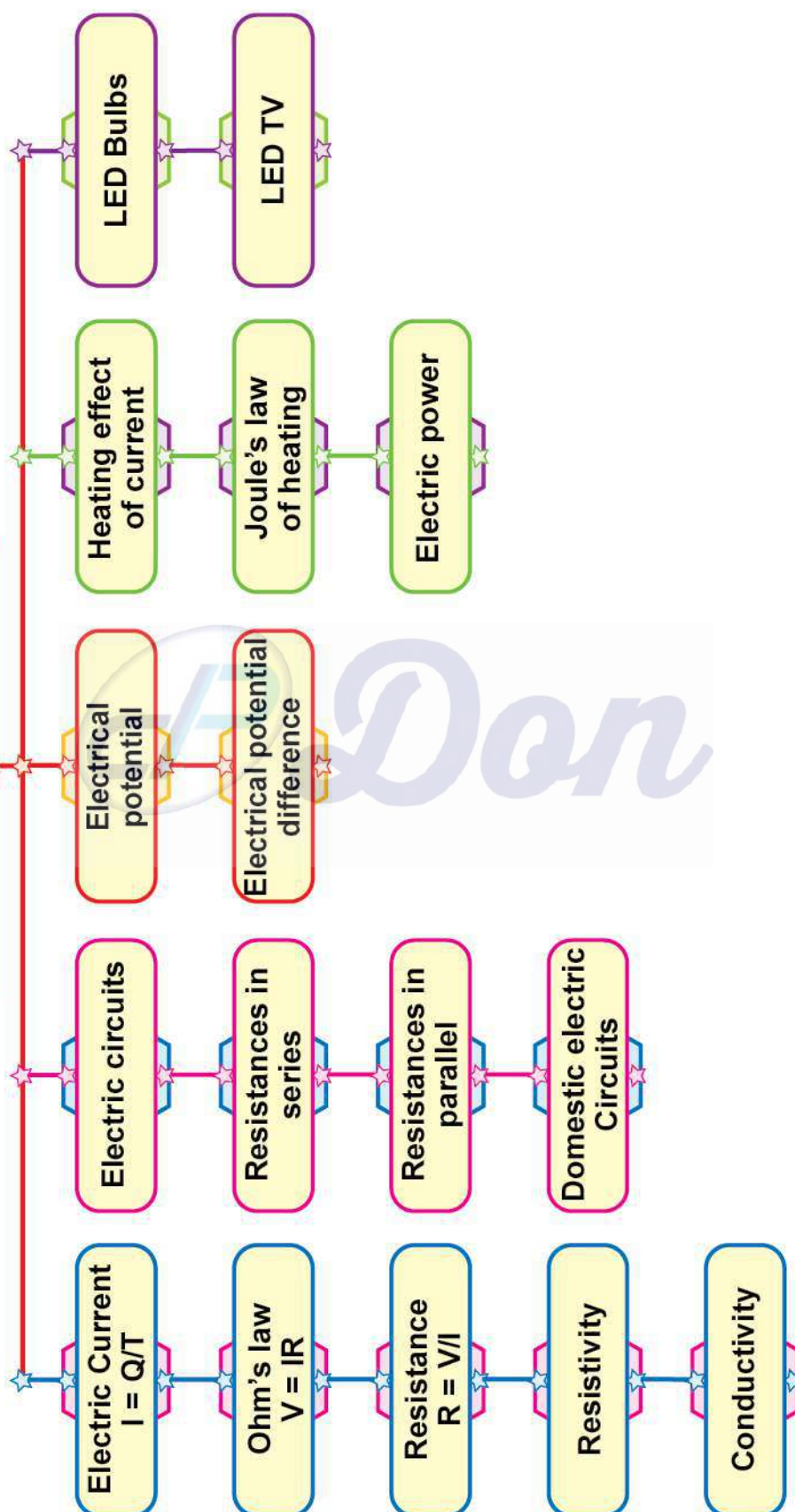
Formulae

Electric Current	$I = \dfrac{Q}{t} = \dfrac{\text{Charge}}{\text{Time}} \Rightarrow Q = It$
Potential difference	$V = \dfrac{W}{Q} = \dfrac{\text{Workdone}}{\text{charge}} \Rightarrow W = vQ$
Ohm's law	$V = IR; \ R = \dfrac{V}{I}$
Electrical Resistivity (or) specific resistance	$\rho = \dfrac{RA}{L}$
Conductance	$G = \dfrac{1}{R} = \dfrac{1}{\text{resistance}}$
Conductivity	$\sigma = \dfrac{1}{\rho} = \dfrac{1}{\text{resistivity}}$
Equivalent resistance in a series combinations	$R_s = R_1 + R_2$
When 'n' resistors are connected in a series combinations	$R_s = nR;$
When 'n' resistors are connected in parallel.	$R_p = \dfrac{R}{n}$
Total resistance in the circuit	$\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$
Series connection of parallel resistors	$R_{total} = R_{P1} + R_{P2}$
Parallel connection of series resistors	$\dfrac{1}{R_{total}} = \dfrac{1}{R_{S1}} + \dfrac{1}{R_{S2}}$
Joule's law of heating	$H = I^2 Rt \ ; \ H = VI\,t$
Electric power	$P = \dfrac{work}{time} = \dfrac{VIt}{t} (or) P = V\,I$
Electrical energy	$E = \text{power} \times \text{time} = VI\,t = VQ$
Resistance	$\text{Resistance } (R) = \dfrac{Voltage\ (V)}{Current\ (I)}$
Electric power	$P = \dfrac{V^2}{R} \ (or) \ P = VI = I^2 = V^2/R$

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◤ **Textbook Evaluation** ◥

</div>

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **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.

2. **SI unit of resistance is** ✶✶
   a) mho   b) joule
   c) ohm   d) ohm meter

3. **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.

4. **Kilowatt hour is the unit of** ✶✶
   a) resistivity   b) conductivity
   c) electrical energy   d) electrical power

Ans:

1.	b) Rate of change of charge is current.	3.	b) Closing the switch completes the circuit.
2.	c) ohm	4.	c) electrical energy

II. Fill in the blanks

1. When a circuit is open, _____ cannot pass through it.

2. The ratio of the potential difference to the current is known as _____. ✶✶

3. The wiring in a house consists of _____ circuits. ✶

4. The power of an electric device is a product of _____ and _____.

5. LED stands for _____.

Ans:

1.	Current	4.	voltage and current
2.	resistance	5.	Light Emitting Diode
3.	parallel		

III. State whether the following statements are true or false. It take Correct the statement.

1. Ohm's law states the relationship between power and voltage. ✶✶ **False**
Ohm's law states the relationship between current and voltage.

2. MCB is used to protect house hold electrical appliances. **True**

3. The SI unit for electric current is the coulomb. ✶ **False**
The SI unit for electric current is ampere.

4. One unit of electrical energy consumed is equal to 1000 kilowatt hour. **False**
One unit of electrical energy consumed is equal to 1kilo watt hour.

5. The effective resistance of three resistors connected in series is lesser than the lowest of the individual resistances. ✶✶ **False**
The effective resistance of three resistors connected in parallel is lesser than the lowest of the individual resistances.

IV Match the items in columns -I to the items in column-II.

Column I	Column II	
1) Electric current	a) volt	(e)
2) Potential difference	b) ohm meter	(a)
3) Specific resistance	c) watt	(b)
4) Electrical power	d) joule	(c)
5) Electrical energy	e) ampere	(d)

V. Reason and Assertion

Mark the correct choice as

a) If both the assertion and the reason are trueand the reason is the correct explanation of the assertion.

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

c) If the assertion is true, but the reason is false.

d) 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) If 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) If 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) If both the assertion and the reason are trueand the reason is the correct explanation of the assertion.

VI. Very short answer questions.

1. Define the unit of current. ✶ ✶ ✶

- The SI unit of current is **ampere (A).**
- The 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.

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

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

- Resistance is inversely proportional to area of cross section.
- A thicker wire has larger area of cross section and hence the **resistance decreases.**

- Resistance $\alpha \dfrac{\text{Length}}{\text{Area}}$

- $$R \,\alpha\, \frac{l}{A}$$

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

- **Melting point** of tungsten is very**.**
- Hence it is used in a **filament** bulb.
- But a fuse wire should be made up of material which has **low melting point.**

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

- Electric heater
- Electric iron work on the heating effect of current.

VII. Short answer questions

1. Define electric potential and potential difference. ✶ ✶

Electric potential:

    The electric potential at a point is defined as the amount of **work done** in moving **a unit positive charge** from **infinity** to that point **against** the **electric force.**

Electrical potential difference:

    The electric potential difference between two points is defined as the amount of **work done** in moving a **unit positive charge** from **one point to another point** against the electric force.

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

- The **earth wire** provides a low resistance path to the electric current.
- The earth wire sends the current from the body of the appliance to the earth, whenever a **live wire** accidently touches the body of the metallic electric appliance.
- Thus the earth wire serves as a protective conductor, which saves us from **electric shock.**

3. State Ohm's law. ✶ ✶

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

$$I \alpha V$$

$$\boxed{V = IR}$$

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

S.No	Resistivity	Conductivity
(i)	It is the **resistance** of a conductor of unit **length** and unit area of **cross section.**	The **reciprocal** of **electrical resistivity** of a material is called electrical conductivity.
(ii)	Its unit is **ohm metre**	Its unit is **ohm^{-1} metre^{-1}**
(iii)	Resistivity is less for conductor than for insulators	Conductivity is more for conductors than for inulators.
(iv)	$\rho = RA / L$	$\sigma = 1 / \rho$

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

Parallel connection is used in domestic appliances.

Reason:

• Each appliance will get the **full voltage.**

• The parallel circuit **divides** the **current** through the appliances.

• Each appliance will get the proper current depending on its **resistance.**

• Each of them can be put on / off **independently**.

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.** ✶ ✶ ✶

Resistors in series:

• A series circuit connects the components **one after the other** to form a 'single loop'.

• A series circuit has only one loop through which **current** can pass.

• If the circuit is interrupted at any point in the loop, no current can pass through the circuit and hence no electric appliances connected in the circuit will work.

• Series circuits are commonly used in devices such as flashlights.

• *Thus, if resistors are connected end to end, so that the same current passes through each of them, then they are said to be connected in series.*
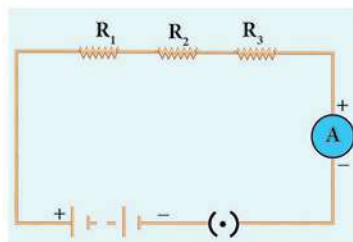
Series connection of resistors

• Let, **three resistances** R_1, R_2 and R_3 be connected in series.

• Let the **current** flowing through them be I.

- According to **Ohm's Law,** the potential differences V_1, V_2 and V_3 across R_1, R_2 and R_3 respectively, are given by:

$$V_1 = I R_1 \qquad .... \qquad (1)$$

$$V_2 = I R_2 \qquad .... \qquad (2)$$

$$V_3 = I R_3 \qquad .... \qquad (3)$$

The **sum** of the potential differences across the ends of each resistor is given by:

$$V = V_1 + V_2 + V_3$$

Using equations (1), (2) and (3), we get

$$V = I R_1 + I R_2 + I R_3 \qquad .... \qquad (4)$$

- The **effective resistor** is a single resistor, which can replace the resistors effectively, so as to allow the same current through the electric circuit.

- Let, the **effective resistance** of the series-combination of the resistors, be R_S.
Then,

$$V = I R_S \qquad .... \qquad (5)$$

Combining equations (4) and (5), you get,

$$I R_S = I R_1 + I R_2 + I R_3$$

$$R_S = R_1 + R_2 + R_3 \qquad .... \qquad (6)$$

- Thus, you can understand that when a number of resistors are connected in series, their equivalent resistance or effective resistance is equal to the **sum** of the **individual resistances**.

- When 'n' resistors of equal resistance R are connected in series, the equivalent resistance is 'n R'.

i.e., $R_S = n R$

- *The equivalent resistance in a series combination is greater than the highest of the individual resistances.*

Resistances in Parallel:

- A parallel circuit has **two or more loops** through which current can pass.

- If the circuit is disconnected in one of the loops, the current can still pass through the other loop(s).

- he wiring in a house consists of parallel circuits.
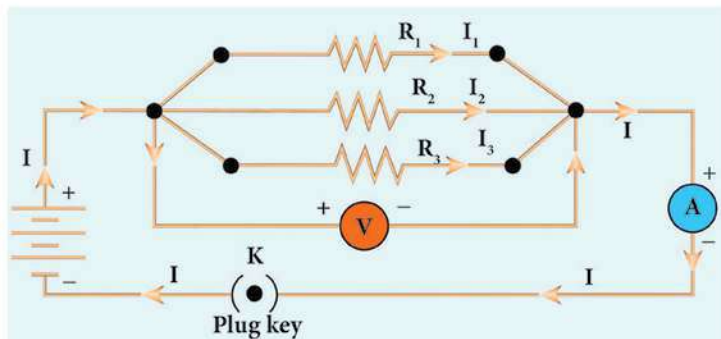
Parallel connections of resistors

- Consider that **three resistors** R_1, R_2 and R_3 are connected **across two common points A and B.**

- The **potential difference** across each resistance is the **same** and equal to the potential difference between A and B.

- This is measured using the **voltmeter.**

- The current I arriving at A divides into three branches I_1, I_2 and I_3 passing through R_1, R_2 and R_3 respectively.

  According to the Ohm's law, you have,

$$I_1 = \frac{V}{R_1} \, . \qquad \text{.................................} \qquad (7)$$

$$I_2 = \frac{V}{R_2} \qquad \text{.................................} \qquad (8)$$

$$I_3 = \frac{V}{R_3} \qquad \text{.................................} \qquad (9)$$

The total current through the circuit is given by

$$I = I_1 + I_2 + I_3$$

Using equations (7), (8) and (9), you get

$$I = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3} \qquad \text{.................................} \qquad (10)$$

- Let the effective resistance of the parallel combination of resistors be R_P. Then,

$$I = \frac{V}{R_P} \qquad \text{.................................} \qquad (11)$$

Combining equations (10) and (11), you have

$$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \qquad \text{.................................} \qquad (12)$$

- Thus, when a number of resistors are connected in parallel, the sum of the reciprocals of the individual resistances is equal to the reciprocal of the effective or equivalent resistance.

- When 'n' resistors of equal resistances R are connected in parallel, the equivalent resistance is $\frac{R}{n}$.

  i.e., $\dfrac{1}{R_P} = \dfrac{1}{R} + \dfrac{1}{R} + \dfrac{1}{R} ... + \dfrac{1}{R} = \dfrac{n}{R}$ .... (13)

  Hence, $R_P = \dfrac{R}{n}$

- *The equivalent resistance in a parallel combination is less than the lowest of the individual resistances.*

2. **a) What is meant by electric current?**
   b) Name and define its unit.
   c) Which instrument is used to measure the electric current? How should it be connected in a circuit? ✦✦

   a) Electric current:

   - Electric current is often termed as **'current'** and it is represented by the symbol 'I'.

   - It is defined as the **rate of flow of charges** in a conductor.

   - This means that the electric current represents the amount of charges flowing in **any cross section** of a conductor (say a metal wire) in **unit time.**

   - If a net charge **'Q' passes** through any cross section of a conductor in **time 't'**, then the current flowing through the conductor is

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

   b) SI unit of electric current:

   - The SI unit of electric current is **ampere (A).**

   - The 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.** Hence,

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

   c) Ammeter is used to measure the electric current. It should be connected in series in a circuit.

3. **a) State Joule's law of heating.**
   b) An alloy of nickel and chromium is used as the heating element. Why?
   c) How does a fuse wire protect electrical appliances? ✦✦✦

   a) Joule's law of heating:

   Joule's law of heating states that the heat produced in any resistor is:

   - directly proportional to the **square** of the **current** passing through the resistor.

   - directly proportional to the **resistance** of the resistor.

   - directly proportional to the **time** for which the current is passing through the resistor.

   b) (i) it has **high resistivity**, (ii) it has a **high melting point**, (iii) it is **not easily oxidized.**

   c) The fuse wire is connected in series, in an electric circuit. When a large current passes through the circuit, the fuse wire **melts** due to **Joule's heating effect** and hence the circuit gets **disconnected**. Therefore, the circuit and the electric appliances are saved from any **damage**. The fuse wire is made up of a material whose melting point is relatively low.

4. **Explain about domestic electric circuits. (circuit diagram not required)**

   - The electricity produced in power stations is distributed to all the domestic and industrial consumers through **overhead and underground cables.**

   - In our homes, electricity is distributed through the domestic electric circuits wired by the electricians.

   - The first stage of the domestic circuit is to bring the power supply to the main-box from a distribution panel, such as **a transformer.**

Main Box Contains:

i) Fuse Box:

- The fuse box contains either a **fuse wire** or a miniature circuit breaker (MCB).
- The function of the fuse wire or a MCB is to protect the house hold electrical appliances from **overloading** due to excess current.
- It has a spring attached to the switch, which is attracted by an **electromagnet** when an excess current passes through the circuit.
- An **MCB** is a **switching device**, which can be activated **automatically** as well as manually.
- Hence, the circuit is broken and the protection of the appliance is ensured.

ii) Meter:

- The meter is used to **record** the **consumption** of electrical energy.

Insulated Wire:

- The electricity is brought to houses by **two** insulated wires.
- Out of these two wires, one wire has a **red insulation** and is called the 'live wire'.
- The other wire has a **black insulation** and is called the 'neutral wire'.
- Both, the live wire and the neutral wire enter into a box where the **main fuse** is connected with the **live wire.**
- After the electricity meter, these wires enter into the **main switch,** which is used to discontinue the electricity supply whenever required.
- After the main switch, these wires are connected to live wires of **two separate circuits.**

5A rating circuit:

- Out of these two circuits, one circuit is of a **5 A rating,** which is used to run the electric appliances with a **lower power rating,** such as tube lights, bulbs and fans.

15 A rating circuit:

- The other circuit is of a **15 A rating,** which is used to run electric appliances with a **high power rating,** such as air-conditioners, refrigerators, electric iron and heaters.
- It should be noted that all the circuits in a house are connected in **parallel**, so that the disconnection of one circuit does not affect the other circuit.
- The electricity supplied to your house is actually an alternating current having an electric potential of 220 V.
- One more advantage of the parallel connection of circuits is that each **electric appliance gets an equal voltage.**

5. **a) What are the advantages of LED TV over the normal TV?**
   b) List the merits of LED bulb.

   ### a) Advantages of LED television:

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

b) **Merits of a LED bulb:**

- As there is no filament, there is no loss of energy in the form of heat. It is cooler than the incandescent bulb
- In comparison with the fluorescent light, the LED bulbs have significantly low power requirement.
- It is not harmful to the environment.
- A wide range of colours is possible here.
- It is cost-efficient and energy efficient.
- Mercury and other toxic materials are not required.

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:

    Energy consumed when heating is maximum = 420 W at a given rate

    i.e., P_1 = 420 W

    Energy consumed when heating is minimum at a given rate P_2 = 180 W

    Applied voltage = 220 V

    Current in each case = ?

    $$P = V \times I$$

    Formula used:
    Power = Voltage × Current

    case (i) $I_1 = \dfrac{P_1}{V} = \dfrac{420}{220} = $ **1.9 A**

    case (ii) $I_2 = \dfrac{P_2}{V} = \dfrac{180}{220} = $ **0.81 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. ✴ ✴ ✴**

    Given:

    Formula used:
    $E = P \times t$

    Power of the first electric bulb = 100 W = 100 / 1000 = 0.1 kW

    Time = 5 hours

    Power of the second electric bulb = 60 watt = $\dfrac{60}{1000}$ = 0.06 kW

    Total number of bulbs = 4

    Time = 5 hours.

    Energy consumed in the month of January = ?

    Energy = Power × time

    Energy consumed by the first bulb in a day = 0.1 × 5 = 0.5 kWh

    Energy consumed by the four 60 W bulb in a day = 0.06 × 4 × 5 = 1.2 kWh

    Total energy consumed by both the bulbs = 0.5 + 1.2 = 1.7 kWh

    Total energy consumed in the month of January = **31 × 1.7 = 52. 7 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:

   $V = 3V$

   $I = 300 \text{ mA} = 300 \times 10^{-3} \text{ A}$ time = 4 hours

   Power = ?   resistance = ?   energy = ?

   (a)   Power = $V \times I$

   $= 3 \times 600 \times 10^{-3} = \textbf{1.8 W}$

   (b)   Resistance = $\dfrac{V}{I}$ $[\because V = IR]$

   $= \dfrac{3}{600 \times 10^{-3}} = \textbf{5 } \boldsymbol{\Omega}$

   (c)   Energy consumed in 4 hours

   $= P \times t$

   $= 1.8 \times 4$

   $= \textbf{7.2 Wh}$

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 ratio of the effective resistance in series connection to that of the parallel connection?

   a) Wire is cut into 5 equal parts. Since all dimensions are same, resistance of each wire is equal and has a value $= \dfrac{R}{5}$

   b) Formula for finding the effective resistance when connected in parallel is

   $$\dfrac{1}{R'_P} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \dfrac{1}{R_4} + \dfrac{1}{R_5}$$

   Here, $R_1 = R_2 = R_3 = R_4 = R_5 = \dfrac{R}{5}$

   $$\dfrac{1}{R'_P} = \dfrac{5}{R} + \dfrac{5}{R} + \dfrac{5}{R} + \dfrac{5}{R} + \dfrac{5}{R}$$

   $$\dfrac{1}{R'_P} = \dfrac{25}{R}$$

   $$R'_P = \dfrac{R}{25} \ \Omega$$

c) If the resistors are connected in series, then the effective resistance will be

$$R_s^{''} = \frac{R}{5} + \frac{R}{5} + \frac{R}{5} + \frac{R}{5} + \frac{R}{5}$$

$$R_s^{''} = \frac{5R}{5} = R$$

> **Formula used:**
> Resistors in series
> $R_s = R_1 + R_2 \ldots\ldots + R_n$

Ratio of effective resistance in series connection to that of the parallel connection is

$$\frac{R_s}{R_p} = \frac{R}{R/25} = 25$$

X. Higher Order Thinking Skills (HOTS)

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:

$R_p = 2\ \Omega$

$R_S = 9\ \Omega$

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

$$R_s = R_1 + R_2$$

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

$$R_p = \frac{R_1 R_2}{R_1 + R_2}$$

> **Formula used:**
> $$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \ldots\ldots + \frac{1}{R_n}$$
> $$R_s = R_1 + R_2$$

$R_p = 2\ \Omega;\qquad R_1 + R_2 = 9\ \Omega$

$$2 = \frac{R_1 R_2}{9}\ ;\qquad R_1 R_2 = 18\ \Omega$$

On solving, $\qquad$ **$R_1 = 3\ \Omega$** $\qquad\qquad\qquad\qquad R_1 = 6\ \Omega$

$\qquad\qquad\qquad\qquad\qquad\qquad$ (or)

$\qquad\qquad$ **$R_2 = 6\ \Omega$** $\qquad\qquad\qquad\qquad\qquad R_2 = 3\ \Omega$

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

Given:

$I = 5\ A$

$t = 1\ s$

Number of electrons?

$q = It = 5 \times 1 = 5\ C$

> **Formula used:**
> **$q = It$**
> $$n = \frac{q}{e}$$

$q = ne$ where n is the number of electrons; e is the charge of an electron which is equal to $1.6 \times 10^{-19}\ C$

$$n = \frac{q}{e} = \frac{5}{1.6 \times 10^{-19}} = 3.125 \times 10^{19} = \mathbf{31.25 \times 10^{18}}\ \textbf{electrons.}$$

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 Ω; original length = l, new length $l' = 3l$:
Area will decrease by 3 times.

$$R' = \rho \frac{l'}{A'} = \rho \frac{3l}{A/3} = \frac{9\rho l}{A} = 9R = 9\,(10) = \mathbf{90\ \Omega}$$

> **Formula used:**
> New resistance value
> $$R' = \rho \frac{l'}{A'}$$

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The rate of flow of electric charge in a conductor is
   a) electric current   b) electric potential
   c) potential difference   d) none of the above

2. The SI unit of potential is
   a) volt   b) ampere   c) joule   d) none

3. The number of the free electrons constitute one coulomb of charge is
   a) 6.25×10^{10} electrons   b) 100 electrons
   c) 1000 electrons   d) 6.25×10^{18} electrons

4. The potential difference across any of the electrical home appliance is
   a) 200 V   b) 220 V   c) 100 V   d) 140 V

5. When 2 V is the potential difference across a conductor, the current is 0.4 A, then the resistance is ✹✹
   a) 5 Ω   b) 50 Ω   c) 0.8 Ω   d) 2 Ω

6. The SI unit of conductivity is
   a) ohm m   b) ohm^{-1}m^{-1}
   c) ohm m^{-1} d) ohm

7. A resistor of 18 Ω is connected to 9 V battery, the current in the circuit is
   a) 5 A   b) 50 A   c) 0.5 A   d) 1 A

8. The SI unit of power is
   a) watt   b) joule   c) ampere   d) volt

9. A fuse has ✹
   a) high resistance and high melting point
   b) high resistance and low melting point
   c) low resistance and low melting point
   d) None of the above

10. Fuse wire is made up of
    a) Alloy of lead and tin   b) Alloy of lead and copper
    c) Alloy of tin and copper   d) None of the above

11. **Switch is always connected to**
    a) neutral wire   b) live wire
    c) earth wire   d) None of the above

12. **1 HP =** ✸
    a) 746 W   b) 0.746 W   c) 74.6 W   d) 7.46 W

13. **In series combination of resistances**
    a) Potential difference is same across each resistance
    b) total resistance is reduced
    c) current is same in each resistance
    d) all above are true.

14. **In parallel combination of resistances**
    a) potential difference is same across each resistance
    b) total resistance is increased
    c) current is same in each resistance
    d) all above are true.

15. **When a current I flows through a resistance R for time t, the electrical energy spent is**
    a) IRt b) I^2Rt c) IR^2t d) I^2R/t

Ans:

1.	a) electric current	9.	b) high resistance and low melting point
2.	a) volt	10.	a) Alloy of lead and tin
3.	d) 6.25×10^{18} electrons	11.	b) live wire
4.	b) 220 V	12.	a) 746 W
5.	a) 5 Ω	13.	c) current is same in each resistance
6.	b) ohm^{-1}m^{-1}	14.	a) potential difference is same across each resistance
7.	c) 0.5 A	15.	b) I^2Rt
8.	a) watt		

II. Fill in the blanks

1. The motion of _____ through a conductor constitute an electric current.
2. Galvanometer is used to _____ of current. ✸
3. Voltmeter is used to measure the _____.
4. The potential difference required for the flow of charges is provided by the _____.
5. The electrons flow from the _____ terminal to the _____ terminal of the battery.
6. A difference in _____ is needed for the flow of electric charges in a conductor
7. _____ established the relation between the potential difference and current.
8. The SI unit of resistance is _____
9. _____ is conductor with highest resistivity
10. _____ is the unit for conductance.

11. The reciprocal of electrical resistivity is called as _____ . ✶

12. The wiring in a house consists of _____ circuits.

13. The passage of electric current through a wire results in the production of _____.

14. The SI unit of electric power is _____

15. Electrical energy consumed is taken as the product of _____ and _____. ✶

16. 1 kWh is equal to _____ J

17. _____ is used to record the consumption of electrical energy.

18. The function of the fuse wire is used to protect the appliances from _____ due to excess current.

19. In India domestic circuits are supplied with an alternating current of frequency _____.

20. When a live wire comes in contact with a neutral wire, it causes _____.

Ans:

1.	electric charges (or) electrons	11.	electrical conductivity
2.	indicate the direction	12.	parallel
3.	potential difference	13.	heat
4.	battery	14.	watt
5.	negative, positive	15.	electric power and time
6.	electric potential	16.	3.6×10^6 J
7.	George Simon Ohm	17.	Meter
8.	ohm	18.	overloading
9.	Nichrome	19.	50 Hz
10.	ohm^{-1}	20.	short circuit

III. State whether the following statements are true or false. It take Correct the statement.

1. **Ammeter is used to select the magnitude of current through a circuit.**   **False**
   A Rheostat is used to select the magnitude of current through a circuit.

2. **The circuit must be closed in order that the current passes through it.**   **True**

3. **In a conductor the charges will flow from a point which is at lower electric potential to a point at higher electric potential.** ✶   **False**
   In a conductor the charges will flow from a point which is at higher electric potential to a point at lower electric potential.

4. **Resistance is constant for a given material at a given temperature,**   **True**

5. **Resistance is same for different materials.**   **False**
   Resistance is different for different material.

6. **Conductivity is more for insulators than for conductors.**   **False**

   Conductivity is more for conductors than for insulators.

7. **The equivalent resistance in a series combination is greater than the highest of the individual resistances.** ✹   **True**

8. **In series connection if one appliance is disconnected others will work independently.**   **False**

   In parallel connection if one appliance is disconnected others will work independently..

9. **The heating effect of current is used in electric iron.**   **True**

10. **Nichrome is an alloy of Nickel and copper.**   **False**

    Nichrome is an alloy of Nickel and Chromium.

IV Match the items in columns -I to the items in column-II.

1. **Column I**

   1) Ammeter

   2) Voltmeter

   3) Galvanometer

   4) Rheostat

   Column II

   - a) used to select the magnitude of the current   **(b)**
   - b) used to measure the current   **(c)**
   - c) used to measure the voltage   **(d)**
   - d) used to indicate the flow of current   **(a)**

2. **Column I**

   1) 1 horse power

   2) 1 kWh

   3) Domestic frequency

   4) Charge of an electron

   Column II ✹

   - a) 50 Hz   **(c)**
   - b) 1.6×10^{-19} C   **(d)**
   - c) 746 W   **(a)**
   - d) 3.6×10^6 J   **(b)**

3. **Column I**

   1) LED

   2) LCD

   3) MCB

   4) hp

   Column II

   - a) Horse Power   **(c)**
   - b) Miniature circuit breaker   **(d)**
   - c) Light Emitting Diode   **(b)**
   - d) Liquid Crystal Display   **(a)**

4. **Column I**

   1) Electric heater

   2) Fuse wire

   3) Filament in bulb

   4) LED bulbs

   Column II

   - a) Tungsten   **(c)**
   - b) Gallium Arsenide   **(d)**
   - c) Nichrome   **(a)**
   - d) Lead and tin   **(b)**

V. Reason and Assertion

Mark the correct choice as

a) If both the assertion and the reason are trueand the reason is the correct explanation of the assertion.

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

c) If the assertion is true, but the reason is false.
d) If the assertion is false, but the reason is true.

1. **Assertion:** Resistance is different for different materials.
   Reason: Resistance of a material is its property to oppose the flow of charges and hence passage of current through it.

Ans : a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

2. **Assertion:** Nichrome is used in making heating elements.
   Reason: Nichrome is a conductor with highest conductivity

Ans : c) If the assertion is true, but the reason is false.

3. **Assertion:** When we touch motor casing of a fan, it is warm, due to the heating effect of current
   Reason: For continuous drawing of current the source has continuously spend its energy. A part of the energy is converted into useful work and the rest will be converted into heat energy.

Ans : a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

4. **Assertion:** One way of overcoming the energy crisis is to use more LED bulbs.
   Reason: LED is a semiconductor device that emits visible light when an electric current passes through it.

Ans : b) If both the assertion and the reason aretrue, but the reason is not the correct explanation of the assertion.

5. **Assertion:** Conductivity is more for insulators than for conductors.
   Reason: Electrical resistivity of a conductor is a measure of the resisting power of a specified material to the passage of current. ✹

Ans : d) If the assertion is false, but the reason is true.

VI. Very short answer questions.

1. What is an electric circuit?

An electric circuit is a closed conducting loop (or) path which has a network of electrical components through which electrons are able to flow.

2. What is conductance? Give its unit.

Conductance is defined as the **reciprocal** of its **resistance**. It's unit is **ohm^{-1}**.

3. What is electrical conductivity? Give its unit?

The **reciprocal** of **electrical resistivity** is electrical conductivity. It's unit is **ohm^{-1} m^{-1}**

4. Define Power. ✹

- Power is defined as the rate of doing work.

- Power = Voltage × current

- $\boxed{P = V\,I}$

5. Convert 1 kWh into joules.

1 kWh = 1000 watt hour

= $1000 \times 60 \times 60$ watt second = **3.6×10^6 J.**

6. What is the function of fuse wire or MCB? ✳ ✳
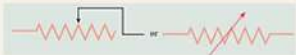
The function of fuse wire or an MCB is to protect the house hold electrical appliances from **overloading** due to **excess current.**

7. How does the overloading happen?

Overloading happens when a large number of appliances are connected in series to the same source of electric power.

VII. Short answer questions

1. Name any 5 components of a circuit. Write the uses and draw the symbols used.

COMPONENT	USE OF THE COMPONENT	SYMBOL USED
Resistor	Used to fix the magnitude of the current through a circuit	
Variable resistor or Rheostat	Used to select the magnitude of the current through a circuit.	
Ammeter	Used to measure the current.	(A)
Voltmeter	Used to measure the potential difference.	(V)
Galvanometer	Used to indicate the direction of current.	(G)

2. Define the unit of resistance.

- The SI unit of resistance is **ohm**.
- Resistance of a conductor is said to be one ohm if a current of **one ampere** flows through it when a potential difference of **one volt** is maintained across its ends.

3. Differentiate series and parallel circuits.

S.No.	CRITERIA	SERIES	PARALLEL
1	Equivalent resistance	**More** than the **highest** resistance.	**Less** than the **lowest** resistance.
2	Amount of current	Current is **less** as effective resistance is **more**.	Current is **more** as effective resistance is **less**.
3	Switching ON/OFF	If one appliance is disconnected, others also **do not work.**	If one appliance is disconnected, others **will work independently.**

4. a) What is Nichrome? ✳
   b) What are the characteristics of a good heating element?.

a) Nichrome is an alloy of Nickel and chromium.

b) A good heating element should have

- high resistivity
- high melting point
- not easily oxidized

5. How does the earth wire serve as a protective conductor which saves us from electric shocks?

- In domestic circuits, a third wire called the earth wire having a green insulation is usually connected to the body of the metallic electric appliance.
- The other end of the earth wire is connected to a metal tube or a metal electrode, which is buried into the Earth.
- This wire provides a low resistance path to the electric current.
- The earth wire sends the current from the body of the appliance to the Earth, whenever a live wire accidentally touches the body of the metallic electric appliance.
- Thus, the earth wire serves as a protective conductor, which saves us from electric shocks. .

6. Write a note on LED Bulbs.

- An LED bulb is a semiconductor device that emits visible light when an electric current passes through it.
- The colour of the emitted light will depend on the type of materials used.
- With the help of the chemical compounds like Gallium Arsenide and
- Gallium Phosphide, the manufacturer can produce LED bulbs that radiates red, green, yellow and orange colours.
- Displays in digital watches and calculators, traffic signals, street lights, decorative lights, etc., are some examples for the use of LEDs.

7. Write a note on seven segment display. ✦

- A 'Seven Segment Display' is the display device used to give an output in the form of numbers or text.
- It is used in digital meters, digital clocks, micro wave ovens, etc.
- It consists of 7 segments of LEDs in the form of the digit 8.
- These seven LEDs are named as a, b, c, d, e, f and g. An extra 8th LED is used to display a dot.
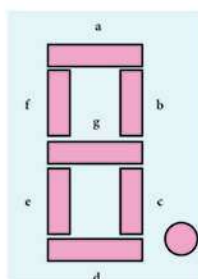
Seven segment display

VIII. Long answer questions

1. With the help of circuit diagrams
   (a) Explain a series connection of parallel resistors and
   (b) Explain a parallel connection of series resistors. ✦✦
   a) Series connection of Parallel resistors:

- If you consider the connection of a set of parallel resistors that are connected in series, you get a series – parallel circuit.
- Let R_1 and R_2 be connected in parallel to give an effective resistance of R_{P1}.

- Similarly, let R_3 and R_4 be connected in parallel to give an effective resistance of R_{P2}.
- Then, both of these parallel segments are connected in series

$$\frac{1}{R_{P1}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_{P2}} = \frac{1}{R_3} + \frac{1}{R_4}$$
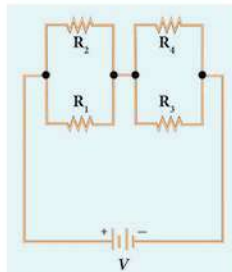
Series-parallel combination of resistors

- The net effective resistance is given by $R_{total} = R_{P1} + R_{P2}$

b) Parallel Connection of Series Resistors:

- If you consider a connection of a set of series resistors connected in a parallel circuit, you get a parallel-series circuit.
- Let R_1 and R_2 be connected in series to give an effective resistance of R_{S1}.
- Similarly, let R_3 and R_4 be connected in series to give an effective resistance of R_{S2}.
- Then, both of these serial segments are connected in parallel.
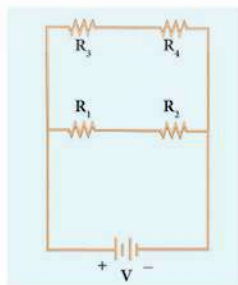
Parallel-series combinations of resistor

- Using above equation, we get

$$R_{S1} = R_1 + R_2, \qquad R_{S2} = R_3 + R_4$$

- Finally, the net effective resistance is given by

$$\frac{1}{R_{total}} = \frac{1}{R_{S1}} + \frac{1}{R_{S2}}$$

2. Explain any three applications of heating effect.

Application of heating effect

1. Electric Heating Device:

- The heating effect of electric current is used in many home appliances such as electric iron, electric toaster, electric oven, electric heater, geyser, etc.

- In these appliances Nichrome, which is an alloy of **Nickel and Chromium** is used as the heating element.
- Because: (i) it has **high resistivity**, (ii) it has a **high melting point**, (iii) it is **not** easily **oxidized**.

2. Fuse Wire:

- The fuse wire is **connected in series,** in an electric circuit.
- When a large current passes through the circuit, the fuse wire melts due to **Joule's heating effect** and hence the circuit gets disconnected.
- Therefore, the circuit and the electric appliances are saved from any **damage**.
- The fuse wire is made up of a material **lead and tin** whose **melting point** is relatively **low**.

3. Filament in bulbs:

- In electric bulbs, a **small wire** is used, known as filament.
- The filament is made up of a material whose **melting point** is very **high**.
- When current passes through this wire, **heat is produced** in the filament.
- When the filament is heated, it **glows** and gives out light.
- **Tungsten** is the commonly used material to make the filament in bulbs.

IX. Numerical Problems:

1. Calculate the potential difference required across a conductor of resistance 5 Ω to pass a current of 1.5 A through it?

   Given

   $R = 5\ \Omega$

   $I = 1.5\ A$

   $V = ?$

   Formula used:
   $V = IR$

   From ohm's law $\quad V = I \times R$

   ∴ Potential difference $V = 1.5 \times 5 = \textbf{7.5 V}$

2. Calculate the resistance of 1 km long copper wire of radius 1 mm. (specific resistance of copper is $1.72 \times 10^{-8}\ \Omega$ m) ✳ ✳

   Given $\quad l = 1\ km = 1000\ m$

   $r = 1\ mm = 10^{-3}\ m$

   $A = \pi r^2 = 3.14 \times (10^{-3})^2 = 3.14 \times 10^{-6}\ m^2$

   $\rho = 1.72 \times 10^{-8}\ \Omega$ m

   Formula used:
   $R = \rho \dfrac{l}{A}$

   $$R = \rho \frac{l}{A} = \frac{\left(1.72 \times 10^{-8}\right) \times 1000}{3.14 \times 10^{-6}} = \textbf{5.5}\ \boldsymbol{\Omega}$$

3. An electric heater of resistance 10 Ω uses 2 A current for 200 seconds. How much electrical energy converts into heat energy? ✳

   $H = I^2 R t = 2^2 \times 10 \times 200 = 8000\ J = \textbf{8 k J}$

   Formula used:
   $H = I^2 Rt$

4. If three resistors 2 Ω, 3 Ω and 4 Ω are connected in parallel to a 6 V battery, what is the equivalent resistance of the circuit.

   Given $\quad R_1 = 2\Omega;\qquad R_2 = 3\ \Omega;\qquad R_3 = 4\ \Omega$

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

$$= \frac{1}{2} + \frac{1}{3} + \frac{1}{4}$$

$$= \frac{6+4+3}{12} = \frac{13}{12}$$

$$R_P = \frac{12}{13}\ \Omega$$

Formula used:

Resistors in parallel

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}\ .... + \frac{1}{R_n}$$

X. Higher Order Thinking Skills (HOTS)

1. A wire of uniform thickness with a resistance of 27 Ω is cut into three equal pieces and they are joined in parallel. Find the resistance of the parallel combination.

Resistance of each piece of wire = $\frac{27}{3}$ = 9 Ω

In parallel, $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Formula used:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2}\ .... + \frac{1}{R_n}$$

$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{9} + \frac{1}{9} = \frac{3}{9}$$

$$R_p = 3\ \Omega$$

2. Calculate the value of the resistance which must be connected to a 15 Ω resistance to provide an effective resistance of 6 Ω.

Since effective resistance is decreased. The two resistors are connected in parallel.

$$\frac{1}{15} + \frac{1}{R} = \frac{1}{6}$$

$$\frac{1}{R} = \frac{1}{6} - \frac{1}{15} = \frac{5-2}{30} = \frac{3}{30} = \frac{1}{10}$$

$$R = 10\ \Omega$$

3. Two fuse wires are rated 5 A and 20 A. Which of the two fuse wires are thicker and why?

- A fuse wire when carries current **more than its rating melts** and disconnects the electric circuit.
- Clearly a 20 A fuse has less resistance than a 5 A fuse and is thicker.

4. In a three pin plug why is the earth pin made longer and thicker than other two pins?

- The longer pin ensures the **initial earthing** of electrical appliances
- The **thicker pin differentiate** the earth pin with other two pins.

5. **The current through a 12 V tungsten filament lamp connected to a 12 V accumulator of negligible resistance is 3.0 A. Calculate**
   (i) **the resistance of the filament**
   (ii) **the power of the lamp**
   (iii) **the electrical energy in kWh consumed in 5 hours.**

Given

$$V = 12\ V; \quad I = 3\ A;\ t = 5h$$

(i) Resistance $R = \dfrac{V}{I} = \dfrac{12}{3} = 4\ \Omega$

(ii) Power $P = V \times I = 12 \times 3 = 36\ W$

(iii) Electrical energy $E = V\ I\ t$

$$= 12 \times 3 \times 5 = 180\ Wh$$

$$= \mathbf{0.18\ kWh}$$

Formula used:

$$R = \dfrac{V}{I}$$
$$P = V \times I$$
$$E = V\ I\ t$$

<div align="center">

Unit Test - 4

Electricity

</div>

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. 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.

2. Kilowatt hour is the unit of
   a) resistivity   b) conductivity
   c) electrical energy   d) electrical power

3. The number of the free electrons constitute one coulomb of charge is
   a) 6.25×10^{10} electrons   b) 100 electrons
   c) 1000 electrons   d) 6.25×10^{18} electrons

4. When 2 V is the potential difference across a conductor, the current is 0.4 A, then the resistance is
   a) $5 \, \Omega$ b) $50 \, \Omega$ c) $0.8 \, \Omega$ d) $2 \, \Omega$

5. A resistor of $18 \, \Omega$ is connected to 9 V battery, the current in the circuit is
   a) 5 A   b) 50 A   c) 0.5 A   d) 1 A

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Define the unit of current.
2. Name any two devices, which are working on the heating effect of the electric current.
3. How does the electric current pass in circuit?
4. Convert 1 kWh into joules.
5. State Ohm's law.

III. Answer the fllowing questions in brief: 2 × 4 = 8

1. Name any 5 components of a circuit. Write the uses and draw the symbols used.
2. i) An alloy of nickel and chromium is used as the heating element. Why?
   ii) How does a fues wire protect electrical appliances?

IV. Answer the fllowing questions in detail: 1 × 7 = 7

1. i) State Joule's law of heating.
   ii) 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.

<div align="center">

❧ ✿ ✿ ✿ ✿ ❧

</div>

- ❧ Time period is the time taken by a particle to complete one vibration in the medium.
- ❧ Frequency is the number of vibrations (waves) produced per second.
- ❧ Particle velocity is the velocity with which the particles of the medium vibrate in order to transfer energy in the form of a wave.
- ❧ Wave velocity is the velocity with which the wave travels through the medium.
- ❧ Pitch is the characteristic of a sound wave, which distinguishes a sharp sound from a dull sound. It depends upon the frequency of the wave.
- ❧ Loudness (L) is the sensation produced in the ear which enables us to distinguish between a loud and a soft sound.
- ❧ Quality is the sensation received by the ear by which, you are able to differentiate two sounds (even if they are of the same pitch and loudness).
- ❧ Doppler effect is defined as the frequency of the sound as received by a listener is different from the original frequency produced by the source whenever there is a relative motion between the source and the listener.
- ❧ Intensity of sound is defined as the power carried by sound waves per unit area in a direction perpendicular to that area. (or) Sound energy passing per second through an unit area held perpendicular.
- ❧ Any vibrating object behaves as a sound source.
- ❧ The human audible range of frequency is 20 Hz to 20000 Hz.
- ❧ The sound waves that have a frequency more than 20000 Hz are called ultrasonic and frequency less than 20 Hz is called infrasonic.
- ❧ A longitudinal wave can travel in all three media.
- ❧ The speed of sound increase with the increase in temperature.
- ❧ Sound waves reflect from any surface similar to light waves and follow the laws of reflection as well.
- ❧ The distinct reflected sound from any right surface is called an echo.
- ❧ The sensation of sound persists in our ears about 0.1 s and speed of sound in air is 340 m/s.
- ❧ The ships use the methods of SONAR to detect a rock, an iceberg or a submarine in their way.
- ❧ Water is rarer compared to air for sound.
- ❧ Air is denser compared to water for sound.
- ❧ The minimum distance required to hear an echo is 17.2 m.
- ❧ Echo is used to determine the velocity of sound waves in any medium.
- ❧ The apparent frequncy is the frequency of the sound as heard by the listener.

MIND MAP

ACOUSTICS

- Sound waves
  - >20000Hz — Ultrasonics
  - 20-20kHz — Audible
  - <20 Hz — Infrasonics
  - Longitudinal wave
  - Characterstics
    - Frequency
    - Time period
    - Amplitude
    - Velocity
    - Wavelength
  - Properties
    - Quality
    - Loudness
    - Pitch
- Doppler effect
  - Different conditions
  - Application
- Reflection of sound wave
  - At Rarer medium
  - At Denser Medium
  - Laws of Reflection
  - Measuring velocity
  - Echo
  - Applications
    - SONAR
    - Ear Trumpet
    - Megaphone
    - Sound Board

Don

Formulae

Effect of density	$V \propto \sqrt{\dfrac{1}{d}}$
Effect of temperature	$v_t = (v_0 + 0.61\ T)\ ms^{-1}$
Speed of sound	$\dfrac{\text{Distance travelled}}{\text{Time taken}} = \dfrac{2d}{t}$
Velocity $= \dfrac{2d}{t}$	$\dfrac{\text{Distance travelled by sound}}{\text{Time taken}}$
Source and listener move towards each other	$n' = \left(\dfrac{v + v_L}{v - v_s}\right) n$
Source and listener move away from each other	$n' = \left(\dfrac{v - v_L}{v + v_s}\right) n$
Listener move towards the stationary source	$n' = \left(\dfrac{v + v_L}{v}\right)$
Listener move away from the stationary source	$n' = \left(\dfrac{v - v_L}{v}\right) n$
Source move towards stationary listener	$n' = \left(\dfrac{v}{v - v_s}\right) n$
Source move away from stationary listener'	$n' = \left(\dfrac{v}{v + v_s}\right) n$
Frequency	$n = \dfrac{1}{\text{Time period (T)}}$
Wavelength	$\lambda = \dfrac{\text{Velocity of sound(V)}}{\text{frequency(n)}}$
Amplitude	$A = \dfrac{D(\text{Distance})}{F(\text{Frequency})}$
Time Period	$T = \dfrac{1}{\text{frequency(n)}}$
Velocity (of a wave) or wave velocity	Velocity $(v) = \dfrac{\text{Distance (D)}}{\text{Timetaken (T)}}$ $V = \lambda \times \dfrac{1}{T}$ Also, $V = \lambda n \qquad [\Rightarrow v = \dfrac{1}{T}]$
Intensity of sound	$I = \dfrac{\text{Work(W)}}{\text{Area(A)} \times \text{time(t)}}$ Also, $I = \dfrac{\text{Power(P)}}{\text{Area(A)}}$

Don

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. When a sound wave travels through air, the air particles
   a) vibrate along the direction of the wave motion
   b) vibrate but not in any fixed direction
   c) vibrate perpendicular to the direction of the wave motion
   d) do not vibrate

2. Velocity of sound in a gaseous medium is 330 m s^{-1}. If the pressure is increased by 4 times without causing a change in the temperature, the velocity of sound in the gas is ✶✶
   a) 330 m s^{-1} b) 660 m s^{-1} c) 156 m s^{-1} d) 990 m s^{-1}

3. The frequency, which is audible to the human ear is
   a) 50 kHz   b) 20 kHz   c) 15000 kHz   d) 10000 kHz

4. The velocity of sound in air at a particular temperature is 330 m s^{-1}. What will be its value when temperature is doubled and the pressure is halved? ✶
   a) 330 m s^{-1} b) 165 m s^{-1}
   c) $330 \times \sqrt{2}$ m s^{-1} d) $320 / \sqrt{2}$ m s^{-1}

5. If a sound wave travels with a frequency of 1.25×10^4 Hz at 344 m s^{-1}, the wavelength will be
   a) 27.52 m   b) 275.2 m   c) 0.02752 m   d) 2.752 m

6. The sound waves are reflected from an obstacle into the same medium from which they were incident. Which of the following changes?
   a) Speed   b) Frequency   c) Wavelength   d) None of these

7. Velocity of sound in the atmosphere of a planet is 500 m s^{-1}. The minimum distance between the sources of sound and the obstacle to hear the echo, should be
   a) 17 m   b) 20 m   c) 25 m   d) 50 m

Ans:

1.	a)	Vibrate along the direction of the wave motion.			
2.	a)	330 ms^{-1}	5.	c)	0.02752 m
3.	b)	20 kHz	6.	d)	None of these
4.	c)	$330 \times \sqrt{2}$ ms^{-1}	7.	c)	25 m

II. Fill up the blanks

1. Rapid back and forth motion of a particle about its mean position is called _____ ✶✶

2. If the energy in a longitudinal wave travels from south to north, the particles of the medium would be vibrating in _____

3. A whistle giving out a sound of frequency 450 Hz, approaches a stationary observer at a speed of 33 m s^{-1}. The frequency heard by the observer is (speed of sound = 330 m s^{-1}) _____.

4. A source of sound is travelling with a velocity 40 km/h towards an observer and emits a sound of frequency 2000 Hz. If the velocity of sound is 1220 km/h, then the apparent frequency heard by the observer is _____. ✹ ✹

Ans:

1.	Vibration	2.	South to north
3.	500 Hz	4.	2067 Hz

III. True or false:- (If false give the reason)

1. **Sound can travel through solids, gases, liquids and even vacuum.** **False**
   Sound can travel through solids, gases, liquids but not in vacuum.

2. **Waves created by Earth Quake are Infrasonic.** **True**

3. **The velocity of sound is independent of temperature.** **False**
   The velocity of sound is dependent of temperature.

4. **The velocity of sound is high in gases than liquids.** **False**
   The velocity of sound is high in liquids than gases.

IV. Match the following

1. 1) Infrasonic - a) Compressions (c)
   2) Echo - b) 22 kHz (d)
   3) Ultrasonic - c) 10 Hz (b)
   4) High pressure region - d) Ultrasonography (a)

V. Assertion and Reason Questions :

Mark the correct choice as

   a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.
   b) If 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:** The change in air pressure affects the speed of sound.
   Reason: The speed of sound in a gas is proportional to the square of the pressure

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

2) **Assertion:** Sound travels faster in solids than in gases.
   Reason: Solid posses a greater density than that of gases.

   Ans: (b) If both the assertion and the reason are true but the reason is not the correct explanation of the assertion.

VI. Answer very briefly

1. What is a longitudinal wave?

If the particles of the medium vibrate along the direction of propagation of the wave, then the waves are said to be longitudinal.

2. What is the audible range of frequency? ✷ ✷

- The audible range of frequency is **20 Hz to 20000 Hz.**
- These are generated by vibrating bodies such as vocal cords, stretched strings, etc.

3. What is the minimum distance needed for an echo? ✷ ✷

The minimum distance required to hear an echo is $1/20^{th}$ part of of the magnitude of the velocity of sound in air.

i.e $\quad \dfrac{1}{20} \times 344 = \textbf{17.2m}$

4. What will be the frequency sound having 0.20 m as its wavelength, when it travels with a speed of 331 m s^{-1}?

$\boxed{V = n\lambda}$

$331 = n(0.20)$

$n = \dfrac{331}{0.20} = \textbf{1655 Hz}$

Formula used:

$V = n\lambda$

5. Name three animals, which can hear ultrasonic vibrations.

Dolphins, dogs, cats can hear the ultrasonic vibrations.

VII. Answer briefly

1. Why does sound travel faster on a rainy day than on a dry day?

- During rainy days, the moisture content is more in the atmosphere and speed of sound increases with **increase in humidity.**
- Hence the **sound travels faster** on rainy days.

2. Why does an empty vessel produce more sound than a filled one?

- When an empty vessel is struck, the air molecules are set in vibration and when filled vessel is struck the liquid molecules are set in vibration.
- Since the amplitude of vibration of air molecules is greater than liquid molecules, empty vessel produces louder sound than the filled vessel.

3. Air temperature in the Rajasthan desert can reach 46°C. What is the velocity of sound in air at that temperature? (V_0 = 331 m s^{-1})

Given

$t = 46° C$

$V_0 = 331 \text{ ms}^{-1}$

$V_T = ?$

$\textbf{V}_T = \textbf{[V}_0 + \textbf{0.61 T] ms}^{-1}$

$\qquad = 331 + [0.61 \times 46] \text{ ms}^{-1}$

$\qquad = 331 + [28.06]$

$\qquad = 359.06 \text{ ms}^{-1}$

Formula used:

$V_T = [V_0 + 0.61 \text{ T}] \text{ ms}^{-1}$

The velocity of sound in air at 46° C is **359.06 ms^{-1}**

Don

4. **Explain why, the ceilings of concert halls are curved?** ✴✴
   - When sound is reflected from a concave surface, the reflected waves are converged at a point.
   - So the ceilings of the concrete wall is curved.

5. **Mention two cases in which there is no Doppler effect in sound?**

   In the cases given below there will be **no Doppler effect.**
   - When source (s) and listener (L) both are at **rest.**
   - When source S and L are moving in mutually **perpendicular directions.**
   - When source and listener move in such a way that distance between them remains **constant.**
   - If the source is situated at the center of the **circle** along which the listener is moving.

VIII. Numerical Problems:

1. **A sound wave has a frequency of 200 Hz and a speed of 400 m s⁻¹ in a medium. Find the wavelength of the sound wave.** ✴✴✴

   Given:

   $n = 200$ Hz

   $V = 400$ ms^{-1}

   $\lambda = ?$

   $V = n\lambda$

   $\lambda = \dfrac{V}{n} = \dfrac{400}{200}$

   $\lambda = 2$ m

   Formula used:
   $$V = n\lambda$$

2. **The thunder of cloud is heard 9.8 seconds later than the flash of lightning. If the speed of sound in air is 330 m s⁻¹, what will be the height of the cloud?**

   The speed of light is so phenomenal that it will render its contribution to the time taken negligible so

   Distance = Velocity × time

   = 330 × 9.8

   Distance = 3234 m

   Formula used:
   $$D = V \times t$$

3. **A person who is sitting at a distance of 400 m from a source of sound is listening to a sound of 600 Hz. Find the time period between successive compressions from the source?** ✴

   Given:

   $n = 600$ Hz

   $T = ?$

   $T = \dfrac{1}{n}$

   $= \dfrac{1}{600} = 0.0016$ s

   (or)

   $T = 1.6$ ms

   Formula used:
   $$T = \dfrac{1}{n}$$

Acoustics

4. **An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the transmission and reception of the wave is 1.6 seconds. What is the depth of the sea, if the velocity of sound in the seawater is 1400 m s⁻¹?**

Given:

$$t = 1.6 \text{ s}$$
$$v = 1400 \text{ ms}^{-1}, \mathbf{V} = \mathbf{d} \times \mathbf{t}$$
$$d = \frac{vt}{2}$$
$$d = \frac{1400 \times 1.6}{2}$$
$$\mathbf{d = 1120 \text{ m}}$$

Formula used:

$$d = \frac{vt}{2}$$

5. **A man is standing between two vertical walls 680 m apart. He claps his hands and hears two distinct echoes after 0.9 seconds and 1.1 second respectively. What is the speed of sound in the air?**

$$d = 680 \text{ m}$$
$$t = 1.1 + 0.9 = 2$$
$$\mathbf{d = \frac{ct}{2}}$$
$$c = \frac{2d}{t}$$
$$c = \frac{2 \times 680}{2}$$
$$\mathbf{c = 340 \text{ ms}^{-1}} \text{ which is the speed of sound in air}$$

Formula used:

$$c = \frac{2d}{t}$$

6. **Two observers are stationed in two boats 4.5 km apart. A sound signal sent by one, under water, reaches the other after 3 seconds. What is the speed of sound in the water?**

Given:

$$d = 4.5 \text{ km} = 4500 \text{ m}$$
$$t = 3 \text{ s}$$
$$v = ?$$
$$\mathbf{v = \frac{d}{t} = \frac{4500}{3}}$$
$$\mathbf{v = 1500 \text{ m/s}}$$

Formula used:

$$v = \frac{d}{t}$$

7. **A strong sound signal is sent from a ship towards the bottom of the sea. It is received back after 1s. What is the depth of sea given that the speed of sound in water 1450 m s⁻¹?**

Given:

$$t = 1s$$
$$v = 1450 \text{ ms}^{-1}$$
$$d = \frac{v \times t}{2} = \frac{1450 \times 1}{2}$$
$$\mathbf{d = 725 \text{ m}}$$

Formula used:

$$d = \frac{v \times t}{2}$$

IX. Answer in Detail :

1. What are the factors that affect the speed of sound in gases? ✹ ✹

Factors affecting velocity of sound:

- The following factors affect the velocity of sound waves.

Effect of density:

- The velocity of sound in a gas is inversely proportional to the square root of the density of the gas.
- Hence, the velocity decreases as the density of the gas increases.

$$V \propto \frac{1}{\sqrt{d}}$$

Effect of temperature:

- The velocity of sound in a gas is directly proportional to the square root of its temperature.
- The velocity of sound in a gas increases with the increase in temperature. $v \propto \sqrt{T}$.
- Velocity at temperature T is given by the following equation:

$$v_T = (v_o + 0.61\ T)\ m\ s^{-1}$$

- Here, v_o is the velocity of sound in the gas at 0° C.
- For air, $v_o = 331\ m\ s^{-1}$.
- Hence, the velocity of sound changes by 0.61 m s⁻¹ when the temperature changes by one degree celsius.

Effect of relative humidity:

- When humidity increases, the speed of sound increases.
- That is why you can hear sound from long distances clearly during rainy seasons.

2. What is meant by reflection of sound? Explain: a) reflection at the boundary of a rarer medium b) reflection at the boundary of a denser medium c)Reflection at curved surfaces.

Reflection of sound waves:

- When sound waves travel in a given medium, and strikes the surface of another medium, they can **bounce back** into the first medium.
- This phenomenon is known as reflection.

a) Reflection at the boundary of a rarer medium

- Consider a wave travelling in a solid medium striking on the **interface** between the **solid** and the **air**.
- The **compression** exerts a force F on the surface of the **rarer medium**.
- As a rarer medium has **smaller resistance** for any deformation, the surface of separation is **pushed backwards.**
- As the particles of the rarer medium are free to move, a rarefaction is produced at the interface.
- Thus, a **compression** is reflected as a rarefaction and a rarefaction travels from **right** to **left**.

b) Reflection at the boundary of a denser medium

- A longitudinal wave travels in a medium in the form of compressions and rarefactions.
- Suppose a compression travelling in air from **left** to **right** reaches a rigid wall, the compression exerts a **force F** on the rigid wall.
- In turn, the wall exerts an **equal** and **opposite** reaction R = – F on the air molecules
- This results in a compression near the rigid wall.
- Thus, a compression travelling towards the rigid wall is **reflected** back as a compression. i.e: the direction of compression is **reversed.**

c) Reflection of sound in plane and curved surfaces

- When the sound waves are reflected from the **curved surfaces**, the **intensity** of the reflected waves is **changed**.
- When reflected from a **convex** surface, the reflected waves are **diverged** out and the intensity is **decreased**.
- When sound is reflected from a **concave** surface, the reflected waves are **converged** and **focused** at a point.
- So the intensity of reflected waves is concentrated at a point.
- **Parabolic** surfaces are used when it is required to focus the sound at a particular **point**.
- Hence, many halls are designed with parabolic reflecting surfaces.
- In **elliptical** surfaces, sound from one focus will always be **reflected** to the **other focus**, no matter where it strikes the wall.

3. a) What do you understand by the term 'ultrasonic vibration'? b) State three uses of ultrasonic vibrations. c) Name three animals which can hear ultrasonic vibrations.

a) Ultrasonic Vibrations:

- The Vibrations produced by sound waves with a frequency **greater than 20 KHz** are called ultrasonic vibrations.
- Human ear cannot detect these waves.

b) Uses of Ultrasonic vibration:

- Ultrasonic devices are used to **detect objects** and measure distances.
- Ultrasound imaging or sonography is often used in **medicine.**
- In the non destructive testing of products and structures. Ultra sound is used to detect **invisible flaws.**

c) Certain creatures like mosquitoes, dogs, bats and dolphins can detect these waves.

4. What is an echo? a) State two conditions necessary for hearing an echo. b) What are the medical applications of echo? c) How can you calculate the speed of sound using echo? ✴

Echo:

- An echo is the sound reproduced due to the **reflection** of the **original sound** from various rigid surfaces such as walls, ceilings, surfaces of mountains, etc.

a) Conditions necessary for hearing echo:

- The persistence of hearing for human ears is 0.1 second.
- This means that you can hear two sound waves clearly, if the time interval between the two sounds is atleast 0.1 s.

- Thus, the minimum time gap between the original sound and an echo must be 0.1 s.
- The above criterion can be satisfied only when the distance between the source of sound and the reflecting surface would satisfy the following equation:

$$\text{Velocity} = \frac{\text{distance travelled by sound}}{\text{time taken}}$$

$$v = \frac{2d}{t}$$

$$d = \frac{vt}{2}$$

since, t = 0.1 second, then $d = \frac{331}{0.20} = \frac{v}{20}$

- Thus the minimum distance required to hear an echo is $1/20^{th}$ part of the magnitude of the velocity of sound in air.
- If you consider the velocity of sound as 344 ms^{-1}, the minimum distance required to hear an echo is 17.2 m.

b) Applications of echo:

- The principle of echo is used in obstetric **ultrasonography**, which is used to create real-time visual images of the developing embryo or fetus in the mother's uterus.
- This is a safe testing tool, as it does not use any harmful radiations.

c) Calculation of speed of sound:

- The sound pulse emitted by the source travels a total distance of 2d while travelling from the source to the wall and then back to the receiver.
- The time taken for this has been observed to be 't'. Hence, the speed of sound wave is given by

$$\text{Velocity} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{2d}{t}$$

X. Higher Order Thinking Skills (HOTS)

1. **Suppose that a sound wave and a light wave have the same frequency, then which one has a longer wavelength?**
   a) Sound   b) Light
   c) both a and b   d) data not sufficient

   Ans: a) Sound

   Sound waves travel a million times slower than light waves. They have wavelengths between 1cm and 10 m and will easily diffract around the corners.

2. **When sound is reflected from a distant object, an echo is produced. Let the distance between the reflecting surface and the source of sound remain the same. Do you hear an echo sound on a hotter day? Justify your answer.**

   An echo is heard when the time for the reflected sound is heard after 0.1 s.

   Time taken = Total distance/Velocity

   On a hotter day, the velocity of sound is more. If the time taken by echo is less than 0.1 s, it will not be heard.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Sound can propagate**
   a) Only through solids
   b) Only through liquids
   c) Only through gases
   d) Through any medium[solid,liquid,gases]

2. **Sound waves are**
   a) longitudinal
   b) tansverse
   c) both longitudinal and transverse
   d) Neither longitudinal nor transverse

3. **The speed of the sound waves**
   a) depends on the properties of the medium
   b) doesnot depends on the properties of the medium
   c) may or may not depends on the properties of the medium
   d) None of the above

4. **Audible range of frequency is**
   a) 20 Hz to 20000 Hz
   b) below 20 Hz
   c) greater than 20000 Hz
   d) None of the above

5. **Sound waves with frequencies below 20 Hz are called as**
   a) Audible waves
   b) Infrasonic waves
   c) Ultrasonic waves
   d) None of the above

6. **Sound waves with frequencies greater than 20 kHz are called as** ✳
   a) Audible waves
   b) Infrasonic waves
   c) Ultrasonic waves
   d) None of the above

7. **Waves Produced by bats are**
   a) Audible waves
   b) Infrasonic waves
   c) Ultrasonic waves
   d) None of the above

8. **Which of these statements are true about sound waves?**
   a) Medium is not required for the propagation
   b) Sound waves are longitudinal
   c) Wavelength ranges from 4×10^{-7} m to 7×10^{-7} m.
   d) The speed of sound waves is 3×10^{8} m/s

9. **The relation between V, λ and n is given by**
   a) $V = n\lambda$
   b) $n = V\lambda$
   c) $\lambda = nV$
   d) $V = \dfrac{n}{\lambda}$

10. **Velocity of sound is**
    a) maximum in solids
    b) maximum in liquids
    c) maximum in gases
    d) equal in all the three media

11. **If V_S, V_L and V_G represent velocity of sound in solids, liquids and gases respectively, then which of the following is correct?** ✳ ✳
    a) $V_S > V_L > V_G$
    b) $V_S < V_L < V_G$
    c) $V_S = V_L = V_G$
    d) $V_S < V_L > V_G$

12. **Velocity of sound in gas is**
    a) inversely proportional to the density of the gas
    b) inversely proportional to the square root of the density of gas
    c) directly proportional to the density of the gases
    d) directly proportional to the square root of the density of the gas

13. **Velocity of sound in a gas**
    a) increase with increase in temperature
    b) increase with decrease in temperature
    c) does not depends on temperature
    d) None of the above

14. **The persistance of hearing for human ear is**
    a) 1 s   b) 10 s
    c) 0.1 s   d) 0.01 s

15. **The minimum distance required to hear an echo is** ✹
    a) 17.2 m   b) 16.2 m
    c) 172 m   c) 1.72 m

16. **To improve the quality of sound heard by the audience in a auditorium which of the following is used?**
    a) ear trumpet   b) megaphone
    c) sound board   d) wall hangings

17. **According to Doppler effect, when the source and the listener are moving towards each other, the apparent frequency is**
    a) more than the actual frequency
    b) less than the actual frequency
    c) equal to the actual frequency
    d) more or less than the actual frequency

18. **A radar sends a signal to an aeroplane at a distance 45 km away with a speed of 3×10^8 ms^{-1}. The time taken to receive the signal back from the aeroplane is**
    a) 3×10^{-4} s   b) 3×10^4 s
    c) 6×10^{-4} s   d) 6×10^4 s

Ans:

1.	d)	Through any medium (Solid, Liquid, Gas)	2.	a)	Longitudinal
3.	a)	depends on the properties of the medium	4.	a)	20 Hz to 20000 Hz
5.	b)	Infrasonic waves	6.	c)	Ultrasonic waves
7.	c)	Ultrasonic waves	8.	b)	Sound waves are longitudinal
9.	a)	$V = n\lambda$	10.	a)	maximum in solids
11.	a)	$V_S > V_L > V_G$			
12.	b)	inversely proportional to the square root of the density of gas			
13.	a)	increase with the increase in temperature	14.	c)	0.1 s
15.	a)	17.2 m	16.	c)	Sound board
17.	a)	more than the actual frequency	18.	a)	3×10^{-4} s

Don

II. Fill up the blanks

1. The human audible range of frequency is _____.

2. The sound waves that have the frequency more than 20,000 Hz are called as _____

3. A distinct reflected sound from any rigid surface is called as _____

4. The speed of a longitudinal wave depends on _____ and _____ of the medium

5. The minimum distance of a reflector should be _____.

6. A_____ is necessary for propagation of sound

7. Velocity of sound waves is maximum in _____ ★

8. Sound waves obey laws of _____

9. When a compression hits the boundary of a _____medium, it is reflected as rarefaction.

10. The principle of _____is used in obstetric ultra sonography

11. The apparent change in frequency was first observed and explained by_____

12. For 1°C rise in temperature the speed of sound in air increases nearly by _____ ms^{-1} ★

13. To detect the obstacles in their path, bats produce _____

14. The distance travelled by the wave in one second is called the _____

15. _____ is the frequency of the sound as heard by the listener

Ans:			
1.	20 Hz to 20 kHz	2.	Ultrasonics
3.	Echo	4.	Elasticity, density
5.	17.2 m	6.	medium
7.	Solids	8.	reflection
9.	Rarer	10.	Echo
11.	Christian Doppler	12.	0.61
13.	Ultrasonic waves	14.	Wave velocity
15.	The apparent frequency.		

III. True or false:- (If false give the reason)

1. Longitudinal displacements results in a series of high and low pressure called compressions and rarefactions   **True**

2. Infrasonic waves are sound waves with a frequency ranging between 20 Hz and 20000 Hz.   **False**

   Audible waves are sound waves with a frequency ranging between 20Hz and 20000Hz.

3. Sound waves do not require medium for propagation. ★   **False**

   Sound waves require medium for propagation.

4. Sound waves are transverse in nature. **False**

Sound waves are longitudinal in nature

5. Dogs can detect ultrasonic waves. **True**

6. The velocity with which the wave travels through the medium is called particle velocity. **False**

The velocity with which the wave travels through the medium is called wave velocity.

7. Velocity of a sound wave is minimum in solids. **False**

Velocity of a sound wave is maximum in solids.

8. The velocity of sound in a gas is directly proportional to the square root of its pressure. **False**

The velocity of sound in a gas is directly proportional to the square root of its temperature.

9. When humidity increases, the speed of sound also increases. **True**

10. Speed of sound is same in all the media. **False**

Speed of sound is different in different media.

11. In a denser medium, the compression travelling towards rigid wall is reflected back as rarefaction. **False**

In a denser medium, the compression travelling towards rigid wall is reflected back as compression.

12. The principle of echo is used in obstetric ultrasonography. **True**

13. When source and listener are moving in mutually perpendicular directions there will be Doppler effect. ✶ **False**

When source and listener are moving in mutually perpendicular directions there will not be Doppler effect.

14. The apparent frequency is the frequency of the sound as heard by the listener. **True**

15. The velocity of sound decreases as the density of the gas decreases. **False**

The velocity of sound decreases as the density of the gas increases.

IV. Match the following

1. 1) Compression   - a) light waves   (d)
    2) Rarefaction   - b) sound waves   (c)
    3) Longitudinal   - c) low pressure   (b)
    4) Transverse   - d) high pressure   (a)

2. 1) Speed of sound   - a) 0.1 s ✶   (d)
    2) Speed of light   - b) 17 m   (c)
    3) Persistence of human hearing   - c) 3×10^8 m/s (a)
    4) Minimum distance to hear an echo - d) 330 ms^{-1} (b)

3. 1) Sound Board   - a) Echo location   (d)
    2) Whispering gallery   - b) Doppler effect   (c)
    3) RADAR   - c) Multiple reflection   (b)
    4) Bats   - d) Reflection of sound   (a)

V. Assertion and Reason Questions :

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

b) If 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:** One does not experience any echo sound in a small room.

   Reason: The minimum distance required to hear an echo is 17.2m.

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

2. **Assertion:** Sound waves are longitudinal. ✸

   Reason: The speed of sound is directly proportional to the square root of elastic modulus.

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

3. **Assertion:** When temperature increases, the velocity of sound waves also increase.

   Reason: Velocity of sound in gas is inversely proportional to the square root of its temperature.

   Ans: (c) Assertion is true but the reason is false

4. **Assertion:** Air is rarer compared to water for sound.

   Reason: The medium in which the velocity of sound decreases compared to the other medium is called denser medium.

   Ans: (d) Assertion is false but the reason is true

VI. Answer briefly

1. **What are sound waves?**

   The vibrating bodies **produce energy in the form of waves,** which are nothing but sound waves.

2. **Suppose you and your friend are on the moon .Will you be able to hear any sound produced by your friend?**

   As the **moon does not have air,** I will not be able to hear any sound produced by my friend.

3. **What are longitudinal waves?**

   • The waves in which the particles of the medium vibrate **along the direction of propagation** of the waves are called longitudinal waves.

   • Eg: Sound waves

4. **What are compressions and rarefactions?** ✸ ✸

   • Longitudinal waves are characterized by compression and rarefactions.

   • A series of **high pressure** regions are called as **compression** and **low pressure** regions are called as **rarefactions.**

5. Distinguish between Infrasonic waves and Ultrasonic waves. ✶✶

S.No	Infrasonic waves	Ultrasonic waves
1	These are sound waves with frequency **below 20 Hz** that cannot be heard by human ear.	These are sound waves with frequency **greater than 20 kHz**. Human ear cannot detect these waves.
2.	e.g.: Waves produced during **earthquake, ocean waves, sound produced by whales, etc**	Waves produced by **bats.**

6. **Define particle velocity.**

The velocity with which the particles of the medium **vibrate in order to transfer energy** in the form of wave is called particle velocity.

7. **Define wave velocity.**

The velocity with which the **wave travels through the medium** is called wave velocity.

VII. Numerical Problems:

1. **A man shouts and hears an echo of sound from a distant hill after 1.4 s. What is the distance of hill from man? (velocity of sound in air = 340 ms⁻¹)**

   Given:

   $$t = 1.4 \text{ s}$$
   $$v = 340 \text{ m/s}$$
   $$\text{Distance} = \text{Velocity} \times \text{time}$$
   $$(2d) = 340 \times 1.4 = 476 \text{ m}$$
   $$\text{Distance of hill (d)} = \frac{476}{2}$$
   $$d = 238 \text{ m}$$

   Formula used:
   $$d = v \times t$$

2. **A stone is dropped in a well of depth 19.6 m. After how many seconds the sound of splash will be heard to the observer (Velocity of sound in air = 340 ms⁻¹] ✶**

   Given:

   $$s = 19.6 \text{ m} \quad V = 340 \text{ ms}^{-1}$$

   Using second equation of motion

   $$s = ut + \tfrac{1}{2} at^2$$
   $$u = 0, \quad a = g$$
   $$s = \frac{1}{2} gt^2$$

   Formula used:
   Second equation of motion
   $$s = ut + \tfrac{1}{2} at^2$$

   Time taken to reach the depth

   $$t_1 = \sqrt{\frac{2s}{g}} = \sqrt{\frac{2 \times 19.6}{9.8}} = 2 \text{ s}$$

   Time taken to the sound to reach observer at the top.

   $$t_2 = \frac{\text{distance}}{\text{Velocity}} = \frac{19.6}{340} = 0.05 \text{ s}$$

   Total time = 2 + 0.05 = **2.05 s**

3. **The human ear can detect sound in the frequency range of 20 Hz to 20000 Hz. Find the corresponding wavelength (If the Speed of sound is 330 ms^{-1}]**

Given:

$$V = 330 \text{ ms}^{-1}, n_{min} = 20 \text{ Hz}, n_{max} = 20 \text{ kHz}$$

V = nλ

$$\lambda = \frac{V}{n}$$

Formula used:

$$V = n\lambda$$

i) for $n_1 = 20$ Hz;

$$\lambda = \frac{330}{20} = \textbf{16.5 m}$$

ii) For $n_2 = 20000$ Hz

$$\lambda = \frac{330}{20000}$$

λ = 16.5 mm

4. **In a SONAR, Ultra sonic waves are sent into the sea water and the reflected waves from a sunken ship are received after 2 s. If the velocity of waves in sea water is 1450 ms^{-1}. Find the depth of the sunken ship.**

Given:

$$v = 1450 \text{ ms}^{-1}, t = 2 \text{ s}$$

$$\textbf{d} = \frac{\textbf{vt}}{\textbf{2}} = \frac{1450 \times 2}{2}$$

$$d = 1450 \text{ m}$$

Formula used:

$$d = \frac{\textbf{vt}}{\textbf{2}}$$

5. **A boy standing in front of a wall at a distance of 85 m produces 2 claps/second. He notices that the sound of his clapping coincides with the echo. The echo is heard only once when clapping is stopped. Calculate the speed of sound. ★**

Given:

$$d = 85 \text{ m}$$

To hear an echo, sound has to travel a total distance 2d = 2× 85 = 170 m

Since 2 claps are made per second each clap is produced after $\frac{1}{2}$ s.

$$t = 0.5 \text{ s}$$

Now the speed = $\frac{170}{0.5}$ = **340 ms^{-1}**

VIII. Answer in Detail :

1. **Explain three different categories of sound waves based on their frequencies.**
   Categories of sound waves based on their frequencies:
   (i) Audible waves:
   • These are sound waves with a frequency ranging between **20 Hz and 20,000 Hz.**
   • These are generated by vibrating bodies such as vocal cords, stretched strings, etc.

(ii) Infrasonic waves:

- These are sound waves with a frequency **below 20 Hz** that cannot be heard by the human ear.
- e.g., waves produced during earthquake, ocean waves, sound produced by whales, etc.

(iii) Ultrasonic waves:

- These are sound waves with a frequency **greater than 20 kHz.**
- Human ear cannot detect these waves, but certain creatures like mosquito, dogs, bats, dolphins can detect these waves.
- e.g., waves produced by bats.

2. Write the difference between the sound waves and light waves. ✹ ✹

S.No	Sound	Light
1.	Medium is **required** for the propagation.	Medium is **not required** for the propagation.
2.	Sound waves are **longitudinal.**	Light waves are **transverse.**
3.	Wavelength ranges from **1.65 cm to 1.65 m**	Wavelength ranges from **4 ×10⁻⁷ m to 7× 10⁻⁷ m.**
4.	Sound waves travel in air with a speed of about **340 ms⁻¹** at NTP.	Light waves travel in air with a speed of **3 ×10⁸ ms⁻¹.**

3. Derive the relation between, velocity, wavelength and frequency of a wave.

Wave velocity:

- The velocity with which the wave travels through the medium is called wave velocity.
- In other words, the distance travelled by a sound wave in unit time is called the velocity of a sound wave.

$$\text{Velocity} = \frac{\text{Distance}}{\text{Time taken}}$$

$$\boxed{v = \frac{d}{t}}$$

- If the distance travelled by one wave is taken as one wavelength (λ) and, the time taken for this propagation is one time period (T), then, the expression for velocity can be written as

$$\text{Velocity} = \frac{\text{Wave length}}{\text{Time taken}}$$

$$\boxed{v = \frac{\lambda}{t}}$$

- Therefore, velocity can be defined as the distance travelled per second by a sound wave.
- Hence, Frequency (n) =1/T, equation can be written as

Velocity = Frequency × Wavelength

$$\boxed{V = n\lambda}$$

4. **State and Explain law of reflection.** ✳
   Laws of reflection:
   - Like light waves, sound waves also obey some fundamental laws of reflection.
   - The following two laws of reflection are applicable to sound waves as well.
   - The incident wave, the normal to the reflecting surface and the reflected wave at the point of incidence lie in the **same plane.**
   - The angle of incidence ∠**i** is **equal** to the angle of reflection ∠**r**
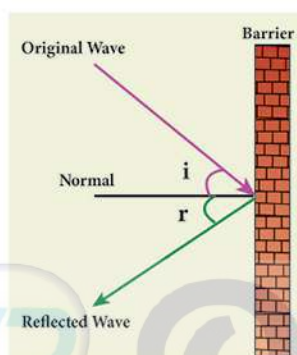
Laws of reflection

   - In the above Figure the sound waves that travel towards the reflecting surface are called the incident waves.
   - The sound waves **bouncing back** from the reflecting surface are called reflected waves
   - For all practical purposes, the point of incidence and the point of reflection is the same point on the reflecting surface.
   - A perpendicular line drawn at the **point of incidence** is called the normal.
   - The angle which the incident sound wave makes with the normal is called the angle of incidence, 'i'.
   - The angle which the reflected wave makes with the normal is called the angle of reflection, 'r'.

5. **How will you measure the velocity of sound by echo method?**
   Measuring velocity of sound by echo method:
   Apparatus required:
      A source of sound pulses, a measuring tape, a sound receiver, and a stop watch.

   Procedure:
   - Measure the distance 'd' between the source of sound pulse and the reflecting surface using the measuring tape.
   - The receiver is also placed adjacent to the source. A sound pulse is emitted by the source.
   - The stopwatch is used to note the time interval between the instant at which the sound pulse is sent and the instant at which the echo is received by the receiver. Note the time interval as 't'.
   - Repeat the experiment for three or four times. The average time taken for the given number of pulses is calculated.

Calculation of speed of sound:

- The sound pulse emitted by the source travels a total distance of 2d while travelling from the source to the wall and then back to the receiver.

- The time taken for this has been observed to be 't'. Hence, the speed of sound wave is given by

$$\text{Speed of sound} = \frac{\text{distance travelled}}{\text{time taken}} = \frac{2d}{t}$$

6. **a) Define Doppler effect b) Write the expression for apparent frequency when i) Both source and listener move towards each other ii) Both source and the listener move away from each other iii) Both source and the listener move one behind the other**

a) Definition:

Whenever there is a relative motion between a source and a listener, the frequency of the sound heard by the listener is different from the original frequency of sound emitted by the source. This is known as "Doppler effect"

b)

Case No	Position of source and listener	Note	Expression for apparent frequency
1	➤ Both source and listener move ➤ They move towards each other	Distance between source and listener decreases Apparent frequency is more than actual frequency	$n' = \left(\dfrac{v + v_L}{v - v_s}\right) n$
2	➤ Both source and listener move ➤ They move away from each other	Distance between source and listener increases Apparent frequency is less than actual frequency v_S and v_L become opposite to that in case-1	$n' = \left(\dfrac{v - v_L}{v + v_s}\right) n$
3	➤ Both source and listener move ➤ They move one behind the other ➤ Source follows the listener	Apparent frequency depends on the velocities of the source and the listener v_S becomes opposite to that in case-2	$n' = \left(\dfrac{v - v_L}{v - v_s}\right) n$

IX. Higher Order Thinking Skills (HOTS)

1. **Why is the speed of longitudinal wave greatest in steel?**

- The speed of longitudinal wave is greatest in steel due to its elasticity.

- Hence speed is also greatest in steel.

2. **A man is standing at a distance of 12 m from a cliff. Will he be able to hear a clear echo of his sound?**

No he will not be able to hear a clear echo, because the minimum distance between the source and the reflector is approximately 17 m.

◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶

<div align="center">

Unit Test - 5

Acoustics

</div>

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. When a sound wave travels through air, the air particles
   a) vibrate along the direction of the wave motion
   b) vibrate but not in any fixed direction
   c) vibrate perpendicular to the direction of the wave motion
   d) do not vibrate

2. The velocity of sound in air at a particular temperature is 330 m s^{-1}. What will be its value when temperature is doubled and the pressure is halved?

   a) 330 m s^{-1} b) 165 m s^{-1} c) 330 × $\sqrt{2}$ m s^{-1} d) 320 / $\sqrt{2}$ m s^{-1}

3. Velocity of sound in the atmosphere of a planet is 500 m s^{-1}. The minimum distance between the sources of sound and the obstacle to hear the echo, should be
   a) 17 m   b) 20 m   c) 25 m   d) 50 m

4. The minimum distance required to hear an echo is
   a) 17.2 m   b) 16.2 m   c) 172 m   c) 1.72 m

5. **Assertion:** The change in air pressure affects the speed of sound.
   Reason: The speed of sound in a gas is proportional to the square of the pressure
   a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.
   b) If 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.

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. What is a longitudinal wave?
2. Air temperature in the Rajasthan desert can reach 46°C. What is the velocity of sound in air at that temperature? (V_0 = 331 m s^{-1})
3. Define acoustics.
4. Write any two uses of echo.
5. What is Doppler Effect?

III. Answer the fllowing questions in brief: 2 × 4 = 8

1. Write the difference between the sound waves and light waves.
2. i) What is Doppler Effect?
   ii) What is the minium distance needed for an echo?

IV. Answer the fllowing questions in detail: 1 × 7 = 7

1. i) A man shouts and hears an echo of sound from a distant hill after 1.4s. What is the distance off hil from man ? (velocity of sound in air = 340 ms^{-1})
   ii) State and Explain law of reflection.

Nuclear Physics

- Henry Becquerel discovered natural radioactivity.

- Radioactivity is the phenomenon of nuclear decay of certain elements with the emission of radiations like alpha, beta and gamma rays.

- Artificial radioactivity was discovered by Irene curie and F. Joliot.

- Artificial radioactivity occurs in lighter elements.

- Units of radioactivity are Curie, Rutherford, Becquerel and Rontgen.

- In Alpha decay, atomic number decreases by two and mass number decreases by four in parent nuclei.

- In Beta decay, atomic number increases by one.

- In gamma decays, both atomic and mass number do not change.

- The phenomenon of breaking the heavier nucleus into two smaller nuclei is called nuclear fission.

- A nuclear reactor is a device in which the nuclear fission reaction takes place in a self - sustained and controlled manner to produce electricity.

- Controlled chain reaction occurs in nuclear reactor.

- Uncontrolled chain reaction occurs in Atom bomb.

- The minimum mass of a fissile material necessary to sustain the chain reaction is called critical mass.

- The phenomenon of two lighter nuclei combine to form a heavier nucleus is called nuclear fusion.

- Atom bomb is based on the nuclear fission whereas stellar energy and hydrogen bomb is based on nuclear fusion.

MIND MAP

Nuclear Physics

Uses
- Agriculture
- Medicine
- Industries
- Archeological research

Radiations
- Alpha
- Beta
- Gamma
  - Positive
  - Negative
  - Neutral

Nuclear reaction
- Fusion
  - Natural → Stellar energy
  - Artificial → Hydrogen Bomb
- Fission
  - Uncontrolled reaction → Atem Bomb
  - Controlled reaction → Nuclear reactor

Radioactivity
- Artificial
- Natural

Nuclear reactor
- Fuel
- Moderator
- Coolant
- Protection wall
- Control rod

Don

❧ Uses of Radioactivity

In Agriculture - to increase the productivity and to increase the life span of agricultural products.

In Medicine - to diagnosis and in therapy
to sterilize the surgical devices.

Industries - to detect the explosives in airlines luggages and to detect smoke leakage.

❧ The first nuclear reactor was built in 1942 at Chicago, USA.

❧ Dosimeter is a device used to detect levels of ionizing radiation

❧ Fuel, moderator, control rods, coolants and protection walls are important componenets of nucleur reactor.

❧ Tarapur Atomic power station is India's first power station

❧ Apsara was the first nuclear reactor in India and Asia

Scientists and Inventions:

400 BC	Democritus	-	Atoms
1803	John Dalton	-	Elements consists of atoms
	J.J. Thomson	-	Cathode rays (electrons)
	Goldstein	-	Protons
1932	Chadwick	-	Neutrons
	Ernst Rutherford	-	Nucleus (named)
	Henri Becquerel	-	Natural radioactivity
	Marie Curie & Pierre curie	-	Radium (named)
1934	Irene Curie & F. Joliot	-	Artificial Radioactivity
	Soddy & Fajan	-	Radioactive displacement law
	Otto Hahn & F. Strassman	-	Nuclear fission
	Einstein	-	Mass energy equivalence
	Dr. Henry Jahangir Bhaba	-	Ist chairman of Indian Atomic energy commission
	Roentgen	-	X-rays
	Martin Klaproth	-	Uranium

Don

UNITS	
Curie	The quantity of radioactive substance which undergoes 3.7×10^{10} disintegrations in one second. This is actually close to the activity of 1g of Radium^{226}. 1 curie = 3.7×10^{10} disintegration per second.
Rutherford (Rd)	The quantity of a radioactive substance, which produces 10^6 disintegrations in one second.
Becquerel	The SI unit of radioactivity is Becquerel. It is defined as the quantity of one disintegration per second.
Roentgen	The quantity of radioactive substance which produces a charge of 2.58×10^{-4} coulomb in 1 kg of air under standard conditions of pressure, temperature and humidity.

IMPORTANT ELEMENTS & THEIR USES	
U^{235}, Pu^{239}, P^{241}	Fissionable material
U^{238}, Pu^{240}, Th^{232}	Fertile material
$_2He^4$	α - particle
$_{-1}e^B$	β - particle
Na^{24}	Effective functioning of heart
I^{131}	Cure goiter
Fe^{59}	Diagnose & treat anaemia
P^{32}	Cure skin disease
Co^{60}, Au^{79}	Treatment of skin cancer
Cf^{252}	Detect explosives
Am^{241}	Smoke detector
C^{14}	Archaeological research

COMPONENTS OF NUCLEAR REACTOR	
Fuel	Uranium
Moderator	Graphite, heavy water
Control rod	Boron & Cadmium
Coolant	Water, air & liquid sodium
Protection wall	Thick concrete lead wall

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Man-made radioactivity is also known as _____**
   a) Induced radioactivity
   b) Spontaneous radioactivity
   c) Artificial radioactivity
   d) a & c

2. **Unit of radioactivity is _____** ✷ ✷
   a) Roentgen
   b) Curie
   c) Becquerel
   d) All the above

3. **Artificial radioactivity was discovered by _____** ✷ ✷
   a) Becquerel
   b) Irene Curie
   c) Roentgen
   d) Neils Bohr

4. **In which of the following, no change in mass number of the daughter nuclei takes place**
   i) α decay   ii) β decay   iii) γ decay   iv) neutron decay
   a) (i) is correct
   b) (ii) and (iii) are correct
   c) (i) & (iv) are correct
   d) (ii) & (iv) are correct

5. **_____ isotope is used for the treatment of cancer.** ✷
   a) Radio Iodine
   b) Radio Cobalt
   c) Radio Carbon
   d) Radio Nickel

6. **Gamma radiations are dangerous because**
   a) it affects eyes & bones
   b) it affects tissues
   c) it produces genetic disorder
   d) it produces enormous amount of heat

7. **_____ aprons are used to protect us from gamma radiations**
   a) Lead oxide
   b) Iron
   c) Lead
   d) Aluminium

8. **Which of the following statements is/are correct?**
   i. α particles are photons
   ii. Penetrating power of γ radiation is very low
   iii. Ionization power is maximum for α rays
   iv. Penetrating power of γ radiation is very high
   a) (i) & (iii) are correct
   b) (ii) & (iii) are correct
   c) (iv) only correct
   d) (iii) & (iv) are correct

9. **Proton - Proton chain reaction is an example of _____**
   a) Nuclear fission
   b) α - decay
   c) Nuclear fusion
   d) β - decay

10. In the nuclear reaction $_6X^{12} \xrightarrow{\alpha \text{ decay}} _ZY^A$, the value of A & Z. ✳✳
    a) 8, 6
    b) 8, 4
    c) 4, 8
    d) cannot be determined with the given data

11. Kamini reactor is located at _____ ✳✳
    a) Kalpakkam
    b) Koodankulam
    c) Mumbai
    d) Rajasthan

12. Which of the following is/are correct?
    i. Chain reaction takes place in a nuclear reactor and an atomic bomb.
    ii. The chain reaction in a nuclear reactor is controlled
    iii. The chain reaction in a nuclear reactor is not controlled
    iv. No chain reaction takes place in an atom bomb
    a) (i) only correct
    b) (i) & (ii) are correct
    c) (iv) only correct
    d) (iii) & (iv) are correct

Ans:					
1.	d)	(a) and (c)	2.	d)	All the above
3.	b)	Irene Curie	4.	b)	(ii) and (iii) are correct
5.	b)	Radio cobalt	6.	b)	it produces genetic disorder
7.	c)	lead	8.	d)	(iii) and (iv) are correct
9.	c)	Nuclear fusion	10.	b)	8,4
11.	a)	Kalpakkam	12.	b)	(i) and (ii) are correct

II. Fill in the blanks

1. One roentgen is equal to _____ disintegrations per second. ✳✳

2. Positron is an _____.

3. Anemia can be cured by _____ isotope. ✳

4. Abbreviation of ICRP _____

5. _____ is used to measure exposure rate of radiation in humans.

6. _____ has the greatest penetration power.

7. $_ZY^A \rightarrow _{Z+1}Y^A + X$; then X is _____.

8. $_ZX^A \rightarrow _ZY^A$. This reaction is possible in _____ decay.

9. The average energy released in each fusion reaction is about _____ J. ✳

10. Nuclear fusion is possible only at an extremely high temperature of the order of _____ K. ✳✳

11. The radio isotope of _____ helps to increase the productivity of crops.

12. If the radiation exposure is 100 R, it may cause _____.

Ans:

1.	3.7×10^{10}	2.	positive charge electron, $_{+1}e^0$
3.	Radio- Iron (Fe^{59})	4.	International Commision on Radiological production
5.	Dosimetre	6.	Gamma rays
7.	$_{-1}e^0$	8.	gamma
9.	3.84×10^{-12} J	10.	10^7 to 10^9
11.	P-32	12.	Leukemia

III. State whether the following statements are true or false. If false, correct the false statement.

1. Plutonium -239 is a fissionable material. **True**

2. Elements having atomic number greater than 83 can undergo nuclear fusion.
False

Element having atomic number greater than 83 can undergo nuclear **fission.** ✸ ✸

3. Nuclear fusion is more dangerous than nuclear fission. **False**

Nuclear fission is more dangerous than nuclear **fusion.** (However fusion produces more heat energy than fission, fission reaction emits harmful radiation)

4. Natural uranium U-238 is the core fuel used in a nuclear reactor. **False**

Natural uranium **U-235** is the core fuel used in a nuclear reactor.

5. If a moderator is not present, then a nuclear reactor will behave as an atom bomb.
False

If a **control rod** is not present, then a nuclear reactor will behave as an atom bomb. ✸ ✸

6. During one nuclear fission on an average, 2 to 3 neutrons are produced. **True**

7. Einstein's theory of mass energy equivalence is used in nuclear fission and fusion.
True

IV. Match the following

1. 1) BARC   - a) Kalpakkam   (c)

   2) India's first atomic power station- b) Apsara   (d)

   3) IGCAR   - c) Mumbai   (a)

   4) First nuclear reactor in India - d) Tarapur   (b)

2. 1) Fuel   - a) Lead   (d)

   2) Moderator   - b) Heavywater   (b)

   3) Coolant   - c) Cadmium rods   (e)

   4) Shield   - d) Uranium   (a)

   5) Control rods   - e) Graphite   (c)

3. 1) Soddy Fajan — a) Natural radioactivity — (b)
    2) Irene Curie — b) Displacement Law — (d)
    3) Henry bequerel — c) Mass energy equivalence — (a)
    4) Albert Einstein — d) Artificial Radioactivity — (c)

4. 1) Uncontrolled fission reaction — a) Hydrogen Bomb — (d)
    2) Fertile material — b) Nuclear Reactor — (c)
    3) Controlled fission reaction — c) Breeder reactor — (b)
    4) Fusion reaction — d) Atom bomb — (a)

5. 1) Co-60 — a) Age of fosil — (c)
    2) I-131 — b) Function of heart — (d)
    3) Na-24 — c) leukemia — (b)
    4) C-14 — d) Thyroid disease — (a)

V. Arrange the following in the correct sequence:

1. **Arrange in descending order, on the basis of their penetration power**
    Alpha rays, beta rays, gamma rays, cosmic rays

    Ans: Cosmic rays, gamma rays, beta rays, alpha rays.

2. **Arrange the following in the chronological order of discovery**
    Nuclear reactor, radioactivity, artificial radioactivity, discovery of radium.

    Ans: Radioactivity (1896), discovery of radium(1898), artificial radioactivity (1934), Nuclear reactor(1942)

VI. Use the analogy to fill in the blanks

1. Spontaneous process   : Natural Radioactivity
    Induced process   : _____

2. Nuclear fusion   : Extreme temperature
    Nuclear fission   : _____

3. Increasing crops   : Radio phosphorous
    Effective functioning of heart : _____

4. Deflected by electric field : Alpha ray
    Null deflection   : _____

Ans:			
1.	Artificial radioactivity	2.	Room Temperature
3.	Radio Sodium	4.	Gamma rays

VII. Numerical problems:

1. $_{88}Ra^{226}$ experiences three α - decay. Find the number of neutrons in the daughter element.

    Solution:

    When an alpha particle emitted atomic number decreases by two, mass number decreases by four. Now three alpha particles emitted, atomic number decreases by six, mass number decreases by twelve.

    $$_{88}Ra^{226} \longrightarrow {}_{82}X^{214} + 3\ _2He^4$$
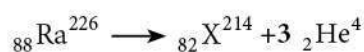
    A = 214   Z = 82

    Number of neutrons in the daughter element N = A – Z

    $$N = 214 – 82$$

    $$\boxed{N = 132}$$

2. **A cobalt specimen emits induced radiation of 75.6 millicurie per second. Convert this disintegration into becquerel (one curie = 3.7 × 10¹⁰ Bq)**

    Solution:

    1 curie = 3.7×10^{10} Bq

    1 milli curie = $3.7 \times 10^{10} \times 10^{-3}$ Bq

    75.6 milli curie = $75.6 \times 3.7 \times 10^{10-3}$ Bq

    $\quad\quad\quad\quad\quad = 279.72 \times 10^7$ Bq

    75.6 millicurie = $\mathbf{2.80 \times 10^9}$ **Bq**

VIII. Assertion and reason type questions

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

b) If 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:** A neutron impinging on U^{235}, splits it to produce Barium and Krypton.
    Reason: U - 235 is a fissile material.

    Ans: a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

2. **Assertion:** In a β - decay, the neutron number decreases by one.
    Reason: In β - decay atomic number increases by one.

    Ans: b) If both the assertion and the reason are true, but the reason is the correct explanation of the assertion.

3. **Assertion:** Extreme temperature is necessary to execute nuclear fusion.
    Reason: In a nuclear fusion, the nuclei of the reactants combine releasing high energy.

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

4. **Assertion:** Control rods are known as neutron seeking rods.
   Reason: Control rods are used to perform sustained nuclear fission reaction
   Ans: a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

IX. Answer in one or two words (VSA)

1. **Who discovered natural radioactivity?** ✷ ✷
   Ans: Henry Becquerel

2. **Which radioactive material is present in the ore of pitchblende?**
   Ans: Radium.

3. **Write any two elements which are used for inducing radioactivity**
   Ans: Boron,Aluminium

4. **Write the name of the electromagnetic radiation which is emitted during a natural radioactivity.**
   Ans: gamma radiation

5. **If A is a radioactive element which emits an alpha particle and produces $_{104}Rf^{259}$ write the atomic number and mass number of the element A.** ✷ ✷
   Ans: Atomic number:106 ; Mass number 263 [In alpha decay atomic number decrease by two and mass number decrease by four]

6. **What is the average energy released from a single fission process?**
   Ans: The average energy released from a single process is $200MeV = 3.2 \times 10^{-11}$ J

7. **Which hazardous radiation is the cause for the genetic disease?**
   Ans: Gamma Radiation

8. **What is the amount of radiation that may cause death of a person when exposed to it?** ✷ ✷
   Ans: 600 R.

9. **When and where was the first nuclear reactor built ?**
   Ans: 1942, Chicago,USA; 1956, Mumbai.

10. **Give the SI unit of radioactivity**
    Ans: Becquerel.

11. **Which material protects us from radiation?**
    Ans: Lead

X. Answer the following questions in few sentences.

1. **Write any three features of natural and artificial radioactivity.** ✷ ✷
   Natural radioactivity:
   - Emission of radiation due to self-disintegration of a nucleus
   - Exhibited by elements with atomic number more than 83
   - This cannot be controlled

Artificial radioactivity:

- Emission of radiation due to disintegration of a nucleus through induced process.
- Exhibited by elements with atomic number less than 83
- This can be controlled

2. Define critical mass.

- The **minimum mass** of fissile material necessary to sustain the **chain reaction** is called critical mass.
- It depends on the **nature, density** and the **size** of the fissile material.

3. Define one roentgen. ✳✳

It is the quantity of radioactive substances which produces a charge of 2.58×10^{-4} **coulombs** in 1 kg of air under standard conditions of pressure, temperature and humidity.

4. State Soddy and Fajan's displacement law. ✳✳

- When a parent element emits an **alpha particle** the new element is formed with a decrease in atomic number by two and **mass number** by **four**.
- When a parent nucleus emits a **beta particle** the daughter nucleus is formed with an increase in **atomic number** by **one** and has **same mass number** of the parent nucleus.
- In gamma decay, the energy level of **nucleus only changes**. No new elements are formed.

5. Give the function of control rods in a nuclear reactor.

- The control rods are used to **control the chain reaction** as they are very good **absorbers of neutrons.**
- By pushing in and pulling out, the reaction rate can be controlled.

6. In Japan, some of the new born children are having congenital diseases. Why? ✳✳

- The nuclear bomb dropped during World War II emitted gamma radiation.
- Gamma rays caused injury to genes in the reproductive cells.
- This gives rise to mutations which pass on from generation to generation.

7. Mr. Ramu is working as an X - ray technician in a hospital. But, he does not wear the lead aprons. What suggestion will you give to Mr. Ramu?

- Radiation emitted by the X-ray machine can easily passes through our body and can cause genetic diseases.
- These have been passed by genetic diseases from generation to generation.
- When the emitted radiation is so high, it leads to death. So Mr. Ramu must wear the lead aprons.

8. What is stellar energy?

Fusion reaction that takes place in the cores of the Sun and other stars results in an **enormous** amount of **energy**, called stellar energy.

9. Give any two uses of radio isotopes in the field of agriculture. ✳✳

- To increase the productivity of crops
- Remains fresh beyond their normal life time

XI. Answer the following questions in detail:

1. **Explain the process of controlled and uncontrolled chain reactions.**

   (a) Controlled chain reaction:

   - In the controlled chain reaction the number of **neutrons released is maintained** to be **one**.
   - This is achieved by **absorbing** the **extra neutrons** with a **neutron absorber** leaving only one neutron to produce further fission.
   - Thus, the reaction is sustained in a controlled manner.
   - The energy released due to a controlled chain reaction can be utilized for constructive purposes.
   - Controlled chain reaction is used in a nuclear reactor to produce energy in a sustained and controlled manner.

   (b) Uncontrolled chain reaction:

   - In the uncontrolled chain reaction the number of neutrons multiplies **indefinitely** and causes fission in a **large amount** of the fissile material.
   - This results in the release of a **huge amount** of **energy** within a fraction of a second.
   - This kind of chain reaction is used in the **atom bomb** to produce an explosion.
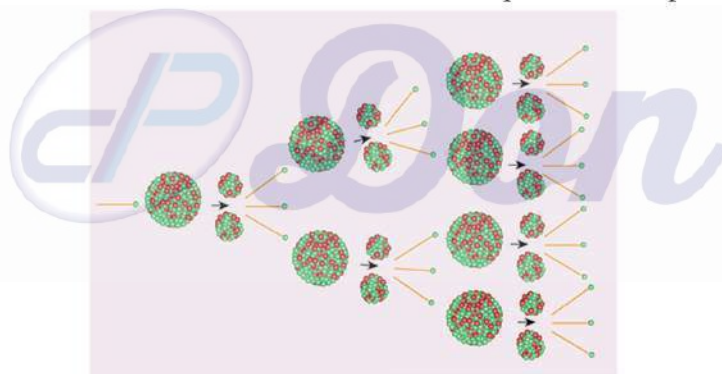
Uncontrolled chain reaction

2. **Compare the properties of alpha, beta and gamma radiations.** ✶ ✶ ✶

Properties	α - ray	β - ray	γ - ray
What are they?	Helium nucleus ($_2He^4$) consisting of two protons and two neutrons.	They are **electrons** ($_{-1}e^0$), basic elementary particle in all atoms.	They are electromagnetic waves consisting of **photons**.
Charge	**Positively** charged particles. Charge of each alpha particle = +2e	**Negatively** charged particles. Charge of each beta particle = –e	**Neutral** particles. Charge of each gamma particle = zero
Ionising power	**100 times** greater than β rays and **10,000 times** greater than γ rays	Comparatively **low**	**Very less** ionization power

Properties	α - ray	β - ray	γ - ray
Penetrating power	**Low** penetrating power (even stopped by a thick paper)	Penetrating power is **greater** than that of α rays. They can penetrate through a thin metal foil.	They have a **very high** penetrating power greater than that of β rays. They can penetrate through thick metal blocks.
Effect of electric and magnetic field	Deflected by **both the fields.** (in accordance with Fleming's left hand rule)	Deflected by both the fields; but the direction of deflection is **opposite** to that for alpha rays. (in accordance with Fleming's left hand rule)	They are **not deflected** by both the fields.
Speed	Their speed ranges from **1/10 to 1/20** times the speed of light.	Their speed can go up to **9/10** times the speed of light.	They travel with the **speed of light** .

3. What is a nuclear reactor? Explain its essential parts with their functions. ✶ ✶ ✶

- A nuclear reactor is a device in which the nuclear fission reaction takes place in a self sustained and controlled manner.

Fuel:

- A fissile material is used as the fuel.
- The commonly used fuel material is uranium.

Moderator:

- A moderator is used to slow down the high energy neutrons to provide slow neutrons.
- Graphite and heavy water are the commonly used moderators.

Control rod:

- Control rods are used to control the number of neutrons in order to have sustained chain reaction.
- Mostly boron or cadmium rods are used as control rods. They absorb the neutrons.

Coolant:

- A coolant is used to remove the heat produced in the reactor core, to produce steam.
- This steam is used to run a turbine in order to produce electricity.
- Water, air and helium are some of the coolants.

Protection wall:

- A thick concrete lead wall is built around the nuclear reactor in order to prevent the harmful radiations from escaping into the environment.
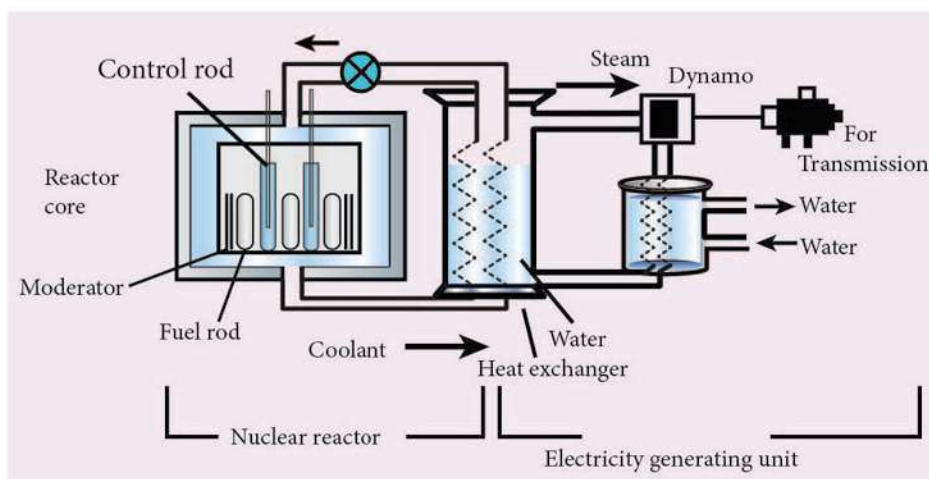
Schematic diagram of a nuclear reactor

XII. Higher Order Thinking Skills (HOTS)

1. **Mass number of a radioactive element is 232 and its atomic number is 90. When this element undergoes certain nuclear reactions, it transforms into an isotope of lead with a mass number 208 and an atomic number 82. Determine the number of alpha and beta decay that can occur.**

   In alpha decay atomic number decreases by two and mass number decreases by four. So

   $$232 - 208 = 24$$

   Mass number decreased by 24. So 6 alpha particle would come out.

   $$_{90}X^{232} \rightarrow {}_{78}Y^{208} + 6 \, _2He^4$$
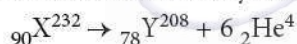
   In beta decay atomic number increases by one

   $$78 + 4 = 82$$

   So, 4 beta particle would come out.

   $$_{78}Y^{208} \rightarrow {}_{82}Z^{208} + 4 \, _{-1}e^o$$
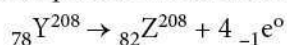
   So, six alpha particle and four beta particles would come out.

2. **'X – rays should not be taken often'. Give the reason.**
   - The intensity of radiation used in X-ray machine is small , so the chance that X-ray will cause severe problems is very low.
   - X-ray posses almost equal energy like gamma radiation.
   - So, if we take often, it may destructive living cell present in our body.
   - It may leads to cancer.

3. **Cell phone towers should be placed far away from the residential area – why?**
   - Cell phone companies are used non-ionised radiations.
   - It is not harmful like X-ray or gamma radiation.
   - In 2006 report issued by the WHO, human body absorbs energy from cell phone towers which is almost five times more than FM and Television.
   - Signals from each mobile towers travels few miles from there.
   - The closer we are the greater the danger.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Cathode rays contains**
   a) proton
   b) electron
   c) neutron
   d) positron

2. **Pitch blende is an ore of**
   a) Uranium
   b) Radium
   c) Plutonium
   d) Alumium

3. $_4Be^9 + _2He^4 \rightarrow _6C^{12} + _0n^1$ **Which is a projectile in above equation?** ✴
   a) $_4Be^9$
   b) $_6C^{12}$
   c) $_0n^1$
   d) $_2He^4$

4. **Arrange the following rays in ascending order according to the ionizing power**
   i) **Alpha**
   ii) **Beta**
   iii) **Gamma**
   a) Gamma, Beta, Alpha
   b) Alpha, Beta, Gamma
   c) Gamma, Alpha, Beta
   d) Alpha, Gamma, Beta

5. **Which of the following is the heaviest one?**
   a) Hydrogen
   b) Alpha
   c) Beta
   d) Gamma

6. **New elements do not formed in**
   a) Alpha decay
   b) Beta decay
   c) Gamma decay
   d) All of these

7. **Reason for nuclear fission to be a chain reaction is**
   a) 200 MeV energy is produced
   b) two smaller nuclei formed
   c) 2 or 3 neutron are formed for further reaction
   d) all of these

8. **In a chain reaction, rate of production of neutrons must be more than the rate of its loss is a**
   a) Critical level
   b) Supercritical level
   c) Subcritical level
   d) both (a) and (c)

9. **eV is a unit of**
   a) radioactivity
   b) critical mass
   c) energy released in nuclear fission
   d) radiation

10. **Positrons are** ✴
    a) electron charge but proton mass
    b) electron charge but neutron mass
    c) proton charge but neutron mass
    d) proton charge but electron mass

11. **Isotope of _____ element is used to age of old oil painting**
    a) Carbon
    b) Californium
    b) Americium
    d) Phosphorous

12. The safe limit of receiving the radiation is about
    a) 1 R   b) 0.1 R   c) 100 R   d) 10 R

13. In a nuclear reactor, boron is used as
    a) fuel   b) moderator
    c) control rod   d) protection wall

14. Nuclear reactor is used for ✴
    a) to generate electricity   b) to produce radio isotopes
    c) to do research in nuclear physics   d) all the above

15. $_ZX^A$, is a atom which releases two alpha rays and followed by two beta rays, now atomic number and mass number of daughter nucleus
    a) Z – 8, A–8   b) Z – 4, A–8   c) Z – 2, A–8   d) Z – 4, A–6

Ans:

1.	b)	electron	2.	b)	Radium
3.	d)	$_2He^4$	4.	a)	gamma, beta, alpha
5.	b)	alpha	6.	c)	gamma decay
7.	c)	2 (or) 3 neutron are formed for further reaction	8.	b)	supercritical level
9.	c)	Energy released in nuclear fission	10.	c)	Proton charge but electron mass
11.	a)	Carbon	12.	b)	0.1 R
13.	c)	Control rod	14.	d)	All the above
15.	c)	Z - 2, A - 8			

II. Fill in the blanks

1. Proton is discovered by _____ .

2. When alpha particle is bombarded with Beryllium _____ is the ejected particle we get. ✴

3. 1 million Becquerel is called as _____ .

4. Charge of an alpha particle is _____ times of charge of a Beta particle.

5. In a gamma decay _____ of the parent nucleus changes.

6. In natural uranium, _____ % of uranium is fissile material.

7. Nuclear chain reaction is controlled by _____ .

8. In atom bomb, the mass of fuel is kept in _____ level.

9. The energy released in a nuclear fission process is about _____ MeV.

10. The ejected particle in nuclear fission is _____ . ✴

11. _____ radio isotope used to increase the productivity of crops as well as in treatment of skin diseases. ✴

12. Helium is used as _____ in nuclear reactor.

13. First reactor in Tamilnadu was built in _____.

14. 1 kg mass converted in to _____ J in a nuclear reactions.

15. Nucleus of Helium is also known as _____ rays. ✴

Ans:			
1.	Goldstein	2.	Neutron
3.	Rutherford	4.	two
5.	Energy level	6.	0.72
7.	Absorbing the extra neutrons	8.	Sub-critical
9.	200	10.	Neutron
11.	Phosphorous	12.	Coolant
13.	Kalpakkam	14.	9×10^{16}
15.	Alpha		

III. State whether the following statements are true or false. If false, correct the false statement.

1. **The charge of an atom is concentrated in its central part**   **False**
   The **mass** of an atom is concentrated in its central part.

2. **In a radioactivity, only harmful radiations emitted.**   **False**
   In a radioactivity, harmful **radiations and elementary particles** are emitted.

3. **In a natural radioactivity, spontaneous emission of radiation takes place**   **True**

4. **1 g of radium – 226 gives 37×10^{10} disintegrations per second**   **False**
   1 g of radium – 226 gives 3.7×10^{10} disintegrations per second

5. **Gamma rays are electromagnetic radiation**   **True**

6. **Hydrogen has only one isotopes called deuterium.**   **False**
   Hydrogen has two isotopes called **deuterium and tritium**.

7. **Uranium core nuclear bomb was used in Nagasaki.** ✴   **False**
   Plutonium core nuclear bomb was used in Nagasaki.

8. **Heavier nuclei participation in nuclear fission**   **True**

9. **Radio – Iodine (I^{131}) is used to cure goiter.**   **True**

10. **Fission materials changed into fertile materials in breeder reactors.** ✴   **False**
    Fertile materials changed into **fission** materials in breeder reactors

IV. Match the following

1. 1) J.J.Thomson - a) neutrons   (b)

    2) Goldstein - b) electrons   (d)

    3) Chadwick - c) nucleus   (a)

    4) Rutherford - d) protons   (c)

2. 1) Alpha rays — a) negative particles ✳   (d)

    2) Beta rays — b) electromagnetic radiation   (a)

    3) Gamma rays — c) positive electron   (b)

    4) Positron — d) nucleus of Helium   (c)

V. Arrange the following in the correct sequence:

1. **Arrange the following nuclear power plants in the chronological order of constructed**

    Kalpakkam power station, Chicogo power station, Kudankulam power station, Tarapur power station.

    Ans: Chicogo power station, Tarapur power station, Kalpakkam power station, Kudankulam power station

2. **Arrange the following process in an atom bomb in explosion.**

    supercritical mass, radiation emitted , subcritical mass, Conventional explosive used

    Ans: Subcritical mass, Conventional explosive used, supercritical mass, radiation emitted.

VI. Use the analogy to fill in the blanks:

1. Traditional unit of radioactivity : Curie
    SI unit of radioactivity : _____

2. Nuclear fission : Splitting of heavier nucleus

3. Detect the explosives in the luggage : Californium
    Smoke 0detector : _____

4. Unit of charge : coulomb
    Unit of energy in atomic level : _____

Ans:

1.	Becquerel	2.	Adding the smaller nuclei
3.	Americium	4.	eV

VII. Assertion and reason type questions

Mark the correct choice as

a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

b) If 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:** Natural radioactivity radiates alpha, beta and gamma rays.
    Reason: They can be controlled.

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

2 **Assertion:** Gamma rays are not deflected by electric field.
Reason: Charge of gamma rays is zero.

Ans: a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion.

3. **Assertion**: In supercritical mass, nuclear fission does not take place.
Reason: In atom bombs, fuel is kept at subcritical mass.

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

4. **Assertion:** Hydrogen bomb itself contains a small atom bomb to start fusion reaction.
Reason: Extremely high temperature and pressure is needed for fusion reaction.

Ans: a) If both the assertion and the reason are true and the reason is the correct explanation of the assertion

VIII. Answer in one or two words (VSA)

1. **Name some elementary particles in atom.**
Ans: Photon, Meson, Positron and Nutrino

2. **Name the two elements of natural radioactive elements with atomic number less than 83.**
Ans: Technetium -43, promethium -61

3. **Which particle is used to bombard radioactive lighter elements for artificial radioactivity?**
Ans: Alpha particles

4. **What are the ejected particles in artificial radioactivity?**
Ans: Neutron, Positron.

5. **What is the relation between units Becquerel and Rutherford?**
Ans: 10^6 Becquerel =1 Rutherford

6. **Who discovered Uranium?**
Ans: Martin klaproth

7. **What is the maximum speed of beta particle?** ✶

Ans: 2.7×10^8 m/s   [Hint: $\frac{9}{10} \times 3 \times 10^8 = \frac{27}{10} \times 10^8 = 2.7 \times 10^8$ m/s]

8. **Write the average energy released in each fission process?**
Ans: 200meV $= 3.2 \times 10^{-11}$ J.

9. **What causes the most destruction during the explosion of Atom bomb?**
Ans: Very high pressure produced during the time of explosion.

10. **Names the nuclear bombs used in Hiroshima and Nagasaki during World War II.**
Ans: Hiroshima –Little boy

Nagasaki –FAT man .

11. Principle of hydrogen bomb and atom bomb

Ans: Principle of hydrogen bomb-nuclear fusion reaction.

Principle of Atom bomb –controlled nuclear fission reaction.

12. Which isotope is used in the treatment of skin diseases ?

Ans: Radio Phosphorous -32

13. What is the safe limit of overall exposure to radiation of human body over a year?

Ans: 20 milli sievert

14. What is the use of helium in a nuclear reactor? ✦

Ans: Coolant.

15. What happens to the atomic number of a parent nucleus when it undergoes an alpha and beta decay successively ?

Ans: Atomic number decrease by one

IX. Answer the following questions in few sentences.

1. Why does not natural radioactivity take place elements which have atomic number less than 83?

- Lighter elements have greater nuclear force.
- This force holds nucleons within the nucleus. So no radiation comes out from lighter elements.

2. Why does mean $_{13}Al^{27}$ (α ,n) $_{15}P^{30}$? ✦

Alpha particle is used as projectile towards $_{13}Al^{27}$ and we get $_{15}P^{30}$ * and a neutron (i.e)

$$_{13}Al^{27} + _2He^4 \rightarrow _{15}P^{30}* + _0n^1$$
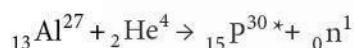
3. What is mass defect?

- In a nuclear reaction, there is a difference in total mass of reactants and total mass of products.
- This difference in mass is called mass defect.

4. A radioactive nucleus 'A' undergo a series of given below.

$$A \xrightarrow{\alpha} A_1 \xrightarrow{\beta} A_2 \xrightarrow{\alpha} A_3 \xrightarrow{\gamma} A_4$$

- The atomic number and mass number of A_2 are 71 and 176 respectively.
- Determine the mass and atomic numbers of A_4 and A.
- In α – decay atomic number decreases by two and mass number decreases by four.
- In β – decay atomic number alone increases by one.
- In gamma decay, no changes in both atomic and mass number. So,

$$A \xrightarrow{\alpha} _{70}A_1^{176} \xrightarrow{\beta} _{71}A_2^{176} \xrightarrow{\alpha} _{69}A_3^{172} \xrightarrow{\gamma} A_4$$

$$_{72}A^{180} \xrightarrow{\alpha} _{70}A_1^{176} \xrightarrow{\beta} _{71}A_2^{176} \xrightarrow{\alpha} _{69}A_3^{172} \xrightarrow{\gamma} _{69}A_4^{172}$$
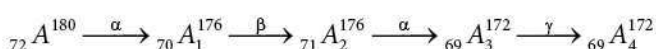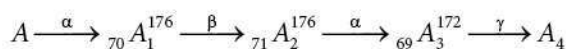
A_4 mass number 172

A_4 atomic number 69

A mass number 180

A atomic number 72

5. **What is dosimeter?** ✶
- It is a device used to **detect the levels of exposure** to an ionizing radiation.
- It is available in pocket size too.

6. **How can you say nuclear energy is good source of energy?**
- It **doesn't produce** any **harmful gases.**
- The fuel is **not a seasonal** one like windmill, hydro power station, etc.
- We can build nuclear reactors **near the sea/ocean.**

X. Answer the following questions in detail:

1. **Differentiate natural radioactivity and artificial radioactivity.** ✶

S.No	Natural Radioactivity	Artificial radioactivity
1	Emission of radiation due to **self disintegration** of a nucleus.	Emission of radiation due to **disintegration** of a nucleus through induced process.
2	**Alpha, beta and gamma** radiations are emitted.	**Mostly elementary particles such as neutron, positron**, etc. are emitted
3	It is a **spontaneous** process	It is an **induced** process.
4	Exhibited by elements with atomic number **more than 83.**	Exhibited by elements with atomic number **less than 83.**
5	This **cannot be controlled.**	This **can be controlled.**

2. **Explain Alpha decay, beta decay and gamma decay with one suitable example for each.**
Alpha decay:
- A nuclear reaction in which an unstable parent nucleus emits an alpha particle and forms a stable daughter nucleus, is called '**alpha decay**'.
- E.g.: Decay of **uranium (U^{238})** to **thorium (Th^{234})** with the emission of an alpha particle.
- $_{92}U^{238} \longrightarrow {_{90}}Th^{234} + {_2}He^4$ (α - decay)
- In α - decay, the parent nucleus emits an **α particle** and so it is clear that for the daughter nucleus, the mass number decreases by four and the atomic number decreases by two.

Beta decay:
- A nuclear reaction, in which an unstable parent nucleus emits a beta particle and forms a stable daughter nucleus, is called '**beta decay**'. E.g.: Beta decay of phosphorous.
$_{15}P^{32} \longrightarrow {_{16}}S^{32} + {_{-1}}e^0$
- In β - decay there is **no change** in the mass number of the daughter nucleus but the atomic number increases by one.
- In a nuclear reaction, the element formed as the product nucleus is identified by the atomic number of the resulting nucleus and not by its mass number.

Gamma decay:
- In a γ - decay, only the energy level of the nucleus changes.
- The atomic number and mass number of the radioactive nucleus **remain the same.**
- $_{86}Rn^{222*} \rightarrow {_{86}}Rn^{222} + γ$ – ray (0.187 MeV)

3. Explain structure and working of atom bomb with neat diagram. ✦ ✦

Structure:

- An atom bomb consists of a piece of **fissile material** whose mass is subcritical.

- This piece has a cylindrical void. It has a cylindrical fissile material which can fit into this void and its mass is also subcritical.

- When the bomb has to be exploded, this cylinder is injected into the void using a conventional explosive.

- The two pieces of fissile material join to form the supercritical mass, which leads to an explosion.
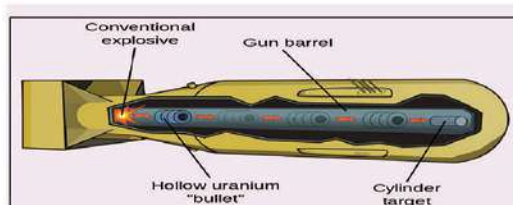
Atom bomb

- During this explosion tremendous amount of energy in the form of heat, light and radiation is released.

- A region of very high temperature and pressure is formed in a fraction of a second along with the emission of hazardous radiation like γ rays, which adversely affect the living creatures.

- This type of atom bombs were exploded in 1945 at Hiroshima and Nagasaki in Japan during the World War II.

4. Write the uses of radioactivity in the following fields.

   i) **Agriculture**   ii) **Medicine**

Agriculture :

- The radio isotope of **phosphorous (P-32)** helps to increase the **productivity of crops.**

- The radiations from the radio isotopes can be used to **kill the insects and parasites** and **prevent the wastage** of agricultural products.

- Certain perishable cereals exposed to radiations remain fresh beyond their normal life, **enhancing** the **storage time.**

- Very small doses of radiation **prevent sprouting and spoilage of** onions, potatoes and gram.

Medicine:

- Radio sodium (Na^{24}) is used for the effective **functioning of heart.**

- Radio – Iodine (I^{131}) is used to **cure goiter.**

- Radio-iron is (Fe^{59}) is used to **diagnose anaemia** and also to provide treatment for the same.

- Radio phosphorous (P^{32}) is used in the treatment of **skin diseases.**

- Radio cobalt (Co^{60}) and radio-gold (Au^{198}) are used in the treatment of **skin cancer.**

- Radiations are used to **sterilize the surgical devices** as they can kill the germs and microbes.

XI. Numerical problems:

1. **The isotope of $_{92}U^{238}$ successively undergo two alpha decays and two beta decays. What is the atomic number and mass number of resulting daughter nuclei.**

When an alpha decay, atomic number and mass number decreases by two and four respectively. In a beta decay, atomic number increases by one.

$$_{92}U^{238} \longrightarrow {}_{88}X^{230} + 2\,{}_2He^4$$

$$_{88}X^{230} \longrightarrow {}_{90}Y^{230} + 2\,{}_{-1}\beta^0$$
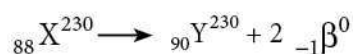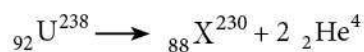
Atomic number of resulting daughter nucleus: **90**

Mass number of resulting daughter nucleus: **230**

2. **A substances undergo disintegration of two α decays and 3 β decays and formed $_{83}X^{206}$. Find the atomic number and mass number of parent nucleus.** ✦

In beta decay atomic number decreases by one

$$_{83}X^{206} + 3\,{}_{-1}e^0 = {}_{80}Y^{206}$$
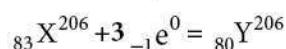
In alpha decay atomic number increases by two and mass number decreases by four

$$_{80}Y^{206} + 2\,{}_2He^4 \longrightarrow {}_{84}T^{214}$$
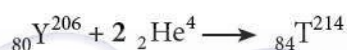
Atomic number of parent nucleus is **84**

Mass number of parent nucleus is **214**

XII. Higher Order Thinking Skills (HOTS)

1. Why do we need very high temperature to start nuclear fusion reaction?

- When two lighter nuclei comes closer, they repel due to electrostatic force (force between two charges).
- We need high energy to overcome this force, so that two lighter nuclei fuse together and form a single nucleus.

2. How can you say artificial radioactivity is controlled?

- Artificial radioactivity occurs only when a projectile particle is bombarded with some lighter elements.
- So when we stop projectile particle, radioactivity stops.

XIII. Label the parts

1. Redraw the diagram and label the parts.
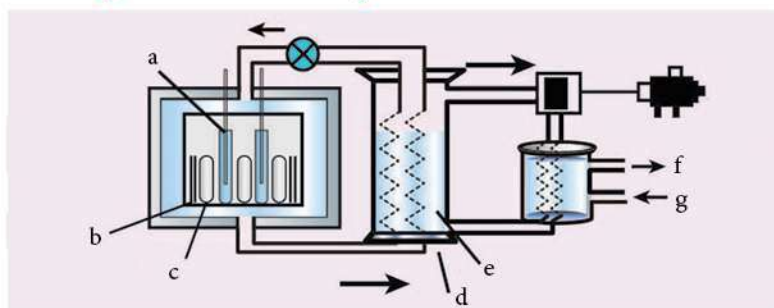
Unit Test - 6
Nuclear Physics

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer. $5 \times 1 = 5$

1. Unit of radioactivity is _____
   a) Roentgen   b) Curie   c) Becquerel   d) All the above

2. Artificial radioactivity was discovered by _____
   a) Becquerel   b) Irene Curie   c) Roentgen   d) Neils Bohr

3. Proton - Proton chain reaction is an example of _____
   a) Nuclear fission   b) α - decay   c) Nuclear fusion   d) β - decay

4. $_4Be^9 + _2He^4 \rightarrow _6C^{12} + _0n^1$ Which is a projectile in above equation?

   a) $_4Be^9$ b) $_6C^{12}$ c) $_0n^1$ d) $_2He^4$

5. $_ZX^A$, is a atom which releases two alpha rays and followed by two beta rays, now atomic number and mass number of daughter nucleus
   a) Z – 8, A–8   b) Z – 4, A–8   c) Z – 2, A–8   d) Z – 4, A–6

II. Answer the following questions in one or two lines. $5 \times 2 = 10$

1. $_{88}Ra^{226}$ experiences three α - decay. Find the number of neutrons in the daughter element.

2. A cobalt specimen emits induced radiation of 75.6 millicurie per second. Convert this disintegration into becquerel (one curie = 3.7×10^{10} Bq)

3. Define one roentgen.

4. Give the function of control rods in a nuclear reactor.

5. Give any two uses of radio isotopes in the field of agriculture.

III. Answer the following questions in brief: $2 \times 4 = 8$

1. Differentiate natural radioactivity and artificial radioactivity.

2. i) Give the function of control rods in a nuclear reactor.
   ii) What is dosimeter?

IV. Answer the following questions in detail: $1 \times 7 = 7$

1. i) What is thermonuclear reaction? Why is nuclear fusion reaction called as thermonuclear reaction?
   ii) Write the uses of radio activity in agriculture.

Atoms and Molecules

- Atoms of the same element having different atomic mass are called isotopes. $[_{17}Cl^{35}, _{17}Cl^{37}]$

- Atoms of different elements having same atomic masses are called isobars $[_{18}Ar^{40}, _{20}Ca^{40}]$

- Atoms of different elements have same number of neutrons are called isotone $[_6C^{13}, _7N^{14}]$

- Atom is the smallest particle that takes part in a chemical reaction.

- Average Atomic Mass of an element is the weighted average of masses of its naturally occurring isotopes.

- Composition of an atom consists of a nucleus composed of protons, neutrons and electrons which encircle the nucleus.

- The sum of the number of protons and neutrons of an atom is called its mass number.

- A molecule is a combination of two or more atoms held together by strong chemical forces of attraction i.e., chemical bonds.

- Homoatomic molecules are classified as monoatomic molecules (Eg. He, Ne), Di-atomic molecules (Eg. O_2, H_2), triatomic molecules (Eg. O_3) and polyatomic molecules (Eg. P_4, S_8)

- Heteroatomic molecules are classified as Diatomic molecules (Eg. HCl, CaO), triatomic molecules (Na_2O, H_2O) and polyatomic molecules (CH_4, $C_6H_{12}O_6$)

- Mole is the amount of a substance that contains as many elementary entities as there are atoms in exactly 12g of the carbon-12 isotope.

- The percentage composition of a compound represents the mass of each element present in 100 g of the compound.

- Avogadro hypothesis explains equal volumes of all gases under similar conditions of temperature and pressure contain equal number of molecules.

- Gay Lussac's law states that for a given mass and constant volume of an ideal gas, the pressure exerted on the sides of its container is directly proportional to its absolute temperature.

MIND MAP

Atomic structure

Avogadro's Hypothesis → Gay-Lussac's law
Atomicity of molecule
Determine molecular formula
Relation between M.M and V.D

Molecule → Molecular Mass → Relative Molecular Mass

Mole Concept

Atom → Atomic Mass → Relative Atomic Mass → Average Atomic Mass

Modern Atomic Theory → Isotopes Isobars Isotones
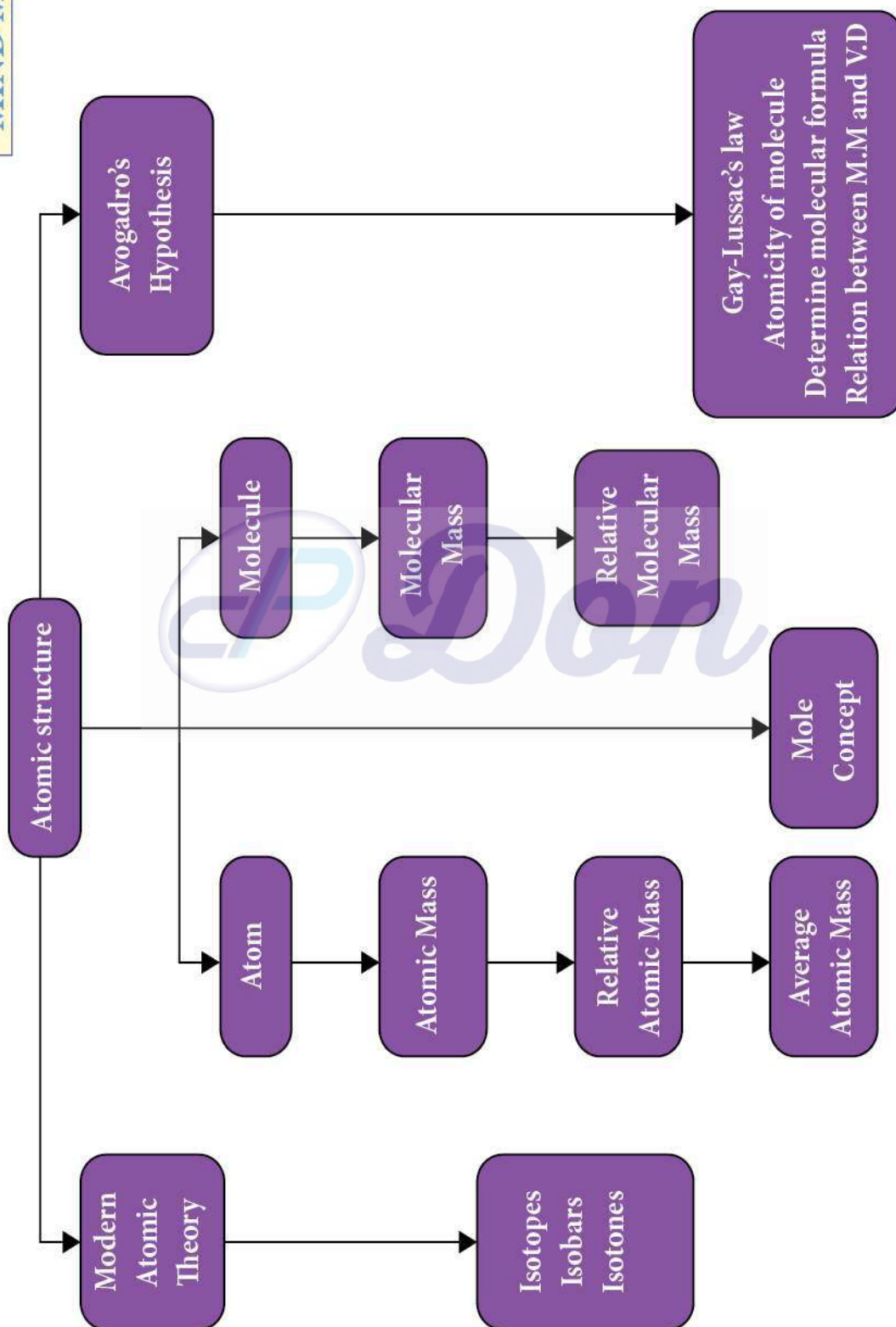
Formulae

Relative Atomic Mass (RAM)	$(A_r) = \dfrac{\text{Average mass of the isotopes of the element}}{\frac{1}{12}^{th}\text{ mass of one Carbon-12 atom}}$
Relative Molecular Mass (RMM)	$\dfrac{\text{Mass of one molecules of the substance}}{\frac{1}{12}^{th}\text{ mass of one C-12 atom}}$
Number of moles	Mass / Atomic Mass Mass / Molecular mass Number of Atoms / 6.023×10^{23} Number of Molecules / 6.023×10^{23} $\dfrac{\text{Volume}}{\text{Molar Volume}}$
Mass % of an element	$\dfrac{\text{mass of that element in the compound}}{\text{molar mass of compound}} \times 100$
Atomicity	$\dfrac{\text{Molecular mass}}{\text{Atomic mass}}$
Vapour Density (V.D)	$\dfrac{\text{Mass of given volume of gas or vapour at S.T.P}}{\text{Mass of same volume of hydrogen}}$
2 × vapour density	Relative molecular mass of a gas
Atomic Number Z	Number of protons = number of electrons
Atomic Mass A	Number of protons + Number of neutrons.

Discoveries and Inventions

Neutrons	Discovered by James Chadwick in the year 1932
First scientific theory of Atom	John Dalton in the year 1808
Plum pudding model of an atom	J.J. Thomson in 1898
Planetary model of an atom	Rutherford in 1909

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. 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

2. Which of the following is a triatomic molecule?
   a) Glucose
   b) Helium
   c) Carbon dioxide
   d) Hydrogen

3. 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

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

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

6. Which of the following statement is incorrect?
   a) One 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.

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

8. 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

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

10. 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}

Ans:

1.	b) 1 atom of He	6.	c) One mole of hydrogen gas contains Avogadro's number of atoms..
2.	c) Carbon dioxide	7.	c) 22.4 litre
3.	b) 2.24 litre	8.	b) 20 protons and 20 neutrons
4.	d) 14 g	9.	c) 32 g
5.	c) $1/12^{th}$ of the mass of a C – 12 atom	10.	a) 6.023×10^{23}

II. Fill in the blanks

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

2. Atoms of different elements having same number of _____ are called isotones.

3. Atoms of one element can be transmuted into atoms of other element by _____

4. The sum of the numbers of protons and neutrons of an atom is called its _____

5. Relative atomic mass is otherwise known as _____

6. The average atomic mass of hydrogen is _____ amu. ✶ ✶ ✶

7. If a molecule is made of similar kind of atoms, then it is called _____ atomic molecule.

8. The number of atoms present in a molecule is called its _____

9. One mole of any gas occupies _____ ml at S.T.P ✶

10. Atomicity of phosphorous is _____

Ans:

1.	Same, different	2.	Neutrons
3.	Artificial trSol:mutation	4.	Mass number
5.	Standard atomic weight	6.	1.008
7.	Homo	8.	Atomicity
9.	22400	10.	Four

III. Match the following

1. **Column I**   **Column II**

Column I		Column II	
1) 8 g of O_2	-	a) 4 moles	(b)
2) 4 g of H_2	-	b) 0.25 moles	(c)
3) 52 g of He	-	c) 2 moles	(e)
4) 112 g of N_2	-	d) 0.5 moles	(a)
5) 35.5 g of Cl_2	-	e) 13 moles	(d)

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

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

2. Noble gases are Diatomic **False**
   Noble gases are monoatomic

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

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

5. Molar mass of CO_2 is 42g. **False**
   Molar mass of CO_2 is 44g.

V. Assertion and 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 explains A.

1. **Assertion:** Atomic mass of aluminium is 27.
   Reason: An atom of aluminium is 27 times heavier than $1/12^{th}$ of the mass of the C-12 atom.

Ans : ii) A is correct, R is wrong.

2. **Assertion:** The Relative Molecular Mass of Chlorine is 35.5 a.m.u.
   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.** ✶ ✶ ✶

   • Relative atomic mass of an element is the ratio between the average mass of its isotopes to $\dfrac{1}{12^{th}}$ part of the mass of a carbon-12 atom.

   • It is denoted as **Ar.**

   • It is otherwise called **"Standard atomic weight".**

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

   Isotopes of oxygen and its percentage abundance

   $_8O^{16}$ - 99.757 %

   $_8O^{17}$ - 0.038 %

   $_8O^{18}$ - 0.205 %

3. **Define: Atomicity.** ✶ ✶ ✶

   The **number of atoms** present in the homo atomic molecule is called its atomicity.

   $$\text{Atomicity} = \dfrac{\text{Molecular mass}}{\text{Atomic mass}}$$

4. **Give any two examples for heterodiatomic molecules.**

   Heteroatomic molecules are classified as

   - Diatomic molecule   -   HCl, CaO
   - Triatomic molecule   - H_2O, CO_2
   - Polyatomic molecule   - H_2SO_4, CH_3COOH

5. **What is the molar volume of gas?**

   - One mole (6.023×10^{23} of entities) of any gas occupies **22.4 litre** or 22400 ml at **STP**.
   - This volume is called as molar volume of gas.

6. **Find the percentage of nitrogen in ammonia.** ✶ ✶

   > **Formula used:**
   > Mass percentage of an elements
   > $= \dfrac{\text{Mass of that element in the compound}}{\text{Molar mass of the compound}} \times 100$

   Molar mass of ammonia (NH_3) = 14 + 3

   $\qquad\qquad\qquad\qquad\qquad\qquad = \mathbf{17}$

   Mass percentage of Nitrogen $= \dfrac{\textbf{mass of nitrogen in ammonia}}{\textbf{molar mass of the ammonia}} \boxtimes \mathbf{100}$

   $$= \frac{14}{17} \times 100 \ = \ \frac{1400}{17} = \mathbf{82.35\ \%}$$

   The mass percentage of nitrogen in ammonia is **82.35%**

VII. Long answer questions:

1. **Calculate the number of water molecules present in one drop of water which weight 0.18 g** ✶ ✶

   Molecular mass of water (H_2O) = H_2O = H × 2 + O × 1

   $\qquad\qquad\qquad\qquad\qquad\qquad = 1 \times 2 + 16 \times 1$

   $\qquad\qquad\qquad\qquad\qquad\qquad = 2 + 16$

   $\qquad\qquad\qquad\qquad\qquad\qquad = 18$

   Number of moles $= \dfrac{\text{Given mass}}{\text{Molecular mass}}$

   > **Formula used:**
   > No. of moles $= \dfrac{\text{Mass}}{\text{Atomic mass}}$

   Number of moles $= \dfrac{0.18}{18} = \dfrac{0.18 \times 100}{18 \times 100} = 0.01$

   Number of moles $= \dfrac{\text{Number of molecules}}{\text{Avogadro's number}}$

   > **Formula used:**
   > No. of moles $= \dfrac{\text{Number of molecules}}{\text{Avogadro's number}}$

   Number of molecules

   $\qquad = $ Number of moles × Avogadro's number

   $\qquad = 0.01 \times 6.023 \times 10^{21}$

   Number of molecules in 0.18 g of water = $\mathbf{6.023 \times 10^{21}}$

   ### Alternative method

   Gram molecular mass of water = H_2O

   $\qquad\qquad\qquad = 1 \times 2 + 16 \times 1 = 2 + 16$

   $\qquad\qquad\qquad = 18$ g

   > **Formula used:**
   > No. of molecules
   > $= \dfrac{\text{Avogadro's number} \times \text{given mass}}{\text{Gram molecular mass}}$

$$\text{Number of molecules} = \frac{\text{Avogadro's number} \times \text{given mass}}{\text{Gram molecular mass}}$$

$$\text{Number of molecules} = \frac{6.023 \times 10^{23} \times 0.18}{18}$$

$$= 6.023 \times 10^{23} \times 0.01$$

Number of molecules of 0.18 g of water = $\mathbf{6.023 \times 10^{21}}$

2. $N_2 + 3H_2 \rightarrow 2NH_3$

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

 1 mole of nitrogen (__g) + 3 moles of hydrogen (__g) → 2 moles of ammonia (__g)

Mass of 1 mole of nitrogen (N_2) $= 2 \times N = 2 \times 14 = 28$ g

Mass of 3 moles of hydrogen (H_2) $= 3[2 \times H]$

$$= 3[2 \times 1] = 3[2]$$

$$= 6 \text{ g}$$

Mass of 2 moles of ammonia (NH_3) $= 2[NH_3]$

$$= 2[1 \times N + 3 \times H]$$

$$= 2[1 \times 14 + 3 \times 1]$$

$$= 2[14 + 3]$$

$$= 2[17] = \mathbf{34 \text{ g}}$$

$$\left. \begin{array}{l} 1 \text{ mole of nitrogen } (\mathbf{28g}) \\ + \\ 3 \text{ mole of hydrogen } (\mathbf{6g}) \end{array} \right\} = 2 \text{ moles of ammonia } (\mathbf{34g})$$

3. **Calculate the number of moles in**
 i) 27 g of Al
 ii) 1.51×10^{23} molecules of NH_4Cl

i) 27 g of Al

$$\text{Number of moles} = \frac{\text{given mass}}{\text{Atomic mass}} = \frac{27}{27} = 1$$

Number of moles of 27 g of Al is **1**

> **Formula used:**
> $$\text{No. of moles} = \frac{\text{Mass}}{\text{Atomic mass}}$$

ii) 1.51×10^{23} molecules of NH_4Cl

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

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

$$= \frac{1.51}{6.023}$$

Number of moles of 1.51×10^{23} molecules of $NH_4Cl = \mathbf{0.25}$

4. Give the salient features of "Modern atomic theory. ✳ ✳ ✳

- An atom is no longer **indivisible**.

- Atoms of the same element may have **different atomic mass** [isotopes $_{17}Cl^{35}$, $_{17}Cl^{37}$]

- Atoms of the different elements may have **same atomic masses** (isobars $_{18}Ar^{40}$, $_{20}Ca^{40}$)

- Atoms of one element can be transmitted into atoms of other elements. So atom is no longer indestructible. It is called **artificial transmutation.**

- Atoms may not always combine in a simple **whole number ratio** [eg. Glucose $C_6H_{12}O_6$, sucrose $C_{12}H_{22}O_{11}$)

- Atom is the smallest particle that takes part in a **chemical reaction.**

- The **mass** of an atom can be converted into **energy** ($E = mc^2$).

5. Derive the relationship between relative molecular mass and vapour density. ✳ ✳ ✳

Relative molecular mass:

Relative molecular mass of a gas or vapour is the ratio between the mass of one molecule of gas or vapour to mass of one atom of hydrogen.

$$\text{Relative molecular mass} = \frac{\text{Mass of 1 molecule of a gas (or) vapour at STP}}{\text{Mass of 1 atom of hydrogen}} \qquad \text{--- (1)}$$

Vapour density:

It is the ratio of the mass of a certain volume of a gas or vapour to the mass of an equal volume of hydrogen measured under the same conditions of temperature and pressure.

$$\text{Vapour density} = \frac{\text{Mass of a given volume of gas (or) vapour at STP}}{\text{Mass of the same volume of the hydrogen}}$$

According to Avogadro's law [Let the number of molecules 'n']

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

cancelling n vapour density $= \dfrac{\text{Mass of 1 molecule of a gas or vapour at STP}}{\text{Mass of 1 molecule of a hydrogen}}$

Hydrogen is diatomic molecule, so

$$\text{Vapour density} = \frac{\text{Mass of 1 molecule of a gas or vapour at STP}}{\text{Mass of 2 atoms of hydrogen}}$$

$$\text{Vapour density} = \frac{\text{mass of 1 molecule of a gas or vapour at STP}}{2 \times \text{mass of 1 atom of hydrogen}}$$

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

From eqn (1)

$$2 \times \text{Vapour density} = \text{Relative molecular mass}$$

VIII. Solve the following problems

1. **How many grams are there in the following?** ✳ ✳
   i) 2 moles of hydrogen molecule, H_2
   ii) 3 moles of chlorine molecule, Cl_2
   iii) 5 moles of sulphur molecule, S_8
   iv) 4 moles of phosphorous molecule, P_4

   i) 2 moles of hydrogen molecule, H_2
   mass = number of moles × molecular mass
   $= 2 \times 2$
   Mass of 2 moles of H_2 = **4g**

   > Molecular mass of H_2
   > $H_2 = H \times 2$
   > $= 1 \times 2 = 2$

   ii) 3 moles of chlorine molecule, Cl_2
   mass = number of moles × molecular mass
   $= 3 \times 71$
   Mass of 3 moles of Cl_2 = **213 g**

   > Molecular mass of Cl_2
   > $Cl_2 = Cl \times 2$
   > $= 35.5 \times 2 = 71$

   iii) 5 moles of sulphur molecules, S_8
   mass = number of moles × molecular mass
   $= 5 \times 256$
   Mass of 5 moles of S_8 = **1280 g**

   > Molecular mass of S_8
   > $S_8 = S \times 2$
   > $= 32 \times 8 = 256$

   iv) 4 moles of phosphorous molecule, P_4
   mass = number of moles × molecular mass
   $= 4 \times 120$
   Mass of 4 moles of P_4 = **480 g**

   > Molecular mass of P_4
   > $P_4 = P \times 4$
   > $= 30 \times 4$
   > $= 120$

2. **Calculate the percentage of each element in calcium carbonate [atomic mass: C-12, O-16, Ca-40]**

   > **Formula used:**
   > Mass % of an element = $\dfrac{\text{mass of that element in the compound}}{\text{molar mass of the compound}} \times 100$

   Molar mass of calcium carbonate $CaCO_3 = Ca \times 1 + C \times 1 + O \times 3$
   $= 40 \times 1 + 12 \times 1 + 16 \times 3$
   $= 40 + 12 + 18 = 100\ g$

   Mass % of an element = $\dfrac{\text{mass of that element in the compound}}{\text{molar mass of the compound}} \times 100$

   Mass % of calcium = $\dfrac{40}{100} \times 100 =$ **40 %**

   Mass % of carbon = $\dfrac{12}{100} \times 100 =$ **12 %**

   Mass % of oxygen = $\dfrac{48}{100} \times 100 =$ **48 %**

3. **Calculate the % of oxygen in $Al_2(SO_4)_3$ [Atomic mass: Al- 2, O-16, S-32]**

Molar mass of $Al_2(SO_4)_3 = Al \times 2 + 3[S \times 1 + O \times 4]$

$27 \times 2 + 3[32 \times 1 + 16 \times 4]$

$= 54 + 3[32 + 64]$

$= 54 + 3[96]$

$= 54 + 288 = \mathbf{342}$

> Mass of oxygen: 12 oxygen
>
> $12 \times O$
>
> $12 \times 16 = 192$

Mass % of an element $= \dfrac{\text{mass of that element in the compound}}{\text{molar mass of the compound}} \times 100$

Mass % oxygen in $Al_2(SO_4)_3 = \dfrac{192}{342} \times 100$

$= 0.5614 \times 100 = \mathbf{56.14\ \%}$

Mass % of oxygen in $Al_2(SO_4)_3$ is **56.14 %**

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

We consider B-11 isotope presents x % in nature. So B-10, isotope presents $(1 - x)$ %.

Average atomic mass = mass of B-11 + mass of B-10

$10.804 = x \times 11 + (1 - x) \times 10$

$10.804 = 11x + 10 - 10x$

$10.804 = x + 10$

$x = (10.804 - 10)$

$\mathbf{x = 0.804}$

So, % relative abundance of B-11 is $0.804 \times 10 = 80.4\ \%$

% relative abundance of B-10 is $(1 - x) \times 100$

$= (1 - 0.804) \times 100$

$= 0.196 \times 100$

$= \mathbf{19.6\ \%}$

% relative abundance of B-10 and B-11 are **19.6%** and **80.4%** respectively.

IX. Higher Order Thinking Skill (HOTS)

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

   $CaCO_3 \rightarrow CaO + CO_2$

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

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

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

   i) **1 mole** of calcium carbonate are involved

   ii) Gram molecular mass of $CaCO_3 \rightarrow Ca \times 1 + C \times 1 + O \times 3$

   $40 \times 1 + 12 \times 1 + 16 \times 3$

   $40 + 12 + 48 = 100\ g$

   Gram molecular mass of $CaCO_3$ is **100 g / mol.**

   iii) **1 mole** of CO_2 are there in above equation.

X. Answer for activities:

1. Activity

Complete the following table by filling the appropriate values /terms

Element	No. of Protons	No. of Neutrons	Mass Number	Stable Isotopes (abundance)	Atomic Mass (amu)
	7			N-14 (99.6 %)	
		8		N-15 (0.4 %)	
	14		28	S-28 (92.2 %)	
Sulphur	14			S-29 (4.7 %)	
		16		S-30 (3.1 %)	
	17			Cl-35 (75 %)	
	17			Cl-37 (25 %)	

Ans:

Element	No. of Protons	No. of Neutrons	Mass Number	Stable Isotopes (abundance)	Atomic Mass (amu)
Nitrogen	7	7	14	N-14 (99.6 %)	13.944
	7	8	15	N-15 (0.4 %)	0.66
	14	14	28	Si-28 (92.2 %)	25.816
Silicon	14	15	29	Si-29 (4.7 %)	1.363
	14	16	30	Si-30 (3.1 %)	0.93
Chlorine	17	18	35	Cl-35 (75 %)	26.25
	17	20	37	Cl-37 (25 %)	9.25

Calculation:

i) The average atomic mass of nitrogen $= \left(\dfrac{99.6}{100} \times 14\right) + \left(\dfrac{0.4}{100 \times 15}\right)$

$$= 14 \times 0.996 + 0.004 \times 15$$

$$= 13.944 + 0.66$$

The average atomic mass of Nitrogen = **14.004 amu**

ii) The average atomic mass of Silicon $= \dfrac{92.2}{100} \times 28 + \dfrac{4.7}{100} \times 29 + \dfrac{3.1}{100} \times 30$

$$= 0.922 \times 28 + 0.047 \times 29 + 0.031 \times 30$$

$$= 25.816 + 1.363 + 0.93$$

The average atomic mass of Silicon = **28.109 amu**

iii) The average atomic mass of chlorine $= \dfrac{75}{100} \times 35 + \dfrac{25}{100} \times 35$

$$= 0.75 \times 35 + 0.25 \times 37$$

$$= 26.25 + 9.25$$

The average atomic mass of chlorine = **35.5 amu**

2. **Activity**

Classify the following molecules based on their atomicity and fill in the tables:
Fluorine (F_2), Carbon dioxide (CO_2), Phosphorous (P_4), Sulphur (S_8), Ammonia (NH_3), Hydrogen iodide (HI), Sulphuric Acid (H_2SO_4), Methane (CH_4), Glucose ($C_6H_{12}O_6$), Carbon monoxide (CO)

Molecule	Diatomic	Triatomic	Polyatomic
Homo			
Hetero			

Ans:

Molecule	Diatomic	Triatomic	Polyatomic
Homo	F_2	-	P_4, S_8
Hetero	HI, CO	CO_2	NH_3, H_2SO_4, CH_4, $C_6H_{12}O_6$

3. **Activity**

Under same conditions of temperature and pressure if you collect 3 litre of O_2, 5 litre of Cl_2 and 6 litre of H_2,

i) Which has the highest number of molecules?

ii) Which has the lowest number of molecules?

Ans:

Under same conditions of temperature and pressure all atoms and molecules have same number of molecules in 1 litre. so

i) 6 litres of H_2 has the highest number of molecules

ii) 3 litres of O_2 has the lowest number of molecules.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The first scientific theory of the atom was proposed by
   a) Avogadro
   b) J-J Thomson
   c) John Dalton
   d) Niels Bohr

2. Atoms of different elements have same number of neutrons are called as ✸
   a) Isotones
   b) Isotopes
   c) Isobars
   d) Isothermal

3. In Einstein mass energy equivalence $E = mc^2$, 'c' is
   a) Charge of the atom
   b) Mass of carbon atom
   c) Number of moles
   d) Velocity of light in vaccum

4. The sum of the number of protons and neutrons of an atom is called its ✸
   a) atomic number
   b) mass number
   c) relative atomic mass
   d) relative molecular mass

5. Relative atomic mass of magnesium is
   a) 6   b) 12   c) 48   d) 24

6. Which of the following is not an isotope of oxygen?
   a) $_8O^{16}$ b) $_8O^{17}$ c) $_8O^{18}$ d) $_8O^{19}$

7. Noble gases are �֎ ✖
   a) Monoatomic molecule   b) Diatomic molecules
   c) Triatomic molecules   d) Polyatomic molecules

8. Atomicity of Ozone is
   a) 3   b) 4   c) 6   d) 7

9. Mass of carbon -12 atom is
   a) 1 amu   b) 12 amu   c) 1/12 amu   d) none of these

10. 1 mole contains ✖
    a) 6.023×10^{23} atoms   b) 6.023×10^{23} molecules
    c) 6.023×10^{23} ions   d) Any of these

11. Mass percentage of carbon and oxygen in CO is
    a) 43 % and 57 %   b) 57 % and 43 %
    c) 50 % and 50 %   d) 25 % and 75 %

12. Volume of 2 mole of hydrogen gas is
    a) 22.4 litre   b) 44.8 litre
    c) 2 litre   d) 11.2 litre

13. Number of neutrons in $_{11}Na^{23}$ is
    a) 11   b) 23   c) 12   d) 34

Ans:

1.	c) John Dalton	8.	d) 7
2.	a) Isotones	9.	b) 12 amu
3.	d) Velocity of light in vaccum	10.	d) Any of these
4.	b) mass number	11.	a) 43 % and 57 %
5.	d) 24	12.	b) 44.8 litre
6.	d) $_8O^{19}$	13.	c) 12
7.	a) Monoatomic molecules		

II. Fill in the blanks

1. The smallest particle that takes part in chemical reaction is called_____ .

2. Anything that has mass and occupies space is called _____.

3. _____ represents the total charged particles present in the nucleus of an atom.

4. _____ elements generally have atomicity one. ✖

5. In homoatomic molecule, _____ is an example for tetra atomic molecule.

6. Gram molecular mass of methane [CH_4] is _____.

7. 12.046×10^{23} atoms of Carbon occupies _____ volume at STP ✖

8. Avogadro's hypothesis law is in agreement with _____ theory.

9. Number of moles of 64 g oxygen molecule is _____.

10. Standard temperature is _____.

Ans:

1.	Atom	2.	Matter
3.	Atomic number	4.	Noble gases
5.	Phosphorous	6.	16g
7.	44.8 litre	8.	Dalton's atomic
9.	2	10.	273.15 K

III. Match the following

1. **Column I**   **Column II**
   1) Avogadro number   - a) Gay-lussac   (d)
   2) Molar volume   - b) Albert Einstein   (c)
   3) 2 × vapour density   - c) 22.4 litres   (e)
   4) $E = mc^2$ - d) 6.023×10^{23} (b)
   5) Law of combining
      volume of gases   - e) Relative molecular mass   (a)

2. **Column I**   **Column II**
   1) $_1H^1$, $_1H^2$ - a) Isotones   (c)
   2) $_6C^{13}$, $_7N^{14}$ - b) Hetero atomic molecules (a)
   3) $_6C^{14}$, $_7N^{14}$ - c) Isotopes   (e)
   4) Water   - d) Homoatomic molecules   (b)
   5) Ozone   - e) Isobars   (d)

3. **Column I**   **Column II**
   Element   **Relative atomic masses**
   1) Carbon   - a) 9   (b)
   2) Magnesium   - b) 12   (d)
   3) Beryllium   - c) 32   (a)
   4) Oxygen   - d) 24   (e)
   5) Sulphur   - e) 16   (c)

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

1. **Atoms of one element cannot be converted into atoms of another element.   False**
   Atoms of one element can be converted into atoms of another element.

2. **Unit of mass in atomic level is amu.**   **True**

3. **Atomicity of Sulphur is 8.**   **True**

4. **Ratio of molecular mass to a given mass of a substance gives number of moles present in that given mass.**   **False**
   Ratio of a given mass to molecular mass of a substance gives number of moles presents in that given mass.

5. **Sodium chloride is an example for polyatomic molecule.**   **False**

Sodium chloride is an example for Diatomic molecules.

V. Assertion and 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 explains A.

1. **Assertion:** 35.5 g of chlorine molecule contains 6.023×10^{23} atoms.

    Reason: 25 % Cl - 35 and 75 % Cl - 37 % isotopes combination occurs naturally.

Ans : ii) A is correct, R is wrong.

2. **Assertion:** The molecule that consist of atoms of different elements is called heteroatomic molecule.

    Reason: H_2O is a triatomic molecule.

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

3. **Assertion:** Neon is a diatomic molecule. ✶

    Reason: Neon is an inert gas (or) noble gas.

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

VI. Short answer questions.

1. Define: Average atomic mass.

The average atomic mass of an element is the **average weight** of the masses of its naturally occuring isotopes.

2. State Avogadro's law.

Equal volumes of all gases **under similar conditions** of temperature and pressure contain equal number of molecules.

3. Electron has mass. But mass number of an atom does not conclude the electron. Why? ✶

- Mass of electron (9.11×10^{-31} **kg**) is very very less than the mass of proton (1.672×10^{-27} **kg**) and mass of neutron (1.674×10^{-27} **kg**).

- So mass number of an atom does not conclude the mass of electron.

4. Define: Mole. ✶

Mole is the amount of a substance that contains as many elementary entities (atoms molecules or other particle) as there are atoms in exactly **12 g** of the **carbon-12** isotope.

5. State: Gay-lussac's law.

For a given mass and constant volume of an ideal gas, the **pressure** exerted on the sides of its container is **directly** proportional to its absolute **temperature**.

6. **Write the applications of Avogadro's law.**
   - It explains **Gay-Lussac's law.**
   - It helps in the determination of **atomicity of gases.**
   - **Molecular formula** of gases can be derived using Avogadro's law
   - It determine the relation between **molecular mass** and **vapour density**.

7. **Calculate the gram molar mass of CH_3COOH.** ✴

   Atomic mass of C-12, H-1, O-16

   Gram molar mass of $CH_3COOH = C \times 1 + H \times 3 + C \times 1 + O \times 2 + H \times 1$

   $\qquad\qquad = 12 \times 1 + 1 \times 3 + 12 \times 1 + 16 \times 2 + 1 \times 1$

   $\qquad\qquad = 12 + 3 + 12 + 32 + 1$

   Gram molar mass = **60 g**

   Gram molar mass of CH_3COOH is **60 g.**

8. **What is the vapour density?**

   It is the ratio of the mass of a certain volume of a gas or vapour, to the mass of an equal volume of hydrogen, measured under the **same conditions** of temperature and pressure.

9. **Prove 1 litre = $1 dm^3$.**

   $$1000\,L = 1m^3$$

   $$1\,L = \frac{1m^3}{1000} = \frac{1m^3}{10^3}$$

   $$= 1 \times 10^{-3}\,m^3 \qquad\qquad [10^{-1} = deci]$$

   $$\mathbf{1\,L = 1\,(dm)^3}$$

VII. To interpret what happens in the given situation

1. **There are 12.046×10^{23} atoms of calcium at STP condition in a container.**
   a) What is the volume of the container?
   b) How many molecules of CO_2 needed to fill that same container at STP.

   a) Volume of 6.023×10^{23} atoms of calcium is = **22.4 litre**

   Volume of 12.046×10^{23} atoms of calcium is = **44.8 litre**

   b) At STP condition, all atoms (or) molecules (or) ions filled are of the same volume (i.e) 22.4 litre. So to fill that same container at STP condition $\mathbf{12.046 \times 10^{23}}$ molecules of $\mathbf{CO_2}$ is needed.

2. **Atoms of different elements may be similar in some respects.**

   Atoms of different elements may having same atomic masses are called **isobars.**

3. **Water**
   a) What type of molecule is this?
   b) What is the molecular mass of water?

   a) Water (H_2O) hetero atomic molecule → **triatomic** molecule

   b) Molecular mass of water is $H_2O = H \times 2 + O \times 1$

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

   $$= 2 + 16 = \mathbf{18}.$$

VIII. Long answer question:

1. Differentiate atoms and molecules. ✶ ✶

S.No.	Atoms	Molecules
1	An atom is the smallest particle of an element.	A molecule is the smallest particle of an element or compound.
2	Atom **doesn't exist** in free state except in a noble gas.	Molecules **exist** in free state.
3	Except atoms of some of the noble gases, other atoms are **highly reactive.**	Molecules are **less reactive.**
4	Atom **does not** have a chemical bond.	Atoms in a molecule are **held** by chemical bonds.
5	Eg : He, Al	Eg. HNO_3, $CaCO_3$

2. State Avogadro's hypothesis and prove that Avogadro's hypothesis agreed with Dalton's atomic theory.

Avogadro hypothesis:

Equal volumes of all gases **under similar conditions** of temperature and pressure contain equal number of molecules.

Let us consider the reaction between hydrogen and chlorine to form hydrogen chloride gas.

$$H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$$

1 vol + 1 vol $\rightarrow$ 2 volumes
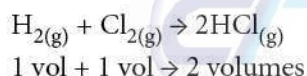
According to Avogadro's law **1 volume** of any gas is occupied by '**n**' number of molecules.

'n' molecules + 'n' molecules = 2 'n' molecules

if n = 1 then,

1 molecule + 1 molecule = 2 molecules

1/2 molecule + 1/2 molecule = 1 molecule

1 molecule of hydrogen chloride gas is made up of 1/2 molecule hydrogen and 1/2 molecule of chloride. Hence the molecules can be subdivided. So hypothesis agrees with **Dalton's atomic theory.**

IX. Solve the following problems

1. Calculate the number of moles for the following ✶ ✶
   i) 3.0115×10^{24} molecules of H_2SO_4
   ii) 12.046×10^{23} atoms of Fe

i) $\text{Number of moles} = \dfrac{\text{Number of molecules}}{\text{Avagadro's number}}$

$$= \frac{3.0115 \times 10^{24}}{6.023 \times 10^{23}}$$

$$= \frac{1}{2} \times 10^{24-23} = 0.5 \times 10^1 = 5$$

> **Formula used:**
> Number of moles
> $$= \frac{\text{Number of molecules}}{\text{Avagadro's number}}$$

3.0115×10^{24} molecules of H_2SO_4 makes **5** moles

ii)   Number of moles = $\dfrac{\text{Number of atoms}}{\text{Avogadro's number}}$

$$= \dfrac{12.046 \times 10^{23}}{6.023 \times 10^{23}} = 2$$

12.046 × 10^{23} atom of Fe forms **2** moles

2. Calculate the vapour density of methane [CH$_4$]

Molecular mass of methane CH$_4$ = C × 1 + H × 4

$$= 12 \times 1 + 1 \times 4$$
$$= 12 + 4 = 16$$

Vapour density of methane = $\dfrac{\text{Relative molecular mass}}{2}$

$$= \dfrac{16}{2} = 8$$

Vapour density of methane is **8**

3. Calculate the number of atoms / molecules present in 50 g CaCO$_3$ and 50 g of Fe.

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

$$= \dfrac{6.023 \times 10^{23} \times 50}{100}$$
$$= 3.0112 \times 10^{23}$$

Gram molecular mass
CaCO$_3$ = Ca × 1 + C × 1 + O × 3
$$= 40 \times 1 + 12 \times 1 + 16 \times 3$$
$$= 40 + 12 + 48 = 100$$

50 g CaCO$_3$ contains **3.0112 × 10^{23}** molecules.

Number of atoms = $\dfrac{\text{Avogadro number} \times \text{given mass}}{\text{Gram Atomic mass}}$

$$= \dfrac{6.023 \times 10^{23} \times 50}{55.9}$$

$$= 5.387 \times 10^{23}$$

50 g Fe contains **5.387 × 10^{23}** atoms.

4. Calculate the gram molecular mass of the following
a) C$_6$H$_{12}$O$_6$ b) H$_2$SO$_4$
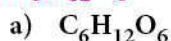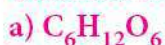
a)   **C$_6$H$_{12}$O$_6$**

Atomic mass of (C-12; H-1; O-16)

Gram molecular mass of C$_6$H$_{12}$O$_6$ = C × 6 + H × 12 + O × 6
$$= 12 \times 6 + 1 \times 12 + 16 \times 6$$
$$= 72 + 12 + 96$$

Gram molecular mass of C$_6$H$_{12}$O$_6$ = **180**
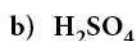
b)   **H$_2$SO$_4$**

Atomic mass of H-1; S-32; O-16

Gram molecular mass of H_2SO_4 = H × 2 + S × 1 + O × 4
$$= 1 × 2 + 32 × 1 + 16 × 4$$
$$= 2 + 32 + 64 = 98$$
Gram molecular mass of H_2SO_4 = **98 g**

5. **Calculate the mass of the following :** ✶ ✶
   a) **$9.0345 × 10^{23}$ atom of sulphur**   b) **$6.023 × 10^{20}$ molecules of H_2O**

   a) **9.0345 atom of sulphur**

   $$\text{mass of an atom} = \frac{\text{number of atoms}}{\text{Avogadro number}} × \text{mass of sulphur}$$

   $$\text{mass of sulphur} = \frac{9.0345 × 10^{23}}{6.023 × 10^{23}} × 32$$

   $$= \frac{3}{2} × 32 = 48 \text{ g}$$

   Mass of $9.0346 × 10^{23}$ atoms of sulphur **48g**

   b) **$6.023 × 10^{20}$ molecule of H_2O**

   Molecular mass of H_2O = H × 2 + O × 1
   $$= 1 × 2 + 16 × 1 = 2 + 16 = 18$$

   $$\text{Mass of an atom} = \frac{\text{Number of atoms}}{\text{Avogadro's number}} × \text{mass of } H_2O$$

   $$= \frac{6.023 × 10^{20}}{6.023 × 10^{23}} × 18$$

   $$= 10^{-3} × 18 = \mathbf{0.018 \text{ g}}$$

6. **Calculate % of 'S' in $CaSO_4$ and 'P' in $CaPO_4$**

   i) % of S in $CaSO_4$

   Atomic mass of Ca-40, S-32, O-16

   Molecular mass of $CaSO_4$ → Ca × 1 + **S × 1** + O × 4
   $$= 40 × 1 + \mathbf{32 × 1} + 16 × 4$$
   $$= 40 + \mathbf{32} + 64$$
   $$= \mathbf{136 \text{ g}}$$

   $$\text{% of an element in a compound} = \frac{\text{mass of that element in the compound}}{\text{molar mass of the compound}} × 100$$

   $$\text{% of S in } CaSO_4 = \frac{32}{136} × 100 = \frac{4}{17} × 100 = 23.53\%$$

   % of S in $CaSO_4$ is **23.53 %**

   ii) % of P in $Ca(PO_4)$

   molar mass of $Ca_3(PO_4)_2$ = Ca × 3 + P × 2 + O × 8
   $$= (40.8 × 3) + (30.97 × 2) + (16 × 8)$$
   $$= 120.24 + 61.94 + 128 = 310.18$$

% of an element in a compound = $\dfrac{\text{mass of that element in the compound}}{\text{molar mass of the compound}} \times 100$

% of 'P' in Ca_3PO_4 = $\dfrac{30.97}{310.18} \times 100 = 9.98\%$

% of 'P' in $Ca_3(PO_4)_2$ is **9.98 %**

7. Calculate the density of 1 mole of CO_2 at STP

Molar mass of CO_2 = C × 1 + O × 2

$= 12 \times 1 + 16 \times 2 = 12 + 32 = 44$ g

Density of CO_2 = $\dfrac{\text{molar mass of } CO_2}{\text{molar volume of } CO_2}$

$= \dfrac{44}{22.4}$

Density of CO_2 is **1.96 kg / m³**

X. Higher Order Thinking Skill (HOTS)

1. **i) Why do we use unit amu to measure mass of atoms (or) molecules?**
    ii) What is the need of the average atomic mass of an element?
    iii) Why do atoms form molecules?

    i) Mass of atoms (or) molecules are very very small. So measuring mass of an individual atom is too difficult. Generally mass is measured in gram (or) kilograms. It is only for macroscopical level. It is difficult to understand the difference in mass of different atoms, if we measure in grams (or) kilograms. So we need microscopic units to measure mass of an atom (or) molecules. So we use unit amu to measure mass of atoms (or) molecules.

    ii) Naturally occuring elements exist as a mixture of isotopes, each of which has its own mass. So we have to consider this isotopic mixture while calculating the atomic mass of an element.

    iii) Atoms combine to form molecules because the gain, loss or share of electrons is such that the outer shells become chemically complete.

◄ ◄ ◄ ◄ ◄ ◄ ◉ ► ► ► ► ► ►

Unit Test -7

Atoms and Molecules

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer. $5 \times 1 = 5$

1. Which of the following is a triatomic molecule?
   a) Glucose   b) Helium
   c) Carbon dioxide   d) Hydrogen

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

3. 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

4. The gram molecular mass of oxygen molecule is
   a) 16 g   b) 18 g
   c) 32 g   d) 17 g

5. In Einstein mass energy equivalence $E = mc^2$, 'c' is
   a) Charge of the atom   b) Mass of carbon atom
   c) Number of moles   d) Velocity of light in vaccum

II. Answer the following questions in one or two lines. $5 \times 2 = 10$

1. What is the molar volume of gas?
2. Find the percentage of nitrogen in ammonia.
3. State Avogadro's law
4. State: Gay-lussac's law.
5. Write the applications of Avogadro's law.

III. Answer the following questions in brief. $2 \times 4 = 8$

1. Calculate the number of water molecules present in one drop of water which weight 0.18 g.
2. i) State Avogadro's law
   ii) Calculate the gram molar mass of CH_3COOH.

IV. Answer the following questions in detail. $1 \times 7 = 7$

1. Calculate the mass of the following:
   i) 9.0345×10^{23} atom of sulphur
   ii) 6.023×10^{20} molecules of H_2O

POINTS TO REMEMBER

Modern periodic law	- The physical and chemical properties of the elements are the periodic functions of their atomic numbers.
Hendry Moseley	– Discovered atomic number of elements and formed modern periodic table.
Periods	– Horizontal rows in the periodic table.
Groups	– Vertical column in the periodic table
Inner transition elements	– Lanthanides and Actinides
Atomic radius	– Distance between centre of its nucleus and the outermost shell valence electron.
Metallic radius	– Half the distance between the nuclei of adjacent metal atoms.
Covalent radius	– Half the distance between the nuclei of two covalently bonded atoms of the same element in a molecule.
Ionic Radii	– The distance from the centre of the nucleus of the ion upto the point where it exerts its influence on the electron cloud of the ion.
Metallurgy	– Metallurgy is a science of extracting metals from their ores and modifying the metals into alloys for various uses, based on physical and chemical properties and their structural arrangement of atoms.
Ionisation energy	– Minimum energy required to remove an electron from gaseous atom.
Electron affinity	– Amount of energy released to gain an electron
Concentration	– Removal of impurities from the ore
Refining	– Purification of metal
Mineral	– A single compound or a complex mixture of various compounds of metals found in Earth.
Ore	– The mineral from which a metal can be readily and economically extracted in a large scale.
Mining	– Extracting the ore from the Earth's crust.
Gangue or matrix	– The rocky impurity associated with an ore.
Flux	– The substance added to the ore to reduce the fusion temperature
Slag	– The fusible product formed when a flux reacts with a gangue during the extraction of metals.

MIND MAP

Elements

Periodic properties
- Atomic radius
- Ionic radii
- Ionisation energy
- Electron affinity

Metallurgy

Modern periodic table

Modern periodic law

Metals of medium reactivity
- Sulphide ore → Roasting
- Carbonate ore → Calcination
- Oxide of metal → Reduction → Purification

Metals of higher reactivity
- Electrolysis of molten ore → pure metal

Seperation of ore
- Gravity separation
- Magnetic separation
- Froath Flotation
- Chemical method

Metal of less reactivity
- Sulphide ore → Roasting → Metal → Purification

Smelting	– Reducing the roasted metallic oxide from the metal in its molten condition
Concentration methods	– Hydraulic, magnetic, froth floatation, chemical method.
Bauxite	– Chief ore of Aluminium
Fluorspar	– Lowers the fusion temperature of electrolyte
Copper pyrite	– Chief ore of copper
Roasting	– Concentrated ore is roasted in excess of air
Haematite	– Chief ore of Iron
Calcination	– Concentrated ore is heated with limited supply of air
Amalgam	– Alloy of mercury with another metal
Alloy	– A homogeneous mixture of two or more methods
Galvanization	– Coating zinc on iron sheets by using electric current.

Formulae

Metallic radius	$\dfrac{\text{Distance between the nuclei of adjacent metal atoms}}{2}$
Covalent radius	$\dfrac{\text{Distance between the nuclei of two covalently bonded atoms of the same element in a molecule}}{2}$

Don

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **The number of periods and groups in the periodic table are_____.** ✶✶
   a) 6,16   b) 7,17   c) 8,18   d) 7,18

2. **The basis of modern periodic law is_____.**
   a) atomic number   b) atomic mass
   c) isotopic mass   d) number of neutrons

3. **_____ group contains the member of halogen family.**
   a) 17th   b) 15th   c) 18th   d) 16th

4. **_____ is a relative periodic property.**
   a) Atomic radii   b) Ionic radii
   c) Electron affinity   d) Electronegativity

5. **Chemical formula of rust is _____.** ✶✶✶
   a) $FeO.xH_2O$ b) $FeO_4.xH_2O$
   c) $Fe_2O_3.xH_2O$ d) FeO

6. In the alumino thermic process the role of Al is _____.
   a) oxidizing agent
   b) reducing agent
   c) hydrogenating agent
   d) sulphurising agent

7. The process of coating the surface of metal with a thin layer of zinc is called_____.
   a) painting
   b) thinning
   c) galvanization
   d) electroplating

8. Which of the following inert gases have 2 electrons in the outermost shell?
   a) He
   b) Ne
   c) Ar
   d) Kr

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

10. _____ is an important metal to form amalgam.
    a) Ag
    b) Hg
    c) Mg
    d) Al

Ans:

1)	d)	7, 18	6)	b)	reducing agent
2)	a)	atomic number	7)	c)	galvanization
3)	a)	17th	8)	a)	He
4)	d)	electron negativity	9)	b)	stable configuration of electrons
5)	c)	$Fe_2O_3 \cdot xH_2O$	10)	b)	Hg

II. Fill in the blanks

1. If the electronegativity difference between two bonded atoms in a molecule is greater than 1.7, the nature of bonding is _____.

2. _____ is the longest period in the periodic table.

3. _____ forms the basis of modern periodic table. ✳ ✳ ✳

4. If the distance between two Cl atoms in Cl_2 molecule is 1.98Å, then the radius of Cl atom is _____.

5. Among the given species A$^-$, A$^+$, and A, the smallest one in size is _____.

6. The scientist who propounded the modern periodic law is _____.

7. Across the period, ionic radii _____.

8. _____ and _____ are called inner transition elements. ✳ ✳

9. The chief ore of Aluminium is _____. ✳

10. The chemical name of rust is _____.

Ans:

1)	ionic	6)	Hendry Moseley
2)	6th period	7)	decreases
3)	Atomic number	8)	Lanthanides, and actinides
4)	0.99Å	9)	Bauxite
5)	A^+	10)	hydrated ferric oxide

III. Match the following

1. i) Galvanisation   – a) Noble gas elements   (b)
   ii) Calcination   – b) coating with Zn   (e)
   iii) Redox reaction   – c) Silver – tin amalgam   (d)
   iv) Dental filling   – d) Aluminium thermic process   (c)
   v) Group 18 elements   – e) Heating in the absence of air   (a)

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

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

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

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

4. **Al wires are used as electric cables due to their silvery white colour.**   **False**
   Al wires are used as electric cables as they are good conductor of electricity

5. **An alloy is a heterogenous mixture of metals.**   **False**
   An alloy is a homogeneous mixture of metals.

V. Assertion and Reason

Answer the following questions using the data given below:
   i) A and R are correct, R explains 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 explains A.

1. **Assertion :** The nature of bond in HF molecule is ionic.
   Reason : The electronegativity difference between H and F is 1.9.
   Ans : i) A and R are correct R explains the A

2. **Assertion :** Magnesium is used to protect steel from rusting.
   Reason : Magnesium is more reactive than iron.
   Ans : ii) A is wrong R is correct

3. **Assertion :** An uncleaned copper vessel is covered with greenish layer.
   Reason : Copper is not attacked by alkali.
   Ans : iv) A and R are correct R does not explains A

Don

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 reaction.** ✸ ✸ ✸

   - A - reddish brown metal - **Copper**
   - When copper is heated at < 1370 K in the presence of oxygen, copper forms black colour **Copper II oxide** (CuO).

   - $2Cu + O_2 \xrightarrow{below\,1370\,K} \underset{(copper\,II\,oxide)}{2CuO}$

   - When copper is heated at > 1370 K in the presence of oxygen, copper forms red colour **Copper I oxide** (Cu_2O)

   - $4Cu + O_2 \xrightarrow{above\,1370\,K} \underset{(Copper\text{-}I\text{-}oxide)}{2Cu_2O}$

   - **A – copper (Cu)**
   - **B – copper II oxide (CuO)** – Black coloured
   - **C – copper-I-oxide (Cu_2O)** – Red coloured

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.**

   - $4Al + 3O_2 \rightarrow 2Al_2O_3$ (Aluminium oxide)
   - A is Aluminium (Al)
   - B is Aluminium oxide (Al_2O_3)

3. **What is rust? Give the equation for formation of rust.** ✸ ✸ ✸

   - Rust is the formation of scaling reddish brown **hydrated ferric oxide** on the surface of iron containing materials.
   - This compound os known as rust and the phenomenon of formation of rust in know as rusting.

   - $4Fe + 3O_2 + xH_2O \rightarrow \underset{\underset{(Hydrated\,ferric\,oxide)}{(Rust)}}{2Fe_2O_3.xH_2O}$

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

   Conditions necessary for rusting of iron.

   - Iron is exposed to moist air.
   - Presence of water droplets in the atmosphere.
   - Presence of Oxygen.

VII. Long answer questions:

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

   b) Along with cryolite and alumina, another substance is added to the electrolyte.

   Addition of caustic alkali to bauxite ore:

   - Bauxite ore is finely ground and heated under pressure with a solution of concentrated caustic soda solution at 150°C to obtain sodium meta aluminate.

- On diluting sodium meta aluminate with water, a precipitate of aluminium hydroxide is formed.
- The precipitate is filtered, washed, dried and ignited at 1000ºC to get alumina.
- $2Al(OH)_3 \xrightarrow{1000ºC} Al_2O_3 + 3H_2O$
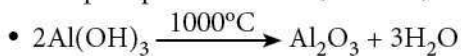
b)

- Fluorspar.
- 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. H_2SO_4 forms C and D along with water. D is a gaseous compound. Find A, B, C and D.**

- Copper gets covered with a green layer of basic **copper carbonate** in the presence of CO_2 and moisture.
- $2 Cu + O_2 + CO_2 + H_2O \rightarrow CuCO_3.Cu(OH)_2$
- Copper reacts with dil H_2SO_4 to from **copper sulphate** and SO_2
- $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 \uparrow + 2H_2O$
- So,   A is – **Copper** (Cu)

    B is – $CuCO_3. Cu(OH)_2$ Basic **copper carbonate.**

    C is – $CuSO_4$ (**copper sulphate**)

    D is – SO_2 (**Sulphur oxide**)

3. **Explain smelting process.** ★ ★ ★

    Smelting (in a Blast Furnace):

- The charge consisting of **roasted ore, coke** and **limestone** in the ratio **8:4:1** is smelted in a blast furnace by introducing it through the cup and cone arrangement at the top.
- There are **three** important regions in the furnace.
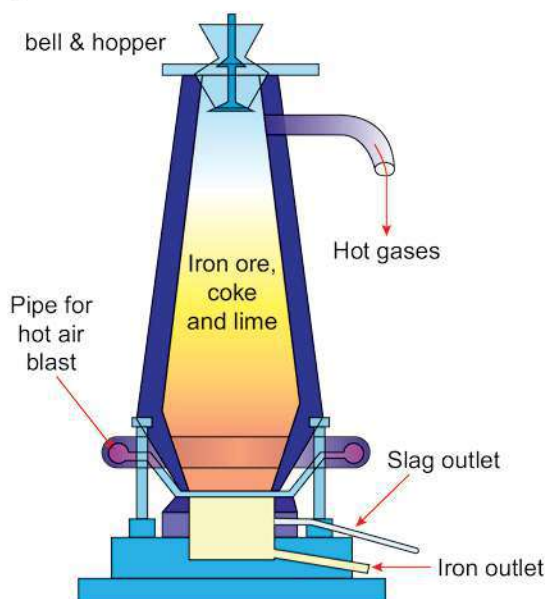
Blast Farnance

a) The Lower Region (Combustion Zone):

- The temperature is at **1500°C.**
- In this region, **coke** burns with **oxygen** to form **CO_2** when the charge comes in contact with a hot blast of air.
- It is an **exothermic reaction** since heat is liberated.

$$C + O_2 \xrightarrow[\Delta]{1500°C} CO_2 + \text{Heat}$$
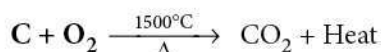
b) The Middle Region (Fusion Zone):

- The temperature prevails at **1000°C.**
- In this region, CO_2 is reduced to **CO.**

$$CO_2 + C \xrightarrow[\Delta]{1000°C} 2CO - \text{Heat}$$
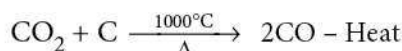
- Limestone decomposes to **calcium oxide** and **CO_2.**

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2 - \text{Heat}$$

- These two reactions are endothermic due to absorption of heat.
- Calcium oxide combines with **silica** to form **calcium silicate** slag.

$$CaO + SiO_2 \longrightarrow CaSiO_3$$
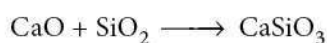
c) The Upper Region (Reduction Zone):

- The temperature prevails at **400°C.**
- In this region carbon monoxide **reduces ferric oxide** to form a fairly pure spongy iron.

$$Fe_2O_3 + 3CO \xrightarrow{400°C} 2Fe + 3CO_2$$

- The molten iron is collected at the bottom of the furnace after removing the slag.
- The iron thus formed is called **pig iron.**
- It is remelted and cast into different moulds.
- This iron is called **cast iron.**

VIII. Higher Order Thinking Skill (HOTS)

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**

- When steam is passed over red hot aluminium, **Aluminium oxide** and Hydrogen is produced.

$$2Al + \underset{\text{(steam)}}{3H_2O} \longrightarrow \underset{\text{(Aluminium oxide)}}{Al_2O_3} + 3H_2 \uparrow$$
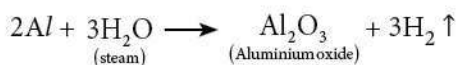
- When Aluminium react with strong caustic alkalis forming aluminate.

$$2\,Al + 2\,NaOH + 2H_2O \longrightarrow \underset{\text{(Sodium meta Aluminate)}}{2Na\,AlO_2} + 3H_2 \uparrow$$
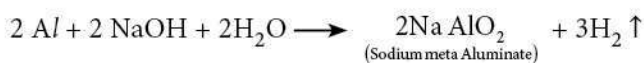
- A is **Aluminium** (Al)
- B is **Aluminium oxide** (Al_2O_3)
- C is **Sodium meta aluminate** (Na AlO_2)

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

- **Dilute or concentrated nitric acid** renders aluminum passive
- It does not attack aluminium but it forms **oxide film** on its surface.

3. a) Identify the bond between H and F in HF molecule.
   b) What property forms the basis of identification?
   c) How does the property vary in periods and in groups?

a) Ionic bond.

b) Electronegativity property.

c)

- **Along the period** from left to right in the periodic table the electronegativity **increases**, because of the increase in the nuclear charge which in turn attracts the electrons more strongly.

- On moving down a **group** the electronegativity of the element **decreases** because of the increased number of energy levels.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The atomic mass of inert gas Argon is _____ amu.
   a) 39.10
   b) 39.95
   c) 39.98
   d) 35.45

2. The vertical columns in the periodic table starting from the top to bottom are called _____
   a) groups
   b) periods
   c) levels
   d) families

3. Ionisation energy is measured in _____. ✴
   a) kJ
   b) J/kg
   c) kJ/mol
   d) kg/mol

4. The rocky impurity associated with an ore is called _____.
   a) mining
   b) matrix
   c) flux
   d) slag

5. Fluorspar is a _____ore.
   a) oxide
   b) carbonate
   c) Halide
   d) sulphide

6. _____ is a chemical formula of cuprite.
   a) $CaCO_3$
   b) CaF_2
   c) PbS
   d) Cu_2O

7. The _____ is a less reactive metals.
   a) mercury
   b) sodium
   c) Aluminium
   d) Calcium

8. Metals are usually malleable except _____.
   a) sodium
   b) aluminium
   c) mercury
   d) gold

9. The melting point of Aluminium is _____. ✴
   a) 660°C
   b) 800°C
   c) 150°C
   e) 1370°C

10. _____ is used in making aeroplanes and other industrial machine parts.
    a) Copper
    b) Iron
    c) Silver
    d) Aluminium

11. When copper reacts with dil HNO_3 _____ gas is liberated
    a) Nitric oxide
    b) sulphur oxide
    c) copper oxide
    d) carbon di oxide

12. An Amalgam is an alloy of _____ with another metal.
    a) metal
    b) non metal
    c) mercury
    d) Gold

13. _____ is used in making an electromagnets.
    a) pig iron
    b) wrought iron
    c) steel iron
    d) none of these

14. When fusing the metal by melting of zinc and copper _____ alloy is collected.
    a) brass
    b) bronze
    c) magnalium
    d) duralumin

15. _____ alloy is used to make propeller. ✴
    a) Stainless steel
    b) Duralumin
    c) Nickel steel
    d) Magnalium

Ans:

1)	b)	39.95	9)	a)	660°C
2)	a)	groups	10)	d)	Aluminium
3)	c)	kJ/mol	11)	a)	Nitric oxide
4)	b)	matrix	12)	c)	mercury
5)	c)	Halide	13)	b)	wrought iron
6)	d)	Cu_2O	14)	a)	Brass
7)	a)	mercury	15)	c)	Nickel steel
8)	c)	mercury			

II. Fill in the blanks

1. The horizontal rows are called _____ and vertical columns are called _____.

2. The largest period of periodic table contains _____ elements.

3. The _____ is the last element of periodic table.

4. The 16th group is called as _____.

5. _____ is the process of removal of impurities from the ore. ✴

6. _____ are less hard metals.

7. _____ is a silvery white metal.

8. The chief ore of copper is _____.

9. The _____ is used for making calorimeters.

10. The chief ore of iron is hematite and its molecular formula is _____.

11. The pig iron contains _____ % of carbon. ✴

12. _____ alloy is used to make pressure cookers.

13. Pamban bridge was opened in _____.

Ans:

1)	periods, groups	8)	copper pyrite
2)	32	9)	copper
3)	oganesson	10)	Fe_2O_3
4)	chalcogen family	11)	2 – 4.5
5)	concentration (or) separation	12)	Duralumin
6)	sodium and potassium	13)	1914
7)	Aluminium		

III. Match the following

1.
   i) Shortest period   – a) 32 elements   (c)
   ii) Long period   – b) 8 elements   (d)
   iii) Longest period   – c) 2 elements   (a)
   iv) Short period   – d) 18 elements   (b)

2.
   i) Boran family   – a) phosphorus   (d)
   ii) Carbon family   – b) Iodine   (e)
   iii) Nitrogen family   – c) sulphur   (a)
   iv) Chalcogen family   – d) Aluminium   (c)
   v) Halogens   – e) silicon   (b)

3.
   i) Removal of impurities from ore   – a) Mining ★   (b)
   ii) Converion of ore into metal   – c) Concentration   (d)
   iii) Purification of metal   – d) Smelting   (e)
   iv) Extracting the ore from earth's crust   – d) Production   (a)
   v) Reducing the roasted metallic oxide from metal in molten condition   – e) Refining   (c)

4.
   i) Brass   – a) Aircrafts   (d)
   ii) Bronze   – b) Scientific instruments   (f)
   iii) Duralumin   – c) Automobile parts   (a)
   iv) Magnalium   – d) Medal   (b)
   v) Stainless steel   – e) Propeller   (c)
   vi) Nickel steel   – f) Statues   (e)

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

1. **The shortest period contains only eight elements.**
   The shortest period contains only two elements (or)
   The short period contains only eight elements.   **False**

2. **In the periodic table 18th group is called as Halogens.** ★
   In the periodic table 18th group is called as Noble gases.   **False**

3. **The ionisation energy decreases down the group in the periodic table.**   **True**

4. **The process of extracting the ores from the Earth crust is called smelting.**

The process of extracting the ores from the Earth's crust is called <u>mining</u>.   **False**

5. **The lighter ores are concentrated by froth floatation method.**   **True**

6. **Metals high density except sodium and potassium.**   **True**

7. **Blister copper contains 2% of pure copper 98% of impurities.** ✴

Blister copper contains <u>98%</u> of pure copper and <u>2%</u> of impurities.   **False**

8. **Copper is a reddish brown metal with low melting point of 100°C.**

Copper is a reddish brown metal with high melting point of 1356°C   **False**

V. Assertion and 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 explains A.

1. **Assertion :** In the modern periodic table sixth period is the longest period.
Reason : It contains 32 elements from Caesium to Radon.

    Ans : iv) A and R are correct R explains the A

2. **Assertion :** The lanthanides and actinides are called inner transition elements.
Reason : In the modern periodic table lanthanam to lutinum elements are called as lanthanides.

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

3. **Assertion :** The process of extracting the ores from the earth's crust is called mining. ✴
Reason : The rocky impurity associated with an ore is called slag.

    Ans : ii) A is correct, R is wrong.

4. **Assertion :** Cryolite is an oxide ore.
Reason : Cryolite molecular formula is Na_2AlF_6.

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

5. **Assertion :** Metals are usually malleable. ✴
Reason : They can be beaten into thin sheets without cracking.

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

6. **Assertion :** Iron is a lustrous metal, greyish white in colour.
Reason : Iron can be magnetized.

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

VI. Find the Odd one out:

1. **a) Helium, Neon, Silicon, Argon.**
   b) Magnesium, Aluminium, Copper, Carbon.

    Ans: a) Silicon
           b) Carbon.

2. a) **Bauxite, Cryolite, Cuprite, Haematite**
   b) **Fluorspar, Galena, Iron pyrite, Zinc blende**
   Ans: a) Cryolite
   b) Fluorspar

3. a) **Brass, Bronze, Nickel, Magnalium**
   b) **Galvanisation, Froth floatation, Electroplating, Anodizing**
   Ans: a) Nickel
   b) Froth floatation

VII. Short answer questions

1. Define – atomic radius.

Atomic radius is defined as the distance between the centre of its nucleus and the outermost shell containing the valence electron.

2. Define – Covalent radius.

It is defined as half the distance between the nuclei of two covalently bonded atoms of the same element in a molecule.

3. Define – Ionisation Energy. ✦ ✦

Ionisation energy is the **minimum energy** required to remove an electron from a gaseous atom in its ground state to or a cation. It is otherwise called as **ionisation enthalpy**.

4. What is electron affinity? ✦ ✦

Electron affinity is the amount of **energy released** when a gaseous atom gains an electron to form its anion. It is represented by

$$Cl_{(g)} + e^- \rightarrow Cl^-_{(g)} + energy$$
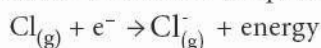
5. Define – Metallurgy.

Metallurgy is a science of **extracting metals** from their ores and modifying the metals into alloys for various uses based on their physical and chemical properties and their structural arrangement of atoms.

6. Name the metallurgical process.

- Concentration or separation of the ore
- Production of the metal
- Refining of the metal

7. Define – Ore.

The mineral from which a metal can be readily and economically extracted on a large scale is said to be an ore

Ex: Clay ($Al_2O_3. 2SiO_2. 2H_2O$)

8. Give the principle of froth floatation.

- This process depends on the **preferential wettability** of the ore with oil and the gangue particles by water.
- Lighter ores such as sulphide ores are separated by this method.

9. Give any four physical properties of Aluminium.

- It is a **silvery white metal.**
- It is a **good conductor** of heat and electricity.
- It is **malleable** and **ductile**.
- It is **low density** and it is light.

10. What is aluminothermic process? ✳

- Mixture of **Aluminium powder** and **iron oxide** when ignited, the latter is reduced to metal
- This process is known as aluminothermic process.

11. List out the uses of Aluminium.

- It is used in household utensils.
- It is used in electrical cable industry.
- It is used in making aeroplanes.
- It is used in industrial machine parts.

12. List the physical properties of Iron.

- It is a lustrous metal.
- It is of greyish white in colour.
- It has high tensility, malleability and ductility.
- It can be magnetized.

VIII. Long answer questions:

1. Give the features of periods in the modern periodic table.

- The **horizontal rows are called periods**. There are **seven** periods in the periodic table.
- **First period** (Atomic number 1 and 2): This is the shortest period. It contains only two elements (Hydrogen and Helium).
- **Second period** (Atomic number 3 to 10): This is a short period. It contains eight elements (Lithium to Neon).
- **Third period** (Atomic number 11 to 18): This is also a short period. It contains eight elements (Sodium to Argon).
- **Fourth period** (Atomic number 19 to 36): This is a long period. It contains eighteen elements (Potassium to Krypton). This includes 8 normal elements and 10 transition elements.
- **Fifth period** (Atomic number 37 to 54): This is also a long period. It contains 18 elements (Rubidium to Xenon). This includes 8 normal elements and 10 transition elements.
- **Sixth period** (Atomic number 55 to 86): This is the longest period. It contains 32 elements (Caesium to Radon). This includes 8 normal elements, 10 transition elements and 14 inner transition elements (Lanthanides).
- **Seventh period** (Atomic number 87 to 118): Like the sixth period, this period also accommodates 32 elements. Recently 4 elements have been included by IUPAC.

2. Give the features of groups in the modern periodic table.

- The vertical columns in the periodic table starting from top to bottom are called **groups.** There are **18 groups** in the periodic table.
- Based on the common characteristics of elements in each group, they can be grouped as various families.

Group Number	Family
1	Alkali Metals
2	Alkaline earth metals
3 to 12	Transition metals
13	Boron Family
14	Carbon Family
15	Nitrogen Family
16	Oxygen Family (or) Chalcogen family
17	Halogens
18	Noble gases

- The Lanthanides and Actinides, which form part of Group 3 are called **inner transition elements**.
- **Except 'group 0'**, all the elements present in each group have the same number of electrons in their valence shell and thus have the same valency.
- For example, all the elements of **group 1** have one electron in their valence shells ($1s^1$). So, the valency of all the alkali metal is '1'.
- As the elements present in a group have **identical** valence shell electronic configurations, they possess similar chemical properties.
- The physical properties of the elements in a group such as melting point, boiling point and density vary gradually.
- The atoms of the **'group 0'** elements have stable electronic configuration in their valence shells and hence they are unreactive

3. List any five physical properties of metal

Physical state:

- All metals are solids at room temperature except mercury and gallium.

Lustre:

- Metals possess a high lustre (called metallic lustre).

Hardness:

- Most of the metals are hard and strong (exceptions: sodium and potassium can be cut with a knife)

Melting point and Boiling point:

- Usually, metals possess high melting and boiling points and vaporize only at high temperatures (exceptions: gallium, mercury, sodium and potassium).

Density:

- Metals have a high density (exceptions: sodium and potassium are less dense than water).

Ductility:

- Metals are usually ductile. In other words, they can be drawn into thin wires without breaking.

4. How Aluminium extracted from Bauxite? ✵ ✵

- Bauxite is the chief ore of aluminium. The extraction of aluminium from bauxite involves two steps:

Conversion of bauxite into alumina – Baeyer's Process:

- The conversion of Bauxite into Alumina involves the following steps:
- Bauxite ore is finely ground and heated under pressure with a solution of concentrated caustic soda solution at **150° C** to obtain sodium meta aluminate.
- On diluting sodium meta aluminate with water, a precipitate of **aluminium hydroxide** is formed.
- The precipitate is filtered, washed, dried and ignited at **1000°C** to get alumina.

Electrolytic reduction of alumina – Hall's Process:

- Aluminium is produced by the electrolytic reduction of fused alumina (Al_2O_3) in the electrolytic cell.

Cathode::

- Iron tank lined with **graphite**.

Anode:

- A bunch of **graphite rods** suspended in molten electrolyte.

Electrolyte:

- Pure alumina+ molten cryolite + fluorspar (fluorspar lowers the fusion temperature of electrolyte)

$$2Al(OH)_3 \xrightarrow{1000°C} Al_2O_3 + 3H_2O$$
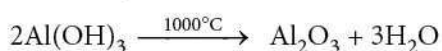
Temperature:

- 900 - 950 °C

Voltage used:

- 5-6 V

Overall reaction:

- $2\ Al_2O_3 \rightarrow 4\ Al + 3\ O_2 \uparrow$

Electrolytic process of manufacturing aluminum
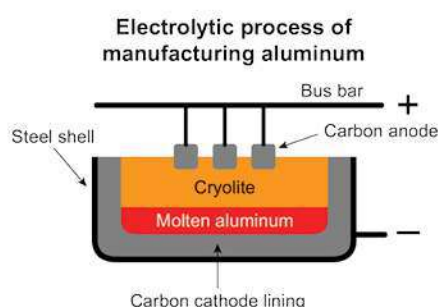
- **Aluminium** is deposited at the **cathode** and **oxygen** gas is liberated at the **anode**.
- Oxygen combines with graphite to form CO_2.

5. Explain the methods of copper extracted from copper pyrite. ✶

- The chief ore of copper is copper pyrite.
- It yields nearly **76%** of the world production of copper. Extraction of copper from copper pyrites involves the following steps.

Concentration of ore:

- The ore is crushed and then concentrated by **froth floatation process.**

Roasting:

- The concentrated ore is roasted in excess of air.
- During the process of roasting, the moisture and volatile **impurities** are removed.
- Sulphur, phosphorus, arsenic and antimony are removed as oxides.
- Copper pyrite is partly converted into sulphides of copper and iron.
- $2\ CuFeS_2 + O_2 \longrightarrow Cu_2S + 2\ FeS + SO_2 \uparrow$

Smelting:

- The roasted ore is mixed with powdered coke and sand and is heated in a blast furnace to obtain matte **(Cu_2S + FeS)** and slag.
- The slag is removed as **waste.**

Bessemerisation:

- The molten matte is transferred to **Bessemer converter** in order to obtain blister copper.
- Ferrous sulphide from matte is oxidized to ferrous oxide, which is removed as slag using silica.

$$2\ FeS + 3\ O_2 \longrightarrow 2\ FeO + 2\ SO_2 \uparrow$$

$$FeO + SiO_2 \longrightarrow FeSiO_3 \text{ (slag)}$$
$$\text{(Iron silicate)}$$

$$2\ Cu_2S + 3O_2 \longrightarrow 2\ Cu_2O + 2\ SO_2 \uparrow$$

$$2\ Cu_2O + Cu_2S \longrightarrow 6\ Cu + SO_2 \uparrow$$
$$\text{(Blister copper)}$$
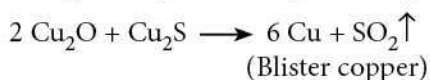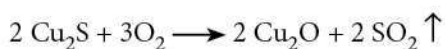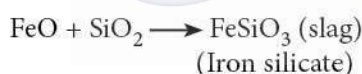
Refining:

- Blister copper contains **98%** of pure copper and **2%** of impurities and is purified by **electrolytic refining**.
- This method is used to get metal of a high degree of purity.
- For electrolytic refining of copper, we use:

Cathode:

- A thin plate of **pure copper metal.**

Anode:

- A block of **impure copper metal.**

Electrolyte:

- Copper sulphate solution **acidified** with sulphuric acid.
- When electric current is passed through the electrolytic solution, **pure copper** gets deposited at the **cathode** and the **impurities** settle at the bottom of the **anode** in the form of **sludge** called **anode mud.**

IX. Higher Order Thinking Skill (HOTS)

1. **The element (A) has the melting point is 660°C. It reacts with dilute acid (B) and liberates hydrogen gas. When concentrated Sulphuric acid is combined with (A), it gives C and D with sulphur di oxide. Find A, B, C, D and write the equation.**

   - A is Aluminium (Al)
   - B is dilute sulphuric acid (H_2SO_4)
   - C is Aluminium sulphate ($Al_2(SO_4)_3$)
   - D is water (H_2O)

   Equation:

   - $2\,Al + 6\,H_2SO_4 \rightarrow Al_2(SO_4)_3 + 6\,H_2O + 3SO_2 \uparrow$
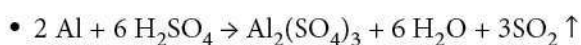
2. **The following Elements A, B, C, D are combine to form alloy E. It is used to make aircrafts and pressure cooker. Find A, B, C, D, E.**

   - A is Aluminium (Al)
   - B is Magnesium (Mg)
   - C is Manganese (Mn)
   - D is Copper (Cu)
   - E is Duralumin, Alloy

Unit Test -8

Periodic Classification of Elements

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. The number of periods and groups in the periodic table are_____.
   a) 6,16   b) 7,17   c) 8,18   d) 7,18

2. _____ group contains the member of halogen family.
   a) 17th   b) 15th   c) 18th   d) 16th

3. Chemical formula of rust is _____.
   a) $FeO.xH_2O$ b) $FeO_4.xH_2O$ c) $Fe_2O_3.xH_2O$ d) FeO

4. The process of coating the surface of metal with a thin layer of zinc is called_____.
   a) painting   b) thinning   c) galvanization   d) electroplating

5. The vertical columns in the periodic table starting from the top to bottom are called _____.
   a) groups   b) periods   c) levels   d) families

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. List out the periodic properties.
2. Define – atomic radius.
3. Define – Covalent radius.
4. What is electron affinity?
5. Give the uses of Copper.

III. Answer the following questions in brief.   2 × 4 = 8

1. Give the features of periods in the modern periodic table.
2. i) Give the types of ore with an example.
   ii) Name the acid that renders aluminium passive. Why?

IV. Answer the following questions in detail.   1 × 7 = 7

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

- Polar compounds are soluble in polar solvents.
- Non-polar compounds are soluble in non-polar solvents.
- In endothermic process, solubility of solid solute increases with increase in temperature.
- In exothermic process, solubility of solid solute decreases with increase in temperature.
- Solution : Homogeneous mixture of two or more substances
- Solute : Present lesser amount in a solution
- Solvent : Present larger amount in a solution.
- Water : " Universal solvent"
- Aqueous solution : Water acts as a solvent
- Non – aqueous solution : Other than water as a solvent
- Saturated solution : Solution in which no more solute can be dissolved in a definite amount of solvent.
- Unsaturated solution : Solution contains less solute than that of the saturated solution
- Super saturated solution : Solution that contains more solute than the saturated solution
- Factors affecting solubility : Nature of solute and solvent, temperature, pressure.
- Concentration : The quantity of solute in a solution
- Hydrated salts : Blue vitriol, Epsom salt, Green vitriol.
- $CuSO_4.5H_2O$: Copper Sulphate pentahydrate (Blue vitriol)
- $MgSO_4.7H_2O$: Magnesium sulphate hepta hydrate
- Hygroscopy : Substance exposed to the atmosphere air at ordinary temperature absorb moisture without changing their physical state.
- Hygroscopic substances : Quick lime, Silica gel, Phosphorous pentoxide.
- Deliquescent substances : Calcium chloride, caustic soda, Ferric chloride

Formulae

Solubility	$\dfrac{\text{mass of the solute}}{\text{mass of the solvent}} \times 100$
Mass Percentage	$\dfrac{\text{mass of the solute}}{\text{mass of the solution}} \times 100$
Volume Percentage	$\dfrac{\text{volume of the solute}}{\text{volume of the solute} + \text{volume of solvent}} \times 100$

MIND MAP

Don

Solvent + Solute → Solution

Solution → Solubility → Factors affecting → Nature, Temperature, Pressure

Solution → Concentration of the Solution → Mass percent, Volume percent

Solvent + Solute → Salt → Hydrated salt, Hygroscopy, Deliquescence

Hydrated salt → Blue vitriol, Epsom salt, White vitriol, Gypsum

Solution → Binary, Ternary

Solution → Types of solution

Types of solution → Physical state Based on solute and solvent → Solid Solution, Liquid Solution, Gaseous Solution

Types of solution → Based on type of solute → Diluted, Concentrated, Super saturated, Unsaturated, Saturated

Types of solution → Based on type of solvent → Aqueous, Non aqueous

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. A solution is a _____ mixture. ✶ ✶
   a) Homogeneous
   b) Heterogeneous
   c) Homogeneous and heterogeneous
   d) Non homogeneous

2. The number of components in a binary solution is _____
   a) 2
   b) 3
   c) 4
   d) 5

3. Which of the following is the universal solvent? ✶ ✶ ✶
   a) Acetone
   b) Benzene
   c) Water
   d) Alcohol

4. 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

5. Identify the non-aqueous solution.
   a) Sodium chloride in water
   b) Glucose in water
   c) Copper sulphate in water
   d) Sulphur in carbon-di-sulphide

6. When pressure is increased at constant temperature the solubility of gases in liquid _____.
   a) no change
   b) increases
   c) decreases
   d) no reaction

7. 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) 12g
   b) 11g
   c) 16g
   d) 20g

8. A 25% alcohol solution means
   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

9. Deliquescence is due to _____ ✶ ✶
   a) strong affinity to water
   b) less affinity to water
   c) strong hatred to water
   d) inertness to water

10. Which of the following is hygroscopic in nature?
    a) Ferric chloride
    b) Copper sulphate penta hydrate
    c) Silica gel
    d) None of the above

Ans:

1.	a)	Homogeneous	6.	b)	Increases
2.	a)	2	7.	b)	11 g
3.	c)	Water	8.	c)	25 ml alcohol in 75 ml of water
4.	a)	Saturated solution	9.	a)	Strong affinity to water
5.	d)	Sulphur in carbon di sulphide	10.	c)	Silica gel

II. Fill in the blanks:

1. The component present in lesser amount, in a solution is called _____
2. Example for liquid in solid type of solution is _____ ✦ ✦ ✦
3. Solubility is the amount of solute dissolved in _____ g of solvent.
4. Polar compounds are soluble in _____ solvents
5. Volume percentage decreases with increases in temperature because _____ ✦ ✦

Ans:

1.	Solute	4.	Polar
2.	Amalgam (or) mercury with sodium	5.	of expansion of liquid
3.	100		

III. Match the following:

1.
1. Blue vitriol   – a) $CaSO_4.2H_2O$ (c)
2. Gypsum   – b) CaO (a)
3. Deliquescence   – c) $CuSO_4.5H_2O$ (d)
4. Hygroscopic   – d) $NaOH$ (b)

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.
   (or)
   In a solution the component which is present in more amount is called solvent.

3. **Sodium chloride dissolved in water forms a non-aqueous solution.**   **False**
   Sodium chloride dissolved in water forms an aqueous solution.

4. **The molecular formula of green vitriol is $MgSO_4.7H_2O$**   **False**
   The molecular formula of green vitriol is $FeSO_4.7H_2O$

5. **When Silica gel is kept open, it absorbs moisture from the air, because it is hygroscopic in nature.**   **True**

V. Short answer questions:

1. **Define the term: Solution.** ✦ ✦ ✦
   - A solution is a **homogeneous mixture** of two or more substance.
     E.g: Sea water.
   - In a solution, the component present in **lesser** amount by weight is called a **solute**.
   - The component present in a **larger** amount by weightis called a **solvent**.

2. What is meant by binary solution?

- A solution must at least be consisting of **two components** a solute and a solvent.
- Such solution which are made of **one solute** and **one solvent** (two components) are called binary solution.
- **E.g:** Addition of copper sulphate crystals to 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 – CO_2 dissolved in water

  ii) solid in liquid – NaCl dissolved in water

  iii) solid in solid – Copper dissolved in Gold

  iv) gas in gas – Mixture of Helium-oxygen gases

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

Aqueous solution:

- The solution in which **water** acts as a **solvent** is called aqueous solution.
- **Example:** Salt in **water**

Non-aqueous solution:

- The solution in which **any liquid** other than water acts as a solvent is called non-aqueous solution.
- **Example:** Sulphur dissolved in carbon di sulphide.

5. Define Volume percentage. ✹✹

- Volume percentage is defined as 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?

- Aquatic animals live more in cold regions.
- More amount of **dissolved oxygen** is present in the water of cold regions.
- This shows that the **solubility of oxygen** in water is **more** at low pressure.

7. Define Hydrated salt. ✹ ✹ ✹

- Ionic substances crystallize out from their **saturated aqueous solution** with a definite **number of molecules** of water.
- The number of water molecules found in the substance is called **water of crystallization.**
- Such salts are called **hydrated salts.**
- E.g: Blue vitriol - $CuSO_2.5H_2O$

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

- The number of water molecule in blue vitriol is **five**.
- The hot saturated solution of copper sulphate has **no water molecule**.
- When cooled the hot saturated solutions **gain five molecules** of water and it will **turn to crystal**.

9. **Classify the following substances into deliquescent, hygroscopic. Conc. Sulphuric acid, Copper sulphate pentahydrate, Silica gel, Calcium chloride, and Gypsum salt.**

Deliquescent	Hygroscopic
Copper sulphate pentahydrate, Calcium chloride, Gypsum salt.	Conc. Sulphuric acid, Silica gel.

VI. Long answer questions:

1. Write notes on i) saturated solution ii) unsaturated solution. ✶ ✶

i. Saturated solution:

- A solution in which **no more solute** can be dissolved in a definite amount of the **solvent** at a **given temperature** is called saturated solution.
- E.g. 36 g of sodium chloride in 100 g of water at 25°C forms saturated solution.
- Further addition of sodium chloride, leaves it **undissolved**.

ii. Unsaturated solution:

- Unsaturated solution is one that contains **less solute** than that of the saturated solution at a given temperature.
- E.g. 10 g or 20 g or 30 g of Sodium chloride in 100 g of water at 25°C forms an unsaturated solution.

2. Write notes on various factors affecting solubility. ✶ ✶ ✶

There are three main factors which govern the solubility of a solute. They are:

- Nature of the solute and solvent
- Temperature
- Pressure

Nature of the solute and solvent:

- The nature of the solute and solvent plays an important role in solubility.
- Although water dissolves an enormous variety of substances, both **ionic** and **covalent**, it does not dissolve everything.
- The phrase that scientists often use when predicting solubility is **"like dissolves like."**
- This expression means that dissolving occurs when **similarities** exist between the solvent and the solute.
- **For example:** Common salt is a polar compound and dissolves readily in polar solvent like water.
- Non-polar compounds **are soluble** in non-polar solvents. For example, Fat dissolved in ether.
- But non-polar compounds, **do not dissolve** in polar solvents; polar compounds do not dissolve in non-polar solvents.

Effect of Temperature:
Solubility of Solids in Liquid:

- Generally, solubility of a solid solute in a liquid solvent increases with increase in temperature.
- For example, a greater amount of 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.

Solubility of Gases in liquid:

- Solubility of gases in liquid **decrease** with increase in temperature.
- Generally, water contains dissolved oxygen.
- When water is boiled, the solubility of oxygen in water decreases, so oxygen escapes in the form of bubbles.
- Aquatic animals live more in cold regions because, more amount of dissolved oxygen is present in the water of cold regions.
- This shows that the solubility of oxygen in water is more at low temperatures.

Effect of Pressure:

- Effect of pressure is observed only in the case of solubility of a gas in a liquid.
- When the pressure is increased, the solubility of a **gas** in **liquid increases.**
- The common examples for solubility of gases in liquids are carbonated beverages, i.e. soft drinks, household cleaners containing aqueous solution of ammonia, formalin aqueous solution of formaldehyde, etc.

3. **a) What happens when $MgSO_4.7H_2O$ is heated? Write the appropriate equation.**
   b) Define solubility.

   a) $MgSO_4.7H_2O$ heating process:

- Its water of crystallization is 7.
- When magnesium sulphate heptahydrate crystals are gently heated, it loses **seven water molecules**, and becomes **anhydrous magnesium sulphate.**

$$\underset{\substack{\text{(magnesium sulphate} \\ \text{hepta hydrate)}}}{MgSO_4.7H_2O} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftarrows}} \underset{\substack{\text{(Anhydrous Magnesium} \\ \text{sulphate)}}}{MgSO_4 + 7H_2O}$$
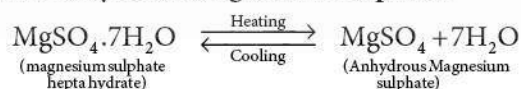
- If you add few drops of water or allow it to cool, the colourless anhydrous salt again turns back into hydrated salt.

   b) Solubility:

- Solubility is defined as the number of grams of a **solute** that can be dissolved in **100 g** of a **solvent** to form its saturated **solution** at a given temperature and pressure.

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

Hygroscopic substances	Deliquescence substances
When exposed to the atmosphere at ordinary temperature, they **absorb moisture** and **do not dissolve.**	When exposed to the atmospheric air at ordinary temperature, they **absorb moisture** and **dissolve**.
Hygroscopic substances **do not change** its physical state on exposure to air.	Deliquescent substances **change** its physical state on exposure to air.
Hygroscopic substances may be **amorphous solids** or liquids.	Deliquescent substances are **crystalline** solids.

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

Given,   mass of solute = 45 g

mass of solvent = 180 g

Mass of percentage = ?

Formula used:

Mass percentage

$$= \frac{\text{mass of solute}}{\text{mass of solute} + \text{mass of solvent}} \times 100$$

$$\text{Mass percentage} = \frac{\text{mass of solute}}{\text{mass of solute} + \text{mass of solvent}} \times 100$$

$$= \frac{45}{45 + 180} \times 100 = \frac{4500}{225}$$

Mass percentage = 20%

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

Given, Volume of ethanol = 3.5 lit

Volume of aqueous ethanol solution = 1.5 lit

Volume percent ethanol solution = ?

Formula used:

Volume percentage

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

$$\text{Volume percentage} = \frac{\text{volume of the solute}}{\text{volume of the solution}} \times 100$$

$$= \frac{3.5}{15} \times 100 = \frac{350}{15}$$

Volume percentage = 23.33 %

VII. Higher Order Thinking Skill (HOTS)

1. **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?**

• Vinu will get faster dissolution of sugar.

• Temperature is one of the factors.

• It will affect the solubility of a solute in a liquid.

• Solvent increases with increase in temperature.

2. **'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.**

• 'A' is copper sulphate pentahydrate ($CuSO_4.5H_2O$)

• 'B' is Anhydrous copper sulphate ($CuSO_4$)

$$CuSO_4.5H_2O \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} CuSO_4 + 5H_2O$$
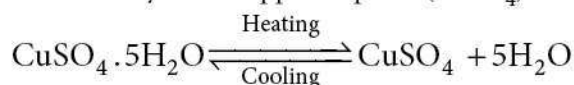
(Copper sulphate   (Anhydrous copper
Penta hydrate)   sulphate)

3. **Will the cool drinks give more fizz at top of the hills or at the foot? Explain**

• Cool drinks give more fizz at the foot of mountain because the atmospheric pressure is less at the top of the mountain.

• So the pressure affects the fizz of the cool drink.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. _____ is the human activity involved in the formation of solution with water.
   a) Dancing   b) Fighting   c) Cleaning   d) Laughing

2. The _____ is a solvent.
   a) Aerated drinks   b) Fruit juice   c) Tea   d) Water

3. In a solution the component which is present in lesser amount is called _____. ✸
   a) Solute   b) Solvent   c) Mixture   d) Solution

4. The process of uniform distribution of solute with solvent is called _____.
   a) binary solution   b) ternary solution
   c) dissolution   d) colloidal solution

5. Cloud is the example of _____ binary solution.
   a) Gas - Gas   b) Liquid – Gas   c) Gas – Liquid   d) Liquid – liquid

6. _____ is a solid – liquid binary solution.
   a) Aqueous solution of ethanol   b) Soda water
   c) Salt water   d) Water vapour

7. 40 g of sodium chloride in 100 g of water at 25°C forms _____ solution. ✸
   a) Saturated   b) Unsaturated   c) Supersaturated   d) Ternary

8. More amount of dissolved _____ is present in the water of cold regions.
   a) oxygen   b) carbon dioxide   c) sulphur   d) chlorine

9. Green vitriol has _____ water molecules in it.
   a) Two   b) Five   c) Seven   d) Three

10. Among the following _____ is a deliquescent substance.
    a) Quick lime   b) Caustic soda   c) Silica gel   d) Con. Sulphuric acid

Ans:

1.	c)	Cleaning	6.	c)	Salt water
2.	d)	Water	7.	c)	Super saturated
3.	a)	Solute	8.	a)	Oxygen
4.	c)	Dissolution	9.	c)	Seven
5.	b)	Liquid – Gas	10.	b)	Caustic soda

II. Fill in the blanks:

1. One of the naturally existing solutions is _____ water.

2. The component which is present in larger amount is called _____ ✸

3. The ternary solution has _____ components.

4. _____ is the mixture of gases in gas – gas type of binary solution.

5. _____ is a non-aqueous solution.

6. Non polar compounds are soluble in _____ solvents.

7. In _____ process solubility increases with increase in temperature.

8. The quantity of the solute in a solution is termed as _____.

9. The IUPAC name of white vitriol is _____.

10. The common name of magnesium sulphate heptahydrate is ___ ✶

11. _____ is the best example of hygroscopy.

12. _____ substances are crystalline solids.

Ans:

1.	Sea	7.	Endothermic
2.	Solvent	8.	Concentration
3.	Three	9.	Zinc sulphate heptahydrate
4.	Helium – oxygen	10.	Epsom salt
5.	Iodine dissolved in carbon di sulphide	11.	P_2O_5
6.	Non – polar	12.	Deliquescent

III. Match the following:

1. 1) Liquid solid   – a) Soda water   (c)
    2) Liquid liquid   – b) Cloud   (e)
    3) Gas liquid   – c) Amalgam   (a)
    4) Liquid Gas   – d) Mixture of Helium-oxygen gas   (b)
    5) Gas Gas   – e) Ethyl alcohol dissolved in water   (d)

2. 1) Binary solution   – a) Three components   (c)
    2) Ternary solution   – b) Sulphur dissolved in carbon di sulphide   (a)
    3) Aqueous solution   – c) 2 Components   (d)
    4) Non aqueous solution   – d) Common salt in water   (b)

3. 1) Calcium carbonate   – a) 48 grams   (d)
    2) Sodium chloride   – b) 80 grams   (c)
    3) Ammonia   – c) 36 grams   (a)
    4) Glucose   – d) 0.0013 grams   (e)
    5) Sodium hydroxide   – e) 91 grams   (b)

4. 1) Copper sulphate pentahydrate   – a) $FeSO_4.7H_2O$ ✶   (c)
    2) Magnesium sulphate heptahydrate – b) $ZnSO_4.7H_2O$ (e)
    3) Calcium sulphate dihydrate   – c) $CuSO_4.5H_2O$ (d)
    4) Iron (II) sulphate heptahydrate   – d) $CaSO_4.2H_2O$ (a)
    5) Zinc sulphate heptahydrate   – e) $MgSO_4.7H_2O$ (b)

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

1. **Benzene is called as universal solvent**   **False**
   Water is called as universal solvent.

2. **The solution in which water acts as a solvent called non-aqueous solution**   **False**
   The solution in which water acts as a solvent is called aqueous solution.

3. **Unsaturated solution is one that contains more solute than the saturated solution at a given temperature.** ✴   **False**
   Super saturated solution is one that contains more solute than the saturated solution at a given temperature.

4. **Water dissolves an enormous variety of substances both ionic and covalent.**   **True**

5. **Fat is soluble in water.**   **False**
   Fat is soluble in ether.

6. **Polar compounds are soluble in non-polar solvents.** ✴   **False**
   Polar compounds are not soluble in non polar solvents.

7. **Solubility of a solid solute in a liquid solvent increases with decrease in temperature**   **False**
   Solubility of a solid solute in a liquid solvent increases with increase in temperature.

8. **In endothermic process solubility decreases with increase in temperature.**   **False**
   In exothermic process solubility decreases with increase in temperature.

9. **The number of water molecule in blue vitriol is seven.**   **False**
   The number of water molecule in blue vitriol is five.

VI. Short answer questions:

1. **Air is the naturally existing solution. Why?**
   - It is a mixture of gases like nitrogen, oxygen, carbon dioxide, and other gases.
   - So, it is called as naturally existing solution.

2. **Define Ternary solution.**
   - In some, solution is made up of **three components.**
   - This solution is known as ternary solution.
   - Ex: Salt, sugar are dissolved with water in a beaker.

3. **Differentiate aqueous and non-aqueous solution.** ✴ ✴

S.No.	Aqueous solution	Non-Aqueous solution
1.	**Water** acts as a solvent.	Any liquid **other than water** acts as a solvent.
2.	**Example:** Common salt in water	**Example:** Sulphur dissolved in carbondisulphide.

4. **Give the factors affecting the solubility.**
   Three main factors which affect the solubility are:
   - Nature of the solute and solvent
   - Temperature
   - Pressure

5. Why does it bubble when water is boiled? ✹

- Water contain dissolved oxygen.
- When water is boiled the solubility of oxygen in water decreases.
- So oxygen escape in the form of bubbles.

6. Define mass of percentage. ✹ ✹

- It is defined as the **percentage by mass** of the solute present in a solution.

- $$\text{Mass percentage} = \frac{\text{mass of solute}}{\text{mass of solute} + \text{mass of solvent}} \times 100$$

7. Write Henry's law. ✹ ✹

Henry's law states that the solubility of a gas in a liquid is directly proportional to the pressure of the gas over the solution at a definite temperature.

8. Define – Hygroscopy.

- Certain substance when exposed to the atmospheric air at ordinary temperature absorb moisture without changing their physical state.
- This property is called as hygroscopy.

9. Define – deliquescence. ✹

- Certain substances which are so hygroscopic, when exposed air at ordinary temperature it **absorbs enough water** and gets completely dissolved.
- This property is called **deliquescence**.

VII. Long answer questions:

1. Describe types of solution based on
   a) Physical state of the solute and the solvent
   b) Type of solvent. ✹

a)

- We know that substances normally exist in three physical states (phases) i.e., solid, liquid and gas.
- In binary solutions, both the solvent and solute may exist in any of these physical states.
- But the solvent constitutes the major part of the solution.
- Its physical state is the primary factor which determine the characteristics of the solution.
- Therefore, there are different types of **binary solutions** as listed in Table.

Solute	Solvent	Example
Solid solution		
Solid	Solid	Copper dissolved in gold (Alloys)
Liquid	Liquid	Mercury with sodium (amalgam)
Liquid solution		
Solid	Liquid	Sodium chloride dissolved in water
Liquid	Liquid	Ethyl alcohol dissolved in water

Solute	Solvent	Example
Gas	Liquid	Carbon-di-oxide dissolved in water (Soda water)
Gaseous solution		
Liquid	Gas	Water vapour in air (cloud)
Gas	Gas	Mixture of Helium-Oxygen gases

b)

- Most of the substances are soluble in water.
- That is why, water is called as 'Universal solvent".
- However some substances do not dissolve in water.
- Therefore, other solvents such as ethers, benzene, alcohol, etc., are used to prepare a solution.
- On the basis of type of solvent, solutions are classified into two types.
- They are **aqueous solutions** and **non-aqueous solutions.**

Aqueous solution:

- The solution in which **water acts as a solvent** is called aqueous solution.
- In general, ionic compounds are soluble in water and form aqueous solutions more readily than covalent compounds.
- **E.g.** Common salt in water, Sugar in water, Copper sulphate in water, etc.

Non – Aqueous solution:

- The solution in which any liquid, **other than water,** acts as a solvent is called non-aqueous solution.
- Solvent other than water is referred to as non-aqueous solvent.
- Generally, alcohol, benzene, ether, carbon di sulphide, acetone, etc., are used as non-aqueous solvents.
- **Examples for non-aqueous solutions:** Sulphur dissolved in carbon di sulphide, Iodine dissolved in carbon tetrachloride.

Unit Test -9

Solutions

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   **5 × 1 = 5**

1. The number of components in a binary solution is _____
   a) 2   b) 3   c) 4   d) 5

2. Which of the following is the universal solvent?
   a) Acetone   b) Benzene   c) Water   d) Alcohol

3. When pressure is increased at constant temperature the solubility of gases in liquid _____.
   a) No change   b) Increases   c) Decreases   d) No reaction

4. 40 g of sodium chloride in 100 g of water at 25°C forms _____ solution.
   a) Saturated   b) Unsaturated   c) Supersaturated   d) Ternary

5. Among the following _____ is a deliquescent substance.
   a) Quick lime   b) Caustic soda   c) Silica gel   d) Con. Sulphuric acid

II. Answer the following questions in one or two lines.   **5 × 2 = 10**

1. What is meant by binary solution?
2. Define Volume percentage.
3. Define Hydrated salt.
4. Define – Hygroscopy.
5. List some examples of deliquescent substance.

III. Answer the following questions in brief.   **2 × 4 = 8**

1. What happens when $MgSO_4.7H_2O$ is heated? Write the appropriate equation.
2. Describe types of solution based on physical state of the solute and the solvent.

IV. Answer the following questions in detail.   **1 × 7 = 7**

1. i) Define Hydrated salt.
   ii) 3.5 litres of ethanol is present in 15 liters of aqueous solution of ethanol. Calculate volume percent of ethanol solution.

Types of Chemical Reactions

- A change may happen spontaneously or it may be facilitated by external force (or) energy

- A balanced chemical equation is the simplified representation of a chemical reaction which describes the chemical composition, physical state of the reactants and the products, and the reaction conditions.

- A combination reaction is the reaction in which two or more reactants combine to form a compound.

- In a decomposition reaction, a single compound splits into two or more simpler substances under suitable conditions. Decomposition reaction takes place, by heat, electricity or light.

- More active elements readily displace less active elements from their aqueous solution is called single displacement reactions.

- When two compounds reacts, if their ions are interchanged, then the reaction is called double displacement reaction.

- Chemical reactions are classified into two types based on the direction of the reaction. They are reversible and irreversible reactions.

- When aqueous solutions of two compounds are mixed, if they react to form an insoluble compound and a soluble compound, then it is called as precipitation reaction.

- Acid reacts with the base to form a salt and water, it is called as neutralization reaction.

- Rate of a reaction is the change in the amount or concentration of any one of the reactants or products per unit time.

- Activation energy is the minimum energy with which the reacting particles must collide.

- Physical equilibrium is a s tate of a physical change at which the volume of all the phases remain unchanged. $H_2O(1) \xrightleftharpoons[\text{Condensation}]{\text{Evaporation}} H_2O(g)$

- Some factors influence the rate of chemical reactions. They are nature, concentration, surface area of reactants, temperature, catalyst and pressure.

- Chemical equlibrium is a state of a reversible chemical reaction in which no change takes place in the amount of the reactants and products.

- The pH is the negative logarithm of the hydrogen ion concentration. i.e $pH = -\log 10[H^+]$

MIND MAP

Don

Chemical Reactions

Occur only with
- Change in state
- Change in colour
- Change in Temperature
- Evolution of gas

Example
- Rusting of Iron

Types of chemical reaction

Factors affecting rate of chemical reactions
- Nature of the reactants
- Concentration of the reactants
- Temperature
- Catalyst
- Pressure
- Surface of the reactants

Reversible Reaction

Irreversible reaction

$Na_2CO_3 + CaCl_2 \rightarrow CaCO_3 + 2NaCl$

Sodium Carbonate   Calcium Chloride   Calcium Carbonate   Sodium Chloride

Double Displacement reaction
- Neutralisation reaction
- Precipitation reaction

Decomposition reaction

$CaCO_3 \rightarrow CaO + CO_2$

Combination reaction

$2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$

- ∞ pH scale is a scale for measuring the hydrogen ion concentration in a solution.
- ∞ Our body works within the pH range of 7.0 to 7.8. Any changes in this value, leads to diseases.
- ∞ Our saliva normally ranges between 6.5 to 7.5 when it falls below 5.5, the enamel gets weathered.
- ∞ Citrus fruits require slightly alkaline soil, rice requires acidic soil and sugarcane requires natural soil.
- ∞ When non-metal oxides emitted by factories and vehicles, is dissolved in rain water, it decreases the PH value of rainwater and causes acid rain.

Formulae

$$pH = -\log_{10}[H^+]$$

$$pOH = -\log_{10}[OH^-]$$

$$pH + pOH = 14$$

$$K_w = [H_3O^+][OH^-] = 1 \times 10^{-14}\ mol^2 dm^{-6}$$

$$K_w = [H^+][OH^-] = 1 \times 10^{-14}\ mol^2 dm^{-6}$$

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$ is a ✶✶✶
   - a) Decomposition Reaction
   - b) Combination Reaction
   - c) Single Displacement Reaction
   - d) Double Displacement Reaction

2. **Photolysis is a decomposition reaction caused by _____**
   - a) heat
   - b) electricity
   - c) light
   - d) mechanical energy

3. **A reaction between carbon and oxygen is represented by $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)} + Heat$. In which of the type(s), the above reaction can be classified?**
   - i. Combination Reaction
   - ii. Combustion Reaction
   - iii. Decomposition Reaction
   - iv. Irreversible Reaction
   - a) i and ii
   - b) i and iv
   - c) i, ii and iii
   - d) i, ii and iv

4. **The chemical equation $Na_2SO_{4(aq)} + BaCl_{2(aq)} \rightarrow BaSO_{4(s)} \downarrow + 2NaCl_{(aq)}$ represents which of the following types of reaction?** ✶✶✶
   - a) Neutralisation
   - b) Combustion
   - c) Precipitation
   - d) Single displacement

5. Which of the following statements are correct about a chemical equilibrium?
   i. It is dynamic in nature.
   ii. The rate of the forward and backward reactions are equal at equilibrium.
   iii. Irreversible reactions do not attain chemical equilibrium.
   iv. The concentration of reactants and products may be different.
   a) i, ii and iii
   b) i, ii and iv
   c) ii, iii and iv
   d) i, iii and iv

6. A single displacement reaction is represented by $X_{(s)} + 2HCl_{(aq)} \rightarrow XCl_{2(aq)} + H_{2(g)}$. Which of the following(s) could be X?
   i. Zn   ii. Ag   iii. Cu   iv. Mg.
   Choose the best pair.
   a) i and ii
   b) ii and iii
   c) iii and iv
   d) i and iv

7. Which of the following is not an "element + element → compound" type reaction?
   a) $C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$
   b) $2K_{(s)} + Br_{2(l)} \rightarrow 2KBr_{(s)}$
   c) $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$
   d) $4Fe_{(s)} + 3O_{2(g)} \rightarrow 2Fe_2O_{3(s)}$

8. Which of the following represents a precipitation reaction?
   a) $A_{(s)} + B_{(s)} \rightarrow C_{(s)} + D_{(s)}$
   b) $A_{(s)} + B_{(aq)} \rightarrow C_{(aq)} + D_{(l)}$
   c) $A_{(aq)} + B_{(aq)} \rightarrow C_{(s)} + D_{(aq)}$
   d) $A_{(aq)} + B_{(s)} \rightarrow C_{(aq)} + D_{(l)}$

9. The pH of a solution is 3. Its $[OH^-]$ concentration is ✳ ✳ ✳
   a) $1 \times 10^{-3}\,M$
   b) $3\,M$
   c) $1 \times 10^{-11}\,M$
   d) $11\,M$

10. Powdered $CaCO_3$ reacts more rapidly than flaky $CaCO_3$ because of _____.
    a) large surface area
    b) high pressure
    c) high concentration
    d) high temperature

Ans:

1..	b)	Combination reaction	2.	c)	light
3.	d)	i, ii and iv	4.	c)	Precipitation
5.	a)	i, ii and iii	6.	d)	i and iv
7.	c)	$2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$	8.	c)	$A_{(aq)} + B_{(aq)} \rightarrow C_{(s)} + D_{(aq)}$
9.	c)	$1 \times 10^{-11}\,M$	10.	a)	large surface area

II. Fill in the blanks

1. A reaction between an acid and a base is called _____. ✳ ✳ ✳

2. When lithium metal is placed in hydrochloric acid, _____ gas is evolved.

3. The equilibrium attained during the melting of ice is known as _____.

4. The pH of a fruit juice is 5.6. If you add slaked lime to this juice, its pH _____ (will increase / will decrease) ✳ ✳

5. The value of ionic product of water at 25^0 C is _____.

6. The normal pH of human blood is _____.

7. Electrolysis is a type of _____ reaction.

8. The number of products formed in a synthesis reaction is _____.

9. Chemical volcano is an example for _____ type of reaction. ✶ ✶ ✶

10. The ion formed by dissolution of H^+ in water is called _____.

Ans:

1.	Neutralization	2.	Hydrogen
3.	Physical equilibrium	4.	Increase
5.	1.00×10^{-14} mol^2cm^{-6}	6.	7.4 (7.3 to 7.45)
7.	Decomposition	8.	One
9.	Decomposition reaction	10.	Hydronium ion

III. Match the following

1. Identify the types of reaction

Reaction	Type	Ans
1. $NH_4OH_{(aq)}+CH_3COOH_{(aq)} \longrightarrow$ $CH_3COONH_{4(aq)}+H_2O_{(l)}$	a) Single displacement	(c)
2. $Zn_{(s)} + CuSO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + Cu_{(s)}$	b) Combustion	(a)
3. $ZnCO_{3(s)} \xrightarrow{Heat} ZnO_{(S)}+CO_{2(g)}$	c) Neutralisation	(d)
4. $C_2H_{4(g)} + 4O_{2(g)} \rightarrow 2CO_{2(g)}+ 2H_2O_{(g)} + Heat$	d) Thermal decomposition	(b)

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

1. **Silver metal can displace hydrogen gas from nitric acid.**   **False**
   Sodium metal can displace hydrogen gas from nitric acid. Because silver is least reactive.

2. **The pH of rain water containing dissolved gases like SO_3, CO_2, NO_2 will be less than 7.**   **True**

3. **At the equilibrium of a reversible reaction, the concentration of the reactants and the products will be equal.**   **False**
   At the equilibrium of a reversible reaction, the concentration of the reactants and the products will be constant.

4. **Periodical removal of one of the products of a reversible reaction increases the yield.**   **True**

5. **On dipping a pH paper in a solution, it turns into yellow. Then the solution is basic.**   **False**
   On dipping a pH paper in a solution, it turns into yellow. Then the solution is acidic not basic.

V. To interpret what happens in the given situations

1. Magnesium sulphate solution is added with aluminium in a beaker. What happens?

There is no change in that beaker. The reaction does not occur, because aluminium is less reactive than magnesium.

2. Methane reacts with oxygen. What does happen?

It will produce large amount of heat and light steam evaporates with carbon-di-oxide.

3. Non-metal oxides dissolve in rain water. What happens?

Non-metal oxides dissolve in rain water,it decreases the pH of the rain water (i.e) below 7. So it causes rain water

VI. Short answer questions:

1. When an aqueous solution of potassium chloride is added to an aqueous solution of silver nitrate, a white precipitate is formed. Give the chemical equation of this reaction.

$$KCl_{(aq)} + AgNO_{3(aq)} \rightarrow AgCl_{(s)} \downarrow + KNO_{3(aq)}$$
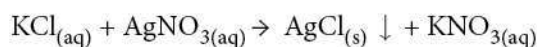
White precipitate of AgCl is formed in aqueous solution of potassium nitrate.

2. Why does the reaction rate of a reaction increase on raising the temperature?

- The temperature of a reaction increases, the adding heat provides energy to **break more bonds** of the reactant molecules.

- So more reactants ions increases, produce more products.

- Thus speed of the reaction increases.

3. Define combination reaction. Give one example for an exothermic combination reaction. ✸ ✸ ✸

- A combination reaction is a reaction in which two or more reactants combine to form a compound.

- It is also called as synthesis reaction (or) composition reaction (a single product).

- $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

- Sulphur reacts with oxygen and produce sulphur di-oxide.

- Most of combination reactions are exothermic in nature, because they involve the formation of new.

4. Differentiate reversible and irreversible reactions. ✸ ✸ ✸

S.No	Reversible	Irreversible
1.	It **can be reversed** under suitable conditions.	It **cannot be reversed.**
2.	**Both forward and backward** reactions take place simultaneously.	It is unidirectional. It proceeds **only in forward direction.**
3.	It **attains** equilibrium.	Equilibrium is **not attained.**
4.	The reactants **cannot be converted** completely into products.	The reactants **can be completely converted** into products.
5.	It is relatively **slow.**	It is **fast.**

VII. Answer in detail

1. What is thermolysis reaction? ✶ ✶

- In a decomposition reaction, a single compound splits into two or more simpler substances by the help of heat. It is called 'Thermolysis'.
- For example, It is a class of compound to element/element decomposition. i.e. a compound (HgO) is decomposed into two elements (Hg and Oxygen).

$$2HgO_{(s)} \xrightarrow{\text{heat}} 2Hg_{(l)} + O_{2(g)}$$
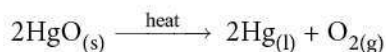
- In thermal decomposition reaction, heat is supplied to break the bonds.
- Such reactions, in which heat is absorbed, are called 'Endothermic reactions'
- When calcium carbonate is heated, it breaks down into calcium oxide and carbon dioxide.
- It is a type of compound to compound/compound decomposition.

$$CaCO_{3(s)} \xrightarrow{\text{heat}} CaO_{(s)} + CO_{2(g)}$$
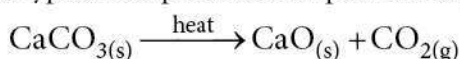
2. Explain the types of double displacement reactions with examples. ✶ ✶ ✶

- When two compounds react, if their ions are interchanged, then the reaction is called double displacement reaction.
- There are major classes of double displacement reactions. They are:
- Precipitation Reactions
- Neutralization Reactions

Precipitation Reactions:

- When aqueous solutions of two compounds are mixed, if they react to form an insoluble compound and a soluble compound, then it is called precipitation reaction.

| Aqueous Solution | + | Aqueous Solution | → | Insoluble compound | + | Soluble compound |

- When the clear aqueous solutions of potassium iodide and lead (II) nitrate are mixed, a double displacement reaction takes place between them.

$$Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \rightarrow PbI_{2(aq)} \downarrow + 2KNO_{3(aq)}$$
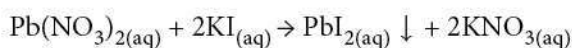
- PbI_2 form a yellow precipitate

Neutralization Reactions:

- It is a type of displacement reaction in which the acid reacts with the base to form a salt and water.
- It is called 'neutralization reaction' as both acid and base neutralize each other.

$$\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water}$$

- Reaction of sodium hydroxide with hydrochloric acid is a typical neutralization reaction.
- Here, sodium displaces hydrogen from hydrochloric acid forming sodium chloride, a neutral soluble salt.

$$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$$
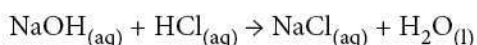
3. Explain the factors influencing the rate of a reaction

Important factors that affect trate of a reaction are

- Nature of the reactants
- Concentration of the reactants
- Temperature
- Catalyst
- Pressure
- Surface area of the reactants

Nature of the reactants:

- The reaction of sodium with hydrochloric acid is faster than that with acetic acid.
- Because Hydrochloric acid is a stronger acid than acetic acid and thus more reactive.
- $2Na_{(s)} + 2HCl_{(aq)} \rightarrow 2NaCl_{(aq)} + H_{2(g)} \rightarrow$ (fast)
- $2Na_{(s)} + 2CH_3COOH_{(aq)} \rightarrow 2CH_3COONa_{(aq)} + H_{2(g)} \rightarrow$ (slow)

Concentration of the reactants:

- The amount of the substance present in a certain volume of the solution is called 'concentration'.
- More the concentration, more particles per volume exist in it and faster the reaction.
- Granulated zinc reacts faster with 2M hydrochloric acid than 1M hydrochloric acid.

Temperature:

- Most of the reactions go faster at higher temperature.
- Because adding heat to the reactants provides energy to break more bonds and thus speed up the reaction.
- **E.g:** Calcium carbonate reacts slowly with hydrochloric acid at room temperature and faster when temperature increases..

Pressure:

- Increasing the pressure of reactant gases increases the reaction rate.
- Because, increasing pressure the reacting particles come closer and collide frequently.

Catalyst:

- A catalyst is a substance which increases the reaction rate without being consumed in the reaction.
- **E.g:** On heating potassium chlorate, it decomposes into potassium chloride and oxygen gas, but at a slower rate.
- If manganese dioxide is added, it increases the reaction rate.

Surface area of the reactants:

- When solid reactants are involved in a reaction, their powdered form reacts more readily.
- Because, powdering of the reactants increases the surface area and more energy is available on collision of the reactant particles.
- Thus, the reaction rate is increased.
- **E.g:** Powdered calcium carbonate reacts more readily with hydrochloric acid than marble chips.

4. **How does pH play an important role in everyday life?** ✶ ✶
   - Our body works within the pH range of 7.0 to 7.8.
   - Different body fluids have different pH values.
   - For example, pH of blood is ranging from 7.35 to 7.45.
   - Any increase or decrease in this value leads to diseases.
   - The ideal pH for blood is 7.4.

   ### pH in our digestive system:
   - HCl present in our stomach helps in digestion.
   - During indigestion our stomach produces more acid and this causes pain and irritation.
   - pH of the stomach fluid is approximately 2.0.

   ### pH changes as the cause of tooth decay:
   - pH of the saliva normally ranges between 6.5 to 7.5.
   - White enamel coating (calcium phosphate) is a hard substance in our body.
   - When the pH value falls below 5.5, it weathers.
   - The basic toothpaste neutralises the excess acid and prevents tooth decay.

   ### pH of soil:
   - Citrus fruits require slightly alkaline soil, rice requires acidic soil and sugarcane requires neutral soil.

   ### pH of rain water:
   - The pH of rain water is approximately 7.
   - If the atmospheric air is polluted with oxides of non-metals, they get dissolved in the rain water and make its pH less than 7.
   - As its pH value is less than 7, then it is called acid rain.
   - When this rain water reaches river water, the survival of aquatic life becomes difficult.

5. **What is a chemical equilibrium? What are its characteristics?** ✶ ✶ ✶
   - Chemical equilibrium is a state of a reversable chemical reaction in which no change in the amount of the reactants and products takes place.
   - At equilibrium
        Rate of forward reaction = Rate of backward reaction

   ### Characteristics of equilibrium:
   - In a chemical equilibrium, the rate of forward and backward reactions are equal.
   - The observable properties such as pressure, concentration, colour, density, viscosity, etc., of the system remain unchanged with time.
   - The chemical equilibrium is a dynamic equilibrium, because both the forward and backward reactions continue to occur even though it appears static externally.
   - In physical equilibrium, the volume of all the phases remain constant.

VIII. Solve the following problems

1. **Lemon juice has a pH 2, what is the concentration of H^+ ions?** ✶ ✶

   Concentration of hydrogen ion $H^+ = 10^{-pH}$ M

   Concentration of hydrogen ion in lemon juice $= 10^{-2}$ M
   $$= 0.01 \text{ M}$$

   Concentration of lemon juice is **0.01 M**

2. Calculate the pH of 1.0×10^{-4} molar solution of HNO_3.

HNO_3 dissociates in water as

$$HNO_{3(aq)} \rightarrow H^+ + NO_3^-$$
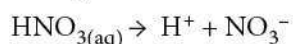
Each Nitric acid gives one H^+ ions in water. So 1.0×10^{-4} molar solution of HNO_3 gives 1.0×10^{-4} moles of ions in water.

Therefore $[H^+] = 1.0 \times 10^{-4}$

> **Formula used:**
> $$pH = -\log_{10}[H^+]$$

$$\begin{aligned}
pH &= -\log_{10}[H^+] \\
&= -\log_{10} 1.0 \times 10^{-4} \\
&= -(-4)\log_{10} 1.0 \times 10^{-4} \\
&= 4\log_{10}^{10} = 4 \times 1
\end{aligned}$$

$$\mathbf{pH = 4}$$

pH of 1.0×10^{-4} molar solution of HNO_3 is **4**

3. What is the pH of 1.0×10^{-5} molar solution of KOH?

KOH is a strong base and dissolve in water and gives

$$KOH \rightarrow K^+ + OH^-$$

Each KOH molecules gives one OH^- ion. So 1.0×10^{-5} molar solution of KOH gives 1.0×10^{-5} OH^- ions.

$$[OH^-] = 1.0 \times 10^{-5}$$

> **Formula used:**
> $$pOH = -\log_{10}[OH^-]$$

$$\begin{aligned}
pOH &= -\log_{10}[OH^-] \\
&= -\log_{10} 1.0 \times 10^{-5} \\
&= -(-5)\log_{10}^{10}
\end{aligned}$$

$$pOH = 5 \times 1$$

$$pOH = 5$$

$$pH + pOH = 14$$

$$\begin{aligned}
pH &= 14 - pOH \\
&= 14 - 5
\end{aligned}$$

$$\mathbf{pH = 9}$$

The pH of 1.0×10^{-5} molar solution of KOH is **9**.

4. The hydroxide ion concentration of a solution is 1×10^{-11}M. What is the pH of the solution? ✦ ✦ ✦

$$[OH^-] = 1 \times 10^{-11}$$

> **Formula used:**
> $$pOH = -\log_{10}[OH^-]$$
> $$pOH = 11$$

$$\begin{aligned}
pOH &= -\log_{10}[OH^-] \\
&= -\log_{10} 1 \times 10^{-11} \\
&= -(-11)\log_{10} 1 \times 10 \\
&= 11\log_{10} 10 = 11 \times 1
\end{aligned}$$

$$pOH = 11$$

$$pH = 14 - pOH$$

$$pH = 14 - 11$$

$$\mathbf{pH = 3}$$

pH of the hydroxide ion concentration of a solution of 1×10^{-11} M is **3**

IX. Higher Order Thinking Skill (HOTS)

1. **A solid compound 'A' decomposes on heating into 'B' and a gas 'C'. On passing the gas 'C' through water, it becomes acidic. Identify A, B and C.**
   - On passing 'C' through water it becomes acidic.
   - Therefore the gas 'C' must be a non-metal oxide (CO_2).
   - So a solid compound must be a calcium carbonate.
   - It decomposes into calcium oxide and carbon dioxide. (C)

$$CaCO_{3(g)} \rightarrow CaO_{(S)} + CO_{2(g)}$$
$$\quad\quad A \quad\quad\quad B \quad\quad\quad C$$
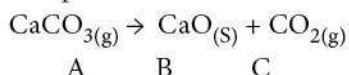
   - A $\rightarrow CaCO_3$
   - B $\rightarrow CaO$
   - C $\rightarrow CO_2$

2. **Can a nickel spatula be used to stir copper sulphate solution? Justify your answer.**
   - No, because Nickel is more reactive than Copper.
   - So Nickel easily reacts and displaces copper from copper sulphate solution.
   - $Ni_{(s)} + Cu_{(aq)} \rightarrow Ni_{(aq)} + Cu_{(S)}$

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. $4NaCl + 2Mg \rightarrow$
   a) $MgCl_2 + 4Na$ b) does not occur   c) $NaMgCl_2$ d) $Na(MgCl)_2$

2. **Metal + Acid $\rightarrow$ Salt + _____.**
   a) Oxygen   b) Water   c) Hydrogen   d) Carbon

3. **Copper is more reactive than _____. ✴**
   a) silver
   c) platinum
   b) gold
   d) all of these.

4. **If the concentration of reactants increases, the rate of reaction will**
   a) increase
   c) remains same
   b) decrease
   d) initially decreases then increases

5. **In a solution [OH^-] is 1×10^{-8} then the solution is**
   a) Basic
   c) Neutral
   b) Acidic
   d) None of these

6. **A substance which alters the rate of reaction without undergoing any change in its mass and composition is known as ✴**
   a) Reactants
   c) Rate of reaction
   b) Products
   d) Catalyst

7. The pH is the _____ of the hydrogen ion concentration.

    a) logarithm   b) positive logarithm

    c) negative logarithm   d) division of logarithm

8. The acid, helps in digestion of food in stomach is

    a) H_2SO_4 b) HNO_3 c) HCl d) H_3PO_4

9. pH value for Antacids

    a) 4 – 5   b) 6 – 8   c) 10   d) 11

10. When Potassium Iodide reacts with lead nitrate, we get _____ as a yellow precipitation. ★

    a) Lead iodide   b) Potassium Nitrate

    c) Potassium Iodide   d) Lead Nitrate

Ans:

1.	b)	does not occur	2.	c)	Hydrogen
3.	d)	all of these	4.	a)	increase
5.	b)	Acidic	6.	d)	Catalyst
7.	C)	Negative logarithm	8.	c)	HCl
9.	c)	10	10.	a)	Lead Iodide

II. Fill in the blanks

1. _____ of iron causes rusting .

2. If a bond is breaking in a chemical reaction , it _____ energy.(absorb/releases)

3. The condition for a chemical reaction is mentioned _____ the arrow mark.

4. The colour of silver bromide is _____.

5. Precipitation reaction is a type of _____ reaction. ★

6. Rate $= -\dfrac{d[A]}{dt} = +\dfrac{d[B]}{dt}$ Here [ ] represents _____.

7. When temperature increases, the speed of reaction _____.

8. The pH value of coffee is _____.

9. When we add water in acid, its pH value _____. ★

10. pH of a substance is 9. When we add acid in it, its pH value _____.

Ans:

1.	Oxidation	2.	Absorbs
3.	Above	4.	Light yellow
5.	double displacement	6.	Concentration
7.	Increases	8.	5.6
9.	Increases	10.	will decrease

III. Match the following

1. Identify the types of reaction. ✶

1) Compound + Element → Compound	- a) Speed induced by catalyst	(c)
2) $2AgBr \rightarrow 2Ag + Br_2$	- b) Do not react	(d)
3) $CaCl_2 + Fe \rightarrow$	- c) Combination	(b)
4) $2KClO_3 \xrightarrow{MnO_2} 2KCl + 3O_2$	- d) Photolysis	(a)

2. Substances and its colour in pH paper

1) Stomach acid	- a) Dark blue	(d)
2) Drain cleaner	- b) Pale blue	(a)
3) Egg white	- c) Red	(b)
4) Freshmilk	- d) Dark red	(c)

3.

1) Digestion juice	- a) Fast process	(b)
2) Soft drinks	- b) Acidic in nature	(e)
3) Digestion process	- c) Slow process	(a)
4) Rusting of iron	- d) Alkaline in nature	(c)
5) Milk of magnesia	- e) Carbonic acid	(d)

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

1. **Oxidation of Iron causes rusting.** **True**

2. **Chemical formula for marble is $Ca(OH)_2$** **False**
   Chemical formula for marble is $CaCO_3$

3. **In a double displacement reaction, one cation replaces anion from another molecule.** ✶ **False**
   In a double displacement reaction the ion of one compound will be displaced by ion of another compound.

4. **On recharging the mobile, chemical energy is stored in the form of electric energy.** **False**
   On recharging the mobile, electric energy is stored in the form of chemical energy.

5. **Addition of reactants, increase the forward reaction.** ✶ **True**

6. **Unit of concentration of acid is pH value.** **False**
   Unit of concentration of acid is mole.

7. **Rice plants needs acidic soil.** **True**

8. **pOH of a substance is four. Then it is acidic in nature.** **False**
   pOH of a substance is four. Then it is basic in nature.

Don

V. Assertion and reason type questions

Answer the following questions using the data given below.

    a) A and R are corrrect, R explains the A

    b) A is wrong, R is correct.

    c) A is correct, R is wrong.

    d) A and R are correct, R does not explains A.

1. **Assertion:** The physical state of the substances in a chemical reaction are denoted in superscript of the formula.

    Reason: Balanced equation should give full information about the reaction.

    Ans: b) A is wrong, R is correct.

2. **Assertion:** Hydrogen displace copper from its compounds.
    Reason: Hydrogen is more reactive than copper .

    Ans: a) A and R are correct, R explains the A

3. **Assertion:** Reversible reaction reaches chemical equilibrium level. ✳
    Reason: In a reversible reaction, the forward reaction is always faster than the backward reaction.

    Ans: c) A is correct, R is wrong

4. **Assertion :** To increase the speed of reaction, the metal may be powdered.
    Reason: By increasing surface area, the speed of a reaction can be increased.

    Ans: a) A and R are correct, R explains the A

VI. Short answer questions:

1. What happen during a chemical reaction? ✳

- In a chemical reaction, the atoms of the reacting molecules (or) atoms are **rearranged** to form new molecules.
- Old chemical bonds between atoms are **broken** and new chemical bonds are **formed**.
- Bond breaking absorbs energy whereas bond formation releases energy.

2. What is photolysis? Write an equation for photolysis? ✳ ✳

- Some of the reactants (i.e silver Bromide, etc) breaking down, when it expose to light is called photolysis.

- Eg. $2AgCl_{(S)} \xrightarrow{\text{sun light}} 2Ag_{(S)} + Cl_{2(g)}$

- It is also called as **photo decomposition reaction.**

3. All combustion reactions are oxidations but all oxidations are not combustion. Why?

- The process of combustion need fuel and oxygen.
- Addition of oxygen with a substance (fuel) is called oxidation which gives heat and light (i.e. combustion).
- But additionof oxygen with all substances does not give heat and light, however it is called oxidation but not combustion. (Eg: rusting of Iron)

4. $2H_2O_{2(aq)} \rightarrow 2H_2 + 2O_{2(g)}$ **But H_2O_2 is poured in wound, the backward reaction does not take place. Why?**

When we poured H_2O_2 on wounds, it decomposes into H_2 and O_2, but oxygen gas moves away from wound, the backward reaction does not take place.

5. **Write the equation for rate of a chemical reaction. Mention all symbols used in the equation.** ✴ ✴

- The rate of chemical equation is given by

$$\boxed{Rate = -\frac{d[A]}{dt} = +\frac{d[B]}{dt}}$$

Where

$[A] \rightarrow$ Concentration of A

$[B] \rightarrow$ Concentration of B

- The negative sign indicates the decrease in the concentration of A with time.
- The positive sign indicates the increase in the concentration of B with time.
- [ ] Represents concentration.
- 'd' represents the infinitesimal change in the concentration.

6. **Conductivity of electricity in water is a reversible reaction. This reversible reaction attains equilibrium very quickly why?**

- When electricity passes through water it produces Hydronium ion (H_3O^+) and Hydroxyl ion (OH^-).
- Hydronium ion is strong and acidic in nature and hydroxyl ion is strong and basic in nature.
- So these react quickly again to form water.
- So, this irreversible reaction attains equilibrium very quickly.

VII. Answer in detail

1. **What is combination reaction? Write its types, Write an equation for each type of combination reactions.**

- A combination reaction is a reaction in which two or more reactants combine to form a compound.

Element + Element → Compound

- In this type of combination reaction, two elements react with one another to form a compound.
- Metal reacts with non-metallic elements.

$$2Na_{(s)} + Cl_{2(g)} \rightarrow 2NaCl_{(s)}$$
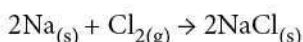
- Two non-metals react with each other.

$$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$$
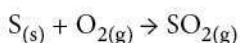
Compound + Element → Compound

- A compound reacts with an element to form a new compound.

$$PCl_{3(l)} + Cl_{2(g)} \rightarrow PCl_{5(s)}$$
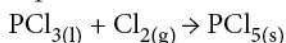
Compound + Compound → Compound

- It is a reaction between two compounds to form a new compound.

$$SiO_{2(s)} + CaO_{(s)} \rightarrow CaSiO_{3(s)}$$
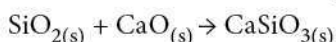
VIII. Solve the following problems

1. **The hydroxyl ion concentration of a solution is 1×10^{-8} M. a) what is the pOH value of the solution? b) Is the given solution acidic (or) basic?**

a) $[OH^-] = 1 \times 10^{-8}$

$pOH = -\log_{10}[OH^-]$

$pOH = -\log_{10}(1 \times 10^{-8})$

$= -(-8) \log_{10}1 \times 10 = 8 \log_{10}10 = 8 \times 1$

pH = 8

b) $pOH = 8$

$pH = 14 - pOH$

$= 14 - 8$

pH = 6

> **Formula used:**
>
> $pOH = -\log_{10}[OH^-]$
>
> $pOH = 8$

The given solution is acidic as its pH value is less than **7**.

2. **Calculate the pH of 1×10^{-5} molar solution of Li(OH)**

LiOH is a strong base and it gives

$Li(OH) \rightarrow Li^+ + OH^-$

One Lithium hydroxide give one OH^- ion in water so 1×10^{-5} molar solution gives 1×10^{-5} OH^- ions in water therefore

$[OH^-] = 1 \times 10^{-5}$

$pOH = -\log_{10}[OH^-]$

$pOH = -\log_{10}(1 \times 10^{-5})$

$= -(-5) \log_{10}1 \times 10$

$= 5 \log_{10}10 = 5 \times 1$

$pOH = 5$

$pH = 14 - pOH$

$= 14 - 5$

pH = 9

> **Formula used:**
>
> $pOH = -\log_{10}[OH^-]$
>
> $pOH = 5$

pH value of 1×10^{-5} molar solution of LiOH is **9**

3. **Calculate the P^H value of 1×10^{-3} molar solution of H_3PO_4** ✴

H_3PO_4 is dissociate in water and give $H_3PO_4 + H_2O \rightarrow H_3PO_4^- + H_3O^+$
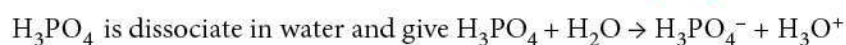
$[H_3O^+]$ may be simply written as $[H^+]$

One H_3PO_4 (phosphoric acid) gives one $[H^+]$ ion in water. So 1×10^{-3} molar solution of H_3PO_4 gives 1×10^{-3} H^+ of ions in water.

$[H^+] = 1 \times 10^{-3}$ M

$pH = -\log_{10}[H^+]$

> **Formula used:**
>
> $pH = -\log_{10}[H^+]$

$$pH = -\log_{10} 1 \times 10^{-3}$$
$$= -(-3) \log_{10} 1 \times 10$$
$$= 3 \log_{10} 10 = 3 \times 1$$
$$pH = 3$$

pH value of 1×10^{-3} molar solution of H_3PO_4 is 3

IX. Higher Order Thinking Skill (HOTS)

1. Why should we keep soft drinks in refrigerator?

- Soft drinks contain dissolved CO_2 as carbonic acid.
- When temperature increases to room temperature, the CO_2 undissolved back to the gas phase.
- So when kept in a refrigerator, temperature decreases, more CO_2 is dissolved and forms carbonic acid which helps in digestion.

2. Why should we store silver bromide in dark colour bottles?

- It is because silver bromide decomposes into silver and bromine gas in the presesnce of sun light.

$$2AgBr_{(S)} \xrightarrow{\text{sunlight}} 2Ag_{(S)} + Br_{2(g)}$$
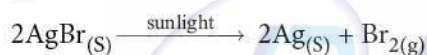
3. Why should chemical equation be balanced?

- The equation should be balanced because matter can neither be created nor be destroyed.
- The total mass of reactants should be equal to the total mass of products.

◄◄◄◄◄◄ ● ►►►►►►

Unit Test - 10

Types of Chemical Reactions

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer. $5 \times 1 = 5$

1. $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$ is a
   a) Decomposition Reaction   b) Combination Reaction
   c) Single Displacement Reaction   d) Double Displacement Reaction

2. The pH of a solution is 3. Its $[OH^-]$ concentration is
   a) 1×10^{-3} M   b) 3 M   c) 1×10^{-11} M   d) 11 M

3. Powdered $CaCO_3$ reacts more rapidly than flaky $CaCO_3$ because of _____.
   a) Large surface area   b) High pressure
   c) High concentration   d) high temperature

4. A substance which alters the rate of reaction without undergoing any change in mass and composition is known as
   a) Reactants   b) Products   c) Rate of reaction   d) Catalyst

5. The acid, helps in digestion of food in stomach is
   a) H_2SO_4 b) HNO_3 c) HCl   d) H_3PO_4

II. Answer the following questions in one or two lines. $5 \times 2 = 10$

1. What happen during a chemical reaction?

2. What is photolysis? Write an equation for photolysis.

3. All combustion reactions are oxidations but all oxidations are not combustion reaction. Why?

4. What are the factors influencing the rate of a reaction?

5. Conductivity of electricity in water is a reversible reaction. This reversible reaction attains equilibrium very quickly why?

III. Answer the following questions in brief. $2 \times 4 = 8$

1. Explain the factors influencing the rate of a reaction.

2. Why should we store silver bromide in dark colour bottles?

IV. Answer the following questions in detail. $1 \times 7 = 7$

1. i) What is a chemical equilibrium? What are its characteristics?
  ii) Why should we keep soft drinks in refrigerator?

- Carbon forms more than 5 million compounds. All these compounds are made of covalent bond.

- Acyclic compounds are the compounds in which the carbon atoms are linked in a linear pattern to form the chain.

- If all the carbon atoms in the chain are connected by single bonds, then the compound is called as saturated.

- Organic compounds in which the chain of carbon atoms is closed or cyclic are called c-smallcyclic compounds.

- Organic compounds are classified as open chain compounds and closed chain compounds.

- The organic compounds that are composed of only carbon and hydrogen atoms are called hydrocarbons.

- The organic compounds that are composed of only carbon and hydrogen atoms are called hydrocarbons.

- These hydrocarbons are classified as Alkanes, Alkenes and Alkynes.

- Alkanes (saturated hydrocarbons)

- Alkenes, Alkynes (unsaturated hydrocarbons) decolourise bromine water.

- If the chain contains only carbon atoms, such compounds are called carbocyclic compounds.

- If the chain contains carbon and other atoms like oxygen, nitrogen, sulphur, etc., these compounds are called heterocyclic compounds.

- Aromatic compounds contain one or more benzene rings.

- A functional group is an atom or group of atoms in a molecule which gives its characteristic chemical properties.

- A functional group is an atom or group of atoms in a molecule which gives its characteristic chemical properties.

- Homologous series is a group or a class of organic compounds having same general formula and similar chemical properties in which the successive members differ by a $-CH_2$ group.

Don

MIND MAP

Carbon and its compounds

Daily use
- alcohol
- Organic acid
- Drugs
- Fuel
- Tyre
- Plastic

Naming
- IUPAC
  - Root word
  - Prefix
  - Suffix
- Common name
  - Source

Classification
- Open chain compounds
  - Saturated
  - Unsaturated
- Closed chain compounds
  - Carbo cyclic compounds
  - Hetero cyclic compounds
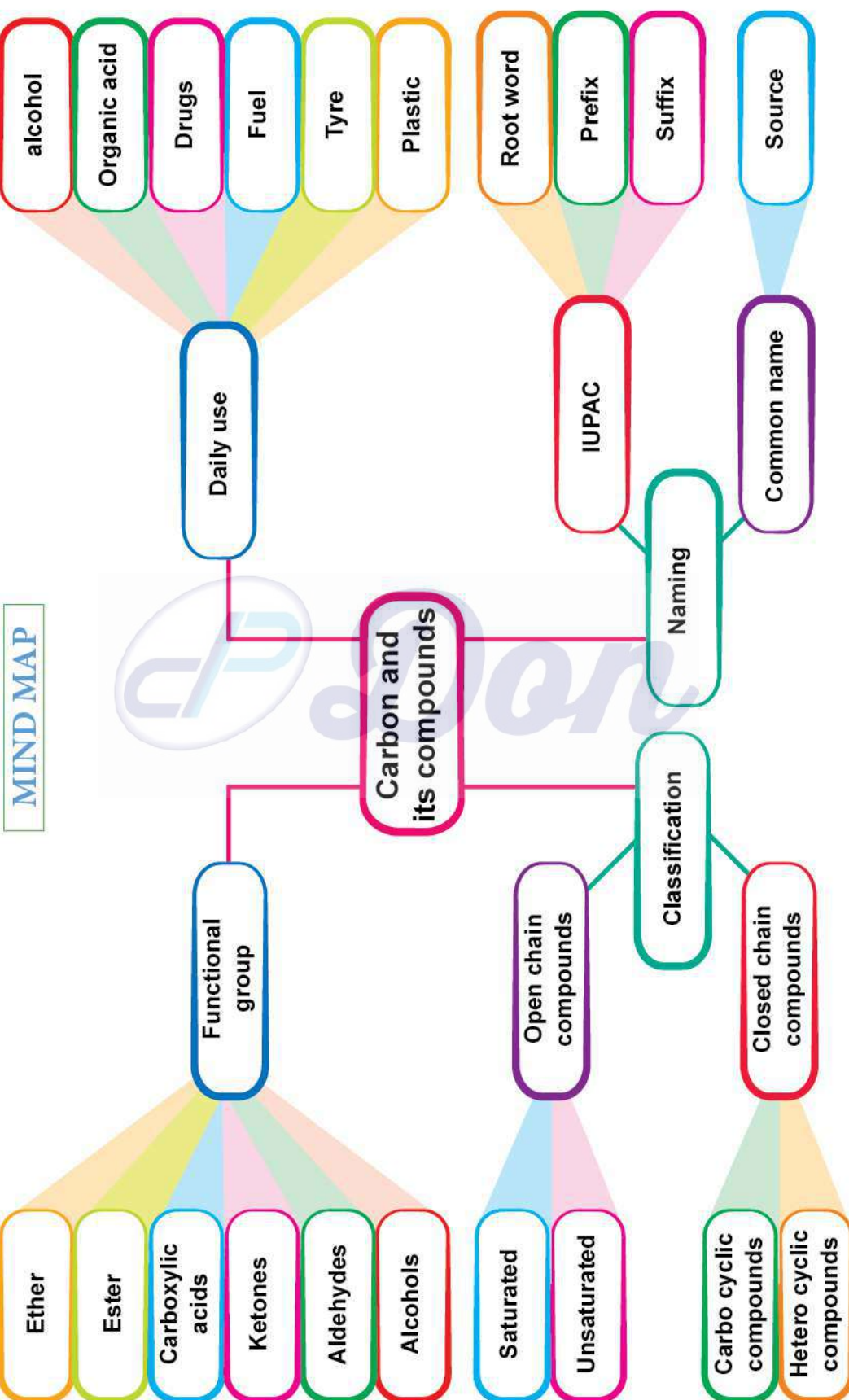
Functional group
- Ether
- Ester
- Carboxylic acids
- Ketones
- Aldehydes
- Alcohols

- Components of IUPAC names are

  i) Root word - depend upon the carbon skeleton

  ii) Prefix - substituents (other than hydrogen atom)

  iii) Suffix - functional group, double, triple bonds.

- Ethanol is commonly known as alcohol. Manufacture of ethanol has four steps. They are

  i) Dilution of molasses   ii) Addition of nitrogen source

  iii) Addition of yeast   iv) Distillation of waste

- Rectified spirit (mixture of 95.5% of ethanol and 4.5% of water)

- Power alcohol is the mixture of petrol and ethanol

- TFM means TOTAL FATTY MATTER.

- Ethanoic acid is prepared from ethanol.

- Soaps are sodium (or) potassium salts of so long chain contains caustic soda, soft soap contains potassium salt.

- Soaps molecule are prepared by adding sulphuric acid to the processed hydrocarbons.

- Detergents form two ends, one is water loving end (hydrophilic), other is water hating end (hydrophobic).

- These forms miscells and remove strains in soft and hard waters.

- Some molcules added to detergents for some specific purpose like fragrant, glow, clothes remove biological strains.

Equations:

Number of carbon atoms	Root word
1	Meth-
2	Eth-
3	Prop-
4	But-
5	Pent-
6	Hex-
7	Hept-
8	Oct-
9	Non-
10	Dec-

Functional group	Suffix used
-OH	-ol
-CHO	-al
$\overset{O}{\overset{\|}{-C-}}$	-one
-COOH	-oic acid

Substituent	Prefix used
-F	Fluoro
-Cl	Chloro
-Br	Bromo
-I	Iodo
$-NH_2$	Amino
$-CH_3$	Methyl
$-CH_2-CH_3$	Ethyl

General formula for hydrocarbons

Saturated - Alkanes - C_nH_{2n+2}

Unsaturated i) Alkenes - C_nH_{2n}

  ii) Alkynes - C_nH_{2n-2}

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The molecular formula of an open chain organic compound is C_3H_6. The class of the compound is
   a) alkane
   b) alkene
   c) alkyne
   d) alcohol

2. The IUPAC name of an organic compound is 3-Methyl butan-1-ol. What type of compound it is?
   a) Aldehyde
   b) Carboxylic acid
   c) Ketone
   d) Alcohol

3. The secondary suffix used in IUPAC nomenclature of an aldehyde is _____
   a) - ol
   b) – oic acid
   c) - al
   d) - one

4. **Which of the following pairs can be the successive members of a homologous series?**
   a) C_3H_8 and C_4H_{10} b) C_2H_2 and C_2H_4
   c) CH_4 and C_3H_6 d) C_2H_5OH and C_4H_8OH

5. **$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ is a**
   a) Reduction of ethanol   b) Combustion of ethanol
   c) Oxidation of ethanoic acid   d) Oxidation of ethanal

6. **Rectified spirit is an aqueous solution which contains about _____ of ethanol.** ✳✳✳
   a) 95.5 %   b) 75.5 %   c) 55.5 %   d) 45.5 %

7. **Which of the following are used as anaesthetics?**
   a) Carboxylic acids   b) Ethers
   c) Esters   d) Aldehydes

8. **TFM in soaps represents _____ content in soap.** ✳✳
   a) mineral   b) vitamin   c) fatty acid   d) carbohydrate

9. **Which of the following statements is wrong about detergents?**
   a) It is a sodium salt of long chain fatty acids
   b) It is sodium salts of sulphonic acids
   c) The ionic part in a detergent is $-SO_3^-Na^+$
   d) It is effective even in hard water.

Ans:

1.	b)	alkene	6.	a)	95.5 %
2.	d)	Alcohol	7.	b)	Ethers
3.	c)	- al	8.	c)	fatty acid
4.	a)	C_3H_8 and C_4H_{10}	9.	a)	It is a sodium salt of long chain fatty acids
5.	b)	Combustion of ethanol			

II. Fill in the blanks

1. An atom or a group of atoms which is responsible for chemical characteristics of an organic compound is called _____. ✳✳✳

2. The general molecular formula of alkynes is _____

3. In IUPAC name, the carbon skeleton of a compound is represented by _____ (root word / prefix / suffix)

4. (Saturated / Unsaturated) _____ compounds decolourize bromine water. ✳✳✳

5. Dehydration of ethanol by conc. Sulphuric acid forms _____ (ethene/ ethane)

6. 100 % pure ethanol is called _____

7. Ethanoic acid turns _____ litmus to _____

8. The alkaline hydrolysis of fatty acids is termed as _____ ✳✳

9. Biodegradable detergents are made of _____(branched / straight) chain hydrocarbons

Ans:

1.	functional group	2.	C_nH_{2n-2}
3.	root word	4.	unsaturated
5.	ethene	6.	absolute alcohol
7.	blue, red	8.	saponification
9.	straight		

III Match the following

1. Column I   **Column II**

1) Functional group -OH   - a) Benzene   (c)
2) Hetero cyclic   - b) Potassium stearate   (d)
3) Unsaturated   - c) Alcohol   (e)
4) Soap   - d) Furan   (b)
5) Carbocyclic   - e) Ethene   (a)

IV. Assertion and 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 explains A.

1. **Assertion:** Detergents are more effective cleansing agents than soaps in hard water.
   Reason: Calcium and magnesium salts of detergent are water soluble.
   Ans : ii) A is correct, R is wrong.

2. **Assertion:** Alkanes are saturated hydrocarbons.
   Reason: Hydrocarbons consist of covalent bonds.
   Ans : iv) A and R are correct, R doesn't explains A.

V. Short answer questions.

1. Name the simplest ketone and give its structural formula.

Simplest ketone	Structural formula
Acetone	$\begin{array}{ccc} H & O & H \\ | & || & | \\ H-C & -C & -C-H \\ | & & | \\ H & & H \end{array}$ (CH_3COCH_3)

2. Classify the following compounds based on the pattern of carbon chain and give their structural formula: i) Propane, ii) Benzene, iii) Cyclobutane, iv) Furan

i) Propane - saturated compounds open chain compounds

   $CH_3-CH_2-CH_3$

ii) Benzene - Aromatic compound in carbocyclic compounds

$$H-C \overset{\overset{\displaystyle H}{|}}{\underset{}{C}} ... C-H$$
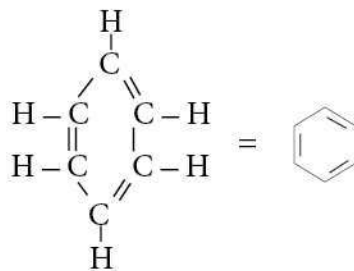
iii) Cyclobutane - Alicyclic compound in carbocyclic compounds.

$$\begin{array}{ccc} H_2C & \!\!\!\!-\!\!\!\!- & CH_2 \\ | & & | \\ H_2C & \!\!\!\!-\!\!\!\!- & CH_2 \end{array} = \square$$
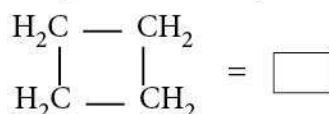
Benzene and cyclobutane are types in carbo cyclic compounds.

iv) Furan - Heterocyclic compounds in cyclic compounds

$$\begin{array}{ccc} HC & \!\!-\!\! & CH \\ \| & & \| \\ HC & & CH \\ & \diagdown O \diagup \end{array}$$
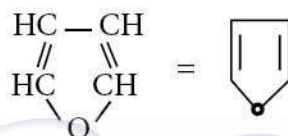
3. How is ethanoic acid prepared from ethanol? Give the chemical equation. ✶✶✶

Ethanoic acid is prepared by the oxidation of ethanol in the presence of **alkaline potassium permanganate** or **acidified potassium dichromate.**

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[2[O]]{KMnO_4/OH^-} \underset{\text{Ethanoic acid}}{CH_3COOH} + H_2O$$
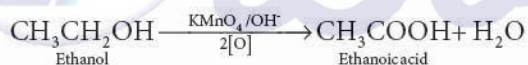
4. How do detergents cause water pollution? Suggest remedial measure to prevent this pollution.

• Some detergents have a highly **branched hydrocarbon** chains, which are not fully bio-degradable by micro organisms present in water.

• So they settle as insoluble chemical in water bodies.

• To avoid this type of water pollution, we should use detergents which have straight hydrocarbon chains.

• Because these are easily degraded by bacteria.

5. Differentiate soaps and detergents. ✶✶✶

S.No	Soaps	Detergents
1	It is a sodium salt of long chain fatty acids	It is sodium salts of sulphonic acids.
2	The ionic part of a soap is $-COO^-Na^+$	The ionic part in a detergent is $-SO_3^-Na^+$
3	It is prepared from animal	It is prepared from hydrocarbons obtained from crude oil.
4	Soaps are biodegradable	Most of detergents are non-biodegradable.

VI. Long answer questions

1. **What is called homologous series? Give any three of its characteristics.** ✸ ✸ ✸

   - Homologous series is a group or a class of organic compounds having **same general fromula** and **similar chemical properties** in which the successive members differ by a CH_2 group.
   - E.g: Methane   – CH_4
     Ethane   – CH_3CH_3
     Propane   – $CH_3CH_2CH_3$

   Characteristics:

   - Each member of the series differs from the preceeding or succeeding member by one methylene group ($-CH_2$) and hence by a molecular mass of 14 amu.
   - All members of a homologous series contain the same elements and functional group.
   - All the members can be prepared by a common method.

2. **Arrive at, systematically, IUPAC name of the compound $CH_3-CH_2CH_2-OH$.** ✸ ✸

   $$CH_3-CH_2-CH_2-OH$$
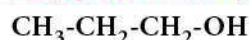
   Step 1:

   - The parent chain consists of **3 carbon atoms.**
   - The root word is **"Prop"**

   Step 2:

   - All are **single bonds** between carbon atoms of the chain.
   - So the primary suffix is **'ane'**

   Step 3:

   - Since the compound contains the **-OH** group, it is a alcohol.
   - The carbon chain is numbered from the **end** which is closest to **–OH** group.

   $$\overset{3}{C}H_3 - \overset{2}{C}H_2 - \overset{1}{C}H_2 - OH$$
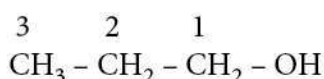
   Step 4:

   - The locant number of –OH group is **1** and thus the secondary suffix is **'1 – ol'**.
   - Terminal **'e'** of **'ane'** is removal as per Rules.
   - The name of the compund is

     prop + ane + (1 – ol) = Propan – 1 – ol

3. **How is ethanol manufactured from sugar-cane?** ✸ ✸ ✸

   - **Molasses** is a **dark coloured syrupy** liquid left after the crystallization of sugar from the concentrated sugarcane juice.
   - It contains **30 %** of **sucrose**, which cannot be separated by crystallization.

   Dilution of molasses:

   - Molasses is first **diluted** with water to bring down the concentration of sugar to about **8 to 10 percent.**

Addition of Nitrogen source:

- Molasses contains enough nitrogenous matter to act as food for yeast during the fermentation process.
- If the nitrogenous matter is poor, **ammonium sulphate** or **ammonium phosphate** is added.

Addition of yeast:

- This solution kept in large fermentation tank and **yeast** is added to and it kept at about 303 K for a few days.
- During this period, the enzymes **invertase** and **zymase** present in yeast, converts **sucrose** into **ethanol**.

- $$\underset{\text{sugar}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{invertase}} \underset{\text{fructose}}{C_6H_{12}O_6} + \underset{\text{glucose}}{C_6H_{12}O_6}$$

- $$\underset{\text{fructose (or) Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{zymase}} \underset{\text{ethanol}}{2C_2H_5OH} + 2CO_2$$

- The fermented liquid is technically called **wash**.

Distillation of wash:

- This wash containing **15 to 18 %** alcohol, is now subjected to **fractional distillation.**
- The main fraction drawn in an aqueous solution of ethanol which contains **95.5 %** of ethanol and **4.5 %** of water.
- This is called **rectified spirit.**
- This mixture is then **refluxed** over **quicklime** for about 5 to 6 hour and then allowed to stand for **12 hours.**
- On **distillation** of mixture, **pure alcohol (100 %)** is obtained.
- This is called **absolute alcohol.**

4. **Give the balanced chemical equation of the following reactions.**
   - i) **Neutralization of NaOH with ethanoic acid**
   - ii) **Evolution of carbon dioxide by the action of ethanoic acid with NaHCO$_3$**
   - iii) **Oxidation of ethanol by acidified potassium dichromate.**
   - iv) **Combustion of ethanol.**

   i) $$\underset{\text{Ethanoic acid}}{CH_3COOH} + NaOH \rightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + H_2O$$

   ii) $$\underset{\text{Ethanoic acid}}{CH_3COOH} + NaHCO_3 \rightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + CO_2 + H_2O$$

   iii) $$CH_3CH_2OH \xrightarrow[2[O]]{K_2Cr_2O_7/H^+} CH_3COOH + H_2O$$

   iv) $$\underset{\text{Ethanol}}{C_2H_5OH} + 3O_2 \rightarrow \underset{\text{Carbon-di-oxide}}{2CO_2} + 3H_2O$$
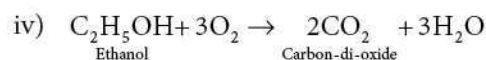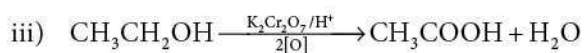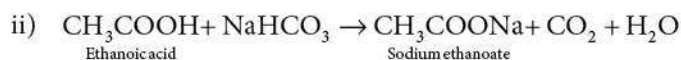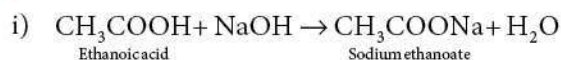
5. **Explain the mechanism of cleansing action of soap.**
   - A soap molecule contains **two chemically distinct parts** that interact differently with water.
   - It has one polar end, which is a **short head** with a **carboxylate group** (–COONa) and one non-polar end having the long tail made of the hydrocarbon chain.

- The polar end is hydrophilic **(Water loving)** in nature and this end is **attracted** towards water.
- The non-polar end is hydrophobic **(water hating)** in nature and it is **attracted** towards **dirt** or **oil** on the cloth, but not attracted towards water.
- Thus, the hydrophobic part of the soap molecules traps the dirt and the hydrophilic part makes the entire molecule soluble in water.
- These forms miscelles in water. The **dirt** is thus surrounded by the **non-polar end** of the soap molecules.
- The charged **carboxylate** end of the soap molecules makes the miscelles **soluble** in water.
- Thus, the dirt is **washed away** with the soap.

VII. Higher Order Thinking Skill (HOTS)

1. The molecular formula of an alcohol is $C_4H_{10}O$. The locant number of its –OH group is 2.

(i) Draw its structural formula.
(ii) Give its IUPAC name.
(iii) Is it saturated or unsaturated?

i) Structural formula:

$$CH_3 - CH_2 - CH - CH_3$$
$$|$$
$$OH$$
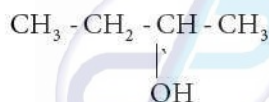
ii) Butan-2-ol (or) 2–Butanol.

iii) It is saturated, because all bonds in the structural formula is single.

2. An organic compound 'A' is widely used as a preservative and has the molecular formula $C_2H_4O_2$. This compound reacts with ethanol to from a sweet smelling compound 'B'.

i) Identify the compound 'A'

ii) Write the chemical equation for its reaction with ethanol to form compound 'B'

iii) Name the process

i) Compound 'A' is Ethanoic acid - CH_3COOH [$C_2H_4O_2$]

ii) $$\underset{\text{Ethanoic acide}}{CH_3COOH} + \underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow{\text{conc. }H_2SO_4} \underset{\text{Ethyl Ethanoate}}{CH_3COOCH_2CH_3}$$
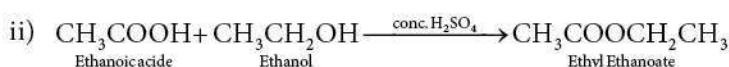
iii) Esterification

Reason: **Ethyl ethanoate** is an ester.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **All carbon compounds are made of**
   a) Atomic bonds
   b) Co-ordinated bonds
   c) Covalent bonds
   d) Metallic bonds

2. **Volatile substance means**
   a) high melting point
   b) low melting point
   c) easily evaporates
   d) high density

3. **Benzene is a**
   a) aromatic compounds
   b) alicyclic compounds
   c) number of moles
   d) acyclic compounds

4. **C_5H_8 is _____ classes**
   a) Alkanes
   b) Alkynes
   c) Alkenes
   d) saturated carbons

5. **Physical properties of a carbon compounds depends on**
   a) functional group
   b) alkyl group
   c) oxygen presence
   d) both a and b

6. **In a homogeneous series, each member has** ✸ ✸
   a) same functional group
   b) same general molecular formula
   c) same physical properties
   d) both a and b

7. **$CH_3 - CH - CH_2 - CH_3$ IUPAC name of this compound** ✸
   $\qquad\quad |$
   $\qquad\;\, CH_2$
   $\qquad\quad |$
   $\qquad\;\, CH_3$
   a) 2 Ethyl pentane
   b) 2 Ethyl butane
   c) 3-methyl hexane
   d) 2-methyl hexane

8. **The enzyme zymase converts _____ into _____.**
   a) molassess, sugar
   b) sugar, fructose
   c) sugar, glucose
   d) fructose, ethanol

9. **Soda lime is a mixture of**
   a) $NaOH$, $CaCl_2$
   b) $Ca(OH)_2$, NaO
   c) CaO, $NaOH$
   d) CaO, $Na(CH)_2$

10. **The substance sodium silicate is used to** ✸
    a) not damage the washing machine
    b) glow clothes
    c) remove blood strain
    d) give fragrant smell

11. **A soap molecule contains two parts when dissolved in water, one is polar end. other is**
    a) carboxylate group
    b) hydrophilic end
    c) hydrocarbon chain
    d) water loving end

12. _____ is used as pain killer

    a) Aldehydes   **b)** Ethers   **c)** Esters   **d)** Ketones

Ans:

1.	c)	Covalent bonds	7.	c)	3-methyl hexane
2.	c)	easily evaporates	8.	d)	fructose, ethanol
3.	a)	aromatic compounds	9.	c)	CaO, NaOH
4.	b)	Alkynes	10.	a)	not damaging the washing machine
5.	b)	alkyl group	11.	c)	hydrocarbon chain
6.	d)	both a and b	12.	b)	Ethers

II. Fill in the blanks

1. Generally covalent compounds have _____ melting and boiling points. (high, low, moderate).

2. Fourth member of the alkene family is _____.

3. Saturated hydrocarbons are called _____.

4. Chemical properties of a carbon compound depend upon its _____. ✶

5. Root word for 7 carbon atoms is _____.

6. The fermented liquid is technically called _____.

7. Denaturated spirit is a mixture of ethanol and _____.

8. The prefix word used for $-NH_2$ is _____.

9. IUPAC name of CH_3CH_2COOH is _____. ✶

10. The product of dehydrogenation of ethanol _____.

11. All the cooking oils and liquids contain _____.

Ans:

1.	low	2.	pentene
3.	alkane	4.	functional group
5.	Hept–	6.	wash
7.	pyridine	8.	amino
9.	propanoic acid	10.	acetadehyde (or) ethanal
11.	esters		

III Match the following

1.

Column I		Column II	
1) Alkene	-	a) Alkyl group	(e)
2) Alkyne	-	b) oct-	(c)
3) R-OH here 'R' is	-	c) Bromine test	(a)
4) 8 carbons	-	d) Acid	(b)
5) R-COOH	-	e) C_2H_4	(d)

Don

2. **Column I**   **Column II** ✳

1) Butanol	- a) Glucos to Ethanol	(b)
2) Fermentation tank	- b) $CH_3CH_2CH_2CH_2OH$	(d)
3) Butanal	- c) Sugar to Glucose	(e)
4) invertase	- d) 303 K	(c)
5) zymase	- e) $CH_3CH_2CH_2CHO$	(a)

3. **Column I**   **Column II** ✳

1) 95 % ethanol with methanol	- a) Ethanoic acid	(b)
2) 95.5 % ethanol with water	- b) Poisonous alcohol	(e)
3) Petrol with ethanol	- c) Ethanol	(d)
4) Coagulating rubber	- d) Power alcohol	(a)
5) Anti-freezer	- e) Rectified spirit	(c)

IV. Assertion and 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 explains A.

1. **Assertion:** Alkaline $KMnO_4$ is an oxidising agent.
   Reason: It changes ethanol into ethanoic acid.

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

2. **Assertion:** $CH_3CH_2OCH_3$ and CH_3CH_2OH are isomers. ✳
   Reason: Isomerism is a phenomenon where two or more compounds have the same chemical formula but possesses different structural formula i.e., different properties.

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

3. **Assertion:** The compounds formed by carbon are very stable.
   Reason: Nucleus of the carbon is of small size. So electrons are nearer to the nucleus.

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

V. Interpretation

1. **What do we get if we add ethanoic acid to sodium hydroxide?**
   Generally we get salt and water when an acid reacts with base. So when ethanoic acid reacts with sodium hydroxide and gives sodium ethanoate and water.

2. **What happens when propyne is added to bromine water?**
   Propyne is an unsaturated hydrocarbons. So it decolourise the bromine water.

3. **What will happen when soap is used in hard water?**
   Soap reacts with salt in hardwater and forms scum which deposit in the clot doesnot easily rinse away.

VI. Short answer questions.

1. Write the structure of possible isomers for C_5H_{10}. ✶ ✶

- Pentene - CH_3-CH_2 CH=CH-CH_3

- Cyclo pentane

$$
\begin{array}{c}
H_2 \\
C \\
/ \quad \backslash \\
H_2C \quad\quad CH_2 \\
| \quad\quad\quad | \\
H_2C - CH_2
\end{array}
$$

2. Write the IUPAC and common name for the following.
i) CH_3CHO　　ii) CH_3COCH_3　　iii) CH_3COOH　　iv) $HCOOH$

Molecular formula	IUPAC Name	Common Name
CH_3CHO	Ethanol	Acetaldehyde
CH_3COCH_3	Propane	Acetone
CH_3COOH	Ethanoic acid	Acetic acid
$HCOOH$	Methanoic acid	Formic acid

3. What changes happen in fermentation tank in the manufacture of ethanol? Write equations for that.

- Molasses is added with ammonium sulphate (or) ammonium phosphate if needed.

- This solution is kept in fermentation tanks at 330 K for a few days.

- During this period, the enzymes invertase and zymase present in yeast, bring about the conversion of sucrose into ethanol.

$$\underset{\text{(sugar)}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{invertase}} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{(glucose (or) fructose)}}{C_6H_{12}O_6} \xrightarrow{\text{zymase}} \underset{\text{ethanol}}{2C_2H_5OH} + 2CO_2$$

4. What is esterification? Write equation for that reaction. ✶ ✶ ✶

- The reaction of an alcohol with carboxylic acid gives a compound having a fruity odour.

- This compound is called as ester and the reaction is called esterification.

- Ethanol reacts with ethanoic acid in the presence of conc. H_2SO_4 and gives ethyl ethanoate (i.e. ester).

$$\underset{\text{Ethanol}}{CH_3CH_2OH} + \underset{\text{Ethanoic acid}}{CH_3COOH} \xrightarrow{\text{Conc.}H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOCH_2CH_3} + H_2O$$

5. What is saponification of oil? Write a general equation for it.

- Alkaline solution (10 %) is added to oil.

- This mixture is boiled by passing steam through it.

- The oil gets hydrolysed after several hours of boiling.
- This process is called saponification. It is the reverse process of esterification.

$$\text{Ester} \xrightarrow[\text{NaOH}]{\text{H}_2\text{O}} \text{Carboxylate salt} + \text{Alcohol}$$
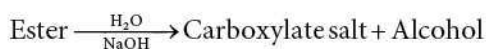
6. Write about decarboxylation salt of ethanoic acid.

When a sodium salt of ethanoic acid is heated with soda lime [solid mixture of 3 part of NaOH and 1 part CaO], methane gas is formed.

$$\underset{\text{Sodium ethanoate}}{CH_3COONa} \xrightarrow{NaOH/CaO} \underset{\text{methane}}{CH_4} + Na_2CO_3$$
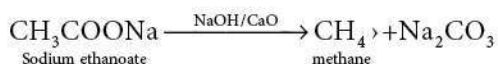
VII. Long answer questions:

1. Write the general characteristics of organics compounds.

- Organic compound have high molecular weight and a complex structure.
- They are mostly insoluble in water, but soluble in organic solvents.
- They are highly inflammable in nature.
- Organic compounds are less reactive compared to inorganic compounds.
- Mostly organic compounds form covalent bonds in nature.
- They have lower melting point and boiling point when compared to inorganic compounds.
- They exhibit the phenomenon of isomerism.
- They are volatile in nature.
- Organic compounds can be prepared in the laboratory.

2. Arrive at, systematically, the IUPAC name of the compound.

$$CH_3 - CH_2 - CH_2 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - CH_3$$
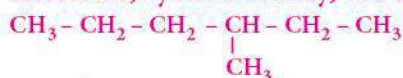
Step 1:

- The longest chain contains **six** carbon atoms and hence the root word is **'Hex'**

Step 2:

- There is a substituent.
- So the **carbo chain** is numbered from the right end which is closest to a substituent.

$$\overset{6}{CH_3} - \overset{5}{CH_2} - \overset{4}{CH_2} - \overset{3}{\underset{\underset{CH_3}{|}}{CH}} - \overset{2}{CH_2} - \overset{1}{CH_3}$$
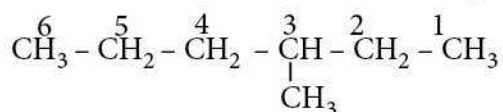
Step 3:

- All are **single bonds** between the carbon atoms and thus the suffix is **'ane'**.

Step 4:

- The substituent is a methyl group and it is located at 3 carbon atom.
- So its locant number is **3**. Thus the prefix **'3 - methyl'**
- The name of the compound

    3-methyl + Hex + ane = **3-methyl Hexane**
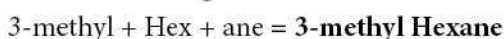
3. **Write the balanced equation for the following**
   i) **Dehydration of ethanol**
   ii) **Dehydrogenation of ethanol**
   iii) **Decarboxylation of ethanoic acid**

i) **Dehydration of ethanol:**

$$CH_3CH_2OH \xrightarrow[\text{443 K}]{\text{conc. } H_2SO_4} CH_2 = CH_2 + H_2O$$

ii) **Dehydrogenation of ethanol:**

$$CH_3CH_2OH \xrightarrow[\text{573 K}]{\text{Cu}} CH_3CHO + H_2 \uparrow$$

iii) **Decarboxylation of ethanoic acid:**

$$CH_3COONa \xrightarrow{NaOH + CaO} CH_4 \uparrow + Na_2CO_3$$
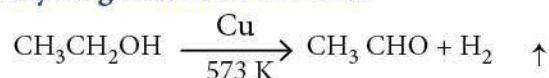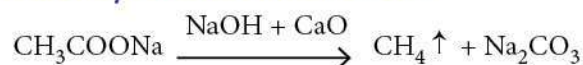
VIII. Higher Order Thinking Skill (HOTS)

1. **What is the difference in fructose and glucose structures?**
   - Glucose and fructose have same molecular formula, but they have different structures.

```
CHO              CH₂OH
|                |
CH–OH            C = O
|                |
CH–OH            CH OH
|                |
CH–OH            CH–OH
|                |
CH–OH            CH–OH
|                |
CH₂OH            CH₂OH
```
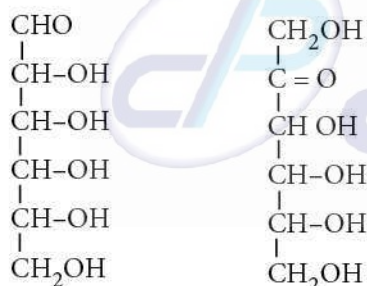
2. **Draw the electron dot structure for ethanol and butane.**
   - Molecular formula for butane is CH_3CH_2OH
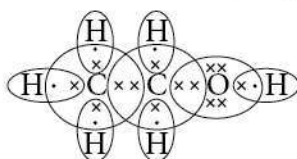
   - Molecular formula for butane is $CH_3CH_2CH_2CH_3$
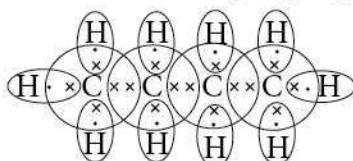
   - • hydrogen electrons
   - × carbon (or) oxygen electrons.

Unit Test - 11

Carbon and its Compounds

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   **5 × 1 = 5**

1. The IUPAC name of an organic compound is 3-Methyl butan-1-ol. What type of compound it is?
   - a) Aldehyde
   - b) Carboxylic acid
   - c) Ketone
   - d) Alcohol

2. Which of the following pairs can be the successive members of a homologous series?
   - a) C_3H_8 and C_4H_{10}
   - b) C_2H_2 and C_2H_4
   - c) CH_4 and C_3H_6
   - d) C_2H_5OH and C_4H_8OH

3. TFM in soaps represents _____ content in soap
   - a) mineral
   - b) vitamin
   - c) fatty acid
   - d) carbohydrate

4. Sodalime is a mixture of
   - a) $NaOH, CaCl_2$
   - b) $Ca(OH)_2, NaO$
   - c) $CaO, NaOH$
   - d) $CaO, Mg(OH)_2$

5. The substance sodium silicate is used for
   - a) not damaging the washing machine
   - b) glow to clothes
   - c) remove blood strain
   - d) fragrand smell

II. Answer the following questions in one or two lines.   **5 × 2 = 10**

1. Name the simplest ketone and give its structure formula.
2. Differentiate soaps and detergents.
3. What is homologous series?
4. What is Esterification? Write equation for that reaction.
5. What is saponification of oil? Write a general equation for it.

III. Answer the following questions in brief.   **2 × 4 = 8**

1. Classify the following compounds based on the pattern of carbon chain and give their structural formula: i) Propane, ii) Benzene, iii) Cyclobutane,iv) Furan
2. Differentiate soaps and detergents.

IV. Answer the following questions in detail.   **1 × 7 = 7**

1. i) What is the difference in fructose and glucose structures?

   ii) Write the general characteristics of organics compounds.

Plant Anatomy and Plant Physiology

Photosynthesis : Green Plants are capable of synthesizing glucose from CO_2 and H_2O in the presence of light.

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyl}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2 \uparrow$$
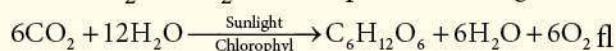
Light reaction : It takes place in grana of chloroplast.

Dark reaction : It takes place in stroma of chloroplast.

Accessory Pigments : Chlorophyll. b. and carotenoids.

Primary Pigment : Chlorophyll. a also called reaction centre

Aerobic respiration : Takes place in the presence of oxygens.

Anaerobic respiration : $C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH + Energy(ATP)$

Respiratory quotient : Respiratory quotient $= \dfrac{\text{Volume of } CO_2 \text{ liberated}}{\text{Volume of } O_2 \text{ consumed}}$

Cellular respiration : Biochemical process occurs within cells where the food is oxidized to obtain energy.

Mitochondria : It is called as power houses of the cell or ATP factory of the cell.

Tissues : Tissue is a group of similar or dissimilar cells having a common origin and performing similar functions.

Xylem : Xylem conducts water to different parts of the plant.

Phloem : Phloem conducts food materials to different parts of the plant.

Radial Vascular bundles : Xylem and Phloem within the vascular bundles are placed in different radii alternating with each other.

Conjoint bundles : Xylem and Phloem lie on the same radius.

Collateral : Xylem lies towards the centre and phloem lies towards the periphery.

Bicollateral : Phloem is present on both the inner and outer sides of xylem

Open : When cambium is present between xylem and phloem in collateral bundles, it is called open.

MIND MAP

```
                          Living world
                           of Plants
        ┌──────────────────────┼──────────────────────┐
   Plant Anatomy          Photosynthesis            Respiration
        │                      │                        │
```

Plant Anatomy
Monocot & Dicot
❖ Root
❖ Stem
❖ Leaves
Vascular system

Photosynthesis
Chloroplast structure
Light dependent reaction
Light independent reaction
Affecting factors

Respiration
Structure of Mitochondria
❖ Glycolysis
❖ Krebs Cycle
❖ ETC
❖ Affecting factors

```
   Open ──── Vascular ──── Closed
             Bundle (VB)
                 │
        ┌────────┴────────┐
     Radial            Conjoint
                  ┌────────┼────────┐
             Collateral Bi-collateral Concentric
                                        │
                                  ┌─────┴─────┐
                                  Amphicribal
                                  Amphivasal
```

Don

Closed	: Collateral bundles without cambium in between xylem and phloem is called closed.
Amphivasal	: Xylem completely surrounds the phloem.
Amphicribal	: Phloem completely surrounds the xylem.
Endarch	: Protoxylem lies towards the centre and metaxylem towards the periphery.
Exarch	: Metaxylem towards the centre and protoxylem lies towards the periphery.
Epiblema	: Outermost layer of the root also called as the rhizodermis.
Oxysomes	: The inner mitochondrial membrane bear minute tennis racket shaped particles called oxysomes or F1 particles.

Abbreviations:

TCA	–	Tri carboxylic Acid Cycle.
ETC	–	Electron Transport chain.
ATP	–	Adenosine Triphosphate
ADP	–	Adenosine Diphosphate
NAD	–	Nicotinamide Adenine Dinucleotide
NADP	–	Nicotinamide Adenine Dinucleotide Phoisphate

Scientists and Inventions:

- Nehemish Grew is known as the father of Plant Anatomy.
- Sachs in 1875 classified the tissue system in plants into three types.
- Light dependent photosynthesis was discovered by Robin Hill in 1939.
- Melvin Calvin, an American biochemist, discovered the chemical pathway for photosynthesis. He was awarded the Nobel Prize in the year 1961.
- C.N. Rao, who was conferred Bharat Ratna, is now working on artificial photosynthesis.
- The mitochondria were first discovered by Kolliker in 1857.

Tabulation

Tissue System	Components	Functions
Dermal Tissue System	Epidermis and Periderm (in older stems and roots)	Protection Prevention of water loss
Ground Tissue System	Parenchyma tissue Collenchyma tissue Sclerenchyma tissue	Photosynthesis Food storage Regeneration Support Protection
Vascular Tissue System	Vascular tissues - Xylem tissue - Phloem tissue	Transport of water and minerals Transport of food

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Casparian strips are present in the _____ of the root.
  a) cortex   **b)** pith
  c) pericycle   **d)** endodermis

2. The endarch condition is the characteristic feature of
  a) Root   **b)** Stem
  c) Leaves   **d)** flower

3. The xylem and phloem arranged side by side on same radius is called _____.
  a) Radial   **b)** Amphivasal
  c) Conjoint   **d)** None of these

4. Which is formed during anaerobic respiration?
  a) Carbohydrate   **b)** Ethyl alcohol
  c) Acetyl CoA   **d)** Pyruvate

5. Krebs cycle takes place in ✶ ✶
  a) chloroplast   **b)** mitochondrial matrix
  c) stomata   **d)** inner mitochondrial membrane

6. Oxygen is produced at what point during photosynthesis?
  a) When ATP is converted to ADP
  b) When CO_2 is fixed
  c) When H_2O is splitted
  d) All of these

Ans:

1.	d)	endodermis	4.	b)	Ethyl alcohol
2.	b)	Stem	5.	b)	Mitochondrial matrix
3.	c)	Conjoint	6.	c)	When H_2O is splitted

II. Fill in the blanks

1. Cortex lies between _____.

2. Xylem and phloem occurring on the same radius constitute a vascular bundle called _____.

3. Glycolysis takes place in _____ . ✶ ✶

4. The source of oxygen liberated in photosynthesis is _____.

5. _____ is ATP factory of the cells. ✶ ✶

Ans:

1.	Epidermis and Endodermis	2.	conjoint vascular bundles
3.	Cytoplasm	4.	H_2O
5.	Mitochondria		

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

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

Xylem tissue is involved in the transport of water in plants.

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

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

In monocot stem cambium is **not** present in between xylem and phloem.

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

Palisade parenchyma cells occur below upper epidermis in **dicot leaf**.

5. Mesophyll contains chlorophyll.   **True**

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

Anaerobic respiration produces **less** ATP than aerobic respiration.

IV. Match the following

1.

Column I		Column II	
1. Amphicribal	-	a) Dracaena	(c)
2. Cambium	-	b) Translocation of food	(d)
3. Amphivasal	-	c) Fern	(a)
4. Xylem	-	d) Secondary growth	(e)
5. Phloem	-	e) Conduction of water	(b)

V. Answer in a sentence

1. What is collateral vascular bundle? ✷ ✷

When xylem lies towards the **centre** and **phloem** lies towards the **periphery**, it is called collateral vascular bundle.

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

The carbon that plants need for photosynthesis comes from **carbon dioxide**, or CO_2 that's present in our atmosphere.

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

Glycolysis is the common step in both aerobic and anaerobic pathway.

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

Anaerobic respiration is a process by which carbohydrates are converted into ethyl alcohol.

VI. Short answer questions

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

- A large number of vascular bundles are present in **dicot stem.**
- They are arranged in the form of a **ring** around the pith.
- Vascular bundles are **conjoint, collateral, endarch** and **open**.

2. Write a short note on mesophyll.

- The tissue present between the **upper** and the **lower epidermis** is called mesophyll.
- Mesophyll cells contain chloroplasts.
- In dicot leaf, the mesophyll is differentiated into **palisade** parenchyma and **spongy** parenchyma.
- Palisade cells do not have intercellular spaces and take active part in photosynthesis. Whereas, spongy parenchyma cells have large **intercellular spaces** and helps in **gaseous exchange.**

3. Draw and label the structure of oxysomes. ✸ ✸ ✸

Structure of Oxysomes
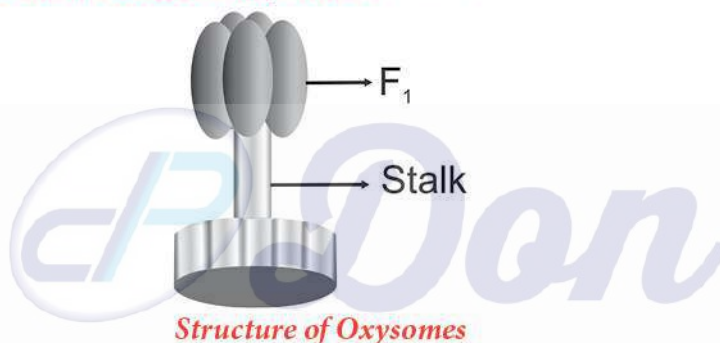
4. Name the three basic tissues system in flowering plants. ✸

- Dermal or Epidermal tissue system
- Ground tissue system
- Vascular tissue system

5. What is photosynthesis? Where in a cell does it occur? ✸ ✸

- Photosynthesis is a process by which autotrophic organisms like green plants, algal and chlorophyll containing bacteria utilize the energy from **sunlight** using CO_2 and H_2O to synthesize their own food.
- It occurs in the chloroplasts of the cell.

6. What is respiratory quotient? ✸ ✸

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

- $$RQ = \frac{\text{Volume of } CO_2 \text{ liberated}}{\text{Volume of } O_2 \text{ consumed}}$$

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

- During light independent reaction CO_2 is reduced to carbohydrate by **ATP** and **NADPH$_2$** which are generated during light dependent reaction.
- So light dependent reaction should occur before the light independent reaction.

8. Write the reaction for photosynthesis. ✳

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyl}]{\text{Light}} C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$$
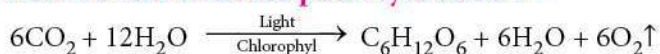
Carbon dioxide + Water ⟶ Glucose + Water + Oxygen

VII. Long answer questions

1. Differentiate the following. ✳ ✳ ✳

a) Monocot root and Dicot root

S.No.	Tissues	Dicot Root	Monocot Root
1.	Number of Xylem	Tetrach	Polyarch
2.	Cambium	Present (During secondary growth only)	Absent
3.	Secondary Growth	Present	Absent
4.	Pith	Absent	Present

b) Aerobic and Anaerobic respiration

Basis for Comparison	Aerobic respiration	Anaerobic respiration
It occurs in	The cytoplasm and mitochondria.	Cytoplasm only.
Final product	Carbon dioxide, water and energy	Carbon dioxide, Lactic acid (animal cells), ethanol (plant cell) and energy
It requires	Oxygen and glucose to produce energy.	It does not require oxygen but uses glucose to produce energy
Number of ATP released	38 ATP.	2 ATP.

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

- The 3 stages of aerobic respiration are Glycolysis, Krebs cycle and Electron Transport Chain.

Glycolysis:

- Glycolysis takes place in the **cytoplasm** of the cell.
- It is the breakdown of **one** molecule of **glucose** (6 carbon) into **two** molecules of **pyruvic acid** (3 carbon).

Krebs cycle:

- This cycle occurs in the **mitochondrial** matrix.
- At the end of glycolysis **2** molecules of **pyruvic acid** enter into mitochondria.
- Oxidation of **pyruvic acid into CO$_2$** and water takes place.
- It is also called **Tricarboxylic Acid Cycle.**

Electron Transport Chain:

- **NADH$_2$** and **FADH$_2$** molecules formed during glycolysis and Krebs cycle are oxidised to **NAD$^+$** and **FAD$^+$** to release energy through electrons.

- These electrons move through the **electron transport chain** and release energy.
- This energy is used by **ADP** to synthesize **ATP**.
- This is called **oxidative phosphorylation.**
- In this process O_2 gets reduced to **water.**
- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$

3. **How does the light dependent reaction differ from the light independent reaction? What are the end product and reactants in each? Where does each reaction occur within the chloroplast?** ✹

a) **Difference between Light dependent and Light independent reactions:**

S.No.	Light dependent Reaction	Light Independent Reaction
1.	It requires sunlight.	It does not require sunlight.
2.	It takes place in the thylakoid membrane (grana) of the chloroplast.	It takes place in the stroma of the chloroplast.
3.	These reactions use light energy to make ATP and $NADPH_2$.	These reactions use the energy derived from light dependent reactions to form glucose.

b) **Reactants and End products:**

S.No.	Reactions	Reactants	End products
1.	Light dependent	Photosynthetic pigment, light, H_2O	ATP, $NADPH_2$, O_2↑, H_2O
2.	Light independent	CO_2, ATP, $NADPH_2$	Glucose

c) **Place of occurrence:**

- **Light Dependent**   : Thylakoid membrane (grana) of the chloroplast.
- **Light Independent** : Stroma of the chloroplast

VIII. Higher Order Thinking Skills (HOTS)

1. **The reactions of photosynthesis make up a biochemical pathway.**
   (A)   **What are the reactants and products for both light and dark reactions?**
   (B)   **Explain how the biochemical pathway of photosynthesis recycles many of its own reactions and identify the recycled reactants.**

(A) The light-dependent reactions require light and water and produce ATP and $NADPH_2$. The light-independent reactions require carbon dioxide and this CO_2 is reduced to carbohydrates.

(B) **During photosynthesis, two important processes are taking place:**

- The light reactions and the dark reactions (Calvin cycle).
- The light reactions use light to synthesize **ATP** and **$NADPH_2$.**
- The Calvin cycle uses these reactants to produce sugar from additional CO_2 molecule.
- This cycle then produces NAP$^+$, ADP + Pi (Inorganic phosphate) which is used in the light reactions, with H_2O molecules, to produce ATP and $NADPH_2$ again.

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

The light-dependent reactions occur in the **thylakoids** (grana) and the light independent reactions (Calvin cycle) occur in the **stroma**.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. _____ is parenchymatous with profuse intercellular spaces in monocot stem.
a) Hypodermis   b) Ground tissue   c) Vascular bundles   d) Cortex

2. Single layered without hair
a) Endodermis   b) Epidermis   c) Hypodermis   d) Pericycle

3. Bulliform or motor cells are present on ✳
a) Root   b) Stem
c) Isobilateral leaf   d) Dorsiventral leaf

4. Bulliform cells differ from other cells in being
a) small and thick walled   b) small and thin walled
c) large and thick walled   d) large and thin walled

5. The endarch condition is characteristic of
a) root   b) stem   c) leaves   d) petiole

6. Passage cells are present in
a) cortex   b) pericycle   c) pith   d) endodermis

7. Innermost layer of cortex is
a) pericycle   b) endodermis   c) cortex   d) peristerm

8. Starch sheath is
a) endodermis of stem   b) outer cortex
c) inner cortex   d) covering of vascular bundle

9. Endodermis is not differentiated in ✳
a) monocot root   b) dicot root   c) monocot stem   d) dicot stem

10. Open vascular bundles are those in which
a) the protoxylem lies towards the pith
b) there is no cambium
c) cambium is present between xylem and phloem
d) phloem is found on both outer and inner sides of xylem

11. Stele consists of ✳
a) Endodermis, pericycle, vascular bundle and pith
b) pericycle, vascular bundle and pith
c) Vascular bundle and pith
d) Vascular bundles only

12. Which of these characters does/do not apply to the vascular bundle of monocot stem?

    I. Conjoint   II. Collateral   III. Open   IV. Endarch

    a) I and II only   **b)** II and III only   **c)** III and IV only   **d)** III only

13. Epidermal hairs are not present in

    a) Monocot stem   **b)** Monocot root

    c) Dicot stem   **d)** Dicot root

14. Cell organelles responsible for preparation and storage of food:

    a) Mitochondria   **b)** Plastids   **c)** Lysosomes   **d)** Ribosomes

15. Fuel Produced by using the technology Artificial photosynthesis is _____

    a) Oxygen   **b)** Nitrogen   **c)** Hydrogen   **d)** Methane

16. Proteins which forms channel for the passage of molecules through the outer mitochondrial membrane is _____ ✹ ✹

    a) porin molecules   **b)** cristal   **c)** oxysomes   **d)** matrix

17. The common step in both aerobic and anaerobic respiration is _____

    a) Krebs cycle   **b)** Electron Transport chain

    c) Oxidation   **d)** Glycolysis

18. The chemical pathway of photosynthesis was discovered by

    a) C.N. Rao   **b)** Melvin Calvin

    c) Sachs.   **d)** Robin Hill

19. Power house of the cell _____

    a) Mitochondria   **b)** Leucoplast   **c)** Chromopalast   **d)** Chloroplast

Ans:

1.	b)	Ground tissue	11.	b)	pericycle, vascular bundle and pith
2.	b)	Epidermis	12.	d)	III only
3.	c)	Isobilateral leaf	13.	a)	Monocot stem
4.	d)	Large and thin walled	14.	b)	Plastids
5.	b)	Stem	15.	c)	Hydrogen
6.	d)	Endodermis	16.	a)	porin molecules
7.	b)	Endodermis	17.	d)	Glycolysis
8.	a)	endodermis of stem	18.	b)	Melvin Calvin
9.	c)	Monocot stem	19.	a)	Mitochondria
10.	c)	cambium is present between xylem and phloem			

II. Fill in the blanks

1. _____ increases the inner surface area of the mitochondrial membrane.

2. Conjunctive tissue is made of _____ cells in dicot root.

3. _____ is a ground tissue that is present between both epidermal layers in leaf.

4. Vascular bundles are skull shaped in _____.

5. Roots possess _____ xylem.

6. Light reactions takes place in the _____ of chloroplast.

7. _____ are orange coloured plastids. ✴

8. Number of vascular bundles are many in _____.

9. Phloem is present on both outer and inner side of xylem in _____ vascular bundle.

10. Vascular bundles are conjoint, collateral and closed in _____.

11. Each vascular bundle is surrounded by parenchymatous bundle sheath _____.

12. Thylakoids are arranged in the form of dics stacked one above the other called as _____.

13. Vascular bundles are tetrach in _____. ✴ ✴

14. Vascular bundles are arranged in the form of a ring around the pith in _____.

15. Each vascular bundle is surrounded by sclerenchymatous bundle sheath _____.

16. Chlorophyll b and carotenoids are called _____ pigments. ✴ ✴

17. Calvin cycle is carried out in the _____ of light.

18. Protoxylem lacuna is present in _____ (monocot stem, monocot root)

19. _____ helps the cells to maintain normal concentration of calcium ions.

20. Photosynthetic pigments are found in _____

21. Inner mitochondrial membrane gives rise to finger-like projections called _____.

22. Minute tennis rocket shaped particles called _____ are present in the inner mitochondrial membrane.

Ans:

1.	cristae	2.	parenchyma
3.	Mesophyll	4.	Monocot stem
5.	exdarch	6.	Grana
7.	Chromoplast	8.	monocot stem
9.	bicollateral	10.	Dorsiventral leaf (or) dicot leaf
11.	in leaf	12.	grana
13.	dicot root	14.	dicot stem
15.	Monocot stem	16.	accessory pigments
17.	absence	18.	monocot stem
19.	Mitochondria	20.	Thylakoids
21.	cristae	22.	oxysomes

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

1. X or Y shaped vessels are present in monocot root. ✶   **False**
   X or Y shaped vessels are present in **monocot stem.**

2. Parenchyma cells which are responsible for the gaseous exchange in mesophyll of leaf is spongy parenchyma.   **True**

3. Medullary rays are present in Monocot stem.   **False**
   Medullary rays are present in **Dicot stem.**

4. Secondary growth is present in Monocot stem.   **False**
   Secondary growth is present in **Dicot stem**.

5. Leucoplasts are colourless plastids. ✶   **True**

6. Glucose is converted to ethanol in the presence of oxygen.   **False**
   Glucose is converted to ethanol in the **absence** of oxygen.

IV. Assertion and Reason

a) Both if assertion and reason are true and reason is the correct explanation of assertion
b) Both if assertion and reason are true and reason is not the correct explanation of assertion
c) If assertion is true and reason is false
d) Both if assertion and reason are false

1. **Assertion:** A cell cannot get its energy directly from glucose.
   Reason: The energy released from glucose during respiration is used to make ATP.

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

2. **Assertion:** Carbondioxide is reduced to carbohydrates during light reactions.
   Reason: With the help of ATP and $NADPH_2$ formed in the light reactions, carbohydrates are formed.

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

3. **Assertion:** Xylem is exarch and tetrarch in dicot root.
   Reason: Protoxylem lies towards the centre in dicot root.

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

4. **Assertion:** Collenchyma forms the hypodermis of dicot stems.
   Reason: Flexibility of dicot stems is because of collenchyma cells.

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

5. **Assertion:** In collateral vascular bundles, phloem is situated towards the inner side.
   Reason: In monocot stem, cambium is present.

   Ans: d) Both if assertion and reason are false.

6. **Assertion:** Spongy parenchyma helps in gaseous exchange in dorsiventral leaf.
   Reason: Bulliform cells are present in the epidermis of dorsiventral leaf.

   Ans: c) If assertion is true and reason is false.

V. Match the following

1. **Column I**   **Column II** ✴

    1) Krebs cycle   -   a) Suberin   (c)
    2) Anaerobic   -   b) Oxidative phosphorylation   (d)
    3) Isobilateral   -   c) Tricarboxylic acid cycle   (e)
    4) Casparian strips   -   d) Ethanol   (a)
    5) ETC   -   e) Bulliform   (b)

2. **Column I**   **Column II**

    1) Pericycle   -   a) Bulliform cells   (b)
    2) Large and thin walled cells -   b) Lateral roots originate from   (a)
                                           this layer in upper epidermis
    3) Casparian strips   -   c) Mesophyll tissue of dicot leaf   (d)
    4) Spongy parenchyma   -   d) Suberin deposition in the   (c)
                                           radial walls of endodermis

VI. Answer in a sentence

1. What is bicollateral vascular bundle?
   When phloem is present on **both sides** of the xylem, it is called bicollateral vascular bundle.

2. What are radial bundles? ✴
   When xylem and phloem are present in **different radii** alternating with each other, it is called radial bundles.

3. What is amphivasal vascular bundle?
   When **xylem surrounds the phloem** it is called amphivasal vascular bundle.

4. What is amphicribal vascular bundle?
   When **phloem surrounds the xylem** it is called amphicribal vascular bundle.

5. What is endarch vascular bundle? ✴
   When **protoxylem** lies towards the **centre** and **metaxylem** lies towards the **periphery** it is said to be endarch.

6. What is exarch vascular bundle?
   When **protoxylem** lies towards the **periphery and metaxylem** lies towards the **centre** it is said to be exarch.

7. Name the three types of plastids.
   Chloroplast, Chromoplast and Leucoplast are the three types of plastids.

8. Who classified the tissue system in plants into three types?
   Sachs (1875) classified the tissue system in plants into three types.

9. Which is called as reaction centre? Why?

> Chlorollphyll.a. – It traps solar energy.

10. Where does the light dependent reaction take place during photosynthesis?

> The light dependent reaction takes place in the **thykaroid membranes** of chloroplast.

11. What are the other names of Calvin cycle?

> C_3 cycle or calcium-Benson-Basharm cycle or pentose phophate cycle.

12. Define cellular respiration. ★ ★

- Biochemical process occurs **within cells** where the food is oxidized to obtain energy is known as cellular respiration.

- Cellular respiration is a **biochemical pathway** by which cells regain energy from the chemical bonds of food molecules and provide energy for essential process of life.

VII. Short answer questions

1. Write a short note on plastids.

- Plastids are **double membrane** bound organelles found in plants and some algae.

- They are responsible for the **preparation** and **storage** of **food**.

- There are three types of plastids.

> Chloroplast – **green colour** plastid
>
> Chromoplast – **yellow** or **orange** coloured plastid
>
> Leucoplast – **colourless** plastid

2. Write short note on the functions of chloroplast. ★ ★

- Photosynthesis
- Storage of starch
- Synthesis of fatty acids
- Storage of lipids

3. Write notes on photosynthetic pigments.

- Pigments involved in **photosynthesis** are called photosynthetic pigments.

- They are of two classes. **Primary** and **accessory** pigments.

- Primary pigment traps the **solar energy** and converts it into **electrical** and **chemical energy.** Hence, it is called the **reaction centre**.

- Pigments such as **chlorophyll b** and **carotenoids** are called accessory pigments.

- Reaction centre (chlorophyll a) and accessory pigments are called photosystems.

4. What are oxysomes? Give the functions of oxysomes.

- **Cristae of mitochondria** bear minute regularly spaced tennis rocket shaped particles are called oxysomes.

- They involve in **ATP** synthesis.

5. How does a cell get its energy?

- A cell **cannot** get energy directly from glucose.

- During **cellular respiration** glucose is oxidized to release energy.

- This energy is trapped by **ADP** to synthesize **ATP** which the energy currency of the sell.

- The cell **consumes** this energy when it needs.

6. Which is the power house of cells? Why? ✳

- Mitochondria.
- It produces a large number of **ATP** molecules.

VIII. Long answer questions

1. Write a note on structure of chloroplast. ✳

- Chloroplasts are **green plastids** containing green pigment called **chlorophyll**.
- Chloroplasts are oval shaped organelles having a **diameter** of **2-10 micrometer** and a **thickness** of **1.2 micrometer**.
- The outer and inner membranes of the envelope are **separated** by **intermembrane space.**
- Matrix present **inside** the membrane is called **stroma**. It contains DNA, ribosomes and other molecules required for **protein synthesis.**
- Disc like **membranous sacs** present in the chloroplast are called **thylakoids**. These thylakoids are stacked one above the other called as **grana**.
- These are **interconnected** to each other by membranous lamellae called **Fret channels**.

2. Write notes on the structure of Mitochondria.

It consists of two membranes called inner and outer membrane.

- Outer membrane is **smooth and permeable** to molecules.
- It contains enzymes, proteins and lipids.
- It has porin molecules (proteins) which form **channels** for passage of molecules through it.
- Inner mitochondrial membrane is **semi-permeable** and regulates the passage of materials in and out of Mitochondria.
- It is rich in enzymes and carrier proteins. It consists of **80% proteins** and **lipids**.

3. Draw and label the parts of different types of vascular bundles.

Xylem

Phloem

Radial

Phloem

Cambium

Xylem

Conjoint, collateral and open

Conjoint, collateral and closed

Outer Phloem
Outer Cambium
Xylem
Inner Cambium
Inner Phloem
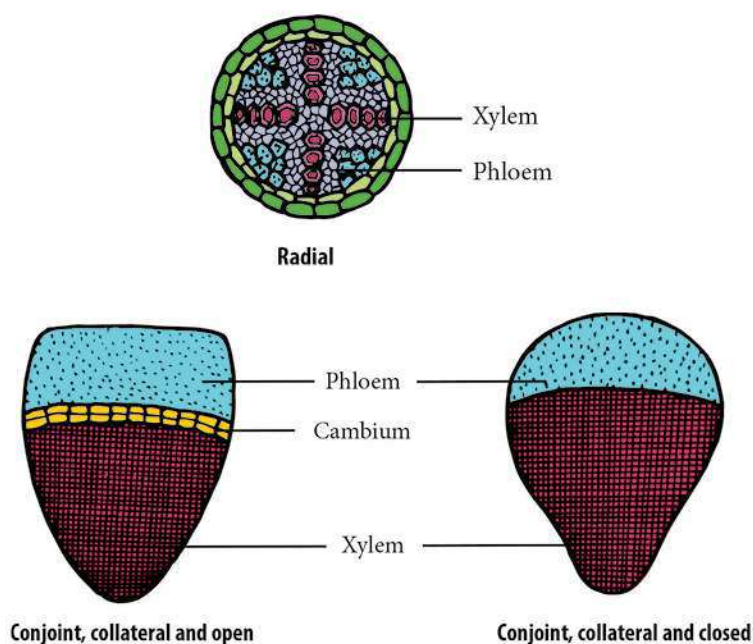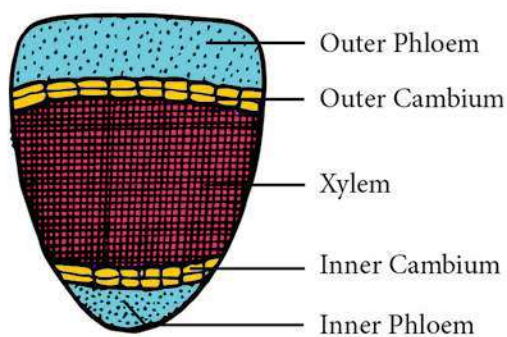
Conjoint, Bicollateral

Xylem
Phloem
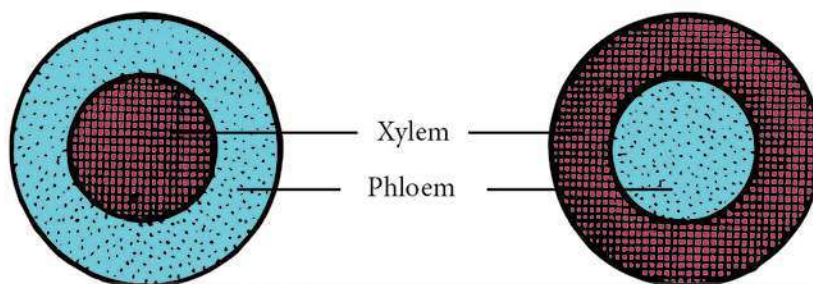
Concentric and Amphicribral

Concentric and Amphivasal

4. Observe the diagram and answer the following questions

  i)   **Mention the type of transverse section.**

  ii) **Describe the vascular bundle.**

 i) **1. Dicot root**

Root hair
Piliferous layer
Cortex
Endodermis
Phloem
Pericycle
Xylem
Casparian strip
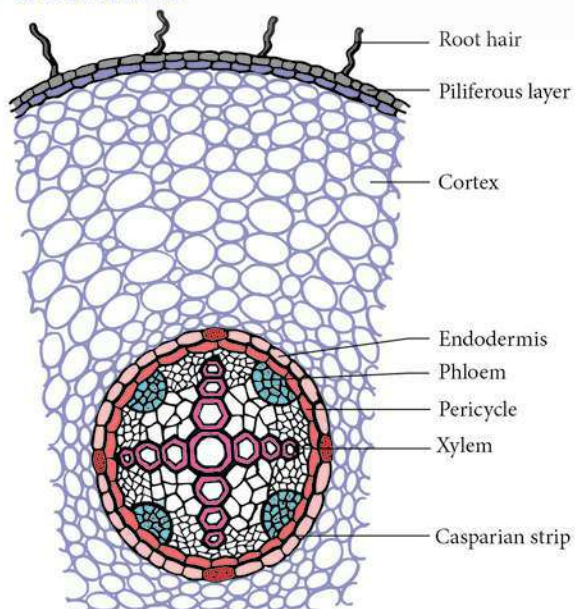
Transverse section of Dicot root

Transverse section of a Dicot root:

• Vascular bundle is radial.

• Xylem is exarch and tetrach.

- The tissue present between xylem and phloem is called conjunctive tissue.
- In dicot root, it is made up of parenchyma.
- Young root contains pith whereas in old root pith is absent.

2. Monocot root

Root hair
Piliferous layer
Cortex
Casparian strip
Endodermis
Pericycle
Phloem
Xylem
Pith
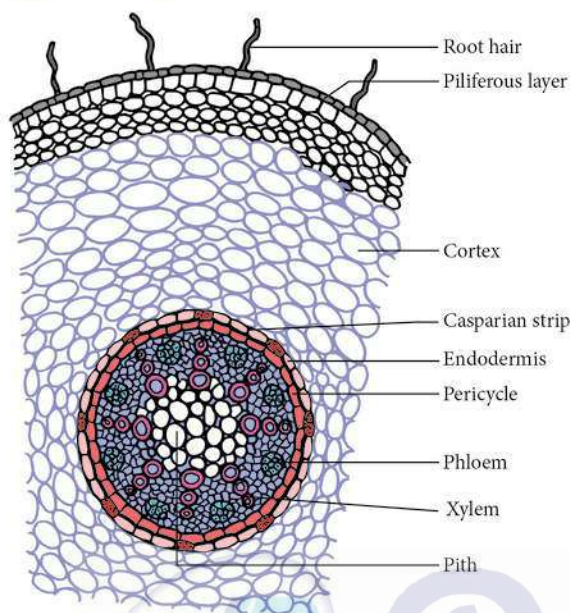
Transverse section of Monocot root

Transverse section of a Monocot root:

- **Vascular tissues:** It consists of many patches of xylem and phloem arranged radially.
- The xylem is exarch and polyarch.
- The conjunctive tissue is made up of sclerenchyma.
- It is present at the center.
- It is made up of parenchyma cells with intercellular spaces.

3. Dicot stem

Epidermal hair
Cuticle
Epidermis
Collenchyma
Chlorenchyma
Parenchyma
Endodermis
Phloem
Cambium
Xylem
Pith
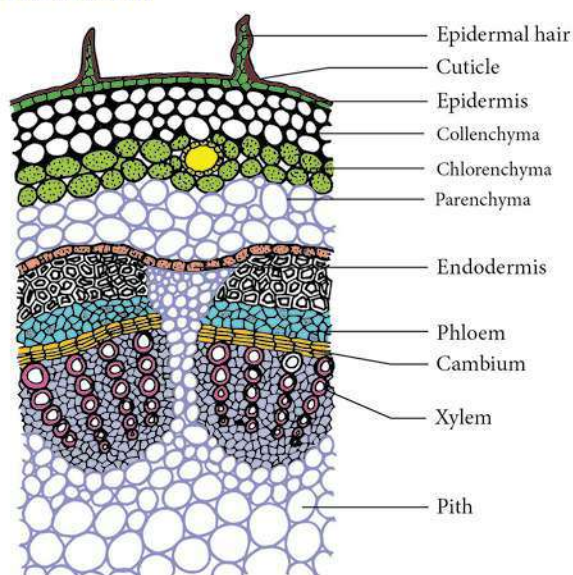
Transverse section of Dicot stem

Transverse section of a Dicot stem

- Vascular bundles are conjoint, collateral, endarch and open.
- They are arranged in the form of a ring around the pith.
- Pith is a large central parenchymatous zone with intercellular spaces.

4. Monocot stem
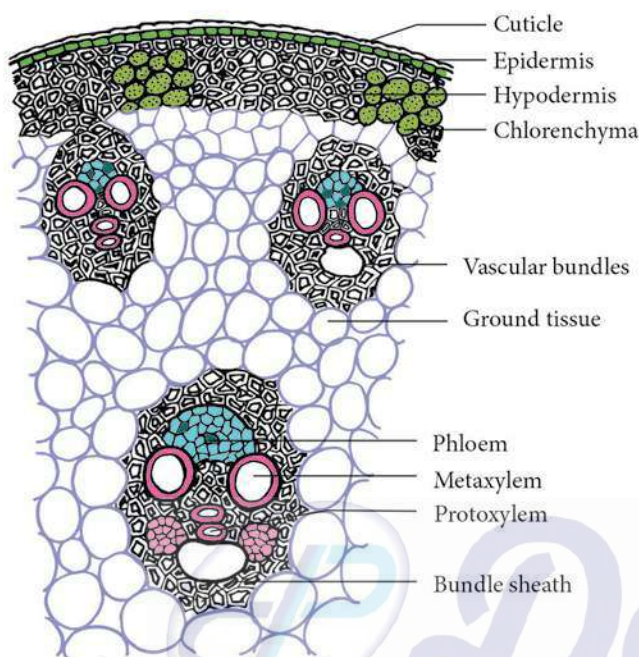
Transverse section of monocot stem

Transverse section of a Monocot stem

- Vascular bundles are skull shaped and scattered in the ground tissue.
- Vascular bundles are conjoint, collateral, endarch and closed.
- Each vascular bundle is surrounded by few layers of sclerenchyma cells called bundle sheath.

ii) Vascular bundles:

- Large number of vascular bundles are present, some of which are small and some are large.
- Each vascular bundle is surrounded by parenchymatous bundle sheath.
- Vascular bundles are conjoint, collateral and closed.
- Xylem is present towards upper epidermis and phloem towards lower epidermis.

(a) Xylem:

- It consists of metaxylem and protoxylem. Xylem vessels are arranged in V or Y shape.
- In mature vascular bundle, the lower most protoxylem disintegrates and form a cavity. This is called protoxylem lacuna.

(b) Phloem:

- It consists of sieve tube elements and companion cells.
- Phloem parenchyma, and phloem fibers are absent.

(c) Pith:

- Pith is not differentiated in monocot stems.

5. Draw and label the parts of Chloroplast.
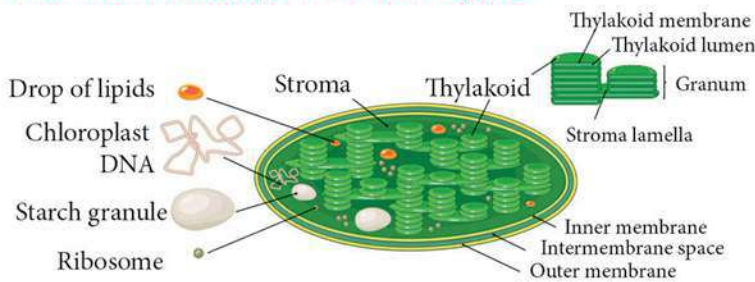
Ultrastructure of chloroplast

6. Draw and label the parts of Mitochondria.
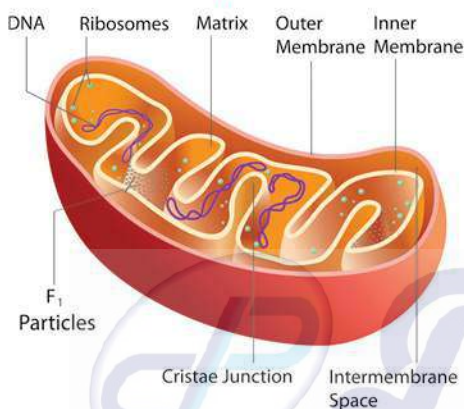
Structure of mitochondria

7. Differences between Dicot and Monocot Stem.

S. No.	Tissues	Dicot Stem	Monocot Stem
1	Hypodermis	Collenchymatous	Sclerenchymatous
2	Ground tissue	Differentiated into cortex, endodermis, pericycle and pith	Undifferentiated
3	Vascular bundles	i) Less in number ii) Uniform in size iii) Arranged in a ring iv) Open v) Bundle sheath absent	(i) Numerous (ii) Smaller near periphery, bigger in the centre (iii) Scattered (iv) Closed (v) Bundle sheath present
4	Secondary growth	Present	Mostly absent
5	Pith	Present	Absent
6	Medullary rays	Present	Absent

Unit Test - 12

Plant Anatomy and Plant Physiology

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. The endarch condition is the charateristic feature of
   a) root   b) Stem   c) Leaves   d) flower

2. The xylem and phloem arranged side by side on same radius is called _____.
   a) radial   b) Amphivasal   c) Conjoint   d) None of these

3. _____ is parenchymatous with profuse intercellular spaces in monocot stem.
   a) Hypodermis   b) Ground tissue   c) Vascular bundles   d) cortex

4. Single layered without hair
   a) Endodermis   b) Epidermis   c) Hypodermis   d) Pericycle

5. Starch sheath is
   a) endodermis of stem   b) Outer cortex
   c) Inner cortex   d) covering of vascular bundle

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Write a short note on mesophyll.
2. Draw and label the structure of oxysomes.
3. What is respiratory quotient?
4. Write short note on the functions of chloroplast.
5. Write notes on photosynthetic pigments.

III. Answer the following questions in brief.   2 × 4 = 8

1. i) What is collateral vascular bundle?
   ii) Draw and label the structure of oxysomes.

2. i) Write a short note on mesophyll.
   ii) What is the common step in aerobic and anaerobic pathway?

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Write a notes on xylem and phloem.
   ii) Draw the transverse section of Dicot stem and label its parts.

Structural Organisation of Animals

1. Animalia is divided into two groups, Invertebrates and Chordates.

2. Scientific name of Indian cattle leech is *Hirudinaria granulosa* which belongs to Phylum Annelida.

Taxonomic position

Phylum	Annelida
Class	Hirudinea
Order	Gnathobdellida
Genus	*Hirudinaria*
Species	*Granulosa*

- Annelids are metamerically segmented worms with well developed organ systems.

- Leech is an ectoparasite and feeds on the blood of fishes, frogs, cattles and humans.

- Leech is sanguivorous (blood sucking) in nature.

- Metamerism is the segmentation of the body.

- Its body is divided into 33 segments.

- Each segment is further divided into annulus.

- Clitellum is formed in the segments 9-11, which is meant for producing cocoon.

- There are five pairs of eyes on the dorsal side of the first five segments.

- Annular receptors and segmental receptors are the two types of sensory receptors.

- Annular receptors are located in each annulus and segmental receptors are located on the first annulus of each segment.

- Leech has two suckers. Anterior or oral sucker and posterior sucker.

MIND MAP

External Morphology

Leech

Moist Slimy Skin
Metameres
Annular segmental receptors
Anterior posterior sucker

Rabbit

Metameres
Skin, claws, nail, hair
Head, trunk, tail
External ear
Sweat, sebaceous, mammary glands

Organ and Organ systems

Leech

Crop, stomach, Intestine
Cutaneous (skin)
Haemocoelomic channels
Supra and subpharyngeal ganglion
Nephridia
Hermaphrodite (Testis and ovary)

Rabbit

Buccal cavity, stomach, Intestine, Liver, Pancreas
Pulmonary lungs
Heart
Fore, Mid, Hind brain
Metanephric kidney
Sexual dimorphism Testis in male and ovary in female

Digestion
Respiration
Circulation
Nervous
Excretion
Reproduction

- Anterior sucker occupies the five segments. Posterior sucker is formed by the fusion of last seven segments.

- Both the suckers help in attachment to the host and locomotion. Anterior sucker helps in feeding also.

- Mouth is situated in the middle of the anterior sucker.

- Anus is present in the 26th segment.

- There are 17 pairs of nephridiopores which lie ventrally on the last annulus of each segment from 6 to 22.

- There is a male genital pore between the 2nd and 3rd annuli of the 10th segment.

- There is a female genital pore between the second and third annuli of the 11th segment.

- Body of leech is divided into six regions.

Region	Segments
Cephhalic	1st – 5th
Preclitellar	6th, 7th and 8th
Clitellar	9th, 10th and 11th
Middle	12th – 22nd
Caudal	23rd – 26th
Posterior	27th – 33rd

- Body wall is divided into five layers. (i) cuticle (ii) epidermis (iii) dermis (iv) muscular layer (v) botryoidal tissue.

- Movement in leech takes place by (i) looping or crawling movement (ii) swimming movement.

- The buccal cavity has three jaws with single row of minute teeth.

- The jaws contain papillae which bear the openings of salivary glands.

- Muscular pharynx is surrounded by salivary glands. Saliva contains a protein called hirudin which prevents the blood clotting.

- Crop is the largest portion of the alimentary canal. It is divided into 10 chambers.

- The chambers of the crop has a pair of outgrowth known as caeca or diverticula.

- Crop and diverticula stores a large amount of blood which is slowly digested. Mouth → buccal cavity → pharynx → oesophagus → crop → stomach → intestine → rectum → anus.

- Digestive system of Leech
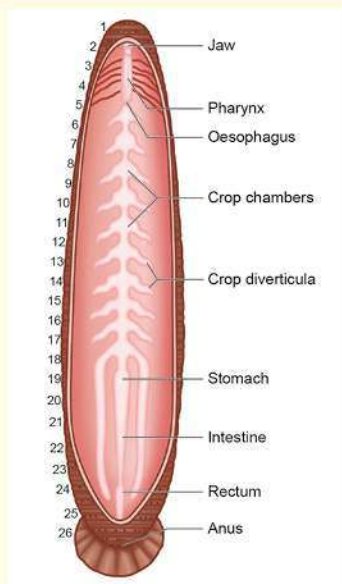
Digestive system of Leech

☙ Segmentation of leech

External and Internal features	Segments in which the structures are present
Body segments	33
Anterior Sucker, Mouth, Eyes	1st - 5th
Posterior sucker	27th - 33rd
Pharynx	5th - 8th
Crop	9th - 18th
Stomach	19th
Intestine	10th - 22nd
Rectum	23rd - 26th
Anus	26th
Nephridiopores	6th - 22nd
Male genital aperture	10th
Female genital aperture	11th

☙ Respiration takes place through the skin in leech.

☙ Respiration takes place by a process called diffusion.

☙ Oxygen dissolved in water diffuses through the skin into the haemocoelic fluid while carbondioxide diffuses out.

☙ The skin is kept moist and shiny due to the secretion of mucus.

☙ There are **no true blood vessels.**

☙ Blood vessels are replaced by haemocoelic channels. These channels are filled with coelomic fluid which contains haemoglobin.

- There are four longitudinal channels surrounding the alimentary canal. The two lateral channels serve as heart and has valves.
- The central nervous system consists of a nerve ring and a paired ventral nerve cord.
- Nerve ring is formed of **suprapharyngeal ganglion, circumpharyngeal connective** and **subpharyngeal ganglion.**
- In leech, excretion takes place through nephridia.
- There are 17 pairs of nephridia which open out by nephridiopores from 6th to 22nd segments.
- Leech is a **hermaphrodite** (Both the male and female sex organs are present in the same animal).
- Male reproductive system consists of 11 pairs of testes. One pair of testes in each segment from 12th to 22nd segments.
- From the testes arises a short duct called **vas efferens** and joins with **vasdeferens.**
- Vas deferens becomes convoluted to form epididymis or sperm vesicle. It stores **spermatozoa.**
- The epididymis leads to the **ejaculatory duct.**
- **Female reproductive system consists of ovaries,** oviducts and vagina.
- Single pair of ovary is present in the 11th segment. Each ovary is ribbon shaped. **Ova** is produced from the ovary.
- Ovary leads to the oviduct which further opens into the vagina.
- **Internal fertilization** takes place in leech.
- Cocoon is formed around 9th, 10th and 11th segment.
- Development is **direct.**
- Scientific name of common rabbit is *Oryctolagus cuniculus* which belongs to phylum chordate and class **Mammalia**. Rabbits are warm blooded vertebrates

Taxonomic position	
Phylum	Chordata
Sub-Phylum	Vertebrata
Class	Mammalia
Order	Lagomorpha
Genus	*Oryctolagus*
Species	*Cuniculus*

- Body of rabbit is divided into head, neck, trunk and tail. Nostrils are present.
- Whiskers called as **Vibrissae** are present on the sides of the upper lip.
- Trunk is divisible into an anterior thorax and posterior abdomen.
- In female four to five **teats** or **nipples** are present on the ventral surface.

- The trunk bears two pairs of **pentadactyl limbs.** All the digits bears claws.

- In males, penis is present and in females, a slit like vulva is present. Males have a pair of testes enclosed by **scrotal sacs.**

- Hairs, claws, nails and glands like sweat glands, sebaceous glands and mammary glands are derived from the integument (skin).

- The body of rabbit is divisible into thoracic cavity and abdominal cavity separated by diaphragm.

- **Diaphragm** is the characteristic feature of mammals. Breathing movements are brought by the movement of diaphragm.

  Thoracic cavity   -   Lungs and Heart

  Abdominal cavity -   Digestive and Urinogenital system

- The digestive system of rabbit includes alimentary canal and associated digestive glands.

- Mouth → buccal cavity → Pharynx → Oesophagus → stomach → Small intestine → Large Intestine → Anus

- Large Intestine has Colon and Rectum.

- The digestive glands are salivary glands, gastric glands, liver, pancreas and intestinal glands.

- Rabbit has two sets of teeth, milk teeth and permanent teeth. Hence, called as **diphyodont** dentition.

- There are different types of teeth, hence called as the heterdont.

- The four kinds of teeth in mammals are **incisors**(I), **canines** (C), **premolars**(PM), and **molars**(M).

- Dental formula is $\left(I\frac{2}{1}, C\frac{0}{0}, PM.\frac{3}{2}, M\frac{3}{3} \right)$ in rabbit which is written as $\frac{2033}{1023}$.

- In rabbit, **canines are absent**. The gap between the incisors and premolars is called **diastema**.

- Respiration takes place by a pair of **lungs**, enclosed in the thoracic cavity. On the lower side is the diaphragm.

- Lung is enclosed by a double membranous pleura.

- External nostril → nasal passage → pharynx → glottis → Trachae.

- Larynx or voice box is present in the anterior part of the wind pipe. Vocal cord lies inside the larynx. Vibrations of vocal cord produce the sound.

- The **epiglottis** prevents the entry of food into the trachea.

- Trachea divides into branches called **bronchi**. This further divides into branches called **bronchioles**. This ends in **alveoli**.

- Heart is enclosed by a double layered membrane called **pericardium**.

- It lies inside the thoracic cavity in between the lungs.

- Heart has four chambers. Right and left auricle is separated by **interauricular septum**. Right and the left ventricle is separated by **interventricular septum.**

- Right auricle opens into the right ventricle by right auriculoventricular aperture guarded by **tricuspid valve.** Left auricle opens into the left ventricle by left auriculoventricular aperture guarded by **bicuspid valve** or mitral valve.

- The opening of the pulmonary artery and aorta are guarded by three **semilunar valves.**

- The right auricle receives deoxygenated blood through two **precaval** and one **postcaval** vein from all parts of the body.

- The left auricle receives oxygenated blood from the pulmonary veins from the lungs.

- From the right ventricle arises pulmonary trunk which carries deoxygenated blood to the lungs. Systemic aorta arises from the left ventricle and carries oxygenated blood to all parts of the body.

- Nervous system in rabbit is formed of the **central nervous system**(CNS), **peripheral nervous system**(PNS) and **autonomic nervous system**(ANS).

- CNS consists of brain and spinal cord.

- PNS is formed of 12 pairs of cranial nerves and 37 pairs of spinal nerves.

- ANS comprises **sympathetic** and **parasympathetic** nerves.

- Brain is covered by the outer duramater, inner piamater and middle arachnoid membrane.

- The brain is divided into fore brain, mid brain and hind brain.

- **Fore brain** consists of a (i) a pair of olfactory lobes, cerebral hemispheres and **diencephalon.**

- The right and the left cerebral hemispheres are connected by a nerve tissue called **corpus callosum.**

- The mid brain consists of **optic nerves.**

- Hind brain consists of the **cerebellum**, **pons varolii** and **medulla oblongata.**
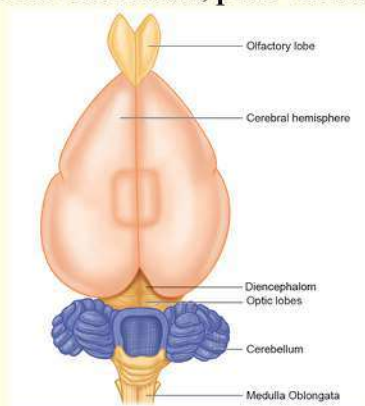
Brain of Rabbit

- Kidneys are made of **nephrons**. Excretion is in the form of Urea.

∾ **Ureters** arise from the kidney and opens into the **urinary bladder** which leads into a thick walled muscular duct called **urethra**.

∾ **Sexual dimorphism** is exhibited.

∾ Male reproductive system consists of a pair of testes. Each testes consists of fine tubules called **seminiferous tubules**.

∾ These seminiferous tubules lead into a coiled tubule called epididymis, which leads into the **sperm duct** called **vas deferens**.

∾ There are 3 accessory glands in the male reproductive system called **prostrate gland, cowpea's gland** and **perineal gland.**

∾ Female reproductive system consists of a pair of ovaries. A pair of oviducts opens into the body cavity.

∾ The anterior part of the oviduct is the **fallopian tube**. It leads into a wider tube called the uterus.

∾ **Uterus** opens into the vagina.

∾ Union of urinary bladder and the vagina is called **urinogenital canal or vestibule**.

∾ Accessory glands of the female reproductive system are a pair of cowper's gland and perineal gland.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. In leech locomotion is performed by
   a) Anterior sucker
   b) Posterior sucker
   c) Setae
   d) None of the above

2. The segments of leech are known as
   a) Metameres (somites)
   b) Proglottids
   c) Strobila
   d) All of the above

3. Pharyngeal ganglion in leech is a part of ✸ ✸
   a) Excretory system
   b) Nervous system
   c) Reproductive system
   d) Respiratory system

4. The brain of leech lies above the
   a) Mouth
   b) Buccal cavity
   c) Pharynx
   d) Crop

5. The body of the leech has ✸ ✸
   a) 23 segments
   b) 33 segments
   c) 38 segments
   d) 30 segments

6. Mammals are _____ animals.
  a) Cold blodded
  b) Warm blodded
  c) Poikilothermic
  d) All the above

7. The animals which give birth to young ones are
  a) Oviparous
  b) Viviparous
  c) Ovoviviparous
  d) All the above.

Ans:

1.	d)	None of the above	5.	b)	33 segments
2.	a)	Metameres (somites)	6.	b)	Warm blodded
3.	b)	Nervous system	7.	b)	Viviparous
4.	c)	Pharynx			

II. Fill in the blanks:

1. The posterior sucker is formed by the fusion of the _____ segments.

2. The existence of two sets of teeth in the life of an animal is called _____ dentition. ✴ ✴

3. The anterior end of leech has a lobe like structure called _____.

4. The blood sucking habit of leech is known as _____.

5. _____ separates nitrogenous waste from the blood in rabbit. ✴ ✴

6. _____ spinal nerves are present in rabbit. ✴ ✴

Ans:

1.	Seven	4.	Sanguivorous
2.	Diphyodont	5.	Nephrons
3.	Prostomium	6.	37 pairs

III. Identify whether the statements are True or False. Correct the false statement.

1. **An anticoagulant present in saliva of leech is called heparin.**   **False**
   An anticoagulant present in saliva of leech is called hirudin.

2. **The vas deferens serves to transport the ovum.**   **False**
   The vas deferens serves to transport the sperm.

3. **The rabbit has a third eyelid called tympanic membrane which is movable.** **False**
   The rabbit has a third eyelid called nictitating membrane which is movable.

4. **Diastema is a gap between premolar and molar teeth is rabbit.**   **False**
   Diastema is a gap between incisors and premolar teeth is rabbit.

5. **The cerebral hemispheres of rabbit are connected by band of nerve tissue called corpora quadrigemina.**   **False**
   The cerebral hemispheres of rabbit are connected by band of nerve tissue called corpus callosum.

IV. Match the columns I, II and III correctly

1.

Organs	Membranous Covering	Location
Brain	pleura	Abdominal cavity
Kidney	Capsule	Mediastinum
Heart	Meninges	Enclosed in thoracic cavity
Lungs	Pericardium	Cranial cavity

Answer:

Organs	Membranous covering	Location
Brain	Meninges	Cranial cavity
Kidney	Capsule	Abdominal cavity
Heart	Pericardium	Enclosed in thoracic cavity
Lungs	Pleura	Mediastinum

V. Answer in a sentence

1. **Give the common name for *Hirudinaria granulosa*.** ✦✦✦
   The Indian cattle leech.

2. **How does leech respire?**
   Respiration takes place through **skin.**

3. **Write the dental formula of rabbit.** ✦✦
   Dental formula is $\left(I\dfrac{2}{1}, C\dfrac{0}{0}, PM.\dfrac{3}{2}, M\dfrac{3}{3} \right)$ in rabbit which is written as $\dfrac{2033}{1023}$.

4. **How many pairs of testes are present in leech?**
   There are **eleven** pairs of testes in leech.

5. **How is diastema formed in rabbit?** ✦
   Diastema is a **gap** between **incisors** and **premolar** formed due to **absence** of **canine.**

6. **What organs are attached to the two bronchi?**
   Lungs are attached to the two bronchi.

7. **Which organ acts as suction pump in leech?**
   Blood is sucked by muscular pharynx, which act as a suction pump.

8. **What does CNS stand for?**
   Central Nervous System.

9. **Why is the teeth of rabbit called heterodont?**
   There are **different** types of teeth in rabbit. Hence, called as heterodont dentition.

10. **How does leech suck blood from the host?** ✦✦
    The leech makes a **triradiate** or 'Y' shaped incision in the skin of the host by the jaws protruded through the mouth and sucks the blood by **muscular pharynx.**

VI Short answer questions

1. Why are the rings of cartilages found in trachea of rabbit? ✳

Rings of cartilages are found in the tracheal walls of rabbit to help in the free **passage of air.**

2. List out the parasitic adaptations in leech.

Leech is a parasite and sucks the blood of vertebrates and show adaptations.

- Blood is sucked by **pharynx**.
- Suckers are present in the **anterior** and **posterior** ends of the body, by which the animal attaches itself to the body of the host.
- The three jaws inside the mouth causes a triradiate or **Y shaped** wound in the skin of the host.
- Saliva contains a protein called **hirudin** which prevents the blood clotting. Thus **continuous supply** of blood is maintained.
- **Parapodia** and **setae** are completely absent.
- Blood is stored in the **crop**. It gives nourishment to the leech for several months. Hence, there is no digestive juices and enzyme.

VII. Long answer questions

1. How is the circulatory system designed in leech to compensate the heart structure?

- Circulation is brought about by **haemocoelic system.**
- There are **no true** blood vessels.
- The blood vessels are replaced by **haemocoelic channels** filled with blood like fluid. This fluid contains **haemoglobin**.
- There are **four** longitudinal channels. One lies above the alimentary canal, one below the alimentary canal and two on either side of the alimentary canal, which serve as the heart and has inner valves.

2. How does locomotion take place in leech? ✳ ✳

Locomotion takes place in leech by

- Looping or crawling movement
- Swimming movement.

Looping or crawling movement:

- This type of movement is brought about by the contraction and relaxation of muscles.
- The two suckers help in attachment during the 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. ✳ ✳ ✳

- Male reproductive system consists of a **pair of testes,** which are **ovoid** in shape.
- Testes is enclosed by **scrotal sacs** in the abdominal cavity.
- Each testes consists of **numerous fine tubules** called seminiferous tubules.
- This network of tubules lead into the coiled tubule called epididymis which leads to the sperm duct called **vas deferens.**

- Below the urinary bladder is the **urethra**. Vas deferens **joins** the urethra.
- Urethra runs **backward** and passes into the **penis**.
- There are **three** accessory glands namely prostate gland, cowper's gland and perineal gland. Their **secretions** are involved in **reproduction**.
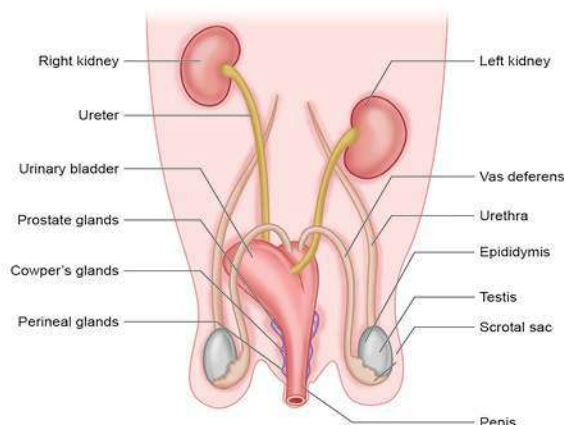
Male reproductive system of Rabbit

VIII. Higher Order Thinking skills (HOTS)

1. **Arjun is studying in tenth standard. He was down with fever and went to meet the doctor. As he went to the clinic he saw a patient undergoing treatment for severe leech bite. Being curious, Arjun asked the doctor why leech bite was not felt as soon as it attaches to the skin. What would have been the reply given by the doctor?**

   The leech, while making incision on the skin it also injects an anaesthetic substance that prevents the host from feeling the bite.

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?**
   - Canines are absent.
   - Hence, a gap is seen between the incisors and premolars.
   - This is called diastema.
   - It helps in mastication and chewing of food in herbivorous animals.

IX. Value based questions

1. **Leeches do not have an elaborate secretion of digestive juices and enzymes. Why?**
   - Slime glands are present in the body wall. Their secretion keeps the body moist and slippery so that the host can't remove it easily while it sucks blood.
   - The availability of the host to the leeches is not regular. Hence, a large amount of blood is stored in the crop whenever it gets food. Digestion is also very slow.
   - It may take more than a year for the complete digestion after a full meal.
   - In leech the ingested blood is stored in crop chambers. It may take more than a year for the complete digestion and absorption of a full meal. So there is no need for an elaborate secretion of digestion juices and enzymes.

2. How is the digestive system of rabbit suited for herbivorous mode of feeding?

- Herbivores have a more specialised digestive system than that of a carnivore because it is more difficult to digest vegetarian than meat.
- Plant material is difficult to digest, particularly plant cellulose.
- The herbivorous animals have a longer intestine than the carnivorous animals giving more time for digestion.
- The teeth is also designed to grind the grass and plant material rather than the sharp teeth of carnivores designed to tear flesh.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. There are five pairs of eyes on the dorsal side of the first five segments
   a) Five pairs   b) Six pairs   c) Eight pairs   d) Nine pairs

2. Leech has _____ suckers.
   a) Three   b) Two   c) Four   d) five

3. Anus is present in the _____ segment.
   a) 42nd b) 32nd c) 26th d) 27th

4. There are _____ pairs of nephridiopores. ✳
   a) 23   b) 32   c) 17   d) 48

5. There is a female genital pore in the _____ segment.
   a) 11th b) 13th c) 12th d) 15th

6. Body wall of leech is divided in to _____ layers.
   a) Six   b) Five   c) Three   d) Two

7. Crop is divided into _____ chambers. ✳
   a) 10   b) 12   c) 9   d) 8

8. Respiration in leech takes place through _____.
   a) Lungs   b) Skin   c) Mouth   d) Nostrils

9. There are _____ pairs of nephridia.
   a) 16   b) 18   c) 17   d) 10

10. Male reproductive system consists of _____ pairs of testes.
    a) 10   b) 11   c) 12   d) one of the above

11. Single pair of ovary is present in the _____ segment. ✳
    a) 10th b) 12th c) 11th d) 9th

12. Heart of rabbit has _____ chambers.
    a) Four   b) Three   c) Two   d) One

13. Excretion in rabbit is in the form of _____.
    a) Ammonia   b) Urea   c) Uric acid   d) Amino acid

14. Annelids are
    a) Radially symmetrical
    b) Externally segmented
    c) Triploblastic
    d) Pseudocoelomate

15. Which is not a feature of Annelid? ✴
    a) Metameric segmentation
    b) Nephridia
    c) Pseudocoelom
    d) clitellum

16. In rabbit _____ teeth are absent
    a) molars
    b) premolars
    c) canines
    d) incisors.

17. The shape of the wound in the skin of the host caused by leech is _____
    a) V
    b) X
    c) U
    d) Y

Ans:

1.	a)	Five pairs	10.	b)	11
2.	b)	Two	11.	c)	11th
3.	c)	26th	12.	a)	Four
4.	c)	17	13.	b)	Urea
5.	a)	11th	14.	a)	Radially symmetrical
6.	b)	Five	15.	c)	Pseudocoelom
7.	a)	10	16.	c)	canines
8.	b)	Skin	17.	d)	Y
9.	c)	17			

II. Fill in the blanks:

1. Scientific name of Indian cattle leech is _____ .

2. _____ is formed in the segments 9-11, meant for producing cocoon.

3. _____ and _____ receptors are the two types of sensory receptors.

4. _____ and _____ stores a large amount of blood which is slowly digested. ✴ ✴

5. In leech, excretion takes place through _____ .

6. _____ stores spermatozoa in rabbit.

7. Trunk of rabbit bears two pairs of _____ limbs.

8. Breathing movements are brought by _____ which is a characteristic feature of mammal.

9. There are two sets of teeth in rabbit, milk teeth and permanent teeth called as _____ dentition. ✴

10. Lung is enclosed by a double membranous _____ .

11. Heart is enclosed by a double layered membrane called _____ .

12. _____ is present between the left auricle and left ventricle.

13. In a substratum the locomotion of leech is by _____ movement.

14. Leech can suck blood _____ times more than their body weight.

15. Leeches can sense vibrations through their _____.

16. _____ are used for preparation of pharmaceutical drugs that can treat hypertension.

17. _____ is a technique of bleeding in a patient to remove toxic impurities from the body. ✶ ✶

18. Thoracic cavity and abdominal cavity is separated by transverse partition called _____.

19. _____ are the mammary glands.

Ans:

1.	Hirudinaria granulosa	11.	Pericardium
2.	Clitellum	12.	Bicuspid valve or Mitral valve
3.	Annular, segmental	13.	Looping or crawling
4.	Crop and diverticula	14.	5
5.	Nephridia	15.	Skin
6.	Epididymis or sperm vesicle	16.	Saliva of leech
7.	Pentadactyl	17.	Blood letting
8.	Diaphragm	18.	diaphragm
9.	Diphyodont	19.	Modified glands of the skin.
10.	Pleura		

III. Identify whether the statements are True or False. Correct the false statement.

1. **There is a male genital pore in the 10th segment.**   False
   There is a male genital pore in the 11th segment.

2. **Body of leech is divided into eight regions.**   False
   Body of leech is divided into six regions.

3. **The buccal cavity has two jaws.**   False
   The buccal cavity has three jaws.

4. **Muscular pharynx is surrounded by salivary glands.**   True

5. **There are no true blood vessels.**   True

6. **Leech has an ear in the 8th segment.**   False
   Leech doesn't have ears.

7. **External fertilization takes place in leech.**   False
   Internal fertilization takes place in leech

8. **Pulmonary artery and aorta are guarded by two semilunar valves.**   False
   Pulmonary artery and aorta are guarded by three semilunar valves.

9. **The left auricle receives oxygenated blood from the pulmonary veins from the lungs.**   True

Don

IV. Answer in a sentence

1. Give the scientific name for the segmentation of the body in leech.

Metamerism is the segmentation of the body.

2. Name the two types of movement in leech.

Looping or crawling movement and swimming movement

3. Give the scientific name of common rabbit. ✳

Scientific name of common rabbit is *Oryctolagus cuniculus.*

4. Name the organs present in the thoracic cavity.

Heart and Lungs.

5. Name the organ system present in the abdominal cavity. ✳

Digestive and Urinogenital system.

6. Which is the largest portion of the alimentary canal?

Crop is the largest portion of the alimentary canal.

7. What are the whiskers in rabbit called as?

Whiskers in rabbit is called as **vibrissae.**

8. What are the four kinds of teeth in mammals?

The four kinds of teeth in mammals are **incisors(I), canines (C), premolars(PM),** and **molars(M).**

9. Which prevents the entry of food into trachea? ✳

Epiglottis prevents the entry of food into trachea.

10. Name the partition which separates the right and the left auricle.

Interauricular septum is the partition which separates the right and the left auricle.

11. Name the partition which seperates the right and the left ventricle.

Interventricular septum is the partition which seperates the right and the left ventricle.

12. Name the valve present between the right auricle and the right ventricle.

Tricuspid valve is present between the right auricle and the right ventricle

13. Which blood vessel carries the oxygenated blood from the heart to different parts of the body?

Systemic aorta carries the oxygenated blood from the heart to different parts of the body.

14. Which blood vessel carries the deoxygenated blood from the heart to the lungs?

Pulmonary trunk carries the deoxygenated blood from the heart to the lungs.

15. How many cranial and spinal nerves from the peripheral nervous system . ✳

Peripheral nervous system is formed of **12 pairs** of cranial nerves and **37 pairs** of spinal nerves.

16. Name the 3 membranes which cover the brain.

Brain is covered by the outer duramater, inner piamater and middle arachnoid membrane.

17. What is the functional unit of kidney in rabbit?

Nephrons are the functional unit of kidney.

18. **Find the number of segments in leech which are covered by a dark band of clitellum.**

Clitellum is formed in the segments **9-11,** which is meant for producing cocoon.

19. **The digestive system of the rabbit is made up of the following parts. Arrange them in order beginning from mouth.** ✶ ✶

Mouth, Pharynx, Buccal cavity, Stomach, Oesophagus, Large intestine, small intestine, Anus.

V Short answer questions

1. **Where are the suckers present in the leech and what are their functions?**

Leech has two suckers.

- The **anterior sucker or oral sucker** is located in the anterior end of a leech.
- It is **ventral** in position.
- The **posterior sucker** is formed by the fusion of the last seven segments.
- The anterior sucker helps in feeding, while both the suckers help in attachment and loco-motion.

2. **Name the layers present in the body of leech.** ✶

Body wall of leech has **five layers.**

- Cuticle
- Epidermis
- Dermis
- Muscular layer
- Botryoidal tissue

3. **Where are the external apertures present in the body of leech?**

- **Mouth** is present in the **anterior** sucker.
- **Anus** is present in the **26th segment.**
- **Nephridiopores** are present in the last annulus of each segment from **6 to 22.**
- There is a **male** genital pore in the **10th** segment and a **female** genital pore in the **11th segment.**

4. **Give an account of the nervous system of Leech.**

- Central nervous system consists of leech consists of a **nerve ring** and a **paired ventral nerve cord.**
- Nerve ring is formed of suprapharyngeal ganglion, circumpharyngeal connective and subpharyngeal ganglion.
- The subpharyngeal ganglion is formed by the **fusion of four pairs** of ganglia.

5. **Write the taxonomic position of Rabbit.**

- Phylum   – chordata
- Sub. phylum   – Vertebrata
- Class   – Mammalian
- Order   – Lagomorpha
- Genus   – Oryctolagus
- Species   – Cuniculus

6. What are structures derived from the outer covering skin of Rabbit?

Hairs, claws, nails, sweat glands, sebaceous glands and mammary glands are the structures derived from outer covering skin of Rabbit.

7. What are the nervous systems seen in Rabbits nervous system?

Central nervous system (C.N.S) ⟨ brain
Spinal chord

Peripheral nervous system (P.N.S) ⟨ 12 pairs of cranial nerve
37 pairs of spinal nerve

Autonomic nervous system (ANS) ⟨ sympathetic nerves
parasympathetic nerves
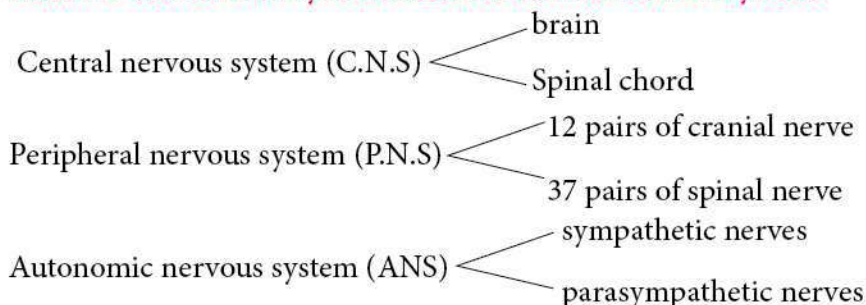
VI. Long answer questions

1. Give an account on the digestive system of leech.

- Digestive system consists of a long alimentary canal and the digestive glands.
- Alimentary canal runs from mouth to anus.
- Mouth is a triradiate aperture which leads to the small buccal cavity.
- Buccal cavity leads to **pharynx**, which is surrounded by salivary glands.
- Secretion of saliva contains **hirudin** which prevents the coagulation of blood.
- Pharynx leads to **crop** through oesophagus.
- Crop is a largest portion of alimentary canal which has **10 chambers.**
- A pair of outgrowth arises as outgrowth from each chamber known as caeca or diverticula.
- This stores a **large amount** of blood.
- The last chamber leads to the stomach which in turn leads to the intestine.
- Intestine opens into rectum. Rectum opens into anus.

1
2 ─── Jaw
3
4
5 ─── Pharynx
6 ─── Oesophagus
7
8
9
10 ─── Crop chambers
11
12
13
14 ─── Crop diverticula
15
16
17
18
19 ─── Stomach
20
21
22 ─── Intestine
23
24 ─── Rectum
25
26 ─── Anus
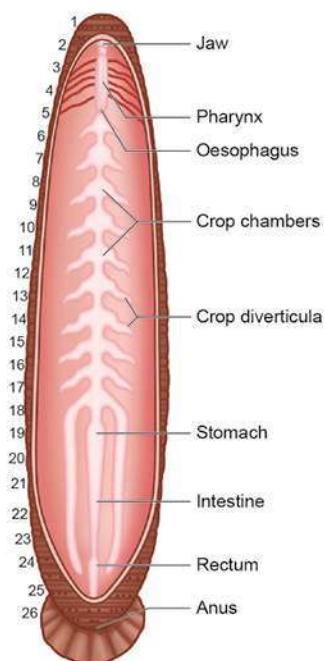
Digestive system of Leech

2. Describe the male reproductive system in leech. ✳

- There are **eleven pairs** of testes, one pair in each segment form **12 to 22nd segment.**
- They are present in the testes sacs or scrotal sacs.
- Vas efferens **arises** from the testes.
- This **joins** with the vas deferens.
- The vas deferens becomes **convoluted** to form epididymis or sperm vesicle.
- The genital atrium is formed on either side of the **ejaculatory duct.**
- The genital atrium consists of two regions, prostrate glands and the penial sac.
- Penial sac contains the penis which opens through the genital pore.
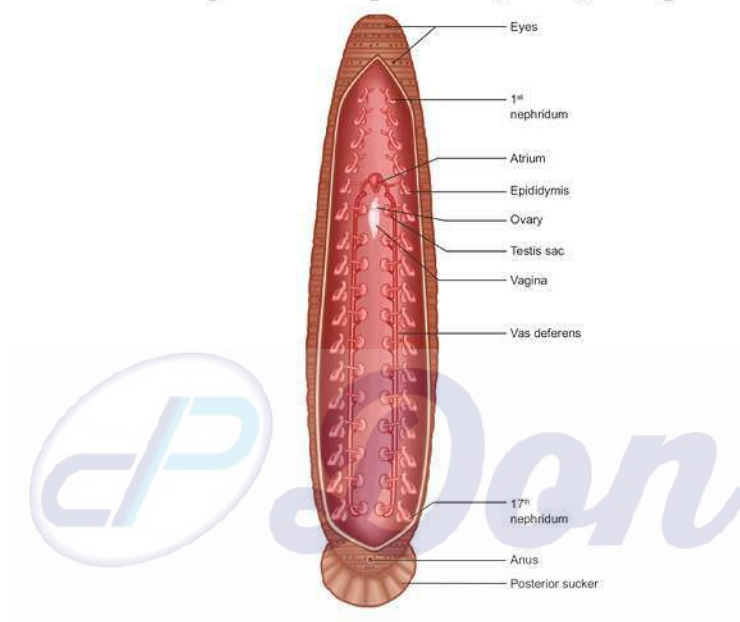
Reproductive system of Leech

3. Give an account on the external morphology of rabbit.
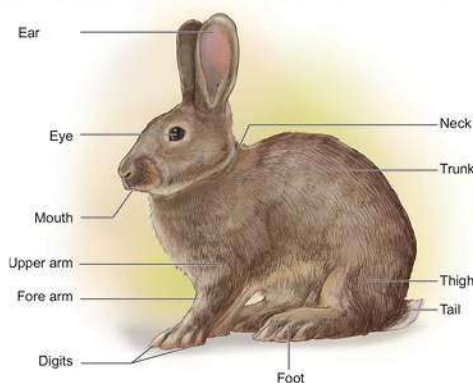
Rabbit - External features

- Body is covered with fur and is divided into head, neck, trunk and tail.
- There is a mouth and just above the mouth are two openings called nostrils.
- Hair arises from each side of the upper lip called vibrissae (whiskers).
- External ear is situated on top of the head.
- Neck connects the head and the trunk.

- Trunk is divided into anterior thorax and posterior abdomen.
- In females, teats or nipples are present on the ventral side of the body.
- Trunk bears two pairs of pentadactyl limbs.
- In females, slit like vulva is present on the ventral side and in males, penis is present on the ventral side of the anus.
- Testes is enclosed by scrotal sacs.
- Tail is short.
- Skin is the outermost covering of the body and structures like hairs, claws, nails and glands like sweat glands, sebaceous glands and mammary glands are present.

4. Describe the digestive system of rabbit.

- The digestive system includes the alimentary canal and the associated digestive glands.
- The alimentary canal consists of the mouth, buccal cavity, pharynx, oesophagus, stomach, small intestine, caecum, large intestine and anus.
- Mouth leads to the **buccal** cavity.
- Through the **pharynx** it reaches oesophagus.
- Oesophagus opens into the stomach followed by small intestine.
- Caecum is present in between the small intestine and large intestine.
- Caecum contains bacteria that helps in the digestion of cellulose.
- Large intestine has colon and rectum.
- It finally **opens** into the anus.
- The digestive glands are salivary glands, gastric glands, liver, pancreas and intestinal glands. The secretion of digestive glands help in digestion of food.
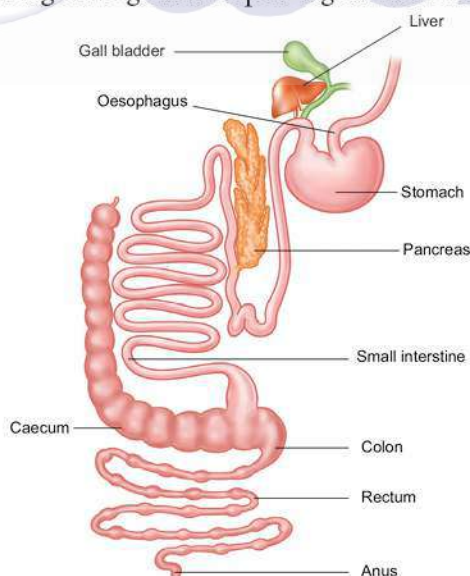
Digestive system of Rabbit

5. Give an account on the dentition of rabbit.

- Rabbit has **two sets** of teeth, milk teeth and permanent teeth. Hence called as diphyodont dentition.
- There are **four kinds** of teeth in mammals. Hence called as the heterodont dentition. They are Incisors(I), canines(C), premolars(PM) and molars(M).

- Dental formula of rabbit is $\left(I\dfrac{2}{1}, C\dfrac{0}{0}, PM.\dfrac{3}{2}, M\dfrac{3}{3} \right)$ which is written as $\dfrac{2033}{1023}$.

- Canines are absent in rabbit. The gap between the incisor and premolar is called **diastema**.

- It helps in mastication and chewing of food.
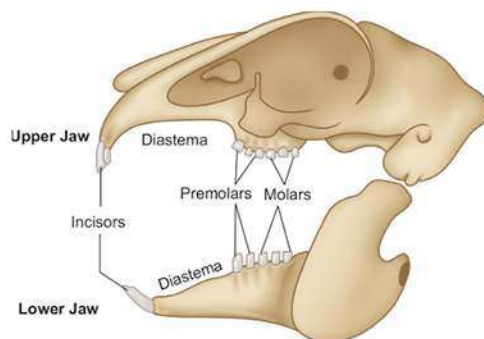
Dentition of Rabbit (Arrangement of teeth in jaws)

6. Explain the pathway of respiratory system in rabbit. ✶
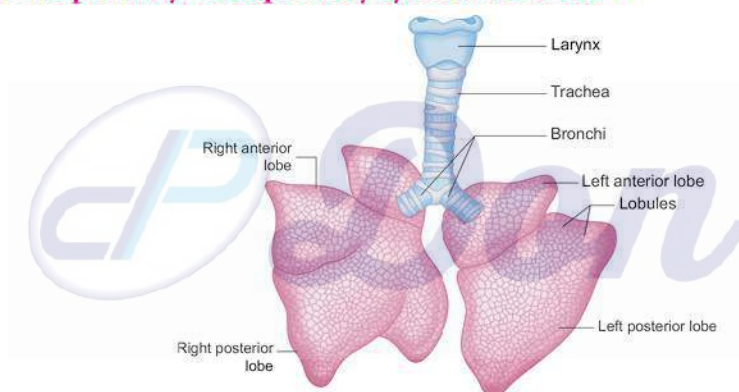
Lungs of Rabbit

- The larynx leads to the trachea or wind pipe.
- Tracheal walls are supported by cartilaginous rings which help in the free passage of air.
- Epiglottis prevents the entry of food into the trachea.
- Trachea divides into two branches called bronchi.
- Bronchi, on entering each lung, divides into many branches called bronchioles. It ends in alveoli.
- Expiration and Inspiration takes place which allows the exchange of gases.
- Inspiration is an active process and expiration is a passive process.

7. Explain the structure of heart in rabbit.

- Heart is enclosed by a double layered membrane called the pericardium.
- Heart is four chambered with two auricles and two ventricles.
- The right and left auricle and is separated by interauricular septum.
- The right and left ventricle is separated by interventricular septum.
- The right auricle opens into the right ventricle by right auriculoventricular aperture guarded by a tricuspid valve.
- The left auricle opens into the left ventricle by left auriculoventricular aperture guarded by a bicuspid valve or mitral valve.

- The opening of the pulmonary artery and aorta are guarded by three semilunar valves.
- The right auricle receives deoxygenated blood through two precaval and one postcaval veins from all parts of the body.
- Left auricle receives oxygenated blood from the pulmonary veins from the lungs.
- Pulmonary trunk arises from the right ventricle carrying the deoxygenated blood to the lungs.
- Systemic aorta arises from the left ventricle supplying oxygenated to all parts of the body.
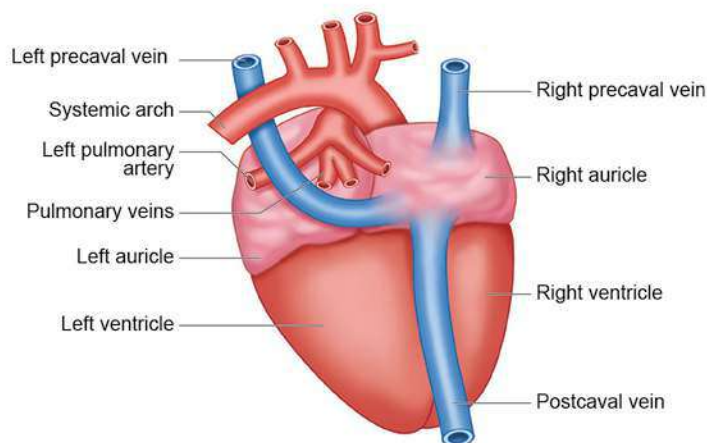
Heart of Rabbit

8. **Elaborate on the internal structure of brain in rabbit.**
- Brain is situated in the cranial cavity.
- It is enclosed by three membranes called the outer duramater, inner piamater and the middle arachnoid membrane.
- Brain is divided into forebrain (prosencephalon), midbrain (mesencephalon) and hind brain (rhombencephalon).
- Forebrain consists of a pair of olfactory lobes, cerebral hemispheres and diencephalon.
- The right and left cerebral hemispheres are connected by a nerve tissue called corpus callosum.
- Midbrain consists of optic fibres.
- Hindbrain consists of the cerebellum, pons varolii and medulla oblongata.
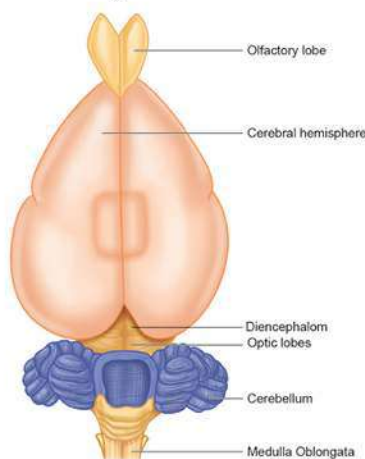
Brain of Rabbit (Dorsal view)

9. **Explain the female reproductive system of rabbit with a labelled diagram.**

- Female reproductive system consists of a pair of ovaries. From each ovary arises the oviduct.

- Anterior part of the oviduct is the fallopian tube which leads to the uterus.

- The uterus joins together to form a median tube called vagina.

- The common tube formed by the union of urinary bladder and vagina is called urinogenital canal vestibule. This opens into the exterior called the vulva.

- A pair of cowper's gland and perineal gland are the accessory glands in the female reproductive system.

Female reproductive system of Rabbit
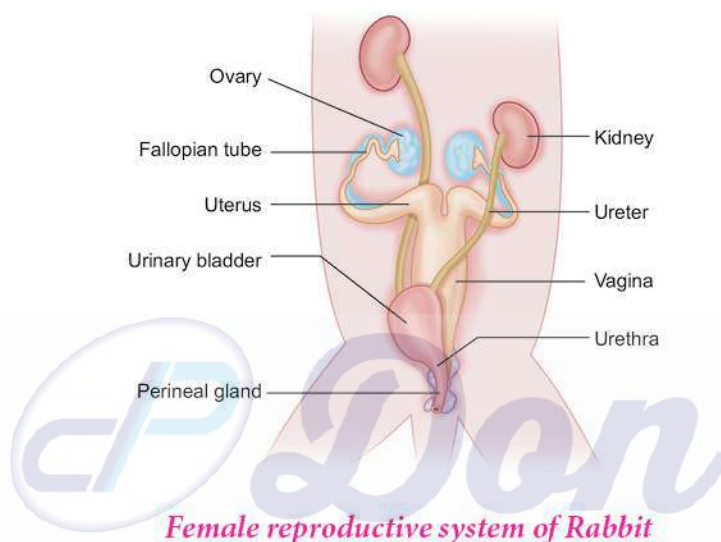
10. **Give an account on the feeding and digestion in leech.**

- The leech feeds by sucking the blood of cattle and other domestic animals.

- During feeding, it attaches itself to the host with the help of the posterior sucker and makes a triradiate or 'Y' shaped incision in the skin of the host.

- Blood is sucked by muscular pharynx and salivary amylase is poured.

- This blood is stored in the crop and diverticula.

- The blood then passes into the stomach.

- Digestion takes place in stomach by the action of proteolytic enzyme.

- The digested blood is slowly absorbed by the intestine.

- Undigested food is stored in rectum and ejected by the anus.

- Leeches prevent blood clotting by secreting a protein called hirudin.

VII. Higher Order Thinking skills (HOTS)

1. **What is blood letting and where is it used?**

- Blood letting is a technique of bleeding in a patient to remove toxic impurities from the body.

- Leech therapy is used as a treatment in ayurveda.

◄◄◄◄◄◄ ◉ ►►►►►►

Unit Test - 13

Structural Orgnaisation of Animals

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. The segments of leech are known as
   a) Metameres (somites)   b) Proglottids
   c) Strobila   d) All of the above

2. The animals which give birth to young ones are
   a) Oviparous   b) Viviparous   c) Ovoviviparous   d) All the above.

3. There are five pairs of eyes on the dorsal side of the first five segments
   a) Five pairs   b) Six pairs   c) Eight pairs   d) Nine pairs

4. Crop is divided into _____ chambers.
   a) 10   b) 12   c) 9   d) 8

5. Excretion in rabbit is in the form of _____
   a) Ammonia   b) Urea   c) Uric acid   d) Amino acid

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Write the dental formula of rabbit.
2. Which organ acts as suction pump in leech?
3. How does leech suck blood from the host?
4. Why are the rings of cartilages found in trachea of rabbit?
5. Give an account of the nervous system of Leech

III. Answer the following questions in brief.   2 × 4 = 8

1. Where are the suckers present in the leech and what are their functions?
2. Explain the male reproductive system of rabbit with a labelled diagram.

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) How is the circulatory system designed in leech to compensate the heart structure?
   ii) Where are the external apertures present in the body of leech?

&❀❀❀&

POINTS TO REMEMBER

- Transport of materials in and out of the cells is carried out by diffusion and active transport in plants.

- **Diffusion:** The movement of molecules in liquid and solid from a region of higher concentration to a region of lower concentration without the utilization of energy is called **diffusion**. This is a **passive** process.

- **Active transport :** The movement of molecules against the concentration gradient is called **active transport**. This movement utilizes energy.

- **Proteins** use energy to carry the substances across the membrane and hence are called as **pumps**.

- **Uphill transport :** These pumps transport substances from a low concentration to higher concentration called the '**uphill**' transport.

- **Osmosis** is the movement of solvent or water molecules from the region of higher concentration to a region of lower concentration through a semipermeable membrane. This is a passive process.

- **Plasmolysis** occurs when water moves out of the cell resulting in the shrinkage of the cell membrane away from the cell wall.

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

- The three regions in the root hair are **Region of meristematic activity, Region of elongation** and **Region of maturation.**

- **Root cap** is present in the tip of the root hair.
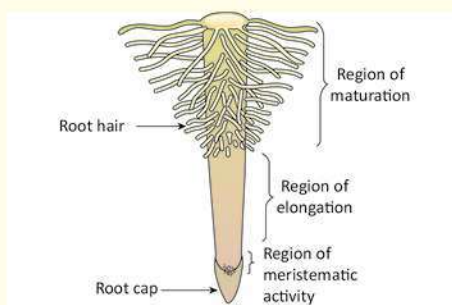
Root Tip with Root Hairs

- The pathway of water entering the root hairs to the stem and leaves is given here.

- Root hair -cortex - xylem - stem & leaves

MIND MAP

Transportation in plants

Transport in Plants
- Diffusion — Passive
- Active transport — Up hill transport
- Osmosis — Passive
- Plasmolysis — Water moves out
- Imbibition — Water Moves in

Root hair

Pathway of water absorbed by plants
- Apoplastic Pathway — Through intercellular space and walls of the cells
- Symplastic Pathway — Through the cells

Transpiration
- Stomata — Transpirational pull
- Importance of transpiration
  - ◆ Creates transpirational pull
  - ◆ Supplies water for photosynthesis
  - ◆ Transports minerals
  - ◆ Cools the surface of the leaves
  - ◆ Keeps the cells turgid

Root Pressure
- Pushing water to smaller heights

Translocation
- Mineral Ions — Phosphorous Sulphur Nitrogen & Potassium
- Sugar — Pressure flow hypothesis

Ascent of sap
- ◆ Root pressure
- ◆ Capillary action
- ◆ Adhesion - cohesion of water
- ◆ molecules
- ◆ Transpiration pull

Circulatory System

Blood
- Plasma
- Blood Cells
  - Red Blood Corpuscles — Oxygen Transport
  - White Blood Corpuscles
    - Neutrophilis Eosinophils Basophils
    - Lymphocytes Monocytes
  - Blood Platelets — Blood clotting
- Blood Groups
  - ABO grouping
  - Rh factor

Lymph

Blood vessels and types of circulation
- Arteries
- Capillaries
- Veins
- Systemic Circulation
- Pulmonary Circulation
- Coronary Circulation

Heart and its Functioning
- Four chambered structure
- Heart beat — Sinoatrial node (Pacemaker)
- Cardiac cycle
- Heart sound — 1st sound (lubb) 2nd sound (Dubb)
- Blood pressure — 120/80

Don

- There are two distinct pathways by which the water moves from the root hairs into the root layers. They are Apoplast pathway and symplast pathway.

- **Apoplast pathway:** This type of movement occurs through intercellular spaces and walls of the cells . Here, the water does not cross the cell membrane. Movement is dependent on the gradient.

- **Symplast pathway:** A narrow thread of cytoplasm that passes through the cell walls of adjacent cells is called plasmodesmata. Here water travels through the cytoplasm. Water enters the cells through the cell membrane.

- **Transpiration:** Evaporation of water in plants through stomata in the leaves is called transpiration.

Turgid and flaccid

- The opening and closing of stomata is due to the change in the turgidity of guard cells. When water enters the guard cells, it becomes turgid and the stoma opens. When the guard cells lose water it becomes flaccid and the stoma closes.

- **Transpiration pull :** As water evaporates through the leaves, pressure is created at the top to pull more water from the xylem to the mesophyll cells. Transpiration through stomata creates a vacuum which creates suction. This process is called transpiration pull.

Root pressure

- As ion from the soil are actively transported into the vascular tissue of the root, water moves along and increases the pressure inside the xylem. This pressure is called the root pressure.

- Movement of food materials in phloem is always bidirectional (upwards and downwards).

- Movement of water and minerals in xylem is always unidirectional (upwards only).

- **Capillary action:** Water from any liquid rises in a capillary tube because of physical forces. This phenomenon is called capillary action.

- **Cohesion:** The force of attraction between the molecules of water is called cohesion.

- **Adhesion:** The force of attraction between the molecules of different substances is called adhesion.

Guttation

- Excess of water is exudated in the form of a liquid due to root pressure. This is seen as dews on the leaves of grass. This phenomenon is called **Guttation** which takes place through specialised cells called **hydathodes**.

- **Blood** is a fluid connective tissue.

- The two main components of blood are the fluid **plasma** and the **blood cells** which are suspended in the plasma.

- **Plasma** is alkaline substance and substances like proteins, glucose, urea, enzymes, hormones, vitamins and minerals are present in plasma. 55% of blood is plasma.

- **Blood cells** or blood corpuscles are of three types.
  - (i)   **Red blood corpuscles** or **Erythrocytes.**
  - (ii)   **White blood corpuscles** or **Leucocytes.**
  - (iii) **Blood platelets** or **Thrombocytes.**
- RBCs are formed in bone marrow.
- RBCs impart red colour due to the presence of the respiratory pigment haemoglobin.
- Mammalian RBCs do not have cell organelles and nucleus.
- Life span is 120 days and are involved in the transport of oxygen from lungs to tissues.
- White blood corpuscles are colourless. They are nucleated. They are capable of amoeboid movement.
- **Granulocytes and Agranulocytes**
- White blood cells are of two types. **Granulocytes** and **Agranulocytes**.
- Granulocytes contain granules in the cytoplasm. They are of 3 types.
  - (i) Neutrophils   (ii) Eosinophils   (iii) Basophils
- **Neutrophils** have 2-7 lobed nucleus. They increase in number during infection and inflammation.
- **Eosinophils** has bilobed nucleus. They increase in number during allergy and parasitic infections. It brings about detoxification of toxins.
- **Basophils** have lobed nucleus. They release chemicals during the process of inflammation.
- **Agranulocytes:** Granules are absent. Agrunulocytes are of two types:
  - (i) Lymphocytes   (ii) Monocytes.
- **Lymphocytes** produce antibodies during bacterial and viral infections.
- **Monocytes** are the largest of the leucocytes and are amoeboid in shape. They are phagocytic and can engulf bacteria.
- **Blood platelets** or **thrombocytes** – They are small and colourless. They do not have nucleus. They play an important role in clotting of blood.
- **Anemia** is decrease in number of erythrocytes.
- **Leucocytosis** is increase in number of leukocytes.
- **Leukopenia** is decrease in number of leukocytes.
- **Thrombocytopenia** is decrease in the number of thrombocytes.
- Threre are three types of blood vessels. They are **arteries**, **veins** and **capillaries**.
- **Arteries** are thick, elastic vessels which carry blood away from the heart to various organs of the body. All the arteries carry oxygenated blood except pulmonary artery which carries deoxygenated blood.
- **Veins** are thin, non elastic vessels that transport blood to the heart from different organs. All veins carry deoxygenated blood except the pulmonary vein which carries oxygenated blood.

- **Capillaries** are formed by branching of arterioles which then unite to form the venules and veins.

- **Open** and closed type are two types of circulatory system.

- In open type, blood is pumped by heart into blood vessels that open into blood spaces called sinuses. These sinuses are body cavities called haemocoel.

- In **closed** type, the blood flows in a complete circuit around the body through specific blood vessels.

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

- Heart is present above the **diaphragm** in the thoracic cavity.

- Heart is made of specialised type of muscle called the **cardiac muscle.**

- Heart is enclosed by a double membrane called **pericardium.**

- It contains **pericardial fluid** to reduce the friction during heart beat.

- The human heart is four chambered. Upper thin walled auricle or atria and lower thick walled chambers called ventricles.

- The chambers are separated by a partition called **septum** which prevents the mixing of oxygenated and deoxygenated blood.

- The two auricles are separated by **interatrial septum.**

- The right atrium receives the blood from different parts of the body through **superior vena cava, inferior vena cava** and **coronary sinus.**

- **Pulmonary veins** bring oxygenated blood to the left atrium from the lungs.

- The two ventricles are separated by **interventricular septum.**

- Right ventricle gives rise to the **pulmonary trunk** which carries the deoxygenated blood to the lungs.

- Left ventricle gives rise to the aorta which carries the oxygenated blood to various organs of the body.

- **Coronary arteries** supply blood to the heart.

- Heart contains three types of valves.

- The valves are the muscular flaps to regulate the flow of blood in a single direction and prevent the back flow of blood.

- **Right atrioventricular valve** is located between the right auricle and the right ventricle and has three flaps and hence called as **tricuspid valve.**

- The apices of the flaps are held in position by **chordae tendinae** arising from **papillary muscles.**

- Left **atrioventricular valve i**s located between the left auricle and left ventricle and had two cusps and hence called as bicuspid valve.

❧ Heart chambers in vertebrate animals

Two chambers	Fishes
Three chambers	Amphibians
Incomplete four chamber	Reptiles
Four chamber	Aves, mammals, crocodiles.

❧ Pulmonary and aortic semilunar valves are present in the pulmonary artery and aorta.

❧ There are three types of blood circulation. **Systemic**, **pulmonary circulation** and **coronary circulation.**

❧ **Systemic circulation:** Circulation of oxygenated blood from the left ventricle to the various organs of the body and return the deoxygenated blood to the right atrium. Aorta carries oxygenated blood to all the organs of the body.

❧ **Pulmonary circulation :** Pulmonary artery starts from the right ventricle and carries the deoxygenated blood to the lungs. Pulmonary veins collect the oxygenated blood from the lungs and supplies it to the left atrium of the heart.

❧ **Coronary circulation:** The supply of blood to the heart muscles is called coronary circulation. Cardiac muscles receive oxygenated blood from coronary arteries that originate from the aortic arch. Deoxygenated blood from the cardiac muscles drains to the right atrium by the coronary sinuses.

❧ Since the blood circulates twice through the heart in one complete cycle it is called double circulation.

❧ In some animals, oxygenated and deoxygenated blood is mixed and passes through the heart only once. This type of circulation is called single circulation.

❧ **Heart Beat:** One complete contraction (systole) and relaxation (diastole) of the atrium and ventricles of heart constitute heartbeat

❧ The heart normally beats 72-75 times per minute.

❧ **Neurogenic** heart beat is initiated by a nerve impulse caused from a nerve ganglion. Eg. Annelids, most arthropods.

❧ **Myogenic** heart beat is initiated by a specialised group of modified heart muscle fibres. Eg. Mollusca and Vertebrates.

❧ Human heart is myogenic in nature.

❧ Contraction is initiated by a special portion of heart muscle called sino-atrial node (SA) .

❧ **Sino-atrial node** acts as a 'pace maker' of heart.

❧ Normal pulse rate ranges from 70-90 / min

❧ **Cardiac cycle:** The sequence of events occurring from the beginning to completion of one heart beat is called cardiac cycle.

❧ Each cardiac cycle lasts about 0.8 second.

❧ Atrial systole: contraction of auricles. (0.1 sec)

- **Ventricular systole:** Contraction of ventricles (0.3 sec)
- **Ventricular diastole:** Relaxation of ventricles (0.4 sec)
- The first sound LUBB is of longer duration and the second DUPP is of shorter duration.
- **Blood pressure** is the force exerted during the flow of blood against the lateral walls of the arteries.
- Blood pressure is expressed in terms of the **systolic pressure** and **diastolic pressure**.
- In an healthy adult during normal resting condition, systole and diastole blood pressure is expressed as 120mm/80mm Hg.
- A prolonged or constant elevation of blood pressure is a condition known as **hypertension** (High blood pressure).
- A **stethoscope** is used to detect the sound produced by the internal organs of human body.
- **Sphygmomanometer** is a clinical instrument used to measure blood pressure when a person is an a relaxed and resting condition.
- Monometric and modern digital types are the apparatus used to measure blood pressure.
- Human blood contains **agglutinogens** or antigens and **agglutinins** or **antibodies** (Ab)
- Persons with 'AB' blood group are called '**Universal Recipient**'.
- Persons with 'O' blood group are called '**Universal donor**'.
- Lymphatic capillaries unite to form large **lymphatic vessels.**
- Lymph is a colourless fluid which drains into the **lymphatic capillaries.**

Distribution of Antigen (RBC) and Antibody (Plasma) in different Blood Groups

Blood Group	Antigens on RBC	Antibodies in Plasma	Can donate to	Can receive from
A	Antigen A	anti- b	A and AB	A and O
B	Antigen B	anti- a	B and AB	B and O
AB	Antigen A and B	No antibody	AB	A, B, AB and O (Universal Recipient)
O	No Antigen	Both anti a and b	A, B, AB and O (Universal Donor)	O

Scientists

- Closed circulatory system was discovered by William Harvey (1628) who is regarded as the Father of Modern Physiology.
- Concept of blood grouping was developed by Karl Landsteiner (1900). He identified the blood groups A, B and O. AB blood group was recognized by Decastello and Steini (1902).
- Rh factor was discovered by Landsteiner and Wiener in 1940 in Rhesus monkey.
- Atrioventricular bundle was discovered by His (1893). So is called the Bundle of His.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Active transport involves** ✸ ✸
   a) Movement of molecules from lower to higher concentrations
   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

4. **Root hairs are**
   a) Cortical cell   b) Projection of epidermal cell
   c) Unicellular   d) Both b and c

5. **Which of the following process requires energy?**
   a) Active transport   b) Diffusion
   c) Osmosis   d) All of them

6. **The wall of the human heart is made of**
   a) Endocardium   b) Epicardium
   c) Myocardium   d) All of the above

7. **Which is the sequence of correct 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 blood group the donor should effectively use for transfusion in this condition?**
   a) O group   b) AB group
   c) A and B group   d) All blood group

9. **'Heart to Heart' is called** ✸
   a) SA node   b) AV node
   c) Purkinge fibres   d) Bundle of His

10. **Which one of the following regarding blood composition is correct?**
    a) Plasma – Blood + Lymphocyte
    b) Serum – Blood + fibrinogen
    c) Lymph – Plasma + RBC + WBC
    d) Blood – Plasma + RBC + WBC + Platelets

Ans:

1.	d	All of the above	6.	d	All of the above
2.	d	Xylem	7.	c	Atrium – ventricle – arteries – vein
3.	c	Water	8.	a	O group
4.	d	Both b and c	9.	a	SA node
5.	a	Active transport	10.	d	Blood – Plasma + RBC + WBC + Platelets

II Fill in the blanks:

1. _____ involves evaporative loss of water from aerial parts.

2. Water enters the root cell through a _____ plasma membrane.

3. Structure in roots that help to absorb water are _____

4. Normal blood pressure is _____ ✸ ✸

5. The normal human heart beat rate is about _____ time per minute. ✸ ✸

Ans:

1.	Transpiration		4.	120mm/80mm Hg
2.	Symplast		5.	72-75
3.	Root hair			

III Match the following

1.
1) Symplastic pathway – a) Leaf **(b)**
2) Transpiration – b) Plasmodesmata **(a)**
3) Osmosis – c) Pressure in xylem **(d)**
4) Root pressure – d) Pressure gradient **(c)**

2.
1) Leukemia – a) Thrombocytes **(d)**
2) Platelets – b) Phagocyte **(a)**
3) Monocytes – c) Decrease in leucocytes **(b)**
4) Leucopenia – d) Blood cancer **(c)**
5) AB blood group – e) Allergic condition **(h)**
6) O Blood group – f) Inflammation **(g)**
7) Eosinophil – g) Absence of antigen **(e)**
8) Neutrophils – h) Absence of antibody **(f)**

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

1. The phloem is responsible for the translocation of food.   **True**

2. Plants lose water by the process of transpiration.   **True**

3. The form of sugar transported through the phloem is glucose.   **False**

The form of sugar transported through the phloem is sucrose.

4. 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 enters the cell.

5. When guard cells lose water the stoma opens. **False**

When guard cells lose water the stoma closes.

6. Initiation and stimulation of heart beat takes place due to nerves. **False**

Initiation and stimulation of heart beat take place due to Sino atrial node.

7. All veins carry deoxygenated blood. **False**

All veins carry deoxygenated blood except pulmonary veins.

8. WBC defend the body from bacterial and viral infections. **True**

9. The closure of the mitral and tricuspid valve at the start of the ventricular systole produces the first sound 'LUBB'. **True**

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

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:** RBC plays an important role in the transport of respiratory gases.
Reason: RBC do not have cell organelles and nucleus.

Ans. a) If both A and R are true and R is correct explanation of A

2. **Assertion:** Persons with AB blood group are called universal recipients, because they can receive blood from all groups.
Reason: Antibodies are absent in persons with AB blood group.

Ans. b) If both A and R are true but R is not the correct explanation of A

VI. Answer in the word or sentence

1. Name the two layered protective covering of human heart. ✴ ✴

Pericardium

2. What is the shape of RBC in human blood?

RBCs are biconcave and **disc** shaped.

3. Why is the colour of the blood red? ✴ ✴

RBCs impart red colour to the blood due to the presence of the respiratory pigment **haemoglobin.**

4. Which kind of cells are found in the lymph?

Plasma, proteins and blood 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 artery.

VII. Short answer questions

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

- The opening and closing of stomata is due to the change in turgidity of the guard cells.
- When water enters into the guard cells they become turgid and the stomata opens.
- When the guard cells lose water, it becomes flaccid and the stomata closes.
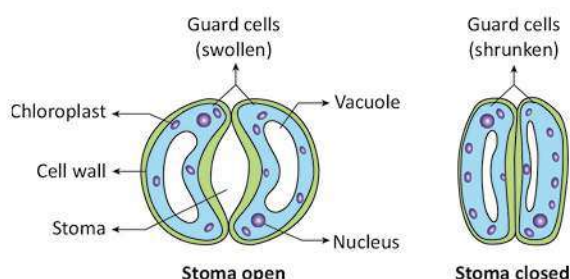
Guard cell in turgid and flaccid condition

2. **What is cohesion?**

The force of **attraction** between molecules of water 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 the leaf.**

- Root pressure → capillary action → Adhesion → Transpiration pull → Transpiration.
- Once the water enters the root hairs, the concentration of water molecules in the root hair cells become more than that of the cortex.
- Thus water from the root hair moves to the cortical cells by osmosis and then reaches the xylem.
- From there the water is transported to the stem and the leaves.
- There are two pathways by which the water absorbed by the root hairs enters the deeper layers. Apoplast pathway and Symplast pathway.
- Apoplast pathway does not involve crossing the cell membrane and the movement is dependent on the gradient.
- In Symplast pathway, water enters the cell through the cell membrane.
- Transpiration is the evaporation of water in plants through stomata in the leaves.
- Water evaporates from mesophyll cells of leaves through stomata.

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

- Transpiration often results in water deficit which causes **injury** to the plants by desiccation.
- Excessive rate of transpiration leads to stunted growth of plants

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

Structure of heart:

- Heart is a muscular pumping organ that pumps out blood into the blood vessels.
- It is enclosed in a **double walled** sac called pericardium.
- The two upper thin walled chambers are called auricles and the two thick walled chambers are called ventricles.
- The chambers are separated by **septum**.
- Heart contains **pericardial** fluid.

Working of heart:

- **Contraction** of heart is called **systole** and **relaxation** is called **diastole**.
- When the auricles are filled with blood they are in diastole. The tricuspid and bicuspid valves remain closed. This is called **atrial diastole.**
- When the auricles are full they contract. This leads to the **opening** of tricuspid and bicuspid valves. Blood from the auricles are pushed to the ventricles. This is called **atrial systole.**
- Now the valves are closed. The ventricles **contract**. The deoxygenated blood from the right ventricle enters the **pulmonary artery** and the oxygenated blood from the left ventricle enters the **aorta**. This is called **ventricular systole.**
- These three events constitute the cardiac cycle.
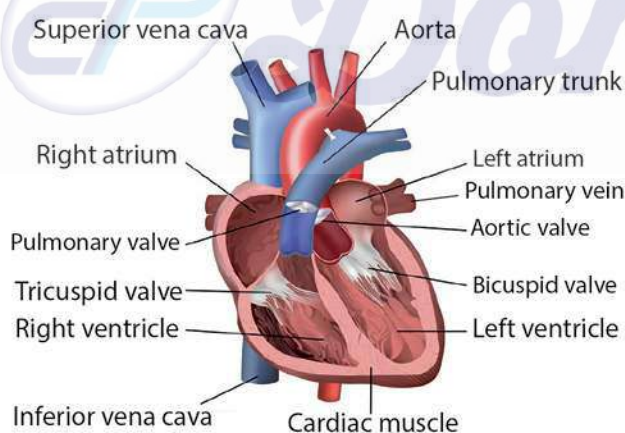
Internal structure of human heart

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

- When the blood circulates **twice** through the heart in **one complete cycle** it is called double circulation.
- In double circulation oxygenated blood **does not mix** with deoxygenated blood.

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

- The rhythmic closure and opening of the valves cause the sound of heart.
- The first sound **LUBB** is of longer duration and is produced by the **closure** of the **tricuspid** and **bicuspid** valves after the beginning of the ventricular systole.
- The second sound **DUBB** is of a shorter duration and is produced by the **closure** of **semilunar valves** at the end of ventricular systole.

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

Valves are the muscular flaps that regulate the flow of blood in a **single direction** and **prevent back flow** of blood.

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

Rh factor was discovered by Landsteiner and Wiener in 1940. It was named so because it was first discovered in Rhesus monkey.

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

- Arteries are thick and elastic vessels that carry blood away from the heart.
- Veins are thin and non-elastic vessels that transport blood to the heart.

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

Sinoatrial node is called the pacemaker of heart because it is capable of initiating impulse which can stimulate the heart muscles to **contract** thereby pushing the blood into the ventricles.

12. Differentiate between systemic circulation and pulmonary circulation.

- Pulmonary circulation moves blood between the heart and the lungs.
- It transports deoxygenated blood to the lungs to absorb oxygen and release carbon dioxide. The oxygenated blood then flows back to the heart.
- Systemic circulation moves blood between the heart and the rest of the body.
- It sends oxygenated blood out to cells and returns deoxygenated blood to the heart.

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

Each cardiac cycle lasts for about 0.8 seconds. The events during a single cardiac cycle involves,

a) **Atrial systole:**	Contraction of auricles	0.1 sec
b) **Ventricular systole:**	Contraction of ventricles	0.3 sec
c) **Ventricular diastole:**	Relaxation of ventricles	0.4 sec
	Total Time	**0.8 sec**

VIII. Give reasons for the following statements.

1. Minerals cannot be passively absorbed by the roots. ✷ ✷ ✷

- All the minerals cannot be passively absorbed by the roots as the concentration of minerals in the soil is usually **low** and they are present as **charged particles.**
- So, they cannot move across cell membranes.
- These move into the roots by using energy in the form of ATP.
- Since energy is used it is **active** absorption.

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

- The opening and closing of stomata is due to the change in **turgidity** of the guard cells.
- When water **enters** into the guard cells they become turgid and the stomata **opens**.
- When the guard cells **lose water**, it becomes flaccid and the stomata **closes**.

3. The movement of substances in the phloem can be in any direction.

- Phloem **transports food** (sucrose) from a source to a sink.
- The source is part of the plant that synthesize food, i.e., the leaf, and sink, is the part that needs or stores the food.
- But, the source and sink may be **reversed** depending on the season, or the **plant's need.**
- Since the source-sink relationship is variable, the direction of movement in the phloem can be upwards or downwards, i.e., bidirectional.

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

- Minerals are **remobilised** from older dying leaves to younger leaves.
- Elements like phosphorous, sulphur, nitrogen and potassium are easily **mobilised**.
- Small amounts of material exchange takes place between xylem and phloem.
- Hence minerals in the plants are not lost when the leaf falls.

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

This is because blood is **pumped out** of the heart at greater pressure from these chambers compared to the atria.

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

Mammalian RBC lack nucleus and makes the cells biconcave and increase surface area for **oxygen binding**, loss of mitochondria allows the RBC to **transport** all the **oxygen** to tissues, and loss of endoplasmic reticulum allows more **flexibility** for RBC to move through the narrow capillaries.

IX. Long answer questions

1. How do plants absorb water? Explain.

- Plants absorb water and minerals through root hairs present on the tip of the root by diffusion.
- Root hairs are thin walled, slender extension of epidermal cell that increase the surface area of absorption.

Pathway of water absorbed by roots:

- Once the water enters the root hairs, the concentration of water molecules in the root hair cells become more than that of the cortex.
- Thus, water from the root hair moves to the cortical cells by osmosis and then reaches the xylem.
- From there, the water is transported to the stem and leaves.
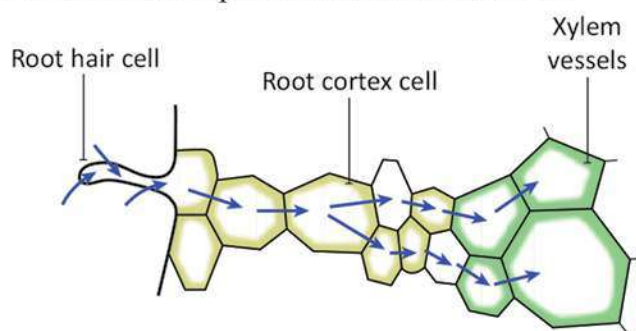
T.S. of the root showing movement of water from soil to xylem

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

- Transpiration is **evaporation** of water in plants through **stomata** in the leaves.
- Creates transpirational pull for transport of water.
- **Supplies water** for photosynthesis.
- Transports **minerals** from soil to all parts of the plant.
- **Cools** the surface of the leaves by evaporation.
- Keeps the cells **turgid**, hence, maintains their **shape**.

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

Granulocytes contain granules in their cytoplasm. They are of three types.

- Neutrophils
- Eosinophils
- Basophils

Neutrophils:

- They are large in size and have 2-7 lobed nucleus.
- These corpuscles form 60% - 65% of the total leucocytes.
- Their numbers are increased during **infection** and **inflammation**.

Eosinophils:

- It has a bilobed nucleus and constitute 2% to 3% of the total leucocytes.
- Their number increases during conditions of allergy and **parasitic infections.**
- It brings about **detoxification** of toxins.

Basophils:

- Basophils have lobed nucleus.
- They form 0.5% to 1.0% of the total leucocytes.
- They release **chemicals** during the process of inflammation.

Agranulocytes:

- Granules are found in the cytoplasm of these cells.
- The agranulocytes are of two types.
- Lymphocytes and monocytes.

Lymphocytes:

- These are about 20-25% of the total leucocytes.
- They produce **antibodies** during bacterial and viral infections.

Monocytes:

- They are the largest of the leucocytes and are amoeboid in shape.
- These cells form 5-6% of the total leucocytes.
- They are **phagocytic** and can **engulf bacteria.**

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

Systole pressure:

- During ventricular systole, the left ventricle contracts and forces blood into the aorta.
- The pressure rises to a peak which is referred to systolic pressure.

Diastole pressure:

- During diastole the ventricles relax and the pressure falls to the lowest value which is referred to diastolic pressure.

Initiation and conduction of heart beat:

- Human heart is myogenic in nature.
- Contraction is initiated by a specialised portion of the heart muscle, the sino-atrial node which is initiated in the wall of the right atrium near the opening of the superior vena cava.
- The Sinoatrial node acts as the pacemaker of the heart because it is capable of initiating impulse which can stimulate the heart muscles to contract.
- This impulse is spread by the contraction of right and the left atrial walls pushing the blood to the ventricles.
- The wave of contraction from SA node reaches the AV (atrio ventricular) node which is stimulated to emit an impulse of contraction spreading to the ventricular muscle through the atrioventricular bundle and the purkinje fibres.
- In an healthy adult during normal resting condition systolic and diastolic blood pressure is expressed as 120mm / 80mm Hg.

5. Enumerate the functions of blood. ✳ ✳ ✳

- Transport of **respiratory gases** (Oxygen and CO_2).
- Transport of **digested food** materials to the different body cells.
- Transport of **hormones**.
- Transport of **nitrogenous** excretory **products** like ammonia, urea, and uric acid.
- It is involved in **protection** of the body and defense against diseases.
- It acts as **buffer** and also helps in regulation of pH and body temperature.
- It maintains proper **water balance** in the body.

IX. 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.

- 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?

The walls of the left ventricle is thicker than the other chambers of the heart because the ventricles have to pump out blood with force away from the heart.

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

- A stethoscope is used to detect the sound produced by the internal organs of human body.
- It is a useful 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?**
   • Pulmonary artery carries **deoxygenated blood to the lungs** while all the other arteries carry oxygenated blood.
   • Pulmonary vein carries **oxygenated blood from the lungs** while all the other veins carry deoxygenated blood.

5. **Transpiration is a necessary evil in plants. Explain.**
   • Transpiration is essential for the movement of water and minerals from the root to the healthy parts of the plant.
   • But excess transpiration may result in drying up of the leaves or wilting and loss of soil water.
   • Hence it is termed as a necessary evil.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Process by which the water moves out of the cell resulting in the shrinkage of the cell membrane away from the cell wall.**
   a) Plasmolysis   b) Osmosis   c) Diffusion   d) Imbibition

2. **The force of attraction between the molecules of water is called.**
   a) Adhesion   b) Imbibition   c) Cohesion   d) Diffusion

3. **Excess of water is seen as dews on the leaves of grass. The phenomenon is called**
   a) Adhesion   b) Cohesion   c) Guttation   d) Imbibition

4. **RBCs impart red colour due to the presence of the respiratory pigment _____. ✴**
   a) Haemoglobin.   b) Granulocytes
   c) Agranulocytes   d) Leucocytes

5. **Heart contains _____ fluid to reduce the friction during heart beat.**
   a) Haemocoel   b) Pericardial
   c) Protoplasm   d) Haemoglobin

6. **_____ is a colourless fluid which drains into the lymphatic capillaries. ✴ ✴**
   a) Haemocoel   b) Pericardial
   c) Haemoglobin   d) Lymph

7. **_____is a clinical instrument used to measure blood pressure when a person is in a relaxed and resting condition.**
   a) Stethoscope   b) Sphygmomanometer
   c) Thermometer   d) Manometer

8. **_____ acts as a 'pace maker' of heart.**
   a) Atrioventricular node   b) Digital meter
   c) Sphygmomanometer   d) Sino-atrial node

9. **Rh factor was discovered by**
    a) Decastello and Steini   b) Landsteiner and Wiener
    c) William Harvey   d) His

10. **_____ is decrease in the number of erythrocytes.**
    a) Anemia   b) Leukopenia   c) Leucocytosis   d) Thrombocytopenia

11. **Root hairs absorb water and minerals by _____.**
    a) Diffusion   b) Osmosis   c) Plosmosis   d) Imbibition

12. **Blood corpuscles capable of amoeboid movement are _____. ✴**
    a) Erythrocytes   b) Leucocytes   c) Blood Platelets   d) R.B.C

13. **_____ release chemicals during the process of inflammation.**
    a) Eosinophils   b) Basophiles   c) Neutrophils   d) Lymphocytes

14. **Closed type circulatory system is seen in _____.**
    a) Arthropods   b) Molluscs   c) Ascidians   d) Vertebrates

15. **Antibodies are absent in _____ blood group.**
    a) 'A' group   b) 'B' group   c) AB group   d) 'O' group

Ans:

1.	a	Plasmolysis	9.	b	Landsteiner and Wiener
2.	c	Cohesion	10.	a	Anemia
3.	c	Guttation	11.	a	Diffusion
4.	a	Haemoglobin	12.	b	Leucocytes
5.	b	Pericardial	13.	b	Basophils
6.	d	Lymph	14.	d	Vertebrates
7.	b	Sphygmomanometer	15.	c	AB group
8.	d	Sino-atrial node			

II Fill in the blanks:

1. The two distinct pathways through which the water moves from the root hairs into the root layers are _____ and _____ pathway.

2. When water enters the guard cells, it becomes _____ and the stoma opens. ✴

3. In symplast pathway, a narrow thread of cytoplasm that passes through the cell walls of adjacent cells is called _____.

4. Transpiration through stomata creates a vacuum which creates suction. This process is called _____ .

5. Guttation takes place through specialised cells called _____ .

6. The force of attraction between the molecules of different substances is called _____.

7. Heart is made up of specialised muscles called _____ ✴ ✴

8. The supply of blood to the heart muscles is called _____ circulation.

9. _____ is also called a extracellular fluid.

10. _____ movement of water occurs exclusively through the inter cellular spaces and the walls of the cells.

11. The opening and closing of the stomata is due to the change in turgidity of the _____.

12. Water in the soil is absorbed by root hairs by _____. ★

13. Due to _____ the water column in xylem tubes is able to rise to great heights in tallest plants.

14. _____ is involved in the transport of oxygen from lungs to tissues.

15. _____ acts as buffer and helps in regulating pH of the body.

16. _____ play an important role in clotting of blood.

17. _____ is called as the Father of Modern physiology.

18. _____ has incomplete four chambered heart.

19. In fishes and amphibians the blood circulation is of _____ type.

20. _____ heart beat is found in Annelids.

21. Normal pulse rate in a minute in human is _____.

22. AB blood group was recognized by _____.

23. When an individual receives a mismatched blood group _____ of blood occurs.

24. Persons with _____ are called Universal Donor. ★

25. _____ supplies nutrients and oxygen to those parts where blood cannot reach.

26. _____ is used to detect the sound produced by the internal organs of human body.

Ans:

1.	Apoplast and symplast	14.	Red blood corpuscles
2.	Turgid	15.	Blood
3.	Plasmodesmata	16.	Platelets (or) Thrombcytes
4.	Transpiration pull	17.	William Harvey
5.	Hydathodes	18.	Reptiles
6.	Adhesion	19.	Single circulation
7.	Cardiac muscles	20.	Neurogentic
8.	Coronary	21.	70 -90
9.	Lymph	22.	Decastello and Steini
10.	Apoplast pathway	23.	Agglutination or Clumping
11.	Guard cells	24.	'O' blood group
12.	Diffusion	25.	Lymph
13.	Transpiration pull	26.	Stethoscope

III Match the following

1. 1) Translocation of food   – a) Tissue fluid   (c)
    2) Lymph   – b) Evaporation of water through leaves (a)
    3) Plasmolysis   – c) Phloem   (d)
    4) Transpiration   – d) Water moves out of the cell   (b)

2. 1) Pulmonary artery   – a) Oxygenated blood   (a)
    2) Pulmonary vein   – b) Clotting of blood   (c)
    3) Monocytes   – c) Deoxygenated blood   (d)
    4) Thrombocytes   – d) Engulf bacteria   (b)

3. **Heart Chambers**   **Animals**
    1) Two Chambers   – a) Aves   (d)
    2) Three Chambers   – b) Reptiles   (c)
    3) Incomplete four chambered   – c) Amphibians   (b)
    4) Four chambered   – d) Fishes   (a)

4. 1) Neutrophil   – a) 8 -10 days ✵   (d)
    2) Eosinophil   – b) 120 days   (c)
    3) Red blood corpuscle   – c) Allergy   (b)
    4) Blood Platelets   – d) Infection   (a)

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

1. Red blood corpuscles are capable of amoeboid movement.   **False**
White blood corpuscles are capable of amoeboid movement.

2. The two ventricles are separated by interatrial septum.   **False**
The two ventricles are separated by interventricular septum.

3. Persons with 'O' blood group are called 'Universal donor' ✵   **True**

4. Blood is a fluid involved in transportation of food is also called as tissue fluid.
    True

5. Osmosis is an active process.   **False**
Osmosis is a passive process.

6. The sinuses are the body cavities which are called haemoglobin.   **False**
The sinuses are the body cavities which are called haemocoel.

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

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:** Sphygmomanometer is a clinical instrument used to measure blood pressure.
   Reason: It helps to estimate the state of blood circulation and the working of the heart.

   Ans: a) If both A and R are true and R is correct explanation of A ✳

2. **Assertion:** White blood cells are colourless.
   Reason: They do not have haemoglobin.

   Ans. a) If both A and R are true and R is correct explanation of A.

3. **Assertion:** Granulocytes contain granules in the cytoplasm.
   Reason: Their nucleus is irregular or lobed.

   Ans. b) If both A and R are true but R is not the correct explanation of A.

VI. Answer in the word or sentence

1. Name the three regions of the root hair.

The three regions in the root hair are region of meristematic activity, region of elongation and region of maturation.

2. What are the components of the blood?

The two main components of blood are the **fluid plasma** and the **blood cells** which are suspended in the plasma.

3. Name the three types of blood cells.

- Red blood corpuscles or Erythrocytes.
- White blood corpuscles or Leucocytes.
- Blood platelets or Thrombocytes

4. Name the three types of granulocytes.

Granulocytes are of 3 types.

- Neutrophils
- Eosinophils
- Basophils

5. Name the types of blood circulations.

- Systemic
- pulmonary circulation
- coronary circulation

6. What are the two types of Agranulocytes? ✳

- Lymphocytes
- Monocytes

7. Name the fluid which is also involved in transportation apart from blood plasma.

Lymph

8. Which would help the seedlings to emerge out of seeds?

Imbibition

9. What increase the surface area of absorption?

Root hairs.

10. How does the transportation of food vary from transportation of water?

Food transportation is bidirectional in contrast to water transportation which is unidirectional.

11. What is the important function of Eosinophil? ✴

Detoxification of toxins

12. What produce antibodies during bacterial and viral infections?

Lymphocytes

13. What is the type of heart beat, found in human heart?

Myogenic heart beat.

14. Where can you feel the 'Pulse'?

Pulse can be felt by placing the fingertip on the artery near the wrist.

VII. Short answer questions

1. What is osmosis?

Osmosis is the movement of solvent or water molecules from the region of higher concentration to the region of lower concentration through a **semi-permeable** membrane.

2. What is plasmolysis?

Plasmolysis occurs when water **moves out of the cell** resulting in the shrinkage of cell membrane away from the cell wall.

3. What is imbibitions?

• 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.

4. What is transpiration?

Evaporation of water in plants through stomata in the leaves is called transpiration.

5. What is ascent of sap?

The **upward movement** of water and minerals from roots to **different parts of the plant** is called ascent of sap.

6. What is Guttation? ✴ ✴

The excess of water present in the plants is exuded in the form of a liquid. This is due to the root pressure. This phenomenon is called Guttation which takes place through specialised cells called **hydathodes**.

7. What is transpiration pull?

Transpiration through **stomata** creates vacuum which in turn creates a suction called transpiration pull.

8. What is leucopenia?

When there is decrease in the **number of leukocytes** in our body the condition is called leucopenia.

9. What is thrombocytopenia?

When there is decrease in the **number of thrombocytes** in our body, the condition is called thrombocytopenia.

10. Write notes on hypertension and hypotension

- In an healthy adult during normal resting condition systolic and diastolic blood pressure is expressed as **120mm/80mm Hg.**
- Blood pressure varies during conditions of physical exercise, anxiety, emotions, stress and sleep.
- A prolonged or constant elevation of blood pressure is a condition known as hypertension or High blood pressure.
- This can increase the risk of heart attack and stroke.
- Decrease in blood pressure is termed **hypotension** (Low blood Pressure).

VIII. Give reasons for the following statements.

1. Sino-atrial node acts as a 'pacemaker' of the heart.

Sino-atrial node acts as a 'pacemaker' of the heart because it is capable of initiating impulse which can **stimulate** the heart muscles to contract.

2. Valves are present in the heart.

The valves **regulate the flow of blood** in a single direction and prevent the backward flow of blood.

IX. Long answer questions

1. Differentiate between Artery and vein. ✶ ✶

S.No	Artery	Vein
1.	**Distributing** vessel.	**Collecting** vessel.
2.	**Pink** in colour.	**Red** in colour.
3.	**Deep** location.	**Superficial** in location.
4.	Blood flow with **high pressure.**	Blood flow with **low pressure.**
5.	Wall of artery is **strong, thick and elastic.**	Wall of vein is **weak, thin and non-elastic.**
6.	All arteries carry **oxygenated** blood except pulmonary arteries.	All veins carry **deoxygenated** blood except pulmonary veins.
7.	Internal valves are **absent.**	Internal valves are **present.**

2. Describe the Pulmonary type of circulation

- The path of pulmonary circulation starts in the right ventricle.
- Pulmonary artery arises from the right ventricle and reaches the lungs with deoxygenated blood.
- Pulmonary veins collect the oxygenated blood from the lungs and supplies it to the left atrium of the heart.

3. Describe the coronary type circulation.

- The supply of blood to the **heart muscles** (cardiac muscles) is called as coronary circulation.
- Cardiac muscles receive oxygenated blood from coronary arteries that originate from the aortic arch.
- Deoxygenated blood from the cardiac muscles drains into the right atrium by the coronary sinuses.

4. Describe the sequence of events occurring in cardiac cycle.

- The sequence of events occurring from the beginning to the completion of **one heart beat** is called cardiac cycle.
- During cardiac cycle **blood flows** through the chambers of the heart in a specific direction.
- Each cardiac cycle lasts about **0.8 second.**
- The events during a single cardiac cycle involves

Atrial systole: Contraction of auricles (0.1 sec)

Ventricular systole: Contraction of ventricles (0.3 sec)

Ventricular diastole: Relaxation of ventricles (0.4 sec)

5. Enumerate the functions of lymph.

Functions of Lymph

- Supplies **nutrients and oxygen** to those parts where blood cannot reach .
- It drains away excess tissue fluid and metabolites and returns proteins to the blood from tissue spaces.
- The lymph also carries **absorbed fats** from small intestine to the blood.
- The lymphatic capillaries of intestinal villi (lacteals) absorb digested fats.
- Lymphocytes in the lymph defend the body from infections.

6. List the Antigens and Antibodies Present in the blood groups.

Distribution of Antigen (RBC) and Anti body (Plasma) in different blood groups.

Blood Group	Antigens on RBC	Antibodies in Plasma	Can donate to	Can receive from
A	Antigen A	anti – b	A and AB	A and O
B	Antigen B	anti – a	B and AB	B and O
AB	Antigen A and B	No antibody	AB	A,B,AB and O (Universal Recipient)
O	No Antigen	Both anti a and b	A,B,AB and O (Universal Donor)	O

IX. Higher Order Thinking skills (HOTS)

1. Why does the heart contain pericardial fluid?

The heart contains pericardial fluid to reduce friction during heart beat and protect it from mechanical injury.

◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶

Unit Test - 14

Tranportation in plants and Circulation in Animals

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. During transpiration there is loss of
   a) Carbon dioxide   b) Oxygen   c) Water   d)None of the above

2. The wall of the human heart is made of
   a) Endocardium   b) Epicardium   c) Myocardium   d) All of the above

3. Heart to Heart' is called
   a) SA node   b) AV node   c) Purkinge fibres   d) Bundle of His

4. Excess of water is seen as dews on the leaves of grass. Phenomenon is called
   a) Adhesion   b) Cohesion   c) Guttation   d) Imbibition

5. **Assertion:** Persons with AB blood group are called universal recipients, because they can receive blood from all groups.

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

   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

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. What is the importance of valves in the heart?
2. Who discovered Rh factor? Why was it named so?
3. How are arteries and veins structurally different from one another?
4. Why is the Sinoatrial node called the pacemaker of heart?
5. Differentiate between systemic circulation and pulmonary circulation.

III. Answer the following questions in brief.   2 × 4 = 8

1. Differentiate between Artery and vein.
2. Describe the Systemic type of circulation.

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Why does the heart contain pericardial fluid?
   ii) Describe the sequence of events occurring in cardiac cycle.

Nervous System

Coordination

This working together of various organs in a systematic, controlled and efficient way to produce proper response to various stimuli is called coordination.

Neuron or nerve cell

A neuron or nerve cell is the structural and functional unit of the nervous system.

Neuroglia

They are non-exciting, supporting cell of the nervous system. Neuroglia are also called as glial cells.

Nerve fibres

The nerve fibres are the long slender processes of neurons. A number of nerve fibres are bundled up together to form nerves.

Neuroplasm

It has a central nucleus with abundant cytoplasm called neuroplasm

Nissl's granules

The cytoplasm has large granular body called Nissl's granules

Dendrites

These are the numerous branched cytoplasmic processes that project from the surface of the cell body.

Axon

The axon is a single, elongated, slender projection

Synaptic knob

The end of axon terminates as fine branches which terminate into knob like swellings called synaptic knob.

Axoplasm

The plasma membrane of axon is called axolemma , cytoplasm is called axoplasm
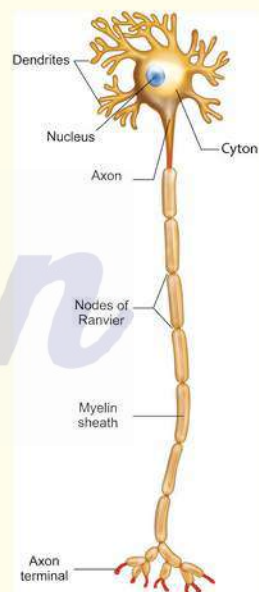
Structure of Neuron

MIND MAP

Nevous System
- Central nervous system
  - Brain
  - Spinal cord
- Peripheral nervous system
  - Cranial nerves
  - Spinal nerves
- Autonomic nervous system
  - Parasympathetic nerves
  - Sympathetic nerves

Brain
- Fore Brain
  - Cerebrum
  - Diencephalon
- Mid Brain
  - Corpora quadrigemina
- Hind Brain
  - Cerebellum
  - Pons
  - Medulla oblongata
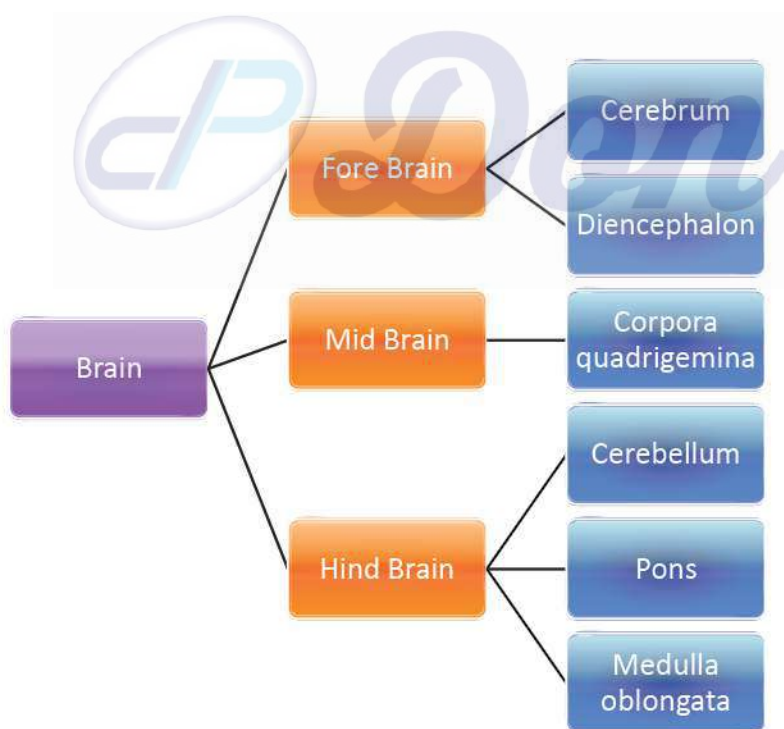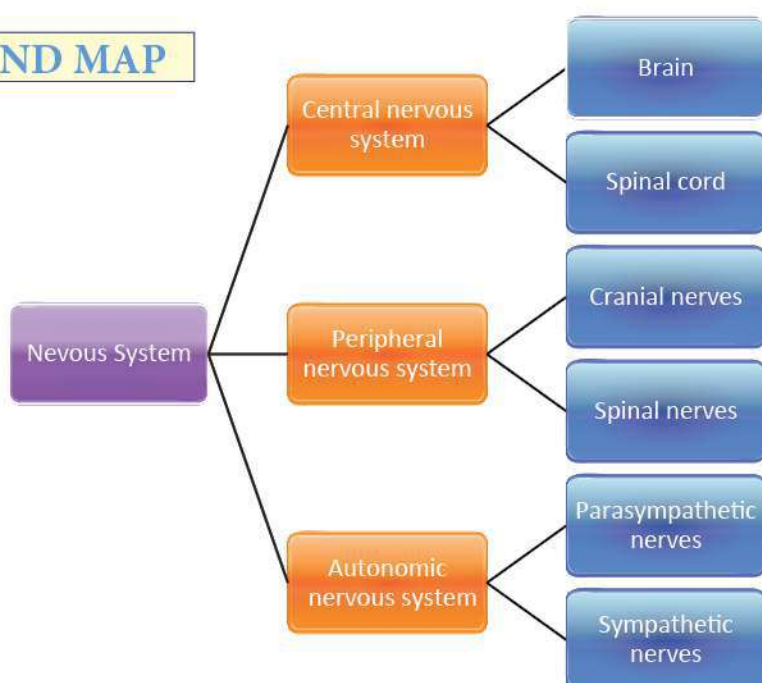
Types of Neuron or nerve cell
- Unipolar neurons
- Bipolar neurons
- Multipolar neurons

Don

Myelin sheath

The axons may be covered by a protective sheath called myelin sheath.

Schwann cells

Myelin sheath is further covered by a layer of Schwann cells.

Nodes of Ranvier

Myelin sheath breaks at intervals by depressions called Nodes of Ranvier. The region between the nodes is called as internode.

Synapse

A junction between synaptic knob of axon of one neuron and dendron of next neuron is called synaptic junction.

Unipolar neurons

Only one nerve process arises from the cyton which acts as both axon and dendron. Found in early embryos but not in adult.

Bipolar neurons

The cyton gives rise to two nerve processes of which one acts as an axon while another as a dendron. Found in retina of eye and olfactory epithelium of nasal chambers.

Multipolar neurons

The cyton gives rise to many dendrons and an axon. They are found in the cerebral cortex of the brain.

Nerve fibres

Nerve fibres are of two types based on the presence or absence of myelin sheath. Myelinated nerve fibre and Non-myelinated nerve fibre.

Neurons are of three types. Sensory or afferent neurons, Motor or efferent neurons and Association neurons.

Synaptic transmission

The flow of nerve impulses from axonal end of one neuron to dendrite of another neuron through a synapse is called synaptic transmission.

Neurotransmitters

Neurotransmitters are the chemicals which allow the transmission of nerve impulse from the axon terminal of one neuron to the dendron of another neuron. The important neurotransmitter released by neurons is called Acetylcholine.

- Human nervous system is differentiated into central nervous system (CNS), peripheral nervous system (PNS) and autonomic nervous system (ANS).
- Brain is covered by three connective tissue membrane or meninges. They are Outer Duramater, Middle Arachnoid membrane, Inner Piamater.
- A human brain is formed of three main parts: (a) Forebrain (b) Midbrain and (c) Hindbrain.
- The forebrain is formed of cerebrum and diencephalon.
- Two cerebral hemispheres are interconnected by thick band of nerve fibres called Corpus Callosum.

- The outer portion of each cerebral hemisphere is formed of grey matter and is called cerebral cortex. The inner or deeper part is formed of white matter and is called cerebral medulla.
- The cortex is extremely folded forming elevations called gyri with depressions between them termed as sulci.
- Each cerebral hemisphere is divisble into a frontal lobe, a parietal lobe, a temporal lobe and an occipital lobe.
- Thalamus acts as a relay centre.
- Hypothalamus acts as a thermoregulatory (temperature control) center of the body.
- Mid brain consists of four rounded bodies called corpora quadrigemina that control visual and auditory (hearing) reflexes.
- Hindbrain is formed of three parts cerebellum, pons and medulla oblongata.
- Cerebellum is second largest part of the brain. It coordinates voluntary movements and also maintains body balance.
- 'Pons' a latin word meaning bridge. It relays signals between the cerebellum, spinal cord, midbrain and cerebrum. It controls respiration and sleep cycle.
- Medulla Oblongata has cardiac centres, respiratory centres, vasomotor centres to control heart beat, respiration and contractions of blood vessels respectively. It also regulates vomiting and salivation.

Overview of brain functions	
Structure	Function
Cerebral cortex	Sensory preception, control of voluntary functions, language, thinking, memory, decision making, creativity
Thalamus	Acts as relay station
Hypothalamus	Temperature control, thirst, hunger, urination, important link between nervous system and endocrine glands
Cerebellum	Maintenance of posture and balance,coordinatevoluntary muscle activity
Pons and medulla	Role in sleep-awake cycle, cardiovascular, respiratory and digestive control centers

Structure of spinal cord

- The spinal cord contains a cerebrospinal fluid filled cavity known as the central canal.
- The brain is suspended in a special fluid environment called cerebrospinal fluid (CSF).

- There are two types of reflexes.
  - i) Simple or basic reflexes: These reflexes are inbuilt and unlearned responses. Many of the actions we perform in our day to day life are simple reflexes.
  - ii) Acquired or conditioned reflexes: These reflexes are the result of practice and learning.
- Most of the reflex actions are monitored and controlled by the spinal cord, hence also known as spinal reflexes.
- The pathway taken by nerve impulse to accomplish reflex action is called reflex arc.
- Stimulus is the heat which is sensed by receptor called as heat receptors or thermoreceptors in our hand.
- The sensory neuron transmits or conveys the message to the spinal cord.
- Motor neurons carry command from spinal cord to our arm.
- Nerves arising from brain are called cranial nerves. Nerves arising from spinal cord are called spinal nerves. In man, there are 12 pairs of cranial nerves. There are 31 pairs of spinal nerves.
- Autonomic nervous system (ANS) is also called as visceral nervous system as it regulates the function of internal visceral organs of our body through its two antagonistic (opposite) components sympathetic and parasympathetic systems.
- Electroencephalogram (EEG) is an instrument which records the electrical impulses of brain.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Bipolar neurons are found in** ✶ ✶
   - **a)** retina of eye
   - **b)** cerebral cortex
   - **c)** embryo
   - **d)** respiratory epithelium

2. **Site for processing of vision, hearing, memory, speech, intelligence and thought is**
   - **a)** kidney
   - **b)** ear
   - **c)** brain
   - **d)** lungs

3. **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

4. **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

5. **The outer most of the three cranial meninges is**
   - **a)** arachnoid membrane
   - **b)** piamater
   - **c)** duramater
   - **d)** myelin sheath

6. There are _____ pairs of cranial nerves and _____ pairs of spinal nerves. ✳✳
   a) 12, 31   b) 31, 12   c) 12, 13   d) 12, 21

7. 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

8. Which nervous band connects the two cerebral hemispheres of brain?
   a) Thalamus   b) Hypothalamus   c) Corpus callosum   d) Pons

9. Node of Ranvier is found in
   a) muscles   b) axons   c) dendrites   d) cyton

10. Vomiting centre is located in
    a) medulla oblongata   b) Stomach
    c) cerebrum   d) hypothalamus

11. Nerve cells do not possess ✳✳
    a) neurilemma   b) sarcolemma   c) axon   d) dendrites

12. A person who had 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

Ans:

1.	a)	retina of eye	7.	c)	efferent neuron
2.	c)	brain	8.	c)	corpus callosum
3.	d)	receptor, spinal cord, muscle	9.	b)	axons
4.	b)	towards, away from	10.	a)	medulla oblongata
5.	c)	duramater	11.	b)	sarcolemma
6.	a)	12, 31	12.	d)	hypothalamus

II. Fill in the blanks

1. _____ is the longest cell in our body. ✳✳

2. Impulses travel rapidly in _____ neurons.

3. A change in the environment that causes an animal to react is called _____.

4. _____ carries the impulse towards the cell body.

5. The two antagonistic component of autonomic nervous system are _____ and _____.

6. A neuron contains all cell organelles except _____.

7. _____ maintains the constant pressure inside the cranium. ✳✳

8. _____ and _____ increases the surface area of cerebrum. ✳

9. The part of human brain which acts as relay center is _____.

Ans:

1.	Neuron	6.	Centriole
2.	Association	7.	Cerebrospinal fluid
3.	Stimulus	8.	Gyri & Sulci
4.	Dendrites	9.	Thalamus
5.	Sympathetic and parasympathetic Systems		

III. State whether the following statements are true or false, if false explain why.

1. **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

2. **Sympathetic nervous system is a part of central nervous system.** ✳   **False**

   Sympathetic nervous system is a part of Autonomic nervous system

3. **Hypothalamus is the thermoregulatory centre of human body.**   **True**

4. **Cerebrum controls the voluntary actions of our body.**   **False**

   Cerebellum controls the voluntary actions of our body

5. **In the central nervous system myelinated fibres form the white matter.** ✳✳

   True

6. **All the nerves in the body are covered and protected by meninges.**   **False**

   Brain is covered and protected by meninges.

7. **Cerebrospinal fluid provides nutrition to brain.**   **True**

8. **Reflex arc allows the rapid response of the body to a stimulus.** ✳   **False**

   Reflex action is the rapid response of the body to a stimulus

9. **Pons helps in regulating respiration.**   **True**

IV. Match the following

1. **Column I**   **Column II**

   1) Nissl's granules   - a) Forebrain   (c)

   2) Hypothalamus   - b) Axon   (a)

   3) Cerebellum   - c) Cyton   (d)

   4) Schwann cell   - d) Hindbrain   (b)

V. Assertion and reasoning type

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

1. **Assertion:** Cerebrospinal fluid is present throughout the central nervous system.
   Reason: Cerebrospinal fluid has no such functions.

   Ans: (c) Both assertion and reason are correct

2. **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

1. Define stimulus. ✷✷

- 'Stimulus' refers to the **changes** in the **environmental condition,** that are detected by **receptors** present in the body.
- A **receptor** is a cell or a group of cells that **receives** the stimuli.
- An **effector** is a part of the body which can **respond** to a stimulus.

2. Name the parts of the hind brain.

It is formed of three parts cerebellum, pons and medulla oblongata.

3. What are the structures involved in the protection of brain?

- Brain is protected by skull.
- Brain is covered by three connective tissue membrane or meninges. They are outer Duramater, middle Arachnoid membrane, inner Piamater. Meningeal membranes protect the brain from mechanical injury.
- The brain is suspended in a special fluid environment called cerebrospinal fluid (CSF). It acts as shock absorbing fluid and protects the brain from damage when it is subjected to sudden jerk.

4. Give an example for conditioned reflexes.

Drawing pictures on seeing a human being or a thing is an example of conditioned reflexes which requires conscious effort, acquired as a result of learning and practice.

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

- The **hypothalamus** is the link between the endocrine and nervous systems.
- The hypothalamus produces releasing and inhibiting hormones, which stop and start the production of other hormones throughout the body.

6. Define reflex arc. ✷

The pathway taken by nerve impulse to accomplish reflex action is called reflex arc.

VII. Differentiate between

1. Voluntary and involuntary actions. ✷✷✷

S.No.	Voluntary action	Involuntary action
1	An action which is under conscious control.	An action which is not under conscious control.
2	Voluntary action is controlled by the brain.	Involuntary action is controlled by the spinal cord.
3	All voluntary actions result in a muscular action.	Involuntary actions result in a muscular action or secretion from some gland.

2. **Medullated and non-medullated nerve fibre.**

S.No.	Medullated nerve fibre	Non-medullated nerve fibre
1.	It is also known as **myelinated** or **white** neuron.	It is also known as **non-myelinated** or **grey** neuron.
2.	It is found in the **white** matter of the brain.	It is found in the **grey** matter of cerebrum.
3.	The neuron is **enclosed** by myelin sheath.	The neuron is **not enclosed** by the myelin sheath.

VIII. Long answer questions:

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

Structure of Neuron
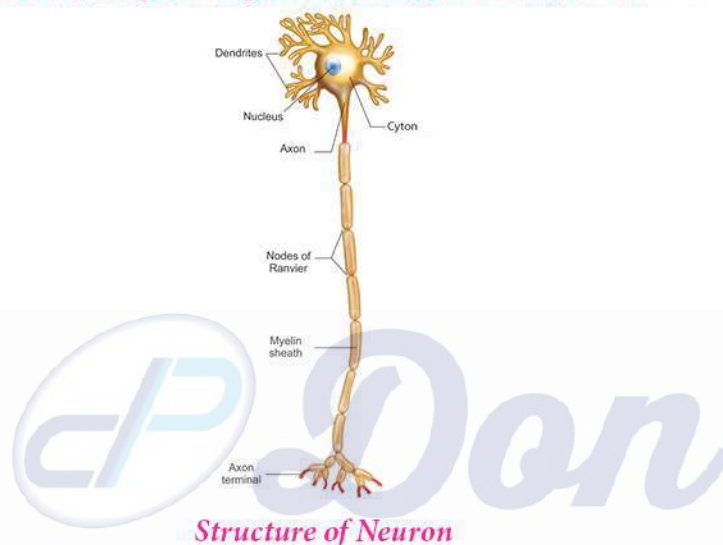
- A neuron typically consists of three basic parts. Cyton, Dendrites and Axon.

Cyton:

- Cyton is also called cell body or perikaryon.
- It has a central **nucleus** with abundant cytoplasm called **neuroplasm**.
- The cytoplasm has large granular body called **Nissl's granules** and the other cell organelles like mitochondria, ribosomes, lysosomes, and endoplasmic recticulum.
- Neurons **do not** have the ability to **divide**.
- Several neurofibrils are present in the cytoplasm that help in transmission of **nerve impulses** to and from the cell body.

Dendrites:

- These are the **numerous** branched **cytoplasmic** processes that project from the surface of the cell body.
- They conduct nerve impulses **towards** the cyton.
- The branched projections **increase** the **surface** area for receiving the **signals** from other nerve cells.

Axon:

- The axon is a **single, elongated, slender** projection.
- The end of axon terminates as fine branches which terminate into knob like swellings called **synaptic knob.**

- The plasma membrane of axon is called **axolemma**, while the cytoplasm is called **axoplasm.**
- It carries impulses away from the cyton.
- The axons may be covered by a **protective sheath** called myelin sheath which is further covered by a layer of **Schwann cells** called **neurilemma.**
- Myelin sheath breaks at intervals by depressions called **Nodes of Ranvier.**
- The region between the nodes is called as internode.
- Myelin sheath acts as **insulator** and ensures **rapid** transmission of nerve impulses.

Synapse:

- A junction between synaptic knob of axon of one neuron and dendron of next neuron is called synaptic junction.

2. **Illustrate the structure and functions of brain.** ✳ ✳ ✳

A human brain is formed of three main parts:

- Forebrain
- Midbrain
- Hindbrain

Forebrain:

- The forebrain is formed of cerebrum and diencephalon.
- The latter consists of dorsal thalamus and ventral hypothalamus.

Cerebrum:

- It is the largest portion forming nearly two-third of the brain.
- The cerebrum is longitudinally divided into two halves as right and left **cerebral hemispheres.**
- Two cerebral hemispheres are interconnected by thick band of nerve fibres called **corpus callosum.**
- The outer portion of each cerebral hemisphere is formed of **grey matter** and is called cerebral cortex.
- The inner or deeper part is formed of **white matter** and is called cerebral medulla.
- The cortex is extremely folded forming elevations called **gyri** with depressions between them termed as **sulci** that increase its surface area.
- Each cerebral hemisphere is divisble into a frontal lobe, a parietal lobe, a temporal lobe and an occipital lobe.
- These lobes are also known as cerebral lobes and are associated with specific functions.
- Any damage in specific lobe inturn affects its function.
- The cerebrum is responsible for the thinking, intelligence, consciousness, memory, imagination, reasoning and willpower.

Thalamus

- Thalamus present in cerebral medulla is a major conducting centre for **sensory** and **motor signalling.**
- It acts as a **relay centre.**

Hypothalamus:

- It lies at the **base** of the **thalamus**.
- It controls **involuntary** functions like **hunger**, **thirst**, sleep, sweating, sexual desire, anger, fear, water balance, blood pressure etc.
- It acts as a **thermoregulatory** (temperature control) centre of the body.
- It controls the secretion of hormones from anterior pituitary gland and is an important link between **nervous system** and **endocrine system.**

Midbrain:

- It is located between thalamus and hind brain.
- The dorsal portion of the mid brain consists of four rounded bodies called corpora quadrigemina that control visual and auditory (hearing) reflexes.

Hindbrain:

- It is formed of three parts cerebellum, pons and medulla oblongata.

Cerebellum:

- It is **second largest part** of the brain formed of two large sized **hemispheres** and **middle vermis.**
- It coordinates voluntary movements and also maintains body balance.

Pons:

- 'Pons' a latin word meaning bridge.
- It is a bridge of nerve fibre that connects the lobes of **cerebellum**.
- It relays signals between the cerebellum, spinal cord, midbrain and cerebrum.
- It controls respiration and sleep cycle.

Overview of brain functions	
Cerebral cortex	Sensory preception, control of voluntary functions, language, thinking, memory, decision making, creativity
Thalamus	Acts as relay station
Hypothalamus	Temperature control, thirst, hunger, urination, important link between nervous system and endocrine glands
Cerebellum	Maintenance of posture and balance,coordinatevoluntary muscle activity
Pons and medulla	Role in sleep-awake cycle, cardiovascular, respiratory and digestive control centers

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

- If someone pricks my hand with a needle, the **stimulus** is the **pain** which is sensed by receptors in our hand. This stimulus in turn triggers an impulse in **sensory neuron.**
- The sensory neuron **transmits** or conveys the message to the **spinal cord.**
- Spinal cord interprets the stimulus and the impulse is passed on to the **relay neuron** which in turn transmits it to a **motor neuron.**
- Motor neurons carry command from **spinal cord** to **our arm.**

- Muscle in our arm **contracts** and we withdraw our hand immediately.
- In this example, muscle is an effector organ which has responded to the prick.
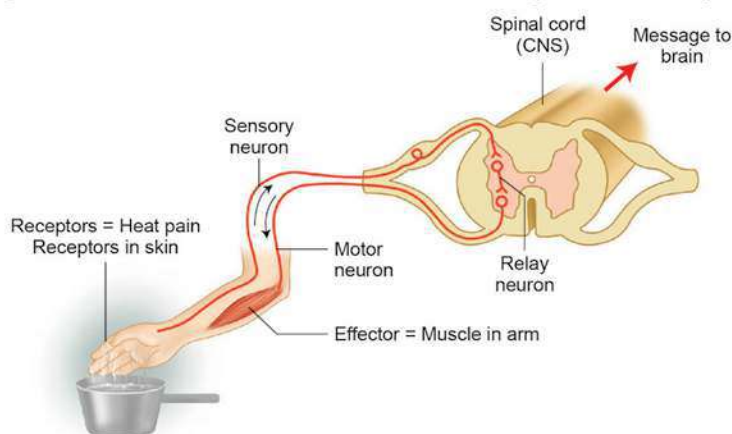
Reflex action and its pathway

4. Describe the structure of spinal cord. ✴ ✴

- Spinal cord is a **cylindrical structure** lying in the neural canal of the vertebral column.
- It is also covered by **meninges**.
- It extends from the **lower end** of **medulla oblongata** to the **first lumbar** vertebra.
- The posterior most region of spinal cord tapers into a thin fibrous thread like structure called **filum terminale.**
- Internally, the spinal cord contains a cerebrospinal fluid filled cavity known as the **central canal.**
- The **grey matter** of spinal cord is 'H' shaped.
- The upper end of letter "**H**" forms posterior horns and lower end forms anterior horns.
- A bundle of fibres pass into the posterior horn forming dorsal or afferent root.
- Fibres pass outward from the anterior horn forming ventral or efferent root.
- These **two roots** joins to form spinal nerves.
- The **white matter** is external and have bundle of nerve tracts.

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

- All the information from the environment are detected by the **receptors** located in our **sense organs** such as the eyes, the nose, the skin, etc.
- Information from the **receptors** is transmitted as **electrical impulse** and is received by the dendritic tips of the neuron.
- This impulse travels from the **dendrite** to the cell body and then along the **axon** to its terminal end.
- On reaching the axonal end, it causes the nerve endings to release a chemical (**neurotransmitter**) which diffuses across a **synapse** and starts a similar electrical impulse in the dendrites of the next neuron, then to their cell body to be carried along the axon.
- The flow of nerve impulses from axonal end of one neuron to dendrite of another neuron through a synapse is called **synaptic transmission.**
- Neurotransmitters are the chemicals which allow the transmission of nerve impulse.
- The important neurotransmitter released by neurons is called **Acetylcholine**.
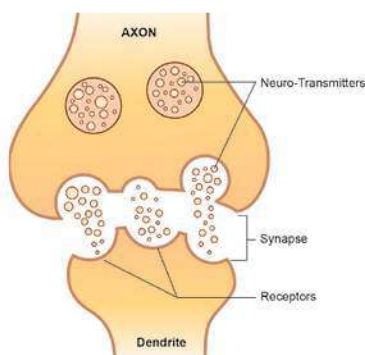
Nerve impulse transmission

6. Classify neurons based on its structure.

Structurally the neurons may be of the following types:

Unipolar neurons:

- Only one nerve process arises from the cyton which acts as both axon and dendron.

Bipolar neurons:

- The cyton gives rise to two nerve processes of which one acts as an axon while another as a dendron.

Multipolar neurons:

- The cyton gives rise to many dendrons and an axon

(A)　　　　　(B)　　　　　(C)
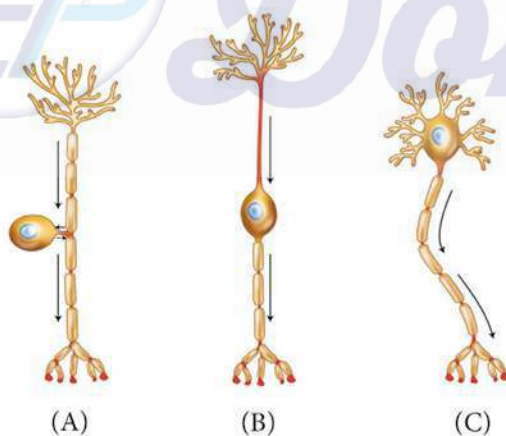
Unipolar (A), Bipolar (B) and multipolar (C) neurons

X. 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 pairs of nerves does D represent?

   (i)   'A' is Spinal cord.

   (ii)   (a) vertebral column (b) meninges

   (iii)   31 pairs of nerves

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 nerves pass.

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.

   (i) Nerve cells or neurons

   (ii) Axon and Dendrites

   (iii) Synapse

   (iv) The chemical is Acetylcholine

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. _____ are non exciting supporting cell of the nervous system.
   a) Neuron   b) Nerve fibre   c) Neuroglia   d) dendron

2. Cytoplasm inside the cyton is called _____
   a) dendron   b) neuroplasm   c) protoplasm   d) axon

3. Neurons which carry impulses from the sense organs to the central nervous system. ✹
   a) Motor   b) Sensory   c) Association   d) Bipolar

4. Nerve fibre in which axon is covered by myelin sheath.
   a) Myelinated   b) Non myelinated
   c) Efferent   d) afferent

5. Unipolar neurons are found in the _____.
   a) brain   b) spinal cord
   c) embryonic nervous tissue   d) adult Nervous tissue

6. The sensory organs contain _____ neurons.
   a) Unipolar   b) Bipolar   c) Multipolar   d) Medullated

7. The part of the brain which controls emotional reactions in our body.
   a) Cerebellum   b) Cerebrum
   c) Thalamus   d) Hypothalamus

8. One of the following is a part of the brain stem
   a) Fore brain and mid brain   b) Mid brain and hind brain
   c) Fore brain and hind brain   d) Fore brain and spinal cord

9. Neurotransmitters are released at the synapse by _____
   a) Dentrites   b) Synaptic knobs
   c) Organelles of cyton   d) Myelin sheath of axon.

10. _____ controls the involuntary functions of visceral organs.
   a) Peripheral Nervous system   b) Autonomic Nervous system
   c) Central Nervous system.   d) Nervous system

11. It is a shock absorbing fluid and protects the brain ✸
   a) neuroplasm   b) axoplasm
   c) cerebrospinal   d) cytoplasm

12. _____ acts as a thermoregulatory centre.
   a) cerebellum   b) cerebrum   c) pituitary gland   d) hypothalamus

13. Neurotransmitters are released at the synapse by
   a) tips of dendrites   b) synaptic knobs
   c) organelles of cyton   d) axon

14. For minor surgeries in the body, doctors administer local anaesthesia to a part of the body, so that the pain will not be felt by the patient. At which part do you think, the nerve impulse is being arrested due to the effect of anaesthesia?
   a) At cyton   b) At axon   c) At synapse   d) Dendrites

15. A nerve cell body with single process or fibre which acts both as axon and dendron. ✸ ✸
   a) Unipolar   b) Bipolar   c) Multipolar   d) White neuron

16. _____ carry impulses from the sense organ to the central nervous system.
   a) Sensory   b) Motor   c) Bipolar   d) Association

17. _____ are called as glial cells.
   a) Neuron   b) Neuroglia   c) Nervefibres   d) Synapse

18. Fibers Pass outward from the anterior horn forming _____.
   a) Sympathetic   b) Para sympathetic
   c) Spinal Nerves   d) None of the above

19. _____ collects and removes wastes from the brain.
   a) Medulla oblongata   b) Thalamus
   c) Spinal Cord   d) Cerebrospinal fluid

20. The length of a nerve cell is _____ μm. ✸
   a) 100   b) 50   c) 1000   d) 10

Ans:

1.	c)	Neuroglia	11.	c)	Cerebrospinal
2.	b)	Neuroplasm	12.	d)	Hypothalamus
3.	b)	Sensory	13.	b)	Synaptic knobs
4.	a)	Myelinated	14.	c)	At synapse
5.	c)	Embryonic nervous tissue	15.	a)	Unipolar
6.	b)	Bipolar	16.	a)	Sensory
7.	d)	Hypothalamus	17.	b)	Neuroglia
8.	b)	Mid brain and hind brain	18.	b)	Para sympathetic
9.	b)	Synaptic knobs	19.	d)	Cerebrospinal fluid
10.	b)	Autonomic Nervous System	20.	a)	100

II. Fill in the blanks

1. _____ is the structural and functional unit of brain.

2. _____ is a cell or group of cells which receives the stimulus.

3. _____ is a part of the body which can respond to a stimulus according to the instructions from the brain or the spinal cord.

4. _____ neurons are not enclosed by myelin sheath.

5. _____ is formed of sympathetic and parasympathetic nerves. ✸

6. The plasma membrane of axon is called _____.

7. _____ is formed of brain and spinal cord.

8. Cytoplasm of axon is called _____.

9. The point of contact between the neighbouring nerve cells is called _____.

10. Neurotransmitters convert the electrical impulse into _____ impulse.

11. _____ consists of cerebrum, thalamus and hypothalamus.

12. _____ is responsible for thinking, memory and decision making.

13. _____ controls the body temperature, urge to eat, anger, fear, etc.

14. In the posterior end of the spinal cord is a fibrous thread like structure called _____.

15. The dorsal portion of the midbrain consists of four hemispherical bodies called _____. ✸

16. _____ comprises of pons, cerebellum and medulla oblongata.

17. There are _____ pairs of cranial nerves that arise from the brain.

18. _____ controls the function of the vital organs of the body.

19. _____ is a tiny gland of the size of a pea attached to the hypothalamus of the brain.

Ans:

1.	Neuron	11.	Fore brain
2.	Receptor	12.	Cerebrum
3.	Effector	13.	Hypothalamus
4.	Grey	14.	Filum terminale
5.	ANS	15.	Corpora quadrigemina
6.	Axolemma	16.	Hind brain
7.	CNS	17.	12 pairs
8.	Axoplasm	18.	ANS
9.	Synapse	19.	Pituitary gland
10.	Chemical		

III. State whether the following statements are true or false, if false explain why.

1. **Sympathetic nervous system belongs to the PNS.** **False**
   Sympathetic nervous system belongs to the ANS.

2. **Sensory neurons carry command from spinal cord to our arm.** ✴ **False**
   Motor neurons carry command from spinal cord to our arm.

3. **Stimulus is passed to the spinal cord, to the relay neuron and then to the motor neuron.** **True**

4. **Acquired reflexes are inbuilt and unlearned responses.** ✴ ✴ **False**
   Simple reflexes are inbuilt and unlearned responses.

5. **Cerebrum maintains the posture and balance.** **False**
   Cerebellum maintains the posture and balance.

6. **Hypothalamus plays an important role in sleep and awake cycle.** **False**
   Pons and medulla plays an important role in sleep and awake cycle.

7. **A very long fibre with a branched distal end is called Axon.** **True**

8. **Sensory hair cells of the sense organs are made up of multipolar neurons.** **False**
   Sensory hair cells of the sense organs are made up of bipolar neurons.

9. **Grey neurons are not enclosed by myelin sheath.** ✴ **True**

10. **The sensory hair cells of the sense organs are made up of unipolar neurons.** **False**

    The sensory hair cells of the sense organs are made up of bipolar neurons.

11. **The innermost covering of the central nervous system is Pia mater.** **True**

12. **Hypothalamus controls body temperature, urge to eat, anger, fear, etc.** **True**

IV. Match the following

1. **Part of the brain**   **Function**

    1) Cerebrum   – a) Respiration, sleep cycle   (c)
    2) Thalamus   – b) Vomitting, salivation   (d)
    3) Hypothalamus   – c) Thinking, intelligence consciousness (e)
    4) Cerebellum   – d) Relay centre   (f)
    5) Pons   – e) Thirst, hunger, urination   (a)
    6) Medulla Oblongata   – f) Maintenance of posture and balance (b)

V. Assertion and reasoning type

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

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:** All spinal nerves are mixed nerves
   Reason: Each spinal nerve has a sensory root and a motor root.

   Ans: (a) If both A and R are true and R is correct explanation of A

2. **Assertion:** Dendrites are cytoplasmic projections from the surface of the cell body.
   Reason: Axon is a single elongated projection from the cell body. ✴

   Ans: (b) If both A and R are true but R is not the correct explanation of A

3. **Assertion:** Thalamus acts as a relay centre.
   Reason: Thalamus is a major conducting centre for sensory and motor signalling.

   Ans: (a) If both A and R are true and R is correct explanation of A

VI. Answer in a sentence

1. **What is Myelin sheath?**

   In myelinated neurons an additional white fatty fibre covers the neurilemma. It is called myelin sheath.

2. **What is Schwann cells?** ✴ ✴

   Myelin sheath is further covered by a layer of Schwann cells.

3. **What are neurons?**

   Neurons are structural and functional unit of nervous system.

4. **What are nerve fibres?**

   Nerve fibres are long slender processes of nerve cells.

5. **What is cyton?**

   Cell body of a nerve cell is called cyton.

6. **What are dendrites?**

   Dendrites are numerous branched cytoplasmic processes that project from the surface of the cell body.

7. **What are Nissl's granules?**

   The cytoplasm of cyton has large granular body called Nissl's granules.

8. **What is axon?**

   The axon is a single, elongated, slender projection from the cell body.

9. **What is synaptic knob?**

   Axon terminates into fine branches which in turn terminates into knob like swellings called synaptic knob.

10. **What is neuroglia?** ✴

    They are non exciting, supporting cell of the nervous system. They are also called as glial cells.

11. **What is neurilemma?**

    Axon is covered by a membrane called neurilemma.

VII. Short answer questions

1. What are Nodes of Ranvier?

Axon is covered by Myelin sheath which breaks at intervals by depressions called Nodes of Ranvier.

2. What are unipolar neurons?

- Only one nerve process arises from the cyton which acts as both axon and dendron.
- Unipolar neurons are found in embryonic tissue.

3. What are bi polar neurons?

- The cyton gives rise to two nerve processes of which one acts as an axon while another as a Dendron.
- Bipolar neurons are found in retina of eye and olfactory epithelium of nasal chambers.

4. What are multipolar neurons?

- The cyton gives rise to many dendrons and an axon.
- Multipolar neurons are found in cerebral cortex of brain.

5. What is nerve impulse?

The conduction of **stimuli** by nerve cells is called nerve impulse.

6. Name the divisions of Human Nervous System.

- Central Nervous system
- Peripheral Nervous system
- Autonomic Nervous system

7. Name the parts of the Central Nervous system. How are they protected? ✴

- Central Nervous system consists of the Brain and the Spinal cord.
- They are protected by the skull and the vertebral column.

8. What are meninges?

The brain and the spinal cord is covered by **three protective covering** called meninges.

9. What is Corpora quadrigemina?

The dorsal portion of the mid brain consists of **four rounded bodies** called corpora quadrigemina.

10. What is the function of corpora quadrigemina?

Corpora quadrigemina **controls** the visual and auditory (hearing) reflexes.

11. What is brain stem?

Mid brain with hind brain together form the brain stem.

12. What is the function of Cerebral cortex? ✴

Sensory perception, control of voluntary functions, language, thinking, memory, decision making, creativity.

13. What is the function of Thalamus?

Thalamus is a major conducting centre for sensory and motor signalling. It acts as a relay station.

14. What is the function of hypothalamus?

Temperature control, thirst, hunger, urination, important link between nervous system and endocrine glands.

15. What is the function of cerebellum?

Maintenance of posture and balance, coordinate voluntary muscle activity

16. What is the function of Pons and Medulla?

Role in sleep-awake cycle, cardiovascular, respiratory and digestive controlling centre.

17. What is filum terminale?

In the posterior end of the spinal cord is a fibrous thread like structure called filum terminale.

18. Classify nerve fibres.

Nerve fibres are of two types based on the presence or absence of myelin sheath.

- **Myelinated nerve fibre:** The axon is covered with myelin sheath

- **Non-myelinated nerve fibre:** The axon is not covered by myelin sheath.

Myelinated and non-myelinated nerve fibres form the white matter and grey matter of the brain.

19. What is conditioned reflex?

- Conditioned reflexes is also called **Acquired reflex**.

- These reflexes are the result of practice and learning.

- Playing harmonium by striking a particular key on seeing a music note is an example of conditioned reflexes which requires conscious training effort.

20. Write a short note on cerebellum.

- It is second largest part of the brain formed of **two** large sized hemispheres and middle vermis.

- It coordinates voluntary movements and also maintains body balance.

21. Meningitis – write notes. ✹ ✹

- Meningitis is an inflammation of the meninges.

- It can occur when fluid surrounding the meninges become infected the most common causes of meningitis are viral and bacterial infections.

22. Which food determines our brains integrity and ability? What are the sources of those food?

- The most crucial molecules that determine brains integrity and ability are Essential Fatty Acids (EFAS).

- EFAS cannot be synthesized and must be obtained from food.

- Fish, green vegetables, almond, walnut are rich sources of EFAS.

23. What are called Neurotransmitters? ✹

- Neurotransmitters are the **chemicals** which allow the transmission of nerve impulse from the **axon** terminal of one neuron to the **dendron** of another neuron or to an effect or organ.

- The important neurotransmitter released by neurons is called **Acetylcholine**.

24. E.E.G – Give the importance of it in the medical world

- Electro encephalogram (EEG) is an instrument which records the **electrical impulses** of brain.

- An EEG can detect abnormalities in the brain waves and help in diagnoses of seizures, epilepsy, brain tumors, head injuries.

25. Which type of reflex action is yawning? Why?

- Yawning is a simple or basic reflex action.
- These reflexes are inbuilt and unlearned responses.
- We perform these actions without thinking.

VIII. Differentiate between

1. Cranial nerves and spinal nerves .

S.No.	Cranial nerve	Spinal nerve
1.	There are **12 pairs** of cranial nerves.	There are **31 pairs** of spinal nerves.
2.	Eg: Optic nerves of eye, eye muscles, muscles of iris and tear gland.	Eg: Dorsal and ventral root of spinal cord.

IX. Long answer questions:

1. List out the functions of various parts of the brain. ✷ ✷

Overview of brain functions	
Cerebral cortex	Sensory preception, control of voluntary functions, language, thinking, memory, decision making, creativity
Thalamus	Acts as relay station
Hypothalamus	Temperature control, thirst, hunger, urination, important link between nervous system and endocrine glands
Cerebellum	Maintenance of posture and balance,coordinatevoluntary muscle activity
Pons and medulla	Role in sleep-awake cycle, cardiovascular, respiratory and digestive control centers

2. How are Neurons classified according to the functions?

On the basis of functions neurons are categorised as:

- Sensory or afferent neurons which carry impulses from the sense organ to the central nervous system.
- Motor or efferent neurons which carry impulses from the central nervous system to effector organ such as the muscle fibre or the gland.
- Association neurons conduct impulses betweeen sensory and motor neurons.

3. Describe the structure of cerebrum. ✷ ✷

- It is the **largest portion** forming nearly two-third of the brain.
- The cerebrum is longitudinally divided into two halves as right and left cerebral hemispheres by a deep cleft called median cleft.
- Two cerebral hemispheres are interconnected by **thick band of nerve fibres** called corpus callosum.
- The outer portion of each cerebral hemisphere is formed of **grey matter** and is called cerebral cortex.
- The inner or deeper part is formed of **white matter** and is called cerebral medulla.
- The cortex is extremely folded forming elevations called **gyri** with depressions between them termed as sulci that increase its surface area.
- Each cerebral hemisphere is divisble into a frontal lobe, a parietal lobe, a temporal lobe and an occipital lobe.

- These lobes are also known as **cerebral lobes** and are associated with specific functions.
- Any damage in specific lobe in turn affects its function.

4. Name the fluid which protects the brain. Write its functions.

- The brain is suspended in a **special fluid** environment called cerebrospinal fluid (CSF).
- It is lymph like, watery fluid that surrounds and protects the brain within the skull.
- It also fills the central canal of the spinal cord.

Functions:

- It acts as shock absorbing fluid and protects the brain from damage when it is subjected to sudden jerk.
- It supplies nutrients to the brain.
- It collects and removes wastes from the brain.
- It is also responsible for maintaining a constant pressure inside the cranium

5. Draw the diagram of structure of brain and label the following parts.

a) Cerebral cortex   b) Thalamus

c) Cerebellum   d) spinal cord

e) Medulla oblongata
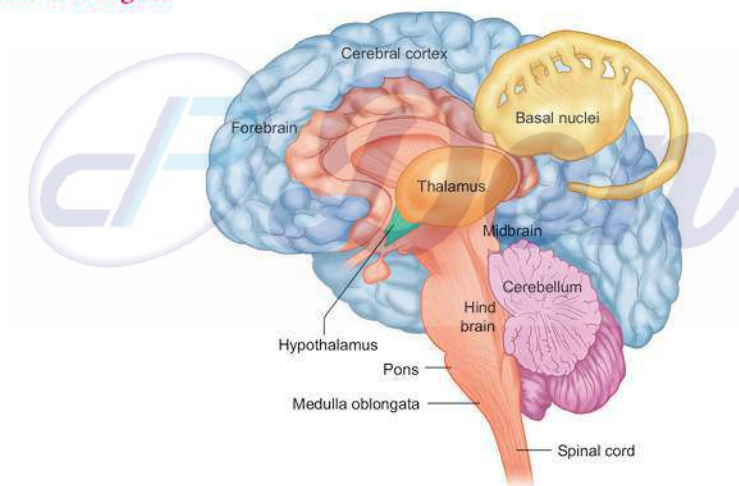
Structure of Brain

<div align="center">**Unit Test - 15**

Nervous System</div>

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. 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

2. Vomiting centre is located in
   a) medulla oblongata   b) Stomach
   c) cerebrum   d) hypothalamus

3. Nerve fibre in which axon is covered by myelin sheath.
   a) Myelinated   b) Non myelinated   c) Efferent   d) afferent

4. The sensory organs contain _____
   a) Unipolar   b) Bipolar   c) Multipolar   d) Medullated

5. One of the following is a part of the brain stem.
   a) Fore brain and mid brain   b) Mid brain and hind brain
   c) Fore brain and hind brain   d) Fore brain and spinal cord

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Define stimulus.
2. What are the structures involved in the protection of brain?
3. Write a short note on cranial nerves.
4. What is conditioned reflex?
5. Differentiate betweenMedullated and non-medullated nerve fibre.

III. Answer the following questions in brief.   2 × 4 = 8

1. i) What is conditioned reflex?
   ii) Differentiate Medullated and non-medullated nerve fibre.

2. i) Write a short note on spinal nerves.
   ii) What is neuroglia?

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) What are multipolar neurons?
   ii) Describe the structure of spinal cord.

POINTS TO REMEMBER

- The function of control and coordination in plants is performed by chemical substances produced by the plants called **plant hormones**.
- Plant hormones are Auxins, Cytokinins, Gibberellins, Abscisic Acid (ABA) and Ethylene .
- **Growth Promotors:** Hormones which promote plant growth are called growth promoters. Eg. auxins, cytokinins and gibberellins
- **Growth Inhibitors:** Hormones which inhibit plant growth are called growth Inhibitors. Eg. Abscisic acid and Ethylene.
- Frits Warmolt Went (1903– 1990), a Dutch biologist demonstrated the existence and effect of auxin in plants. He did a series of experiments in Avena coleoptiles.
- Auxins are produced at the tip of stems and roots.
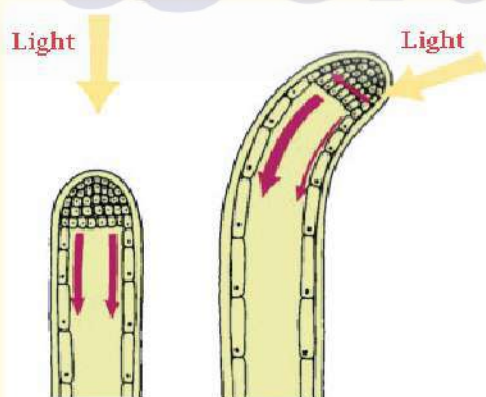
- Auxins are classified into two types, namely natural auxins and synthetic auxins.
- This internodal elongation in rice was caused by fungus *Gibberella fujikuroi*.
- The branch of biology which deals with the study of the endocrine glands and its physiology is known as '**Endocrinology**'.
- The pituitary gland forms the major endocrine gland in most vertebrates. It regulates and controls other endocrine glands and so is called as the "**Master gland**".
- **Dwarfism:** It is caused by decreased secretion of growth hormone in children.
- **Gigantism:** Oversecretion of growth hormone leads to gigantism in children.

Mind Map

Plant Hormones

Growth Promoters
- Auxins
- Cytokinins
- Gibberellins

Growth Inhibitors
- Abscisic Acid
- Ethylene

GH, PRL, TSH, ACTH, FSH, LH ← ADENOHYPOPHYSIS

NEUROHYPOPHYSIS → VASOPRESSIN, OXYTOCIN

PITUITARY GLAND

THYROID GLAND → T3, T4

INSULIN, GLUCAGON ← PANCREAS (ISLETS OF LANGERHANS)

ENDOCRINE GLANDS

PARATHYROID GLAND → PARATHORMONE

THYMUS GLAND

THYMOSIN

GONADS → TESTIS → TESTOSTERONE

OVARY → ESTROGEN, PROGESTERONE

ADRENAL GLAND

ADRENAL CORTEX

CORTISOL, ALDOSTERONE

ADRENAL MEDULLA

EPINEPHRINE NOREPINEPHRINE

- **Acromegaly:** Excess secretion of growth hormone in adults may lead to abnormal enlargement of head, face, hands and feet.

- Gonadotropic hormones (GTH)

  The gonadotropic hormones are follicle stimulating hormone and luteinizing hormone which are essential for the normal development of gonads.

- Prolactin (PRL)

  PRL is also called lactogenic hormone.

- The hormones secreted by the posterior pituitary are:

  a. Vasopressin or Antidiuretic hormone

  b. Oxytocin

- **Hyperthyroidism**

  It is caused due to the excess secretion of the thyroid hormones which leads to Grave's disease.

- **Hypothyroidism**

  It is caused due to the decreased secretion of the thyroid hormones.

- **Cretinism**

  It is caused due to decreased secretion of the thyroid hormones in children.

  Goitre

  It is caused due to the inadequate supply of iodine in our diet.

- **Myxoedema**

  It is caused by deficiency of thyroid hormones in adults.

  Thymosin is the hormone secreted by thymus.

Scientists and inventions:

- The term auxin was introduced by **Kogl** and **Haagen- Smith** (1931).

- **Charles Darwin** (1880), observed unilateral growth and curvature of canary grass (Phalaris canariensis) coleoptiles.

- Frits **Warmolt Went** (1903– 1990), a Dutch biologist demonstrated the existence and effect of auxin in plants. He did a series of experiments in Avena coleoptiles.

- **Thomas Addison** is known as Father of Endocrinology.

- English physiologists **W. M. Bayliss** and **E. H. Starling** introduced the term hormone in 1909. They first discovered the hormone secretin.

- **Kurosawa** (1926) observed Bakanae disease or foolish seedling disease in rice crops.

- Human insulin was first discovered by Fredrick Banting, Charles Best and MacLeod in 1921.

- Edward C. Kendal in 1914 first crystallised thyroxine hormone.

- Application of cytokinin delays the process of ageing in plants. This is called **Richmond Lang effect**.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Gibberellins cause
- **a)** Shortening of genetically tall plants
- **b)** Elongation of dwarf plants
- **c)** Promotion of rooting
- **d)** Yellowing of young leaves

2. The hormone which has positive effect on apical dominance is ✳✳
- **a)** Cytokinin
- **b)** Auxin
- **c)** Gibberellin
- **d)** Ethylene

3. Which one of the following hormones is naturally not found in plants? ✳
- **a)** 2, 4-D
- **b)** GA3
- **c)** Gibberellin
- **d)** IAA

4. Avena coleoptile test was conducted by
- **a)** Darwin
- **b)** N. Smit
- **c)** Paal
- **d)** F.W. Went

5. To increase the sugar production in sugarcanes they are sprayed with _____
- **a)** Auxin
- **b)** Cytokinin
- **c)** Gibberellins
- **d)** Ethylene

6. LH is secreted by
- **a)** Adrenal gland
- **b)** Thyroid gland
- **c)** Anterior pituitary
- **d)** Hypothalamus.

7. Identify the exocrine gland
- **a)** Pituitary gland
- **b)** Adrenal gland
- **c)** Salivary gland
- **d)** Thyroid gland

8. Which organ acts as both exocrine gland as well as endocrine gland ? ✳✳
- **a)** Pancreas
- **b)** Kidney
- **c)** Liver
- **d)** Lungs

9. Which one is referred as "Master Gland"? ✳✳
- **a)** Pineal gland
- **b)** Pituitary gland
- **c)** Thyroid gland
- **d)** Adrenal gland

Ans:

1)	b)	Elongation of dwarf plants	6)	c)	Anterior pituitary
2)	b)	Auxin	7)	c)	Salivary gland
3)	a)	2, 4-D	8)	a)	Pancreas
4)	d)	F.W. Went	9)	b)	Pituitary gland
5)	a)	Auxin			

II. Fill in the blanks

1. _____ causes cell elongation, apical dominance and prevents abscission. ✸✸

2. _____ is a gaseous hormone involved in abscission of organs and acceleration of fruit ripening.

3. _____ causes stomatal closure.

4. Gibberellins induce stem elongation in _____ plants.

5. The hormone which has negative effect on apical dominance is _____. ✸✸

6. Calcium metabolism of the body is controlled by _____.

7. In the islets of Langerhans, beta cells secrete _____. ✸✸

8. The growth and functions of thyroid gland is controlled by _____.

9. Decreased secretion of thyroid hormones in the children leads to _____.

Ans:

1.	Auxin	6.	Parathormone
2.	Ethylene	7.	Insulin
3.	Abscisic acid	8.	Thyroid stimulating hormone TSH
4.	Rice	9.	Cretinism
5.	Cytokinins		

III. Match the following:

1. a) Match Column I with Columns II and III

Column I	Column II	Column III
1. Auxin	a. *Gibberella fujikuroi*	(i) Abscission
2. Ethylene	b. Coconut milk	(ii) Internodal elongation
3. Abscisic acid	c. Coleoptile tip	(iii) Apical dominance
4. Cytokinin	d. Chloroplast	(iv) Ripening
5. Gibberellins	e. Fruits	(v) Cell division

Ans : 1-c-iii, 2-e-iv, 3-d-i, 4-b-v, 5-a-ii

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

Hormones		Disorders	
1. Thyroxine	-	a. Acromegaly	(c)
2. Insulin	-	b. Tetany	(e)
3. Parathormone	-	c. Simple goitre	(b)
4. Growth hormone	-	d. Diabetes insipidus	(a)
5. ADH	-	e. Diabetes mellitus	(d)

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

1. **A plant hormone concerned with stimulation of cell division and promotion of nutrient mobilization is cytokinin.**   **True**

2. **Gibberellins cause parthenocarpy in tomato.**   **True**

3. **Ethylene retards senescence of leaves, flowers and fruits.** ✱ ✱   **False**
   Ethylene hastens the senescence of leaves, flowers and fruits.

4. **Exopthalmic goitre is due to the over secretion of thyroxine.**   **True**

5. **Pituitary gland is divided into four lobes.**   **False**
   Pituitary gland is divided into two lobes.

6. **Estrogen is secreted by corpus luteum.** ✱ ✱   **False**
   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

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:** Application of cytokinin to marketed vegetables can keep them fresh for several days.

   Reason: Cytokinins delay senescence of leaves and other organs by mobilisation of nutrients.

   Ans: a) If both A and R are true and R is correct explanation of A

2. **Assertion (A):** Pituitary gland is referred as "Master gland".
   Reason (R): It controls the functioning of other endocrine glands.
   Ans: a) If both A and R are true and R is correct explanation of A

3. **Assertion (A):** Diabetes mellitus is increased blood sugar level.
   Reason (R): Insulin decreases the blood sugar levels.
   Ans: b) If 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?**
   Gibberellins promote the production of male flowers in Cucurbits.

2. **Write the name of a synthetic auxin.** ✱ ✱
   2,4 Dichlorophenoxy Acetic Acid (2,4 D)

3. **Which hormone induces parthenocarpy in tomatoes?**
   Gibberellins induces parthenocarpy in tomatoes.

4. What is the hormone responsible for the secretion of milk in female after child birth?

Prolactin (PRL) is also called lactogenic hormone, initiates development of mammary glands during pregnancy and stimulates the production of milk after child birth. ✹ ✹

5. Name the hormones which regulates water and mineral metabolism in man.

Growth hormone, Thyroid hormone, Parathormone and Glucocorticoids.

6. Which hormone is secreted during emergency situation in man? ✹

- Epinephrine (Adrenaline)
- Norepinephrine (Noradrenaline)
- They are together called as "Emergency hormones" secreted during emergency situation in man.

7. Which gland secretes digestive enzymes and hormones?

Pancreas

8. Name the endocrine glands associated with kidneys.

Posterior lobe (Neurohypophysis) of pituitary gland.

VII. Short answer questions

1. What are synthetic auxins? Give examples.

- **Artificially synthesized** auxins that have properties like auxins are called as synthetic auxins.
- eg. 2, 4 D (2,4 Dichlorophenoxy Acetic Acid).

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

- **Bolting** is production of a flowering stem in plants.
- Treatment of rosette plants with gibberellin induces **sudden shoot elongation** followed by flowering. This is called bolting.

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

- Abscisic acid promotes the process of **abscission** (separation of leaves, flowers and fruits from the branch).
- During water stress and drought conditions, Abscisic acid causes **stomatal closure.**

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

Application of **auxin** on plants will prevent leaf fall and fruit drop in plants because **Auxins** prevent the formation of abscission layer.

5. What are chemical messengers?

- A chemical messenger is any compound that serves to transmit a **message**.
- **Hormones** act as chemical messengers which are produced by specialized glands.

6. Write the differences between endocrine and exocrine gland. ✹ ✹

S.No	Endocrine gland	Exocrine gland
1.	These are **ductless** glands.	These glands are with **specific ducts.**
2.	Secretions are **directly** diffused into the **blood stream.**	Secretions are passed through the specific dusts.
3.	Secreate **hormones**.	Secreate **saliva, sweat,** etc.
4.	**E.g:** Pituitary gland, thyroid gland.	**E.g:** Salivary glands, sweat glands.

7. **What is the role of parathormone?**
   - The parathormone regulates **calcium** and **phosphorus** metabolism in the body.
   - They act on bone, kidney and intestine to maintain **blood calcium levels**.
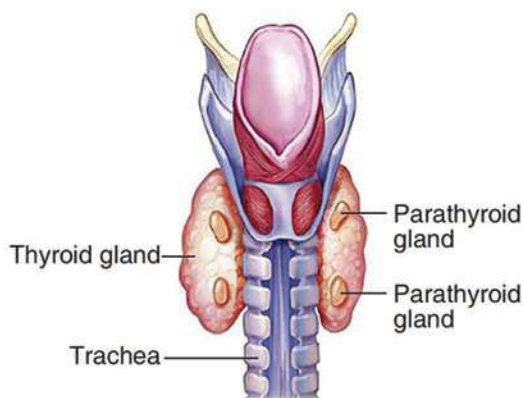
Parathyroid Gland

8. **What are the hormones secreted by posterior lobe of the pituitary gland? Mention the tissues on which they exert their effect.** ✴ ✴

   The hormones secreted by the posterior pituitary are:

   - **Vasopressin or Antidiuretic hormone (ADH)**
     In kidney tubules it increases reabsorption of water.

   - **Oxytocin**
     It helps in the contraction of the smooth muscles of uterus.

9. **Why are thyroid hormones referred as personality hormone?**
   - Thyroid hormone is essential for **normal physical, mental** and **personality** development.
   - Hence it is called as the personality hormone.

10. **Which hormone requires iodine for its formation? What will happen if intake of iodine in our diet is low?**
    - Iodine is involved in the formation of **thyroid hormone.**
    - Goitre is caused due to the inadequate supply of iodine in our diet.

VIII. Long answer questions

1. **(a) Name the gaseous plant hormone. Describe its three different actions in plants. (b) Which hormone is known as stress hormone in plants ? Why?**
   (a) Ethylene is a gaseous plant hormone.

   - It is mainly concerned with maturation and ripening of fruits.
   - Ethylene inhibits the elongation of stem and root in dicots.
   - Ethylene hastens the senescence of leaves and flowers.

   (b)

   Abscisic Acid is also called as stress hormone in plants because it increases tolerance of plants to various kinds of stress.

2. Describe an experiment which demonstrates that growth stimulating hormone is produced at the tip of coleoptile. ★ ★ ★

- **Warmolt Went** (1903– 1990), a Dutch biologist demonstrated the existence and effect of **auxin** in plants. He did a series of experiments in **Avena coleoptiles.**

- He did a series of experiments in **Avena coleoptiles.**

A. Germination of an oat seed
B. Decapitate tip of coleoptile and place on agar block.
C. Agar block is placed on top of the decapitated tip of the seedling.
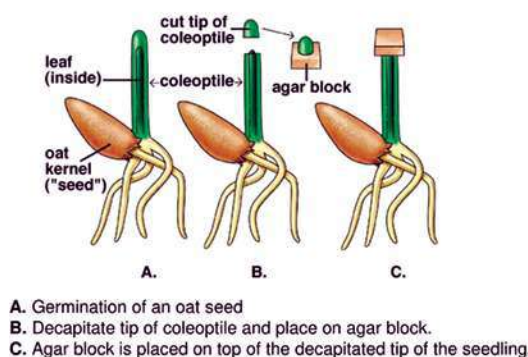
Went's Experiment

First Experiment:

- In his first experiment he **removed the tips o**f Avena coleoptiles.

- The cut tips **did not grow** indicating that the tips produced something essential for growth.

Second Experiment:

- In his second experiment he placed the **agar blocks** on the decapitated coleoptile tips.

- The coleoptile tips **did not show any response.**

Third Experiment:

- In his next experiment he placed the detached coleoptile **tips on agar blocks.**

- After an hour, he discarded the **tips** and placed this **agar block** on the decapitated coleoptile.

- It **grew** straight up indicating that some **chemical** had diffused from the cut coleoptile tips into the agar block which stimulated the growth.

Conclusion:

- He concluded that a chemical diffusing from the tip of coleoptiles was responsible for growth.

- He named it as **"Auxin"** meaning **"to grow".**

3. Write the physiological effects of gibberellins. ★

- Application of gibberellins on plants stimulate extraordinary **elongation** of **internode**. e.g. Corn and Pea.

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

- Gibberellins promote the production of male flowers in monoecious plants (Cucurbits).

- Gibberellins **break dormancy** of potato tubers.

- Gibberellins are efficient than auxins in inducing the formation of **seedless fruit** - Parthenocarpic fruits (Development of fruits without fertilization) e.g. Tomato

4. **Where are estrogens produced? What is the role of estrogens in the human body?**
   - Estrogen is produced by the **Graafian follicles** of the ovary. ✦ ✦

   ### Role of estrogen in the human body:
   - It brings about the changes that occur during **puberty.**
   - It initiates the process of **oogenesis.**
   - It stimulates the **maturation of ovarian follicles** in the ovary.
   - It promotes the development of **secondary sexual characters** (breast development, high pitched voice etc).

5. **What are the conditions which occur due to lack of ADH and insulin? How are the conditions different from one another?**
   - ADH deficiency causes Diabetes insipidus.
   - Insulin deficiency causes Diabetes mellitus.
   - Deficiency of Vasopressin or Antidiuretic hormone (ADH) reduces reabsorption of water in kidney and causes an increase in urine output (polyurea).
   - Deficiency of insulin causes excretion of excess glucose in the urine (Glycosurea).

IX. Higher Order Thinking Skills (HOTS)

1. **What would be expected to happen if**
   a. Gibberellin is applied to rice seedlings.
   b. A rotten fruit gets mixed with unripe fruits.
   c. When cytokinin is not added to culture medium

   a. When **Gibberllin** is applied to rice **seedlings,** it would induce bolting. It is a natural attempt to boost seed production.

   b. When a rotten fruit gets mixed with unripe fruits, the **ethylene** produced from the rotten fruits will hasten the **ripening** of the unripe fruits.

   c. When cytokinin is not added to culture medium, then cell division, growth and differentiation will not be observed.

2. **A plant hormone was first discovered in Japan when rice plants were suffering from Bakanae disease caused by *Gibberella fujikuroi*. Based on this information answer the following questions:**
   a. Identify the hormone involved in this process.
   b. Which property of this hormone causes the disease?
   c. Give two functions of this hormone.

   a. Gibberellins

   b. The active substance was identified as Gibberellic acid, which caused this disease.

   c. Application of gibberellins on plants stimulate **extraordinary elongation** of internode. e.g. Corn and Pea.

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

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.**
   - Hyperthyroidism is caused due to the excess secretion of the thyroid hormones which leads to Grave's disease.
   - This hormone is secreted by the thyroid gland.

4. **Sanjay is sitting in the exam hall. Before the start of the exam, he sweats a lot, with increased rate of heart beat. Why does this condition occur?**

   Adrenaline is known to cause physical symptoms that accompany test anxiety, such as increased heart rate, sweating, and rapid breathing.

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.**

   • Polyurea occurs in people diagnosed with Diabetes mellitus, if blood glucose levels have risen too high.

   • Regular exercise, along with a good diet, can reduce the risk of diabetes.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. _____ promote the elongation of stems and coleoptiles. ✴
   a) Cytokinins   b) Gibberellins   c) Ethylene   d) Auxin

2. _____ promote the growth of lateral buds in the presence of apical bud
   a) Cytokinins   b) Gibberellins   c) Ethylene   d) Auxin

3. _____ inhibits the elongation of stem.
   a) Cytokinins   b) Gibberellins   c) Ethylene   d) Auxin

4. _____ breaks the dormancy of buds, seeds and storage organs.
   a) Cytokinins   b) Gibberellins   c) Ethylene   d) Auxin

5. **An amino acid _____ and iodine are involved in the formation of thyroid hormone. ✴**
   a) Alanine   b) Tyrosine   c) Valine   d) Glycine

6. **The alpha cells of pancreas secrete _____ .**
   a) Glucagon   b) Insulin   c) Valine   d) Glycogen

7. **Beta cells of pancreas secrete _____ . ✴✴**
   a) Glucagon   b) Insulin   c) Valine   d) Glycogen

8. _____ prepares the uterus for the implantation of the embryo .
   a) Estrogens   b) Thymosin
   c) Progesterone   d) Testosterone

9. _____ initiates the process of oogenesis.
   a) Estrogens   b) Thymosin
   c) Progesterone   d) Testosterone

10. **It stimulates protein synthesis and controls muscular growth. ✴**
    a) Estrogens   b) Thymosin
    c) Progesterone   d) Testosterone

11. **It is essential for the formation of placenta.**
    a) Estrogens
    b) Thymosin
    c) Progesterone
    d) Testosterone

12. **It is also known as life-saving hormone.**
    a) Thymosin
    b) Cortisol
    c) Adrenaline
    d) Epinephrine

13. **It is also known as emergency hormone.**
    a) Thymosin
    b) Cortisol
    c) Adrenaline
    d) Insulin

14. **Muscle spasm known as _____. ★**
    a) Thymus
    b) Tetany
    c) Thymosin
    d) Thyroid

15. **It controls the growth of thyroid gland**
    a) TSH
    b) ACTH
    c) GTH
    d) FSH

16. **It helps in the contraction of the smooth muscles of uterus at the time of child birth ★**
    a) Prolactin
    b) Vasopressin
    c) Estrogen
    d) Oxytocin

17. **'Influence' that was observed by Charles Darwin is _____.**
    a) Gibberellins
    b) 2 – 4 D
    c) Auxin
    d) Cytokinins

18. **_____ observed Bakanae disease in rice crops.**
    a) Darwin
    b) Kurosawa
    c) F.W.Went
    d) Koal

19. **_____ is a growth inhibitor hormone.**
    a) Auxin
    b) Cytokinin
    c) Gibberellins
    d) Ethylene

20. **The hormone responsible for the production of female sex hormones is _____. ★**
    a) G.T.H
    b) FSH
    c) LH
    d) TSH

21. **The gland, composed of two distinct lobes lying one on either side of the trache is _____.**
    a) Pineal
    b) Thyroid
    c) Pituitary
    d) Pancreas

Ans:

1)	d)	Auxin	12)	b)	Cortisol
2)	a)	Cytokinins	13)	c)	Adrenaline
3)	c)	Ethylene	14)	b)	Tetany
4)	c)	Ethylene	15)	a)	TSH
5)	b)	Tyrosine	16)	d)	Oxytocin
6)	a)	Glucagon	17)	c)	Auxin
7)	b)	Insulin	18)	b)	Kurosawa
8)	c)	Progesterone	19)	d)	Ethylene
9)	a)	Estrogens	20)	c)	LH
10)	d)	Testosterone	21)	b)	Thyroid
11)	c)	Progesterone			

II. Fill in the blanks

1. _____ was the first plant hormone to be discovered.

2. _____ are the plant hormones that promote cell division in plant cells.

3. _____ promotes senescence in leaves by causing loss of chlorophyll.

4. _____ is a gaseous plant hormone.

5. Melatonin is a hormone produced by the _____ gland.

6. Thyroid is composed of glandular follicles which are filled with colloid material called _____.

7. The branch of biology that deals with the study of the endocrine glands and its physiology is known as _____. ✴

8. _____ gland attached to the hypothalamus by a pituitary stalk.

9. _____ and _____ identified the molecular structure of thyroxine in 1927.

10. A balance between _____ and _____ production is necessary to maintain blood glucose concentration.

11. Insulin helps in the conversion of glucose into _____.

12. Glucagon helps in the breakdown of glycogen to _____ in the liver.

13. Adrenal glands are also called as _____.

14. The adrenal medulla is composed of _____. ✴

15. _____ cells form the endocrine part of the testes.

16. _____ is the hormone secreted by thymus.

17. _____ influences the process of spermatogenesis.

18. _____ is responsible for the development of secondary sexual characters in men.

19. _____ is responsible for the premenstrual changes of the uterus. ✴ ✴

20. _____ promotes the development of secondary sexual characters in women.

21. _____ stimulates the production and differentiation of lymphocytes.

22. _____ is partly an endocrine gland and partly a lymphoid gland.

23. An amino acid _____ and _____ are involved in the formation of thyroid hormone.

Ans:

1.	Auxins	13.	Supra renal glands
2.	Cytokinins	14.	Chromaffin cells
3.	Abscisic acid	15.	Leydig
4.	Ethylene	16.	Thymosin
5.	Pineal	17.	Testosterone
6.	Thyroglobulin	18.	Testosterone
7.	Endocrinology	19.	Progesterone
8.	Pituitary	20.	Estrogen
9.	Charles Harrington and George Barger	21.	Thymosin
10.	Insulin, glucagon	22.	Thymus
11.	Glycogen	23.	Tyrosine, iodine
12.	Glucose		

III. Match the following:

1)	Thyroid	–	a) Child birth	(d)
2)	Prolactin	–	b) Graves disease	(e)
3)	Oxytocin	–	c) Antidiuretic hormone	(a)
4)	Parathyroid	–	d) Personality hormone	(f)
5)	Vasopressin	–	e) Milk production	(c)
6)	Hyperthyroidism	–	f) Tetany	(b)

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

1. **Gibberellins are produced at the tip of stems and roots.** **False**
   Auxins are produced at the tip of stems and roots.

2. **Cytokinin causes cell enlargement.** **True**

3. **Kurosawa (1926) observed Bakanae disease or foolish seedling disease in wheat.** **False**
   Kurosawa (1926) observed Bakanae disease or foolish seedling disease in rice. ✶

4. **Cytokinin induces bolting plants.** **False**
   Gibberellin induces bolting.

5. **Gibberellin is also called as stress hormone.** ✶ **False**
   Abscisic acid is also called as stress hormone.

6. **Ethylene promotes the ripening of fruits.** **True**

7. **Endocrine glands are ductless glands.** **True**

8. **Suppression of serotonin has been implicated in sleep disturbances.** **False**
   Suppression of melatonin has been implicated in sleep disturbances.

9. **Progesterone prepares the uterus for the implantation of the embryo.** **True**

10. **Progesterone brings about the changes that occur during puberty.** **False**

Estrogen brings about the changes that occur during puberty.

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

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:** Auxins produced by the plants are called natural auxins

   Reason: Auxins bring about a variety of physiological effects in different parts of the plant body.

   Ans: a) If both A and R are true and R is correct explanation of A

2. **Assertion:** TSH controls the growth of thyroid gland. ✴

   Reason: The gonadotropic hormones are follicle stimulating hormone.

   Ans: b) If both A and R are true but R is not the correct explanation of A

3. **Assertion:** Melatonin is a hormone produced by the pineal gland. It is known as a 'time messenger'.

   Reason: It signals night time information throughout the body.

   Ans: a) If both A and R are true and R is correct explanation of A

VI. Answer in a word or sentence

1. **Name the five classes of plant hormones.**

   Auxins, Cytokinins, Gibberellins, Abscisic Acid (ABA), Ethylene

2. **Parthenocarpy is induced by the external application of cytokinin.**

   False, Parthenocarpy is induced by the external application of auxins

3. **Which prevents the formation of abscission layer?** ✴

   Auxins prevent the formation of abscission layer.

4. **Give two examples of natural auxins.**

   Phenyl Acetic Acid (PAA) and Indole 3 Acetonitrite (IAN) are natural auxins.

5. **Name the plant hormone which promotes cell division in plant cells.**

   Cytokinins are the plant hormones that promote cell division or cytokinesis in plant cells.

6. **What is Richmond Lang effect?** ✴

   Application of cytokinin **delays** the process of ageing in plants. This is called Richmond Lang effect.

7. **Name the fungus which is responsible for intermodal elongation.**

   Internodal elongation in rice is caused by the fungus *Gibberella fujikuroi.*

8. **Which hormone hastens the senescence of leaves?**

   Ethylene hastens the senescence of leaves.

9. **Which hormone causes the stomatal closure during drought conditions?**

   During water stress and drought conditions **Abscisic acid** (ABA) causes stomatal closure.

10. **Which hormone is known as a time messenger?** ✹

    Melatonin hormone is known as a 'time messenger'.

11. **What is thyroid dysfunction?**

    When the **thyroid gland fails** to secrete the normal level of hormones, the condition is called thyroid dysfunction.

12. **Who is the father of endocrinology?**

    Thomas Addison is known as Father of Endocrinology.

13. **Who introduced the term 'hormone'?**

    English physiologists **W. M. Bayliss** and **E. H. Starling** introduced the term hormone in 1909.

14. **Who first crystallised thyroxine hormone?**

    Edward C. Kendal in 1914 first crystallised thyroxine hormone.

15. **How much iodine is needed in everyday life for thyroxine secretion?**

    Thyroid gland requires "**120 μg**" of iodine everyday for the production of thyroxine.

16. **Where does the breakdown of glycogen to glucose take place?**

    Breakdown of **glycogen to glucose** takes place in the liver.

17. **What is Polydipsia?**

    Increased thirst is Polydipsia.

18. **What is Glycosuria?** ✹ ✹

    Excretion of excess glucose in the urine is Glycosuria.

19. **Who first discovered human insulin?**

    Human insulin was first discovered by **Fredrick Banting, Charles Best** and **MacLeod** in 1921.

20. **Which hormone maintains pregnancy?**

    Progesterone

21. **In which plant did Charles Darwin do the experiments?**

    Canary grass (Phalaris canariensis)

22. **What is the term used to denote the fruit formation without fertilization?**

    The fruit formation without fertilization is called as **parthenocarpy**.

23. **From where was cytokinine isolated at first?**

    It was first isolated from **Herring fish sperm.**

24. **Name the hormone that breaks dormancy of Potato tubers.**

    Gibberellins.

25. **What are the diseases caused by the decreased secretion of Parat hormone?**

    Tetany, painfull cramp of the limb muscles.

26. **Give any two symptoms of Diabetes mellitus, Give any 2**

Polyurea, Polyphagia.

VII. Short answer questions

1. **Write short notes on the types of Auxins.**

   Types of auxins:

   • Auxins are classified into **two** types, namely natural auxins and synthetic auxins.

   Natural Auxins:

   • Auxins produced by the **plants** are called **natural auxins.**

   • **Example:** IAA (Indole – 3 - Acetic Acid)

   Synthetic Auxins:

   • **Artificially synthesized** auxins that have properties like auxins are called as **synthetic auxins.**

   • **Example:** 2, 4 D (2,4 Dichlorophenoxy Acetic Acid).

2. **Mention the causes and symptoms of cretinism.** ✦

   • It is caused due to **decreased secretion** of the thyroid hormones in children.

   • The conditions are stunted growth, mental defect, lack of skeletal development and deformed bones.

   • They are called as **cretins.**

3. **Mention the causes and symptoms of myxoedema.**

   • It is caused by deficiency of **thyroid hormones** in adults.

   • They are mentally sluggish, increase in body weight, puffiness of the face and hand, oedematous appearance.

4. **Mention the causes and symptoms of Dwarfism:**

   Dwarfism:

   • It is caused by **decreased secretion of growth hormone** in children.

   • The characteristic features are stunted growth, delayed skeletal formation and mental disability.

5. **Mention the causes and symptoms of Acromegaly.**

   Acromegaly:

   • **Excess secretion of growth hormone** in adults may lead to abnormal enlargement of head, face, hands and feet.

6. **What is the function of TSH?**

   Thyroid Stimulating Hormone (TSH) **controls** the growth of thyroid gland, **coordinates** its activities and hormone secretion.

7. **What is the function of ACTH?** ✦

   • Adrenocorticotropic hormone (ACTH) **stimulates adrenal cortex** of the adrenal gland for the production of its hormones.

   • It also **influences** protein synthesis in the adrenal cortex.

8. **What is the function of GTH?**

   Gonadotropic hormones (GTH) are follicle stimulating hormone and luteinizing hormone which are essential for the normal **development of gonads.**

9. **What is the function of Pancreatic hormone?**

A balance between insulin and glucagon production is necessary to **maintain** blood glucose concentration.

10. **What is the function of insulin?** ✳ ✳

- Insulin helps in the conversion of **glucose into glycogen** which is stored in liver and skeletal muscles.

- It promotes the **transport of glucose** into the cells.

- It decreases the **concentration of glucose** in blood

11. **What is the function of glucagon?**

- Glucagon helps in the breakdown of **glycogen** to glucose in the liver.

- It **increases** blood glucose levels

- ue to the **excess secretion** of the **thyroid hormones** which leads to Grave's disease.

VIII. Long answer questions

1. **Write the physiological effects of auxin.** ✳

- Auxins promote the **elongation of stems** and coleoptiles which makes them to grow

- Auxins induce **root formation** at low concentration and inhibit it at higher concentration.

- The auxins produced by the apical buds **suppress growth** of lateral buds. This is called apical dominance.

- Seedless fruits without fertilization are induced by the external application of auxins. (Parthenocarpy). **Examples:** Watermelon, Grapes, Lime, etc.

- Auxins **prevent** the formation of abscission layer.

2. **Write the physiological effects of cytokinin.**

- Cytokinin induces **cell division** in the presence of auxins.

- Cytokinin also causes **cell enlargement.**

- Both auxins and cytokinins are essential for the **formation** of **new organs** from the callus in tissue culture.

- Promote the **growth of lateral buds** even in the presence of apical bud.

- Application of cytokinin **delays** the process of **ageing in plants.** This is called Richmond Lang effect.

3. **Write the physiological effects of Abscissic acid.**

- ABA **promotes** the process of abscission (separation of leaves, flowers and fruits from the branch).

- During water stress and drought conditions ABA causes **stomatal closure.**

- ABA promotes **senescence** in leaves by causing loss of chlorophyll.

- ABA induces **bud dormancy** towards the approach of winter in trees like birch.

- ABA is a powerful inhibitor of **lateral bud growth** in tomato.

4. **Write the Physiological effects of ethylene.** ✳

- Ethylene promotes the **ripening of fruits.** e.g. Tomato, Apple, Mango, Banana, etc.

- Ethylene inhibits the **elongation** of stem and root in dicots.

- Ethylene hastens the **senescence** of leaves and flowers.

- Ethylene **stimulates** formation of abscission zone in leaves, flowers and fruits. This leads to premature shedding.
- Ethylene **breaks the dormancy** of buds, seeds and storage organs.

5. **What are the hormones secreted by the anterior lobe of the pituitary gland? Write their functions.**

   The hormones secreted by anterior pituitary are:

   - Growth Hormone – GH **promotes** the development and enlargement of all tissues of the body.
   - Thyroid stimulating Hormone – TSH **controls** the growth of thyroid gland, coordinates its activities and hormone secretion.
   - Adrenocorticotropic Hormone – ACTH stimulates adrenal cortex of the adrenal gland for the **production** of its hormones. It also **influences protein** synthesis in the adrenal cortex.
   - Gonadotropic Hormone which comprises the Follicle Stimulating Hormone and Luteinizing Hormone – which are essential for the normal **development of gonads.**
   - Prolactin – PRL is also called **lactogenic** hormone. This hormone initiates **development** of **mammary glands** during pregnancy and stimulates the production of milk after child birth.

6. **What are the functions of thyroid hormones?** ✷ ✷

   - Production of energy by maintaining the Basal Metabolic Rate (BMR) of the body.
   - Helps to **maintain** normal body temperature.
   - **Influences** the activity of central nervous system.
   - **Controls** growth of the body and bone formation.
   - Essential for normal physical, mental and personality development .
   - It is also known as **personality hormone.**
   - **Regulates** cell metabolism.

7. **Draw and label of the following:**

   i) Thyroid gland   ii) Pancreas   iii) Adrenal gland

Thyroid cartilage

Thyroid gland

Trachea

Nodule

Thyroid Gland

Bile duct

Blood vessel

Islets of Langerhans

Pancreatic duct

Acinar cells

Duodenum

Pancreas

Adrenal gland

Capsule

Medulla

Blood vessels

Cortex

Kidney
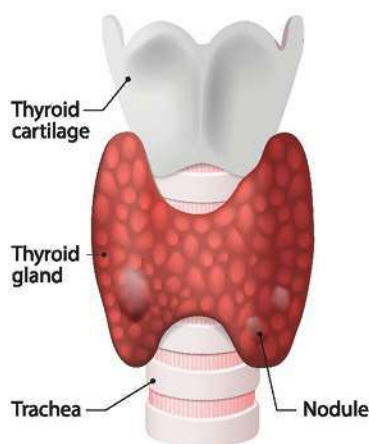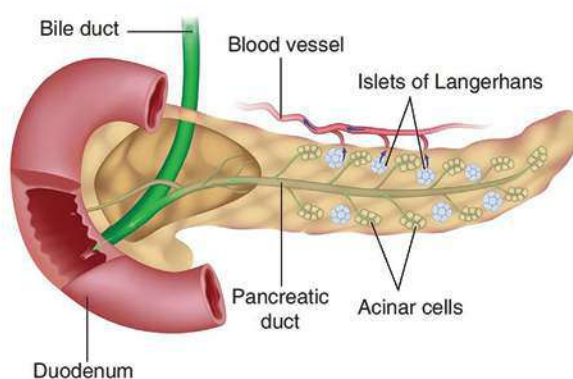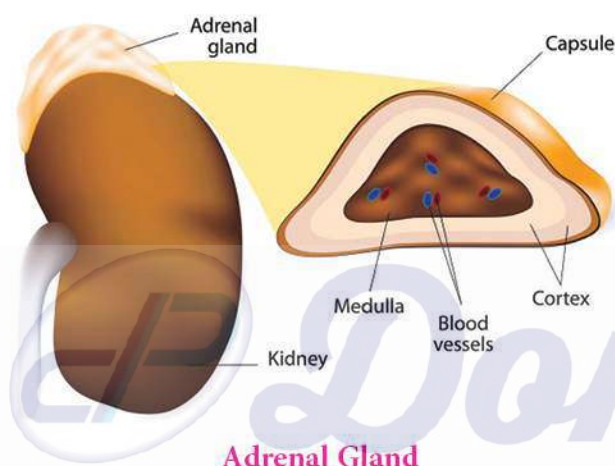
Adrenal Gland

IX. Higher Order Thinking Skills (HOTS)

1. **Exposure to light at night can interrupt sleep. How?**
   - Exposure to light at night, especially short-wavelength light, can decrease melatonin production interrupting sleep.
   - Suppression of melatonin has been implicated in sleep disturbances and related metabolic disorders.

Unit Test - 16

Plant and Animal Hormones

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   **5 × 1 = 5**

1. Which one of the following hormones is naturally not found in plants?
   a) 2, 4-D   b) GA3   c) Gibberellin   d) IAA

2. Avena coleoptile test was conducted by
   a) Darwin   b) N. Smit   c) Paal   d) F.W. Went

3. Identify the exocrine gland
   a) Pituitary gland   b) Adrenal gland   c) Salivary gland   d) Thyroid gland

4. Muscle spasm known as _____
   a) Thymus   b) Tetany   c) Thymosin   d) Thyroid

5. It helps in the contraction of the smooth muscles of uterus at the time of child birth
   a) Prolactin   b) Vasopressin   c) Estrogen   d) Oxytocin

II. Answer the following questions in one or two lines.   **5 × 2 = 10**

1. What are chemical messengers?
2. Write the differences between endocrine and exocrine gland.
3. Why are thyroid hormones referred as personality hormone?
4. Mention the causes and symptoms of myxoedema.
5. Mention the causes and symptoms of Acromegaly.

III. Answer the following questions in brief.   **2 × 4 = 8**

1. Write the physiological effects of auxin.
2. What are the functions of thyroid hormones?

IV. Answer the following questions in detail.   **1 × 7 = 7**

1. i) Describe an experiment which demonstrates that growth stimulating hormone is produced at the tip of coleoptile.

   ii) How are the diseases caused due to thyroid dysfunction?

Reproduction in Plants and Animals

Vegetative reproduction	–	New plants are formed from vegetative cell buds or organs of plants.
Vegetative parts	–	Root, stem, leaf, buds.
Bulbils	–	The flower bud modifies into globose bulbs.
Fragmentation	–	Breaking of the filamentous algae into many filament
Regeneration	–	Ability of the lost body parts of an individual organisms to give rise to an whole new organisms.
Sporangium	–	Spore formation of a structure.
Calyx	-	Consisting of sepals.
Corolla	–	Consisting of petals.
Androecium	–	Consisting of stamens (or) male part
Gynoecium	–	Consisting of carpels (or) female part
Micropyle	–	Nucellus is enclosed by two integuments leaving a opening.
Funiculus	–	Ovule attached to ovary wall by a stalk
Synergids	–	In the egg apparatus one is egg cell and the remaining two cells are synergids.
Pollination	–	Transfer of pollen grain from anther to stigma.
Autogamy	–	Self pollination.
Cross pollination	–	Transfer of pollen grain from anther of a flower to the stigma of a flower on another plant.
Anemophily	–	Pollination by winds
Entomophily	–	Pollination by insects.
Hydrophily	–	Pollination by water.
Zoophily	–	Pollination by animals

MIND MAP

Reproduction in plants

- Asexual Reproduction
- Vegetative reproduction
- Sexual Reproduction

Asexual Reproduction → Spore formation

Vegetative reproduction:
- Leaves, Stem, Root, Bulbils
- Fission
- Budding
- Regeneration
- Fragmentation

Sexual Reproduction:
- Fertilization
- Pollination

Fertilization → Syngamy → Double fertilization

Pollination:
- Self pollination
- Cross pollination

Cross pollination → Agents of cross pollination
- Anemophily (Wind)
- Entomophily (Insect)
- Hydrophily (Water)
- Zoophily (Animal)

SEXUAL REPRODUCTION IN HUMAN

- SEXUAL REPRODCUTION
- FAMILY WELFARE PROGRAMMES
- HYGIENE

SEXUAL REPRODCUTION
- MALE → TESTIS → SPERMATOGENESIS → SPERM
- FEMALE → OVARY → OOGENESIS → OVUM

SPERM / OVUM → FERTILIZATION → IMPLANTATION → GESTATION → PARTURITION → LACTATION

OVUM → MENSTRUAL CYCLE → FOLICUIAR PHASE → OVULATORY PHASE → LUTEAL PHASE

FAMILY WELFARE PROGRAMMES
- POPULATION EXPLOSION
- FAMILY PLANNING → CONTRACEPTION
  - BARRIER METHODS
  - HORMONAL METHODS
  - IUDs
  - SURGICAL METHODS

HYGIENE
- PERSONAL HYGIENE
  - TOILET HYGIENE
  - MENSTRUAL HYGIENE

Scrotum	–	male reproductive part lie outside the abdominal cavity of in a sac like structure
Gametogenesis	–	Formation of sperm in male and the ovum in female.
Spermatogenesis	–	Formation of spermatozoa.
Oogenesis	–	Formation of ova.
Vitelline membrane	–	Membrane forming the surface layer of the ovum.
Menarche	–	In human females the menstrual cycle starts at the age of 11- 13 years which marks onset of puberty.
Menopause	–	In human female the menstrual cycle ceases around 48 - 50 years. This stage is called menopause.
Zygote	–	Fertilized ovum
Cleavage	–	Series of rapid mitotic divisions of the zygote to form many celled blastula.
Uterus	–	Muscular organ in which mammalian embryo develops.
Menarche	–	The menstrual cycle starts at the age of 11 - 12 which marks the onset of puberty and is called menarche.
Menstruation	–	Uterine bleeding that occurs at approximately four-week intervals resulting from the degeneration of the inner lining of uterus.
Gestation	–	Period of complete growth and development of a foetus in the uterus of a mammal.
Ovulation	–	Ovulation is the rupture of the follicle releasing the egg or ovum.
Puberty	–	Period of growth during which humans become sexually mature.
Parturition	–	Expulsion of young one from the mother's uterus at the end of gestation.
Placenta	–	Disc shaped structure which is a temporary association between the developing embryo and maternal tissues.
Umbilical cord	–	Cord containing blood vessels that connects the placenta with foetus.
Lactation	–	The process of milk production after child birth from mammary glands of mother.
Contraceptive device	–	Device used for contraception.

Don

Contraception	–	It is one of the best birth control measures.
Vasectomy	–	It is a surgical method of males to prevent pregnancy.
Tubectomy	–	It is a surgical method of females to prevent pregnancy.
Intra-Uterine device	–	Lipper's loop, Copper - T.
Double fertilization	–	Two types of fusion syngamy and triple fusion takes place an embryo sac.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. The plant which propagates with the help of its leaves is _____ .
   a) onion
   b) neem
   c) ginger
   d) bryophyllum

2. Asexual reproduction takes place through budding in _____ .
   a) amoeba
   b) yeast
   c) plasmodium
   d) bacteria

3. Syngamy results in the formation of _____ . ✶
   a) zoospores
   b) conidia
   c) zygote
   d) chlamydospores

4. The essential parts of a flower are _____ . ✶ ✶
   a) calyx and Corolla
   b) calyx and Androecium
   c) corolla and Gynoecium
   d) androecium and Gynoecium

5. Anemophilous flowers have _____ . ✶ ✶
   a) sessile stigma
   b) small smooth stigma
   c) colored flower
   d) large feathery stigma

6. Male gametes in angiosperms are formed by the division of _____ .
   a) generative cell
   b) vegetative cell
   c) microspore mother cell
   d) microspore

7. 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

8. 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

9. The large elongated cells that provide nutrition to developing sperms are ✶ ✶
   a) Primary germ cells
   b) Sertoli cells
   c) Leydig cells
   d) Spermatogonia

10. **Estrogen is secreted by**
    a) Anterior pituitary
    b) Primary follicle
    c) Graffian follicle
    d) Corpus luteum

11. **Which one of the following is an IUCD?**
    a) Copper – T
    b) Oral pills
    c) Diaphragm
    d) Tubectomy

Ans:

1.	d) Bryophyllum	7.	d) They are formed from gonads
2.	b) Yeast	8.	a) Epididymis
3.	c) Zygote	9.	b) Sertoli cells
4.	d) Androecium and Gynoecium	10.	c) Graffian follicle
5.	d) Large feathery stigma	11.	a) Copper – T
6.	a) Generative cell		

II. Fill in the blanks

1. The embryo sac in a typical dicot at the time of fertilization is _____ .

2. After fertilization the ovary develops into _____ .

3. Planaria reproduces asexually by _____ .

4. Fertilization is _____ in humans.

5. The implantation of the embryo occurs at about _____ day of fertilization. ✸✸

6. _____ is the first secretion from the mammary gland after child birth. ✸✸

7. Prolactin is a hormone produced by _____ . ✸✸

Ans:

1.	nucellus	2.	fruit
3.	regeneration	4.	internal
5.	6 to 7th	6.	colostrum
7.	pituitary gland		

III. Match the following

A. **Column I** — **Column II**

1) Fission	-	a) Spirogyra	(b)
2) Budding	-	b) Amoeba	(c)
3) Fragmentation	-	c) Yeast	(a)

B. **Column I** — **Column II**

1) Parturition	-	a) Duration between pregnancy and birth	(c)
2) Gestation	-	b) Attachment of zygote to endometrium	(a)
3) Ovulation	-	c) Delivery of baby from uterus	(d)
4) Implantation	-	d) Release of egg from Graafian follicle	(b)

IV. State whether the following statements are true or false. Correct the false statement

1. **Stalk of ovule is called pedicle.** ✸✸   **False**
   Stalk of the ovule is called funiculus.

2. **Seeds are the product of asexual reproduction.**   **False**
   Spores are the product of asexual reproduction.
            or
   Seeds are the product of sexual reproduction.

3. **Yeast reproduces asexually by means of multiple fission.**   **False**
   Yeast reproduces asexually 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 pollen is called stigma.

5. **Insect pollinated flowers are characterized by dry and smooth pollen.**   **False**
   Insect pollinated flowers are characterised by brightly coloured, have smell and nector.
            or
   Wind pollinated flowers are charaterised 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**
   Oxytocin hormone is secreted by the posterior pituitary.

8. **Menstrual cycle ceases during pregnancy.**   **True**

9. **Surgical methods of contraception prevent gamete formation.** ✸ ✸   **False**
   Surgical methods of contraception prevent entry of sperm.

10. **The increased level of estrogen and progesterone is responsible for menstruation.**   **False**

    The decreased level of estrogen and progestrone 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 are needed to fertilize 10 ovules.

2. **In which part of the flower germination of pollen grains takes place?**
   The germination of pollen grains takes place in **stigma**.

3. **Name two organisms which are reproduced through budding.**
   Hydra and **yeast** are the organisms which are reproduced through budding.

4. **Mention the function of endosperm.** ✸ ✸
   Endosperm provides food to the **developing embryo.**

5. **Name the hormone responsible for the vigorous contractions of the uterine muscles.**
   Hormone responsible for the vigorous contractions of the uterine muscles is **oxytocin**. ✸

6. What is the enzyme present in acrosome of sperm? ✶ ✶

The enzyme present in acrosome of sperm is **hyaluronidase.**

7. When is World Menstrual Hygiene Day observed?

Every year **May 28** is observed as menstrual hygiene day.

8. What is the need for contraception ?

The need for contraception is **control birth.**

9. Name the part of the human female reproductive system where the following occurs. a. Fertilization   b. Implantation

a) Fertilization occurs in the **oviduct** of the **female genetal tract.**

b) Implantation occurs in **uterus**.

VI. Short answer questions.

1. What will happen if you cut planaria into small fragments?

If I cut planaria into small fragments it will regenerate the organs and produce a new planaria.

2. Why is vegetative propagation practiced for growing some type of plants?

It has only mitotic division, no gametic fusion and daughter plants are genetically similar to the parent plant. So some plants grow by propagation practices.

3. How does binary fission differ from multiple fission? ✶ ✶

S.No	Binary fission	Multiple fission
1.	**Two daughter cells** are produced from a single parent cell.	Two or **multiple daughter cells** are produced from a single parent cell.
2.	Cytoplasm **divides** after each nuclear division.	Cytoplasm **does not divide** after each nuclear division.
3.	It occurs in **favourable** conditions.	It occurs in **unfavourable** conditions.

4. Define triple fusion. ✶ ✶ ✶

- In the fertilization one sperm fuses with egg and forms a diploid zygote.
- The other sperm fuses with **secondary nucleus** to form **primary endosperm** nucleus.
- This fusion is called triple fusion.

5. Write the characteristics of insect pollinated flowers.

- Insect pollinated plants characters are **brightly coloured,** have **smell** and **nectar.**
- The pollen grains are **larger** in **size** the exine is **pitted** and **spiny.**

6. Name the secondary sex organs in male.

The secondary sex organs in male are vas deferens, epididymis, seminal vesicle, prostate gland and penis.

7. What is colostrum? How is milk production hormonally regulated ? ✶ ✶

- The first fluid which is released from the mammary gland **after child birth** is called as colostrum.
- Milk production from alveoli of mammary glands is stimulated by prolactin secreted from the **anterior pituitary.**
- The ejection of milk is stimulated by **posterior** pituitary hormone **oxytocin.**

8. How can menstrual hygiene be maintained during menstrual days?

- Maintaining menstrual hygiene is important for the overall health of women.

The basic menstrual hygiene ways are:

- Sanitary pads should be **changed regularly,** to avoid infections due to microbes from vagina and sweat from genitals.
- Use of **warm water t**o clean genitals helps to get rid of **menstrual cramps.**
- Wearing **loose clothing** rather than tight fitting clothes will ensure the **airflow** around the genitals and prevent sweating.

9. How does developing embryo gets its nourishment inside the mother's body? ✳ ✳

- The **placenta** is a disc shaped structure attached to the uterine wall and is a temporary association between the developing embryo and maternal tissues.
- It allows the exchange of food materials, diffusion of oxygen, excretion of nitrogenous wastes and elimination of carbon dioxide.
- A cord containing blood vessels that connects the placenta with the foetus is called the **umbilical cord.**

10. Identify the parts A, B, C and D

A - Exine
B - Intine
C - Generative cell
D - Nucleus

11. Write the events involved in the sexual reproduction of a flowering plant.
a. Discuss the first event and write the types.
b. Mention the advantages and the disadvantages of that event.
Pollination :

- Transfer of pollen grains from anther to stigma of a flower is called pollination.

Types of Pollination:

- Self-pollination
- Cross pollination

Self-pollination (Autogamy)

- Self-pollination is also known as autogamy.
- The transfer of pollen grains from the anther to the stigma of same flower or another flower borne on the same plant is known as self pollination. e.g. Hibiscus.

Advantages of self-pollination

- Self-pollination is possible in certain bisexual flowers.
- Flowers do not depend on agents for pollination.
- There is no wastage of pollen grains.

Disadvantages of self-pollination

- The seeds are less in numbers.
- The endosperm is minute. Therefore, the seeds produce weak plants.
- New varieties of plants cannot be produced.

12. **Why are the human testes located outside the abdominal cavity? Name the pouch in which they are present.** ✶ ✶
   - The formation of sperm is in a **particular temperature** which is less than our body temperature. So it is located in the outside of the body.
   - The name of the pouch is **scrotum**.

13. **Luteal phase of the menstrual cycle is also called the secretory phase. Give reason**
   - Corpus leuteum produces progestrone and its level increases followed by a decline if menstrual bleeding occurs.
   - Uterine wall ruptures bleeding starts and infertilized egg is expelled.

14. **Why are family planning methods not adopted by all the people of our country?**
   Uneducated, fear, not understanding the population explosion are the factors affect the family planning methods.

VII. Long answer questions

1. **With a neat labelled diagram describe the parts of a typical angiospermic ovule.**
   - The main part of the ovule is the **nucellus** which is enclosed by two integuments leaving an opening called as **micropyle**.
   - The ovule is attached to the ovary wall by a stalk known as **funiculus**.
   - **Chalaza** is the basal part.
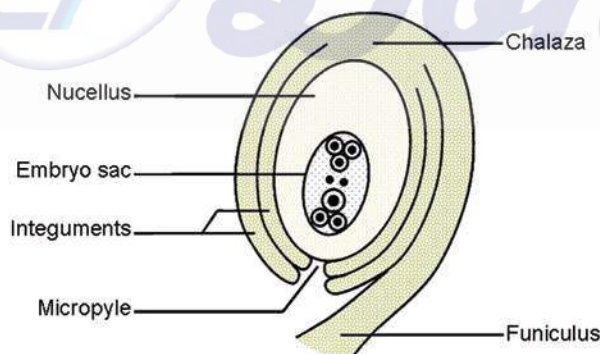
Structure of the Ovule

   - The embryo sac contains **seven cells** and the **eighth nuclei** located within the **nucellus**.
   - Three cells at the **micropylar** end form the **egg apparatus** and the three cells at the **chalaza end** are the antipodal cells.
   - The remaining two nuclei are called **polar nuclei** found in the centre.
   - In the egg apparatus one is the egg cell (female gamete) and the remaining two cells are the **synergids**.

2. **What are the phases of menstrual cycle? Indicate the changes in the ovary and uterus.**
   - Menstrual or Destructive Phase ✶ ✶ ✶
   - Follicular or Proliferative Phase
   - Ovulatory Phase
   - Luteal or Secretory Phase

Phase	Days	Changes in Ovary	Changes in Uterus	Hormonal Changes
Menstrual phase	4-5 days	Development of primary follicles	Breakdown of uterine endometrial lining leads to bleeding	Decrease in progesterone and oestrogen
Follicular phase	6th-13th day	Primary follicles grow to become a fully mature Graafian follicle	Endometrium regenerates through proliferation	FSH and oestrogen increase
Ovulatory phase	14th day	The Graafian follicle ruptures, and releases the ovum (egg)	Increase in endometrial thickness	LH peak
Luteal phase	15th-28th day	Emptied Graafian follicle develops into corpus luteum	Endometrium is prepared for implantation if fertilization of egg takes place, if fertilizaiton does not occur corpus luteum degenerates, uterine wall ruptures, bleeding starts and unfertilized egg is expelled.	LH and FSH decrease, Corpus luteum produces progesterone and its level increases followed by a decline, if menstrual bleeding occurs.

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?**

   - Vegetative cell degenerates and the generative cell divides to form two sperms (or male gametes).
   - Tip of pollen tube bursts and the two sperms enter the embryo sac.
   - One sperm fuses with the egg (syngamy) and forms a diploid zygote.
   - The other sperm fuses with the secondary nucleus (Triple fusion) to form the primary endosperm nucleus which is triploid in nature.
   - Since two types of fusion syngamy and triple fusion take place in an embryo sac the process is termed as double fertilization.
   - After triple fusion, primary endosperm nucleus develops into an endosperm.
   - Endosperm provides food to the developing embryo.
   - The purpose of carrying two gametes is one is to form zygote another is to form endosperm to provide food to the devloping embryo.

2. **Why menstrual cycle does not take place before puberty and during pregnancy ?**

   - Before puberty and during development, the secretion of estrogen and progesterone are not secreted.
   - So it does not form ovary.
   - So menstrual does not take place before puberty and during pregnancy.

Don

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 ?

b) List out the napkin hygiene measures taken during menstruation .

c) Do you think that Rahini's objection towards her parents was correct? If so, Why?

a) The first menstruation is called menarche. It occurs at the age of 11 to 13 years.

b) Napkin hygiene measures are:

- The sanitary pad and tampons should be wrapped properly and discarded because they can spread infections.

- Sanitary pad or tampon should not be flushed down the toilet.

- Napkin incinerators are to be used properly for disposal of used napkins.

c) Rahini's objection is correct.

- The advertisement gives some knowledge about the napkin.

- How to use the napkin and what is the purpose of it.

- The advertisement is answers some more questions.

- It create the awareness among the females. So the object are correct.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Among the following _____ is the vegetative part of plant.** ✴
   - a) root and stem
   - b) flower and dry leaf
   - c) ovule and stigma
   - d) Anther and stigma

2. **Vegetative reproduction by stem is in _____ plant.**
   - a) bryophyllum
   - b) sweet potato
   - c) hibiscus
   - d) yeast

3. **_____ roots can be used for vegetative propagation.**
   - a) Fibrous
   - b) main
   - c) Tap
   - d) Tuberous

4. **Bulbil is the vegetative part in _____ plant.**
   - a) Agave
   - b) Asparagus
   - c) Hydra
   - d) strawberry

5. **Spore formation is the most common method of asexual reproduction in _____**
   - a) plants
   - b) animals
   - c) fungi
   - d) None of these

6. **In sexual reproduction male and female organs are needed to produce _____** ✴
   - a) stem
   - b) leaf
   - c) flower
   - d) gametes

7. Calyx is other wise called as _____
   a) sepal   b) petal   c) stamen   d) carpel

8. _____ is the male part of flower.
   a) sepal   b) stigma   c) Androecium   d) Gynoecium

9. In flower each stamen consist of a stalk called _____.
   a) anther   b) stigma   c) style   d) filament

10. In the pollen grain the intine layer is made up of _____ and cellulose.
    a) hemi cellulose   b) pectin   c) chitin   d) starch

11. _____ is the basal part of ovule. ✳
    a) Funiculus   b) Nucellus   c) Chalaza   d) Micropyle

12. No wastage of pollen grains occur in _____ pollination.
    a) cross   b) bisexual   c) self   d) polar

13. The _____ flowers produce enormous amount of pollen grains.
    a) entomophilous   b) anemophilous   c) hydrophilous   d) zoophilous

14. Approximately 80 % of the pollination, done by _____
    a) butterflies   b) houseflies   c) honeybees   d) mosquitoes

15. Pollination by water occurs in _____ plant.
    a) grass   b) vallisneria   c) silk cotton tree   d) mango tree

16. Pollen grain reach the stigma to form a tube like structure called _____.
    a) germ pore   b) micropyle   c) style   d) pollen tube

17. The _____ is the male secondary sex organ. ✳
    a) fallopian tube   b) vas deferens   c) cervix   d) vagina

18. The _____ is the female secondary sex organ.
    a) fallopian tube   b) vas deferens   c) epididymis   d) seminal vesicle

19. Each testes is covered with a larger fibrous tissue called _____.
    a) graafian follicle   b) seminiferous tubules
    c) tunica albuginea   d) scrotum

20. _____ hormone initiates the process of spermatogenesis.
    a) Testosterone   b) Hyaluronidase   c) Estrogen   d) Progesterone

21. The corona radiata is formed as _____ cells in ovum.
    a) leydig cells   b) sertoli cells   c) vitelline cells   d) follicle cells

22. Generally boys attain puperty between the age of _____ years. ✳ ✳
    a) 13 - 14   b) 11 - 13   c) 12 - 17   d) 10 - 14

23. The process of attachment of blastocyst to the endometrium is called _____.
    a) fertilization   b) blastula formation   c) implantation   d) gastrulation

24. _____ is the rupture of the follicle releasing the egg or ovum.
    a) Fertilization   b) Implantation   c) Gastrulation   d) Ovulation

25. The ejection of milk is stimulated by posterior pituitary hormone _____.
    a) prolactin   b) oxytocin   c) progesterone   c) estrogen

26. _____ is the Urinary Tract Infection that affect both women and men.
    a) cystitis
    b) fever
    c) lephtospirosis
    d) AIDS

27. The inverted _____ triangle is a symbol of family planning in India.
    a) blue
    b) green
    c) red
    d) yellow

28. _____ vegetative reproduction is found in strawberry plant.
    a) Stem
    b) Root
    c) Leaf
    d) Bud

29. In egg apparatus the remaining two cells are called _____.
    a) somatic cell
    b) generative cells
    c) reproductive cells
    d) synergids

30. Sunbird pollinates flowers of _____. ★
    a) canna
    b) hydrilla
    c) vallisneria
    d) grass.

31. The number of primordial follicles in newborn female child ranges over _____.
    a) 1 million
    b) 2 million
    c) 7 million
    d) 300

32. The first cleavage of fertilized ovum takes place about _____ hours after fertilization.
    a) 24
    b) 48
    c) 30
    d) 15

33. During pregnancy the uterus expands upto _____ times of its normal size.
    a) 500
    b) 2
    c) 100
    d) 50

34. _____ is the method of permanent birth control.
    a) Cervical cap
    b) Hormonal methods
    c) Copper. T.
    d) Surgical methods

Ans:			
1.	a) root and stem	18.	a) fallopian tube
2.	c) Hibiscus	19.	c) tunica albuginea
3.	d) Tuberous	20.	a) Testosteroane
4.	a) Agave	21.	d) follicle cells
5.	c) fungi	22.	a) 13 - 14
6.	d) gametes	23.	c) implantation
7.	a) sepal	24.	d) ovulation
8.	c) Androecium	25.	b) oxytocin
9.	d) Filament	26.	a) cystitis
10.	b) pectin	27.	c) red
11.	c) Chalaza	28.	a) Stem
12.	c) self	29.	d) Synergids
13.	b) anemophilous	30.	a) Canna
14.	c) honeybees	31.	c) 7 million
15.	b) vallisneria	32.	c) 30
16.	d) pollen tube	33.	a) 500
17.	b) vas deferens	34.	d) Surgical methods.

II. Fill in the blanks

1. _____ reproduction may takes place through leaf, stem and root.

2. In filamentous algae breaking of the filament into many fragments is called _____

3. _____ takes place by specialized mass of cells in planaria.

4. Asexual reproduction occurs by _____ formation.

5. During spore formation _____ develops from the fungal hypha.

6. A _____ is a reproductive organ of a flowering plant.

7. _____ consists of stamens in a flower.

8. _____ is a female part of flower.

9. In the pollen grains hard outer layer is known as _____.

10. Self pollination is otherwise called as _____.

11. Pollination by water is called as _____.

12. _____ pollinate flowers of silk cotton tree.

13. After triple fusion primary endosperm nucleus develops into an _____. ✳

14. The _____ enlarges and develops into a fruit in post fertilization time.

15. The process of spermatogenesis takes place in the _____.

16. Man will produce over _____ billion sperms in their life time. ✳

17. The formation of ova is called as _____.

18. The _____ gives energy for the movement of tail in sperm.

19. The menstrual cycle contains _____ phases.

20. The graafian follicle rupture and releases the ovum during _____ phase.

21. _____ is a periodical phenomena that continuous from puberty to menopause.

22. Lack of menstruation generally indicates _____.

23. The _____ is a fertilized ovum.

24. A cord containing blood vessel that connects the placenta with the foetus is called _____.

25. Gestation period of human last for about _____ days.

26. Milk production from alveoli of mammary glands is stimulated by _____. ✳

27. In India nation wide family planning programme is launched in _____.

28. _____ prevents deposition of sperms in the vagina.

Ans:

1.	vegetative	2.	fragmentation
3.	regeneration	4.	spore
5.	sporangium	6.	flower
7.	androecium	8.	gynoecium
9.	excine	10.	autogamy
11.	hydrophily	12.	squirrels
13.	endosperm	14.	ovary
15.	seminiferous tubules	16.	500
17.	oogenesis	18.	mitochondria
19.	four	20.	ovulatory
21.	menstruation	22.	pregnancy
23.	zygote	24.	umblical cord
25.	280	26.	prolaction
27.	1952	28.	condom

III. Match the following

A.

Column I	Column II	
Vegetative part	**Organism**	
1) Leaves	- a) Strawberry	(c)
2) Stems	- b) Agave	(a)
3) Root	- c) Bryophyllum	(d)
4) Bulbils	- d) Sweet potato	(b)

B.

Column I	Column II	
1) Calyx	- a) Stamen	(d)
2) Corolla	- b) Carpel	(c)
3) Androecisum	- c) Petal	(a)
4) Gynoecium	- d) Sepal	(b)

C.

Column I	Column II	
1) Self pollination	- a) Apple	(c)
2) Cross pollination	- b) Prostate gland	(a)
3) Male accessory organ	- c) Hibiscus	(b)
4) Female accessory organ	- d) Uterus	(d)

D.

Column I	Column II	
1) Anemophily	- a) Honey bee	(d)
2) Entomophily	- b) Vallisneria	(a)
3) Hydrophily	- c) Squirrels	(b)
4) Zoophily	- d) Grasses	(c)

Don

E.	Column I		Column II	
	1) Spermatozoa	-	a) Copper-T	(c)
	2) Ovum	-	b) Family planning	(d)
	3) Intra uterine device	-	c) Acrosome	(a)
	4) Inverted red triangle	-	d) Zona pellucida	(b)

IV. Assertion and 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 explains A.

1. **Assertion:** Bryophyllum is a best example of vegetative reproduction.
   Reason: In Bryophllum small plants grow at the leaf notches.

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

2. **Assertion:** Androecium and gynoecium are the essential part of the flower.
   Reason: Androecium and gynoecium take part directly in reproducion.

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

3. **Assertion:** Self pollination as known as autogamy.
   Reason: Transfer of pollen from anther to stigma of a flower on to another plant.

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

4. **Assertion:** Insect pollination is called anemophilly.
   Reason: Pollen grains are produced in large number.

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

5. **Assertion:** The secondary sex organs are involved in the development of foetus.
   Reason: The process of spermatogenesis takes place in the seminiferous tubulus.

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

V. Answer in a word or sentence

1. **Which type of reproduction takes place in planaria?**
   Vegetative reproduction - regeneration.

2. **Which type of cell division is involved in asexual reproduction?**
   Mitotic cell division.

3. **What is a flower?**
   Modified shoot with limited growth.

4. **The seeds which are produced as a result of self pollination are weak in nature. Why?**
   Because the endosperm is minute.

5. **What are the adaptations found in the flowers to attract insects for cross pollination?**
   To attract insects the flowers are brightly coloured, with smell and nectar.

6. What is known as Gametogenesis?

The formation of **sperm** in **male** and the **ovum** in **female** is called gametogenesis.

7. Where is the perivitelline space situated?

The fluid filled space between Zona pellucida and the surface of egg is called perivitelline space.

8. What are the hormones that control the secretion of both male and female hormones?

The secretion of both male and female hormones are controlled by the **pituitary gonadotropins** luteinizing hormone (L.H) and follicle stimulating hormone (FSH)

9. What is known as menarche?

In females the **onset of puberty** is called menarche.

10. What is called menopause?

The menstrual cycle ceases in female around **48-50 years** and this stage is called menopause.

11. Define 'Ovulation'. ✶ ✶

Ovulation is the rupture of the follicle releasing the egg or ovum.

12. What is the name of the cord containing blood vessels that connects the placenta with the foetus?

Umbilical cord

13. What is population explosion?

Population explosion is defined as the **sudden and rapid rise** in the size of population.

14. Which micro organism causes cystitis or bladder infection?

Bacteria

15. What is called lactation? ✶

The process of milk production **after child birth** from mammary glands of the mother is called lactation.

16. What are the actions taken by National Health programmes?

- Family Welfare Programme
- Reproductive and Child Health Care (RCH) programme.

VI. Short answer questions.

1. Identify the follows with their type of reproduction.
   I-Algae, II-Amoeba, III-Yeast, IV-Hydra

- Algae   – fragmentation
- Amoeba   – fission
- Yeast   – budding
- Hydra   – budding, regeneration.

2. What is fragmentation? Give one example. ✶

- In filamentous algae, breaking of the **filament** into **many fragments** is called fragmentation.
- Each fragment having atleast one cell, may give rise to a new filament of the algae by cell division e.g. Spirogyra.

3. What is regeneration? Give an example.

- The ability of the lost body parts of an individual organism to give rise to a whole new organism is called regeneration.
- It takes place by **specialized mass of cells.** e.g *Hydra and Planaria.*

4. List the parts of flower.

- Calyx — consisting of sepals
- Corolla — consisting of petals
- Androecium — consisting of stamens
- Gynoecium — consisting of carpels

5. Define - Androecium.

- Androecium, the **male part** of flower is composed of **stamens**.
- Each stamen consists of a stalk called the **filament** and a small bag like structure called **anther** at the tip.
- The pollen grains are produced in the anther within the pollen sac.

6. Define - Pollination.

The transfer of pollen grains from **anther to stigma** of a flower is called as pollination.

7. Give the importance of pollination.

- It results in fertilization which leads to the formation of fruits and seed.
- New varieties of plants are formed through new combination of genes in case of cross pollination.

8. Mention the post fertilization changes.

- The **ovule** develops into a seed.
- The **integuments** of the ovule develop into the seed coat.
- The ovary enlarges and develops into a fruit.

9. Mention the significance of fertilization.

- It **stimulates** the ovary to develop into fruit.
- It helps in development of new characters from two different individuals.

10. List out the male and female accessory sex organs. ✶

Male:

- Vas deferens, epididymis, seminal vesicle, prostate gland and penis.

Female:

- Fallopian tubes, uterus, cervix and vagina.

11. What are the function of accessory sex organs. ✶

It is involved in the:

- Process of ovulation
- Fusion of the male and female gametes (fertilization)
- Division of the fertilized egg upto the formation of embryo
- Pregnancy
- Development of foetus
- Child birth

12. Define - Puberty. ✸

    The reproductive system in both males and females becomes functional with an increase in sex **hormone production** resulting in puberty.

13. List out phases of menstrual cycle.

    The menstrual cycle consists of 4 phases.

- Menstrual or Destructive phase.
- Follicular or Proliferative Phase
- Ovulatory Phase
- Luteal or Secretory Phase

14. Define - Menstruation. ✸

- Menstruation is a **periodical phenomenon** that continues from puberty to menopause.
- This will happen if the released ovum is **not fertilized** by the sperm.
- **Lack** of **menstruation** generally indicates pregnancy.

15. What is implantation?

- The **blastocyst** (fertilized egg) reaches the uterus and gets implanted in the uterus.
- The process of attachment of the blastocyst to the uterine wall (**endometrium**) is called implantation.
- The fertilized egg becomes implanted in about **6 to 7 days** after fertilization.

16. What is gestation?

- It is the time period during which the **embryo** attains its development in the uterus.
- Normally gestation period of human lasts for about **280 days.**
- During pregnancy the uterus expands upto **500 times** its normal size.

17. What is parturition? ✸

- Parturition is the **expulsion** of young one from the mother's uterus at the end of gestation.
- **Oxytocin** from the posterior pituitary stimulates the **uterine contractions** and provides force to expel the baby from the uterus, causing birth.

18. Give the methods followed in contraception.

- Barrier methods
- Hormonal methods
- Intra-Uterine Devices (IUDs)
- Surgical methods

19. What is vasectomy and tubectomy?

- Surgical contraception or sterilization techniques are terminal methods to prevent any pregnancy.
- This procedure in males is **vasectomy (ligation of vas deferens)** and in females it is **tubectomy (ligation of fallopian tube).**
- These are methods of permanent birth control.

20. Give the measures of toilet hygiene.

- The floors of the toilet should be maintained clean and dry.

- This helps to reduce the bad odour and also infection.
- Toilet flush handles, door knobs, faucets, paper towel dispensers, light switches and walls should be cleaned with disinfectants to kill harmful germs and bacteria.
- Hands should be washed thoroughly with soap before and after toilet use.

21. Write few words about napkin hygiene.

- The sanitary pad and tampons should be wrapped properly and discarded because they can spread infections.
- Sanitary pad or tampon should not be flushed down the toilet.
- Napkin incinerators are to be used properly for disposal of used napkins.

22. Define – menstrual cycle.

The cyclic events that take place in a rhythmic fashion during the reproductive period of a woman's life is called menstrual cycle.

VII. Long answer questions

1. Describe fertilization in plants with diagram.

- Pollen grains reach the right stigma and begin to germinate.
- Pollen grain forms a **small tube-like** structure called pollen tube which emerges through the germ pore. The contents of the pollen grain move into the tube.
- Pollen tube grows through the tissues of the stigma and style and finally reaches the ovule through the micropyle.
- Vegetative cell degenerates and the generative cell divides to form two sperms (or male gametes).
- Tip of pollen tube bursts and the two sperms enter the embryo sac.
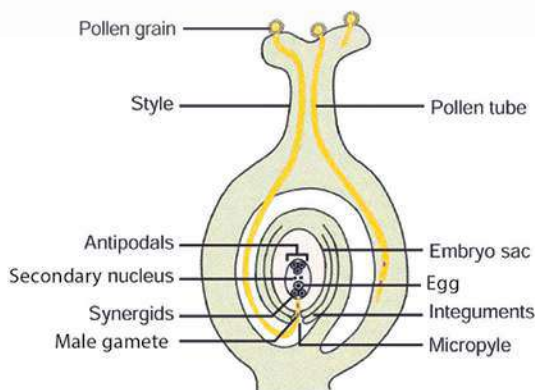
Process of Fertilization

- One sperm fuses with the egg (syngamy) and forms a **diploid** zygote.
- The other sperm fuses with the secondary nucleus (Triple fusion) to form the primary endosperm nucleus which is triploid in nature.
- Since two types of fusion syngamy and triple fusion take place in an embryo sac the process is termed as double fertilization.
- After triple fusion, primary endosperm nucleus develops into an endosperm.
- Endosperm **provides food** to the developing embryo.
- Later the synergids and antipodal cells degenerate.

2. Describe the types of pollination and write its advantages and disadvantages. ✴
Self-pollination (Autogamy)

- Self-pollination is also known as **autogamy**.
- The transfer of pollen grains from the **anther to the stigma** of same flower or another flower borne on the same plant is known as self pollination. e.g. Hibiscus.

Advantages of self-pollination

- Self-pollination is possible in certain bisexual flowers.
- Flowers do not depend on agents for pollination.
- There is no wastage of pollen grains.

Disadvantages of self-pollination

- The seeds are less in numbers.
- The endosperm is minute. Therefore, the seeds produce weak plants.
- New varieties of plants cannot be produced.

Cross pollination

Cross-pollination is the transfer of pollen from the anthers of a flower to the stigma of a flower on another plant of the same species e.g. apples, grapes, plum, etc.

Advantages of cross pollination

- The seeds produced as a result of cross pollination, develop and germinate properly and grow into better plants, i.e. cross pollination leads to the production of new varieties.
- More viable seeds are produced.

Disadvantages of cross-pollination

- Pollination may fail due to distance barrier.
- More wastage of pollen grains.
- It may introduce some unwanted characters.
- Flowers depend on the external agencies for pollination.

3. Describe the structure of human sperm. ✴
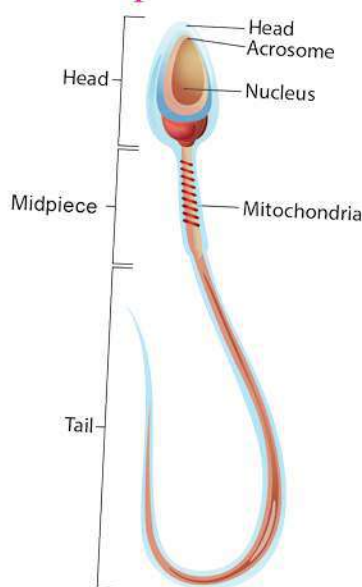
Structure of sperm

- The **spermatozoan** consists of head, a middle piece and tail.
- The sperm head is elongated and formed by the condensation of nucleus.
- The anterior portion has a cap like structure called acrosome.
- It contains hyaluronidase an enzyme that helps the sperm to enter the ovum during fertilization.
- A short neck connects the head and middle piece which comprises the centrioles.
- The middle piece contains the mitochondria which provides energy for the movement of tail.
- It brings about sperm motility which is essential for fertilization.

4. Describe the structure of ovum with diagram.

- The mature **ovum or egg** is spherical in shape.
- The ovum is almost free of yolk.
- It contains abundant cytoplasm and the nucleus.
- The ovum is surrounded by three membranes.
- The **plasma membrane** is surrounded by inner thin **zona pellucida** and an outer thick **corona radiata**.
- The corona radiata is formed of **follicle cells.**
- The membrane forming the surface layer of the ovum is called **vitelline membrane**.
- The fluid-filled space between zona pellucida and the surface of the egg is called **perivitelline space**.
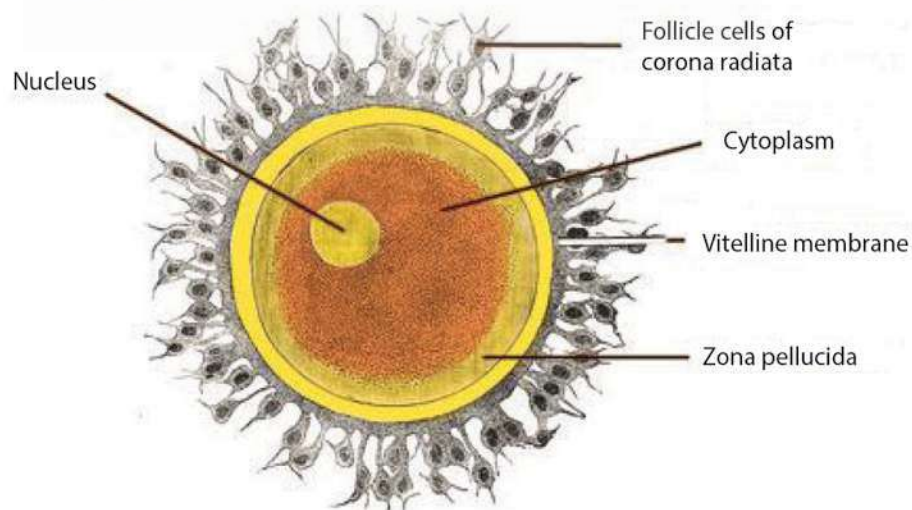
Structure of ovum

5. Desribe about contraception and its methods. ✱

- Contraception is one of the best **birth control measures**.
- A number of techniques or methods have been developed to prevent pregnancies in women.
- The devices used for contraception are called **contraceptive devices**.

Common contraceptive methods used to prevent pregnancy are discussed here.

- Barrier methods
- Hormonal methods
- Intra-Uterine Devices (IUDs)
- Surgical methods

Barrier Methods

- This method prevents sperms from meeting the ovum.
- Its entry into the female reproductive tract is prevented by barrier.

(a) Condom:

- Condom prevents **deposition of sperms** in the vagina.
- Condoms are made of thin rubber or latex sheath.
- Condom also protect against sexually transmitted diseases (STD) like syphilis, AIDS.

(b) Diaphragm (Cervical cap):

- Vaginal diaphragm fitting into the vagina or a cervical cap fitting over the cervix.
- This prevents the entry of sperms into the uterus.

Hormonal Methods

- Hormonal preparations are in the form of **pills** or **tablets** (contraceptive pills).
- These hormones stop (**interfere with ovulation**) the release of egg from the ovary.

Intra-Uterine Devices (IUDs)

- The intrauterine device (IUD) are **contraceptive device**s inserted into the uterus.
- There are two synthetic devices commonly used in India are Lippe's Loop and Copper-T made of copper and plastic (non irritant).
- This can remain for a period of 3 years.
- This reduces the sperm fertilizing capacity and prevents implantation.
- This also helps to give adequate time interval between pregnancies.

Surgical Methods

- Surgical contraception or sterilization techniques are terminal methods to prevent any pregnancy.
- This procedure in males is **vasectomy** (ligation of vas deferens) and in females it is **tubectomy** (ligation of fallopian tube).
- These are methods of permanent birth control.

6. Write notes on Cleavage and formation of Blastula:

- The first cleavage takes place about **30 hours** after fertilization.
- Cleavage is a series of rapid mitotic divisions of the zygote to form many celled blastula (Blastocyst) which comprises an outer layer of smaller cells and inner mass of larger cells.

Implantation:

- The blastocyst (fertilized egg) reaches the uterus and gets implanted in the uterus.
- The process of attachment of the blastocyst to the uterine wall (endometrium) is called implantation.
- The fertilized egg becomes implanted in about 6 to 7 days after fertilization.

Gastrulation:

- The transformation of **blastula into gastrula** and the formation of primary germ layers (ectoderm, mesoderm and endoderm) by rearrangement of the cells is called gastrulation.
- This takes place after the process of implantation.
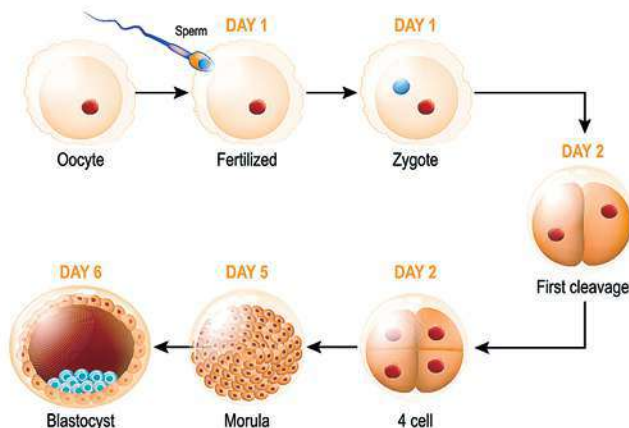
Developmental stages of zygote fromcleavage to blastocyst formation

Organogenesis:

- The establishment of the germ layers namely ectoderm, mesoderm and endoderm initiates the final phase of embryonic development.
- During organogenesis the various organs of the foetus are established from the different germ layers attaining a functional state.

VIII. Label the parts

1. Redraw the diagram and label the parts.
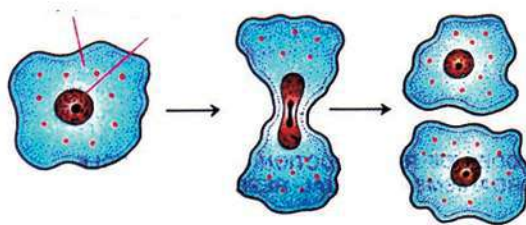
Fission in Amoeba without parts

Ans:
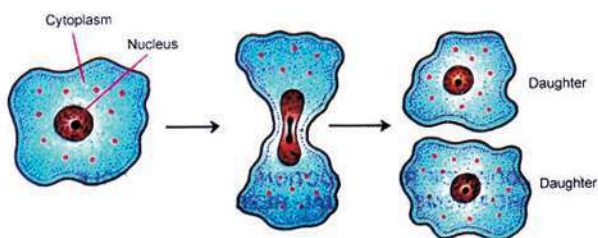
Fission in amoeba with parts

2. **Redraw the diagram and label the parts (any four parts)**

Parts of a flower without parts

Ans:

stigma

pollen tube

Androecium — anther
stamen — filament

Gynoecium
or
pistil

petal
(Corolla)

style

ovule

ovary

receptacle

sepal
(Calyx)

pedicel

Parts of a flower with parts

3. **Redraw the diagram and label the parts (stigma, style, ovary, female gamete)**

Gynoecium without parts

Ans:
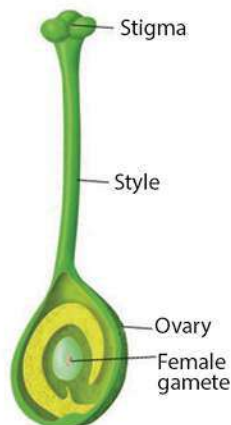
Gynoecium with parts

IX. Higher Order Thinking Skills (HOTS)

1. In some houses a leaf is tied with a thread and is hung from the windows door. How is it possible? Tell the name of the plant.

- The name of the plant is Bryophyllum.
- The Bryophyllum reproduction takes through leaves of the plant.
- This reproduction is the type of vegetative reproduction
- The leaves have small plants that grow at the leaf notches. If can take water from the atomosphere.

2. In a flower A is green colour. Part A is covered the basal part of 'B'. B is colourfull. The innerside the essential part C and D is present. Part C is the male part and D is the female part. Identify A, B, C and D.

- A is Calyx (sepal)
- B is Corolla (petals)
- C is Androecium
- D is Gynoecium.

3. How does identical and non identical twins develope?

- Sometimes ovaries releases two eggs and each is fertilized by a different sperm, resulting in non identical twins.
- If a single egg is fertilised and then divided into two foetus, identical twins developed.

◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶

Unit Test - 17

Reproduction in Plants and Animals

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. Asexual reproduction takes place through budding in _____ .
   a) Amoeba   b) Yeast
   c) Plasmodium   d) Bacteria

2. Syngamy results in the formation of _____ .
   a) Zoospores   b) Conidia
   c) Zygote   d) Chlamydospores

3. Vegetative reproduction by stem is in _____ plant.
   a) Bryophyllum   b) sweet potato
   c) Hibiscus   d) yeast

4. In sexual reproduction male and female organs are needed to produce _____
   a) stem   b) leaf   c) flower   d) gametes

5. _____ is the male part of flower.
   a) sepal   b) stigma   c) Androecium   d) Gynoecium

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Why is vegetative propagation practiced for growing some type of plants?
2. Define triple fusion.
3. Name the secondary sex organs in male
4. What is colostrum? How is milk production hormonally regulated ?
5. How can menstrual hygiene be maintained during menstrual days?

III. Answer the following questions in brief.   2 × 4 = 8

1. With a neat labelled diagram describe the parts of a typical angiospermic ovule.
2. Why menstrual cycle does not take place before puberty and during pregnancy ?

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Desribe about contraception and its methods.
   ii) Describe the structure of ovum with diagram.

❧ ✿✿✿✿ ❧

Heredity

Mendel	Discovered the basic principle of heredity
Monohybrid cross	Inheritance of only one pair of contrasting characteristics.
Genotype	Genetic expression of an organism
Phenotype	External expression of a particular trait.
Genes	Segments of DNA responsible for inheritance of particular phenotypic character.
(TT) or (tt)	homozygous
(Tt)	heterozygous
Allele	Two factors making up a pair of contrasting character
DNA replication	Process by which DNA makes exact copies of itself.
Mutation	Sudden change in the genetic material (DNA) of an organism.
Ploidy	Addition or deletion in the number of chromosomes present in a cell.
Gene / Point mutation	Changes occurring in the nucleotide sequence of a gene.
Hybrid	An offspring resulting from a cross between two genotypically differnt parents.
Karyotype	Karyotype is the number, size and shape of chromosomes in the cell nucleus of an organism.
Dominant	Character which express itself.
Recessive	Character which is masked.
Dihybrid cross	Inheritance of two pairs of contrasting characteristics.
Chromosome	Thin, thread like structure found in cell.
Waldeyer	Term chromosome coined
T.H. Morgan	Determining the role of chromosomes in heredity.

MIND MAP

Heredity

Mendel Experiment
- Monohybrid cross
  - Penotype 3 : 1
  - Genotype 1 : 2 : 1
- Dihybrid cross

Mendels Law of Heridity
- Law of Dominance
- Law of Segregation
- Law of independent Assortment

Mutation
- Chromosomal mutation
  - Changes in the structure
  - Changes in number
  - Euploidy
  - Aneuploidy
  - Down's syndrome
- Genone mutation
  - Substitute
  - Deletion
  - Insertion
  - Inversion

DNA
- Model
  - Nucleotide
    * a pentose sugar
    * a Nitrogenous base
    - Purine
      - Adenine
      - Guanine
    - Pyrimidine
      - Cytosine
      - Thymine
- Replication
  - Orgine of replication
  - unwinding of DNA
  - Formation of RNA primer
  - Synthesis of new complementary DNA
  - Termination

Chromosomes
- Structure
  - Primary construction
  - Secondary construction
  - Centromere
  - Telomere
  - Satellite
- Types of Chromosome
  - Telocentric
  - Acrocentric
  - Submetacentric
  - Metacentric
- Kinds of Chromosome
  - Autosomes
  - Allosomes
- Sex determination
  - Male 44 + XY
  - Female 44 + XX

Locus	Gene is present at a specific position on a chromosome.
Chromonema	Chromatids are made up of spirally coiled thin structure.
Centromere	Two arms of a chromosome meet at a point.
Satellite	Knob like appendage at the end of chromosome.
Telomere	Protective sequences of nucleotides found in chromosomes.
Telocentric	Centromere found on the proximal end.
Acrocentric	Centromere found at the one end with a short arm and a long arm.
Submetacentric	Centromere at the centre of chromosome.
Metacentric	Two equal arms, 'V' shaped.
Autosome	Determines the somatic characters.
Allosome	Determines the sex of the individual.
Diploid(2n)	Chromosome occurs in pairs.
Haploid(n)	Chromosome occur in single.
Idiogram	Diagrammatic representation of karyotype of a species.
Watson and Crick	Three dimensional model of DNA
Purine	Adenine and Guanine
Pyrimidines	Cytosine and Thymine
Nucleoside	Nitrogen base + sugar
Nucleotide	nucleoside + phosphate
Helicase	binds to the origin of replication site.
DNA polymerase	After the formation of RNA primer, nucleotides are added with the help of an enzyme
DNA ligase	Fragments are joined together
Homogametic	Female gametes (22+XX)
Heterogametic	Male gametes (22 +XY)
Hugo De Vries	Introduced the term mutation was introduced
Ploidy	Addition or deletion of chromosomes
Euploidy	It bears more than the usual number of chromosomes.
Triploidy	Three haploid sets of chromosomes
Aneuploidy	loss or gain of one or more chromosomes in a set.
Trisomy	Extra copy of chromosome 21
Sickle cell anaemia	Caused by mutation of a single gene.

Don

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. According to Mendel alleles have the following character
   a) Pair of genes
   b) Responsible for character
   c) Production of gametes
   d) Recessive factors

2. 9 : 3 : 3 : 1 ratio is due to ✴✴
   a) Segregation
   b) Crossing over
   c) Independent assortment
   d) Recessiveness

3. The region of the chromosome where the spindle fibres get attached during cell division
   a) Chromomere
   b) Centrosome
   c) Centromere
   d) Chromonema

4. The centromere is found at the centre of the _____ chromosome.
   a) Telocentric
   b) Metacentric
   c) Sub-metacentric
   d) Acrocentric

5. The _____ units form the backbone of the DNA. ✴✴
   a) 5 carbon sugar
   b) Phosphate
   c) Nitrogenous bases
   d) Sugar phosphate

6. Okasaki fragments are joined together by _____.
   a) Helicase
   b) DNA polymerase
   c) RNA primer
   d) DNA ligase

7. The number of chromosomes found in human beings are _____. ✴✴
   a) 22 pairs of autosomes and 1 pair of allosomes.
   b) 22 autosomes and 1 allosome
   c) 46 autosomes
   d) 46 pairs autosomes and 1 pair of allosomes.

8. The loss of one or more chromosome in a ploidy is called _____.
   a) Tetraploidy
   b) Aneuploidy
   c) Euploidy
   d) polyploidy

Ans:

1.	b)	Responsible for character	2.	c)	Independent assortment
3.	c)	Centromere	4.	b)	Metacentric
5.	d)	Sugar phosphate	6.	d)	DNA ligase
7.	a)	22 pairs of autosome and 1 pair of allosomes	8.	b)	Aneuploidy

II. Fill in the blanks

1. The pairs of contrasting character (traits) of Mendel are called _____.

2. Physical expression of a gene is called _____ .

3. The thin thread like structures found in the nucleus of each cell are called _____.

4. DNA consists of two _____ chains. ✴✴

5. An inheritable change in the amount or the structure of a gene or a chromosome is called _____.

Ans:

1.	Alleles	2.	Phenotype
3.	Chromosomes	4.	polynucleotide
5.	mutation		

III. Identify whether the statement are True or False. Correct the false statement

1. **A typical Mendelian dihybrid ratio of F_2 generation is 3:1.** **False**
   A typical Mendelian dihybrid ratio of F_2 generation is 9: 3: 3: 1

2. **A recessive factor is altered by the presence of a dominant factor.** **True**

3. **Each gamete has only one allele of a gene.** **True**

4. **Hybrid is an offspring from a cross between genetically different parent.** **True**

5. **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

6. **New nucleotides are added and new complementary strand of DNA is formed with the help of enzyme DNA polymerase.** **True**

7. **Down's syndrome is the genetic condition with 45 chromosomes** **False**
   Down's syndrome is the genetic condition with 47 chromosomes

IV. Match the following

1. 1) Autosomes   - a) Trisomy 21   (c)
   2) Diploid condition   - b) 9:3:3:1   (d)
   3) Allosome   - c) 22 pair of chromosome (e)
   4) Down's syndrome   - d) 2n   (a)
   5) Dihybrid ratio   - e) 23rd pair of chromosome (b)

V. Answer in a sentence

1. **What is a cross in which inheritance of two pairs of contrasting characters are studied?**
   Dihybrid cross is a cross in which inheritance of two pairs of contrasting characters are studied.

2. **Name the conditions when both the alleles are identical?**
   The both alleles are identical in **homozygous condition.**

3. **A garden pea plant produces axial white flowers. Another of the same species produces terminal violet flowers. Identify the dominant trait.** ✶ ✶
   The dominant character or trait is axial white flower.

4. **What is the name given to the segments of DNA, which are responsible for the inheritance of a particular character?**

The name of the segment of DNA is **gene**.

5. **Name the bond which binds the nucleotides in a DNA.** ✷ ✷

Hydrogen bond which binds the nucleotides in a DNA.

VI. Short answers questions

1. **Why did Mendel select pea plant for his experiments?**
   - It is naturally **self-pollinating** and so is very easy to raise **pure breeding** individuals.
   - It has a short life span as it is an annual and so it was possible to follow **several generations.**
   - It is easy to **cross-pollinate.**
   - It has deeply defined **contrasting characters.**
   - The flowers are **bisexual.**

2. **What do you understand by the term phenotype and genotype?** ✷ ✷
   - **External expression** of a particular trait is known as phenotype.
   - A genotype is the **genetic expression** of an organism.

3. **What are allosomes?** ✷ ✷ ✷
   - Allosomes are chromosomes which are responsible for **determining** the **sex** of an individual.
   - They are also called as sex chromosomes or **hetero-chromosomes.**

4. **What are Okazaki fragments?** ✷ ✷
   - In the **DNA replication** after the formation of **RNA primer** two strands are formed.
   - In one strand short segments of **DNA** are synthesised.
   - This strand is called lagging strand. The short segments of DNA are called **okazaki fragments.**

5. **Why is euploidy considered to be advantageous to both plants and animals?**
   - Euploidy is the condition in which the individual bears more than the **usual number** of **diploid (2n)** chromosomes.
   - Tetraploidy plants are advantageous as they often result in increased fruit and flower size

6. **A pure tall plant (TT) is crossed with pure dwarf plant (tt), What would be the F_1 and F_2 generations? Explain.**

   Parental generation:
   - Pure breeding tall plant and a pure breeding dwarf plant.

   F_1 generation:
   - Plants raised from the seeds of pure breeding parental cross in F_1 generation were **tall** and **monohybrids.**

   F_2 generation:
   - Selfing of the F_1 monohybrids resulted in tall and dwarf plants respectively in the ratio of **3:1.**
   - The actual number of tall and dwarf plants obtained by Mendel was **787 tall** and **277 dwarf.**

- External expression of a particular trait is known as phenotype. So the phenotypic ratio is **3:1.**

In the F_2 generation 3 different types were obtained:

- Tall Homozygous – TT (Pure) – 1
- Tall Heterozygous – Tt – 2
- Dwarf Homozygous – tt – 1

So the genotypic ratio 1:2:1. A genotype is the genetic expression of an organism

7. Explain the structure of a chromosome. ✦ ✦

Structure of a Chromosome:

- The chromosomes are **thin, long** and **thread like** structures consisting of two identical strands called sister chromatids.
- They are held together by the **centromere**.
- Each chromatid is made up of spirally coiled thin structure called **chromonema**.
- The chromonema has number of bead-like structures along its length which are called **chromomeres**.
- The chromosomes are made up of **DNA,RNA, chromosomal proteins** (histones and non-histones) and certain **metallic ions.**
- These proteins provide structural support to the chromosome
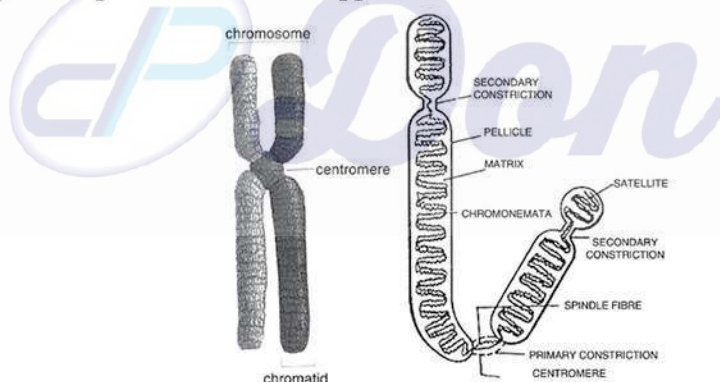
Structure of chromosome

A chromosome consists of the following regions

Primary constriction:

- The two arms of a chromosome meet at a point called primary constriction or centromere.
- The centromere is the region where spindle fibres attach to the chromosomes during cell division.

Secondary constriction:

- Some chromosomes possess secondary constriction at any point of the chromosome.
- They are known as the nuclear zone or nucleolar organizer (formation of nucleolus in the nucleus).

Telomere:

- The end of the chromosome is called telomere. Each extremity of the chromosome has a polarity and prevents it from joining the adjacent chromosome.
- It maintains and provides stability to the chromosomes.

Satellite:

- Some of the chromosomes have an elongated knob-like appendage at one end of the chromosome known as satellite.
- The chromosomes with satellites are called as the sat-chromosomes

8. **Label the parts of the DNA in the diagram given below. Explain the structure briefly**

- DNA molecule consists of **two polynucleotide** chains.
- These chains form a **double helix structure** with two strands which run anti-parallel to one another.
- Nitrogenous bases in the centre are linked to sugar-phosphate units which form the **backbone** of the **DNA**.
- Pairing between the nitrogenous bases is very specific and is always between purine and pyrimidine linked by hydrogen bonds. * Adenine (A) links Thymine (T) with two hydrogen bonds (**A = T**) * Cytosine (C) links Guanine (G) with three hydrogen bonds (**C ≡ G).** This is called complementary base pairing.
- Hydrogen bonds between the nitrogenous bases make the **DNA** molecule **stable**.
- Each turn of the double helix is **34 A° (3.4 nm)**. There are ten base pairs in a complete turn.
- The nucleotides in a helix are **joined** together by phosphodiester bonds.

Nucleotides in a DNA

VII. Long answer questions

1. **Explain with an example the inheritance of dihybrid cross. How is it different from monohybrid cross?** ✷ ✷ ✷

- Dihybrid cross involves the inheritance of two pairs of contrasting characteristics (or contrasting traits) at the same time.
- The two pairs of contrasting characteristics chosen by Mendel were shape and colour of seeds: round-yellow seeds and wrinkled-green seeds.
- Mendel crossed pea plants having roundyellow seeds with pea plants having wrinkledgreen seeds.

Mendel made the following observations:

- Mendel first crossed pure breeding pea plants having **round-yellow** seeds with pure breeding pea plants having **wrinkledgreen** seeds and found that only roundyellow seeds were produced in the **first generation (F$_1$).**

- No wrinkled-green seeds were obtained in the F_1 generation.
- From this it was concluded that round shape and yellow colour of the seeds were dominant traits over the wrinkled shape and green color of the seeds.
- When the hybrids of **F_1 generation** pea plants having round-yellow seeds were **cross-breed** by **self pollination**, then four types of seeds having **different combinations** of shape and colour were obtained in second generation or **F_2 generation.**
- They were round yellow, round-green, wrinkled yellow and wrinkled-green seeds.
- The ratio of each phenotype (or appearance) of seeds in the F_2 generation is **9:3:3:1.** This is known as the Dihybrid ratio.
- From the above results it can be concluded that the factors for each character or trait remain independent and maintain their identity in the gametes.
- The factors are independent to each other and pass to the offsprings (through gametes).
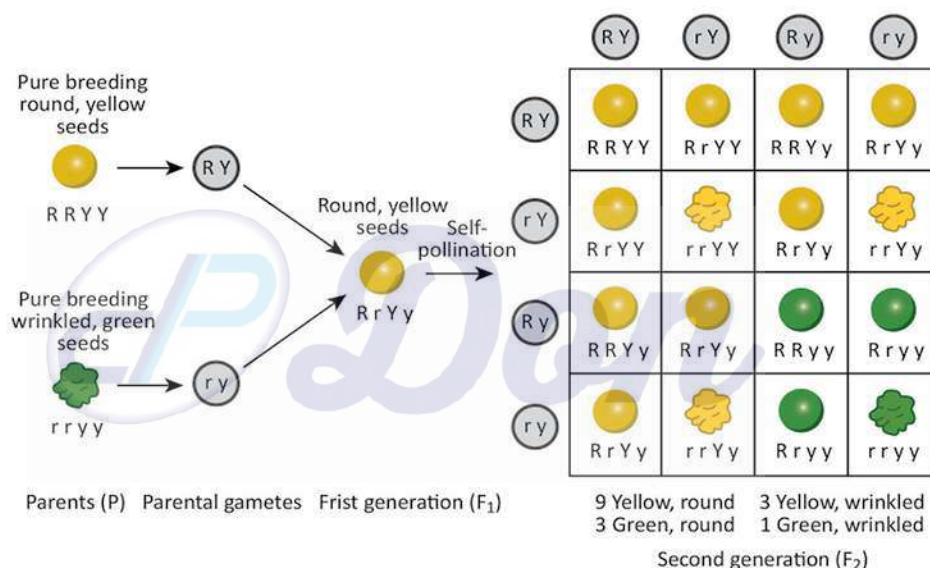
Dihybrid cross

Results of a Dihybrid Cross:

- Mendel got the following results from his dihybrid cross

Four Types of Plants:

- A dihybrid cross produced four types of F_2 offsprings in the ratio of 9 with two dominant traits, 3 with one dominant trait and one recessive trait, 3 with another dominant trait and another recessive trait and 1 with two recessive traits.

New Combination:

- Two new combinations of traits with round green and wrinkled yellow had appeared in the dihybrid cross (F_2 generation)

Monohybrid Cross	Dihybrid Cross
Cross involving inheritance of **only one pair** of contrasting character	Cross involves the inheritance of **two pair** of contrasting character.
E.g) Stem length	E.g) seed shape and seed colour

2. How is the structure of DNA organised? What is the biological significance of DNA? ✶ ✶ ✶

DNA is a large molecule consisting of millions of nucleotides. Hence, it is also called a polynucleotide. Each nucleotide consists of three components.

- A sugar molecules – Deoxyribose sugar.
- A nitrogenous base.
- There are two types of nitrogenous bases in DNA.
- They are
    Purines (Adenine and Guanine)
    Pyrimidines (Cytosine and Thymine)
- A phosphate group

Nucleoside and Nucleotide

- Nucleoside = Nitrogen base + Sugar
- Nucleotide = Nucleoside + Phosphate
- The nucleotides are formed according to the purines and pyrimidines present in them

Watson and Crick model of DNA

- DNA molecule consists of two polynucleotide chains.
- These chains form a double helix structure with two strands which run anti-parallel to one another.
- Nitrogenous bases in the centre are linked to sugar-phosphate units which form the backbone of the DNA.
- Pairing between the nitrogenous bases is very specific and is always between purine and pyrimidine linked by hydrogen bonds. Adenine (A) links Thymine (T) with two hydrogen bonds (A = T) Cytosine (C) links Guanine (G) with three hydrogen bonds(C ≡ G). This is called complementary base pairing.
- Hydrogen bonds between the nitrogenous bases make the DNA molecule stable.
- Each turn of the double helix is 34 A° (3.4 nm). There are ten base pairs in a complete turn.
- The nucleotides in a helix are joined together by phosphodiester bonds.

Significance of DNA

- It is responsible for the transmission of hereditary information from one generation to next generation.
- It contains information required for the formation of proteins.
- It controls the developmental process and life activities of an organism.

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 beings have 23 pairs of chromosomes out of which 22 pairs are autosomes and one pair (23rd pair) is the sex chromosome.
- The female gametes or the eggs formed are similar in their chromosome type (22+XX).
- Therefore, human females are homogametic.
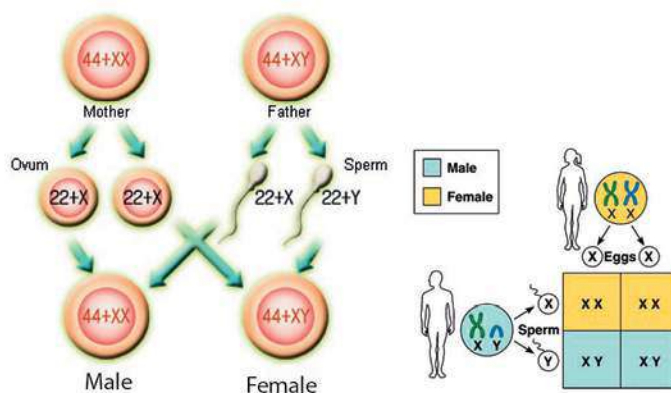
Sex det

- The male gametes or sperms produced are of two types.
- They are produced in equal proportions.
- The sperm bearing (22+X) chromosomes and the sperm bearing (22+Y) chromosomes.
- The human males are called heterogametic.
- It is a chance of probability as to which category of sperm fuses with the egg.
- If the egg (X) is fused by the X-bearing sperm an XX individual (female) is produced.
- If the egg (X) is fused by the Y-bearing sperm an XY individual (male) is produced.
- The sperm, produced by the father, determines the sex of the child. The mother is not responsible in determining the sex of the child.
- Now let's see how the chromosomes take part in this formation.
- Fertilization of the egg (22+X) with a sperm (22+X) will produce a female child (44+XX) while fertilization of the egg (22+X) with a sperm (22+Y) will give rise to a male child (44+XY).

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?**

   He had worked on nearly **10000 pea plants** of 34 different varieties, Mendel noticed that they different from one another in many ways. He were chose 7 pair of contrasting character for his study. They are,

1.	Seed shape	round	wrinkled
2.	Seed colour	yellow	green
3.	Seed constricted	coloured	white
4.	Pod shape	inflated	constricted
5.	Pod colour	green	yellow
6.	Flower position	axillary	terminal
7.	Stem length	long	short

   He chose only one character among the seven. In monohybrid cross he chose only characters using stem height. In dihybrid cross he chose shape and colour of the seed.

2. **Pure-breed tall pea plants are first crossed with pure-breed dwarf pea plants. The pea plants obtained in F_1 generation are then cross-breed to produce F_2 generation of pea plants.**

   a. What do the plants of F_1 generation look like?

   b. What is the ratio of tall plants to dwarf plants in F_2 generation?

   c. Which type of plants were missing in F_1 generation but reappeared in F_2 generation?

   a) The F_1 generation plants **are tall.**

   b) In the F_2 generation there were **3 tall plants** and **a dwarf plant.** The ratio is **3 : 1.**

   c) The dwarf plants were missing in F_1 generation but reappeared in F_2 generation.

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.**

   Kavitha's family member statement is false, because the sex is determined by male. In human being female gametes form the chromosome type 22+ x x. But in male gametes two types of chromosomes are formed. One is **(22 + x)** another one is **(22 + y)**

   • If a female gametes are **(22+ x)** fuses with a male gamete **(22 + x)** its forms a female child.

   • If a female gamete **(22 + x)** is fuses with the male gamete **(22 + y)** it forms a male child.

   • The sex is determinied by the male gamete.

XI. Value based question

1. **Under which conditions does the law of independent assortment hold good and why?**

   • In the dihybrid cross the law of independent assortment holds good because two factors making up a pair of contrasting characters are called alleles or allelomorphs.

   • Mendel crossed two pairs of contrasting characteristics at the same time.

   • He chose shape and colour of seeds, round yellow seeds and wrinkled green seeds.

   • The F_1 generation round yellow seed was formed. In the F_2 generation **9 : 3 : 3 : 1** plants were formed.

   • From the above results it can be concluded that the factors for each character or trait remains independent and maintains their identity in the gametes.

   • The factors are independent to each other and pass on to the offsprings(through gametes)

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. _____ discovered the basic principles of heredity. ✹
   a) T.H. Morgan   b) Mendel   c) J.Watson   d) Francis Crick.

2. Mendel started his famous experiments on the garden _____ plant.
   a) Hibiscus   b) pea   c) Tulasi   d) Tomato

3. In the monohybrid cross the phenotypic ratio is _____.
   a) 3 : 1   b) 9 : 2   c) 3 : 2   d) 1 : 3

4. Two factors making up a pair of contrasting characters are called _____.
   a) dominant   b) recessive   c) allele   d) chromosome

5. _____ is a checker board form devised by R.C. Punnet for study of genetics.
   a) Anna square   b) Punnet square
   c) Mendel square   d) Morgan square

6. T.H.Morgan was awarded Nobel Prize in _____-
   a) 1995   b) 1994   c) 1993   d) 1992

7. The term chromosome was first coined by _____. ✹
   a) T.H.Morgan   b) Punnet   c) Mendel   d) Waldeyer

8. Each gene is present at a specific position in a chromosome called its _____.
   a) Gene   b) Locus   c) Chromonema   d) Chromatid

9. Chromosomes are held together by the _____.
   a) Centromere   b) Chromomere
   c) Satellite   d) Telomere

10. _____are protective sequences of nucleotides found in chromosomes.
    a) Centromere   b) Satellit
    e) Telomere   d) Chromomere

11. Rod shaped chromosomes are called as _____. ✹
    a) Metacentric   b) submetacentric
    c) Acrocentric   d) Telocentric

12. The centromere occurs that in the centre of the chromosome are called _____.
    a) Metacentric   b) Submetacentric
    c) Acrocentric   d) Telocentric

13. Chromosome occurs in pairs called as _____.
    a) Haploid   b) Diploid   c) Triploid   d) Tetraploid

14. _____is the diagrammatic representation of karyotype of a species.
    a) Diploid   b) Haploid   c) Idiogram   d) Allosomes

15. _____were awarded Nobel Prize for medicine in 1962.
    a) Watson   b) F.Crick   c) Franklin   d) Wilkins

16. DNA molecules consists of _____ polynucleotide chains.
    a) one   b) two   c) three   d) four

17. _____ bonds between the nitrogenous base makes the DNA molecule stable.
    a) Nitrogen   b) Oxygen   c) Hydrogen   d) carbon

18. The enzyme called _____ binds to the origin of replication site.
    a) topoisomerase   b) DNA ligase
    c) DNA polymerase   d) helicase

19. The DNA fragments are joined together by the enzymes_____.
    a) topoisomerase   b) DNA ligase
    c) helicase   d) DNA polymerase

20. Down syndrome was first identified by a doctor _____ in 1866. ✵
    a) Watson   b) Wilkins   c) Langdon Down   d) Mendel

21. Gene alteration results in abdominal _____ formation in an organism.
    a) carbohydrate   b) fat   c) lipid   d) protein

22. _____ is caused by the mutation of a single gene.
    a) Lagging strand   b) Leading strand
    c) Okazaki fragments   d) Sickle cell

Ans:

1.	b)	Responsible for character	2.	c)	Independent assortment
3.	c)	Centromere	4.	b)	Metacentric
5.	d)	Sugar phosphate	6.	d)	DNA ligase
7.	a)	22 pairs of autosome and 1 pair of allosomes	8.	b)	Aneuploidy

II. Fill in the blanks

1. Mendel was an _____ monk.

2. Mendel had chosen _____ pairs of contrasting character for his study. ✵

3. Mendel used the character in his experiment _____ is the dominant character of flower position.

4. The genotypic ratio of monohybrid cross is _____.

5. Factors are passed on from one generation to another is referred as _____.

6. Punnet square is a checker board form devised for study of _____.

7. Mendel proposed three important laws called as Mendel's _____.

8. The term _____ was first coined by Waldeyer in 1888. ✵

9. The end of the chromosome is called _____.

10. The two arms of a chromosome meet at a point called _____.

11. Some of chromosome have knob like appendages called _____.

12. The centromere found at one end with a short arm and a long arm is ____.

13. _____ contain genes that determine the Somatic character.

14. _____ are responsible for determining the sex of an individual.

15. The gametes produced by organisms contains single set of chromosome called _____.

16. Watson and Crick proposed the _____ of DNA. ✶

17. There are _____ types of nitrogenous bases in DNA.

18. The DNA polynucleotide chains form a _____ structure.

19. The human male chromosomes are called _____.

20. The addition or deletion in the number of chromosomes are called _____. ✶

21. _____ is one of the commonly known aneuploid condition.

22. Monosomy means _____ number of chromosomes.

23. _____ is transmission of characters from one generation to the next generation.

24. _____ is a graphical representation of possible genotypes in a genetic cross.

25. The secondary constriction zone of the chromosome is known as _____.

26. The chromosomes with satellites are called _____.

27. The plant taken for experiments by Hugo De. Vries is _____.

28. R.N.A primer is synthesized by _____.

29. Sex is determined by the _____.

30. _____ states that in D.N.A. the proportion of adenine is always equal to that of thymine.

Ans:

1.	Austrian	2.	7 (seven)
3.	Auxillary	4.	1 : 2 : 1
5.	Genes	6.	Genetics
7.	Laws of heredity	8.	Chromosomes
9.	Telomere	10.	centromere
11.	Satellite	12.	Acrocentric
13.	Autosomes	14.	Allosomes
15.	Haploid	16.	Three dimensional model
17.	Two	18.	Double helix
19.	heterogametic	20.	ploidy
21.	Down's syndrome	22.	(2n - 1)
23.	Heredity	24.	Punnett square
25.	Nuclear zone or nucleolar organizer	26.	Sat chromosomes
27.	Evening primrose or Oenothera Lamarckiana	28.	D.N.A template
29.	Chromosomes	30.	Erwin Chargaff

III. Identify whether the statement are True or False. Correct the false statement

1. **Watson discovered the basic principles of heredity.** ✸   **False**
   Mendel discovered the basic principles of heredity.

2. **The inheritance of only one pair of contrasting characters are called dihybrid crosses.**   **False**
   The inheritance of only one pair of contrasting characters are called Monohybrid crosses.

   (Or)

   The inheritance of two pairs of contrasting characters are called dihybrid crosses.

3. **The nucleus of each cell contains thin thread like structures called centromere.**   **False**
   The nucleus of each cell contains thin thread like structures called chromosomes.

4. **Satellite are protective sequences of nucleotides found in chromosomes**   **False**
   Telomeres are protective sequences of nucleotides found in chromosomes

5. **In telocentric the centromere is found in the proximal end.** ✸   **True**

6. **Allosome contains genes that determine the somatic character.**   **False**
   Autosome contains genes that determine the somatic character. (or)
   Allosome contains genes that determine the sex of an individual.

7. **In human each cell normally contains 21 pairs of chromosomes.**   **False**
   In human each cell normally contains 23 pairs of chromosomes.

8. **Adenine and guanine is collectively called as pyrimidines.** ✸   **False**
   Adenine and guanine is collectively called as purines.

9. **In a DNA model there are eight base pairs in a complete turn.**   **False**
   In a DNA model there are ten base pairs in a complete turn.

10. **The fragments are joined together by the enzyme helicase.**   **False**
    The fragments are joined together by the enzyme DNA ligase

11. **The term mutation was introduced by Hugo De Vries.**   **True**

IV. Match the following

1.
   1) Basic principle of heredity   - a) Watson & Crick ✸   (e)
   2) Chromosomes   - b) Hugo De vries   (d)
   3) DNA model   - c) T.H. Morgan   (a)
   4) Role of chromosome in heredity   - d) Waldeyer   (c)
   5) Mutation   - e) Mendel   (b)

2.

Character	Dominant	Recessive
Seed Shape	Auxillary	Green
Seed Colour	Round	Short
Flower position	Long	Constricted
Stem length	Yellow	Wrinkled
Pod shape	Inflated	Terminal

Ans:

Character	Dominant	Recessive
Seed shape	Round	wrinkled
Seed colour	Yellow	Green
Flower position	Auxillary	Terminal
Stem length	Long	Short
Pod shape	Inflated	constricted

3.
1) Spirally coiled structure	- a) Satellite	(c)
2) Bread like structure	- b) Polynucleotide	(e)
3) Knob like appendage	- c) Chromonema	(a)
4) Double helix structure	- d) Triploidy	(b)
5) Three haploid sets of chromosomes	- e) Chromomeres	(d)

4.
1) V-shaped cromosome	- a) Submetacentric	(b)
2) One end short arm and other long arm	- b) Metacentric	(d)
3) J shaped chromosome	- c) Telocentric	(a)
4) centromere is found in the proximal end	- d) Acrocentric	(c)

V. Assertion and Reason

a) A and R are corrrect, R explains the A
b) Both A and B are wrong.
c) A is correct, R is wrong.
d) A and R are correct, R does not explains A

1. **Assertion (A):** In monohybrid cross the genotypic ratio is 1 : 2 :1.
   Reason (R) : A genotype is the genetic expression of an organism.
   Ans:: a) A and R are corrrect, R explains the A

2. **Assertion (A):** The two arms of a chromosome meet at a point called centromere.
   Reason (R) : The end of the chromosomes is called telemere.
   Ans: d) A and R are correct, R does not explains A

3. **Assertion (A):** In a DNA the nucleotide is polynucleotide.
   Reason (R) : DNA consists of millions of nucleotide.
   Ans: a) A and R are correct, R explains the A

4. **Assertion (A) :** Adenine and Guanine are called as pyrimidines. ✴
   Reason(R): Cytosine and Thymine are called purines
   Ans: b) Both A and R are wrong.

VI. Answer in a sentence

1. **Human females are homogametic Why?**
   The female gametes or the eggs formed are similar in their **chromosome** type (22+XX)

2. **What is the reason for the changes in the number of chromosome?**
   This is due to **errors** in cell division.

3. **What are the three types of Aneuploidy ?**

Monosomy (2n-1), Trisomy (2n+1), Nullisomy (2n – 2)

4. **Which part of the blood is affected by sickle cell anaemia?**

Alteration in the gene brings a change in the structure of the **protein part of** haemoglobin molecule.

5. **What are the 3 different types of plants obtained in monohybrid cross- F2 gemeration?** ✳

- Tall Homozygous – TT

- Tall Heterozygous - Tpt

- Dwarf Homozygous – tt

VII. Short answers questions

1. **List the elements select Mendel in his experiment in pea plant:**

- Seed shape

- Seed colour

- Seed coat colour

- Pod shape

- Pod colour

- Flower position

- Stem length.

2. **Define – Allelomorphs.**

Two factors making up a pair of contrasting character are called allelomorphs.

3. **What is checker board?**

Checker board is a graphical representation to **calculate** the **probability** of all possible genotype offsprings in a genetic cross.

4. **Write the Law of Dominance:**

When two homozygous individuals with one or more sets of contrasting characters are crossed, the characters that appear in the F1 hybrid are dominant and those that do not appear in F1 are recessive characters.

5. **Write the law of segregation**

When a pair of contrasting factors or genes or allelomorphs are brought together in a heterozygote or hybrid, the two members of the allelic pair remain together without mixing and when gametes are formed, the two separate out, so that only one enters each gamete.

6. **What is diploid and haploid?**

Diploid:

- In the body cells of sexually reproducing organisms, the chromosomes generally occur in pairs.

- This condition is called diploid (2n)

Haploid:

- The gametes produced by a organisms contain a single set of chromosomes.

- This condition is called haploid (n)

7. Name the nitrogenous base.

There are two types of nitrogenous bases in DNA, They are

- Purines (Adenine and Guanine)
- Pyrimidine (cytosine and thyamine)

8. How nucleoside and nucleotide formed?

- Nucleoside is Nitrogen base and sugar molecule
- Nucleotide is nucleoside and phosphate molecule.

9. What is sex determination?

The **formation of zygote** with male or female sex during development is called sex determination.

10. How is a male child and a female child formed?

- Fertilization of the egg (22 + x) with a sperm (22 + x) will produce a female child (44 + xx).
- Fertilization of the egg (22 + x) with a sperm (22 + y) will produce male child (44 +xy).

11. What is ploidy?

Addition and deletion in the number of chromosomes present in a cell is called ploidy.

12. Define chromosomal mutation.

The sudden **change in the structure** or number of chromosomes is called chromosomal mutation.

13. Define aneuploidy and write its types. ★

- It is the loss or gain of one or more chromosomes in a set.
- It is of three types. Monosomy (2n-1), Trisomy (2n+1)and Nullisomy (2n-2).
- In man, Down's syndrome is one of the commonly known aneuploid condition.

14. What are the conditions seen in Down's syndrome affected child?

Mental retardation, delayed development, behavioural problems, weak muscle tone, vision and hearing disability are some conditions seen in Down's syndrome affected children.

15. Define sickle cell anaemia. ★

- Sickle cell anaemia is caused by the **mutation** of a single gene.
- Alteration in the gene brings a change in the structure of the protein part of haemoglobin molecule.
- Due to the change in the protein molecule, the red blood cell (RBC) that carries the haemoglobin is sickle shaped.

VIII. Long answer questions

1. Write the types of chromosomes based on the position of centromere.

Based on the position of centromere, the chromosomes are classified as Telocentric, Acrocentric, Submetacentric and Metacentric

Telocentric:

- The centromere is found on the **proximal end.**
- They are rod shaped chromosomes.

Acrocentric:

- The centromere is found at the **one end** with a short arm and a long arm.
- They are also rod-shaped chromosomes.

Submetacentric:

- The centromere is found **near the centre** of the chromosome.
- Thus forming two unequal arms.
- They are **J** shaped or **L** shaped chromosomes.

Metacentric:

- The centromere occurs in the **centre** of the chromosome and form two equal arms.
- They are **V** shaped chromosomes
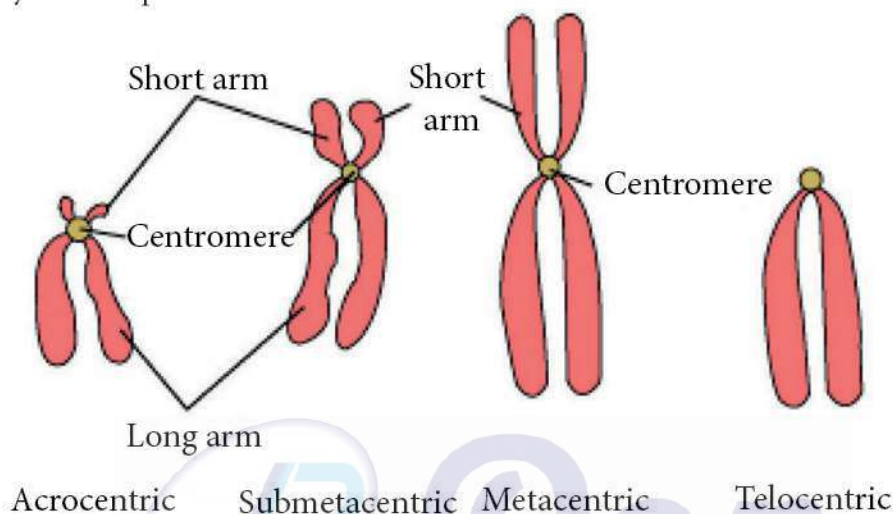
Types of chromosome based on position of centromere

2. Describe mutation and its types. ★

- The term mutation was introduced by **Hugo De Vries** in 1901 when he observed phenotypic changes in the evening primrose plant, Oenothera lamarckiana.
- Mutation is an inheritable sudden change in the genetic material (DNA) of an organism.
- Mutations are classified into two main types, namely chromosomal mutation and gene mutation.

1. Chromosomal mutation:

The s**udden change** in the structure or number of chromosomes is called chromosomal mutation. This may result in

Changes in the structure of chromosomes: Structural changes in the chromosomes usually occurs due to errors in cell division. **Changes** in the **number** and arrangement of genes takes place as a result of deletion, duplication, inversion and translocation in chromosomes.

Changes in the number of chromosomes: They involve **addition** or **deletion** in the **number** of **chromosomes** present in a cell. This is called ploidy. There are two types of ploidy (a) Euploidy, (b) Aneuploidy.

a. Euploidy:

- It is the condition in which the individual bears **more than** the usual number of diploid (2n) chromosomes.
- If an individual has **three haploid** sets of chromosomes, the condition is called **triploidy (3n).**
- Triploid plants and animals are typically **sterile.**

- If it has **four haploid** sets of chromosomes, the condition is called **tetraploidy (4n).**
- Tetraploid plants are advantageous as they often result in increased fruit and flower size.

b. Aneuploidy:

- It is the **loss or gain** of one or more chromosomes in a set.
- It is of **three** types. Monosomy (2n-1), Trisomy (2n+1)and Nullisomy (2n-2).
- In man, Down's syndrome is one of the commonly known **aneuploid condition.**

Down's syndrome

- This condition was first identified by a doctor named **Langdon Down in1866.**
- It is a genetic condition in which there is an extra copy of chromosome 21 (Trisomy 21).
- It is associated with mental retardation, delayed development, behavioural problems, weak muscle tone, vision and hearing disability are some of the conditions seen in these children.

2. Gene or point mutation

- Gene mutation is the **changes** occurring in **nucleotide sequence** of a gene.
- It involves substitution, deletion, insertion or inversion of a single or more than one nitrogenous base.
- Gene alteration results in **abnormal protein formation** in an organism.

IX. Higher Order Thinking Skills (HOTS)

1. In Human beings blue eye colour is recessive to brown eye colour. If a brown eyed man has a blue eyed mother then find.
    i)   What are the possible genotype of his father?
    ii) What is the genotype of the man and his mother?

    i)   Possible genotype BB, Bb

    ii) Genotype of man : Bb

        Genotype of his mother : bb

2. A woman has only daughters Analyse the situation genetically and provide a suitable explanation?
    - Human female have **44+XX** chromosome.
    - They do not play significant role in sex determination of child
    - Male have **44 +XY** chromosomes.
    - Fertilization of egg **22+ X** with sperm carrying **22 + Y** chromosomes give male child **44 + XY** only daughters indicate basis of egg with sperms carrying **22 + X** chromosome every time.
    - So she has given one daughter.

◀◀◀◀◀◀ ▶▶▶▶▶▶

Unit Test - 18
Heredity

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   **5 × 1 = 5**

1. 9 : 3 : 3 : 1 ratio is due to
   a) Segregation   b) Crossing over
   c) Independent assortment   d) Recessiveness

2. The region of the chromosome where the spindle fibres get attached during cell division
   a) Chromomere   b) Centrosome   c) Centromere   d) Chromonema

3. Each gene is present at a specific position in a chromosome called its _____
   a) Gene   b) Locus   c) Chromonema   d) Chromatid

4. Rod shaped chromosomes are called as _____.
   a) Metacentric   b) submetacentric   c) Acrocentric   d) Telocentric

5. The centromere occurs in the centre of the chromosome are called _____.
   a) Metacentric   b) Submetacentric   c) Acrocentric   d) Telocentric

II. Answer the following questions in one or two lines.   **5 × 2 = 10**

1. Why did Mendel select pea plant for his experiments?
2. What do you understand by the term phenotype and genotype?
3. What are Okazaki fragments?
4. Give the genotypic and phenotypic ratio of monohybrid cross.
5. Write the Law of Dominance:

III. Answer the following questions in brief.   **2 × 4 = 8**

1. i) A woman has only daughters, Analyse the situation genetically and provide a suitable explanation.
   ii) How male child and female child formed?

2. i) Define sickle cell anaemia.
   ii) Why did Mendel select pea plant for his experiments?

IV. Answer the following questions in detail.   **1 × 7 = 7**

1. Explain with an example the inheritance of dihybrid cross. How is it different from monohybrid cross?

Origin and Evolution of Life

Evolution	:	It is the gradual change occuring in living organisms over a period of time.
Fossils	:	Preserved part of a plant / animal that has died long back.
Homologous organs	:	Organs with similar developmental pattern but look dissimilar and adapted for different functions.
Analogous organs	:	Organs of different animals which have different origin and different structure but perform same function.
Vestigial organs	:	Degenerated and non-functional organs of animals.
Atavism	:	Reappearance of ancestral characters in some individuals.
Acquired characters	:	The characters developed by the animals during their life time in response to the environmental changes.
Biogenesis	:	Life originates from pre-exis ting life.
Biogenetic law / Recapitulation theory	:	Ontogeny recapitulates Phylogeny.
Archaeopteryx	:	Connecting link between reptiles and birds
Origin of species	:	It is the book of Darwin demonstrates the fact of evolution.
Paleobotany	:	Recovery and identification of plant remains of geological past.
Paleontology	:	It deals with the study of fossils.
Ethnobotany	:	Study of a region's plants and their practical uses.
Ontogeny	:	Stages of development of the individual animal.
Phylogeny	:	Evolutionary history of the entire race of the animal.
Astrobiology	:	It deals with the origin, evolution and dis tribution of life in the Universe.

MIND MAP

Theories on Origin of life
- Special creation
- Spontaneous creation
- Biogenesis

Evidences of Evolution
- Atavism
- Vestigial Organs
- Analogous Organ
- Homologous Organ

Fossil & Fossilization
1. Petrification
2. Molds and casts
3. Carbonization
4. Preservation
5. Compression
6. Infiltration

Theories of Evolution

Lamarckism
- Internal vital force
- Environment and New needs
- Use and disuse theory
- Acquired characters

Darwinism
1. Over production
2. Struggle for existence
3. Variation
4. Survival of the fittest
5. Origin of Species

Don

Scienctists and Inventions:

Louis Pasteur(1862)	- Life orginates from pre exixting life.
Oparin(1922) and Haldane(1929)	- Chemical evolution of life
Ernst Haeckel	- Biogenetic Law
Leonardo da Vinci	- Father of Palaeontology
Jean Baptiste Lamarck (1744 - 1829)	- Philosophic Zoologique
Charles Darwin(1809 - 1882)	- Origin of Species
De Vries	- Mutation theory
Kaspur Maria von Sternberg	- Father of Paleobotany
Birbal Sahani	- Father of Indian paleobotany
W.F.Libby(1956)	- Radio active carbon dating method
J.W.Harshberger(1895)	- Ethnobotany

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Biogenetic law states that _____**
   a) Ontogeny and phylogeny go together
   b) Ontogeny recapitulates phylogeny
   c) Phylogeny recapitulates ontogeny
   d) There is no relationship between phylogeny and ontogeny

2. **The 'use and disuse theory' was proposed by _____.** ✳✳
   a) Charles Darwin   b) Ernst Haeckel
   c) Jean Baptiste Lamarck   d) Gregor Mendel

3. **Paleontologists deal with**
   a) Embryological evidences   b) Fossil evidences
   c) Vestigial organ evidences d) All the above

4. **The best way of direct dating fossils of recent origin is by** ✳✳
   a) Radio-carbon method   b) Uranium lead method
   c) Potassium-argon method d) Both a) and c)

5. **The term Ethnobotany was coined by**
   a) Khorana   b) J.W. Harsbberger
   c) Ronald Ross   d) Hugo de Vries

Ans:

1.	b)	Ontogeny recapitulates phylogeny	2.	c)	Jean Baptiste Lamarck
3.	d)	All the above	4.	d)	Both a) and c)
5.	b)	J.W. Harsbberger			

II. Fill in the blanks

1. The characters developed by the animals during their life time, in response to the environmental changes are called _____.

2. The degenerated and non-functional organs found in an organism are called _____.

3. The forelimbs of bat and human are examples of _____ organs. ✹✹

4. The theory of natural selection for evolution was proposed by _____. ✹✹

Ans:

1.	acquired character	2.	Vestigial organs
3.	Homologous	4.	Darwin

III. State true or false. Correct the false statements

1. The use and disuse theory of organs' was postulated by Charles Darwin.   **False**
   The use and disuse theory of organs' was postulated by Lamarck. ✹✹

2. The homologous organs look similar and perform similar functions but they have different origin and developmental pattern.   **False**
   The analogous organs look similar and perform similar functions but they have different origin and developmental pattern.

3. Birds have evolved from reptiles. ✹✹   **True**

IV. Match the following

1. **Column A**   **Column B**

   1) Atavism   - a) Caudal vertebrae and   (c)
                          vermiform appendix

   2) Vestigial organs - b) A forelimb of a cat and   (a)
                          a bat's wing

   3) Analogous organs - c) Rudimentary tail and   (d)
                          thick hair on the body

   4) Homologous organs - d) A wing of a bat and   (b)
                          a wing of an insect

   5) Wood park   - e) Radio carbondating   (f)

   6) W.F. Libby   - f) Thiruvakkarai   (e)

V. Answer in a word or sentence

1. A human hand, a front leg of a cat, a front flipper of a whale and a bat's wing look dissimilar and are adapted for different functions. What is the name given to these organs?

Homologous organs

2. Which organism is considered to be the fossil bird? ✶ ✶ ✶

Archaeopteryx

3. What is the study of fossils called?

Paleontology

VI. Short answers questions

1. The degenerated wing of a kiwi is an acquired character. Why is it an acquired character?

- Kiwi is a flightless bird. The degenerated wing in Kiwi is an example for organ of disuse.
- When there is a change in the environment, the animals respond to the change.
- They develop adaptive structures (acquired characters).

2. Why is Archaeopteryx considered to be a connecting link? ✶ ✶ ✶

- Archaeopteryx is considered to be a connecting link because it links between **reptiles** and **birds**.
- It had wings with feathers like a bird. It has long tail, clawed digits and conical teeth **like a reptile**.

3. Define Ethnobotany and write its importance.

Ethnobotany is the study of a **region's plants** and their practical uses through the **traditional knowledge** of local culture of people.

Importance

- It provides **traditional uses** of plant.
- It gives information about certain **unknown** and **known** useful plants.
- The ethnomedicinal data will serve as a useful source of information for the chemists, pharmacologists.
- Tribal communities utilise ethnomedicinal plant and prepare medicine to cure many diseases.

4. How can you determine the age of the fossils? ✶ ✶

- The age of fossils is determined by **radioactive elements** present in it.
- They may be carbon, Uranium, lead or pottasium.
- It is used in paleobotany and anthropology for determining the age of human fossils and manuscripts.

VII. Long answer questions

1. Natural selection is a driving force for evolution-How? ✶ ✶

Natural selection is a driving force for evolution.

Overproduction:

- Living beings have the ability to reproduce more individuals and form their **own progeny**.
- This will increase **reproductive potential** leading to over production

Struggle for existence:
- Due to over production, a geometric ratio of **increase** of **population** occurs.
- This creates an intense **competition** among the organisms for food and space leading to **struggle**.
- The struggle for existence are of three types:
  - **a. Intraspecific struggle:**
    Competition among the individuals of **same species.**
  - **b. Interspecific struggle:**
    Competition between the organisms of **different species** living together.
  - **c. Environmental struggle:**
    Natural conditions like extream heat or cold, drought and floods can affect the existence of organisms.

Variations
- The occurrence of variation is a characteristic feature of all plants and animals.
- **Small variations** are important for evolution.
- According to Darwin, **favourable variations** are useful to the organism.
- **Unfavourable variations** are harmful or useless to the organism.

Survival of the fittest or Natural selection
- During the struggle for existence, the organisms which can overcome the challenging situation, **survive** and **adapt** to the surrounding environment.
- Organisms which are **unable** to **face** the challenges, are **unfit** to survive and disappear.
- The process of selection of organisms with **favourable variation** is called as natural selection.

Origin of species:
According to Darwin, **new species** originates by the gradual accumulation of **favourable variations** for a number of generations.

2. **How do you differentiate homologous organs from analogous organs?** ✸ ✸

S.No	Homologous organs	Analogous organs
1.	The homologous organs are those which have been inherited from common ancestors with similar developmental pattern in embryos.	The analogous organs look similar and perform similar function but they have different origin and developmental pattern.
2.	The fore limbs of mammals are homologous structures.	The wings of a bird, wings of an insect are similar.
3.	The mode of development and basic structure of bone is similar.	The development is similar, but their bone structures are different.

3. **How does fossilization occur in plants?**
- 2 million years ago tree trunks that got buried along the river, incourse of time the organic matter was replaced by silica and was fossilized.
- They retained their colour, shape and texture and was converted into solid rocks.
- The annular rings, the texture, colours of the layers, nodes and every properties of plants are still visible.

VIII. Higher Order Thinking Skills (HOTS)

1. **Arun was playing in the garden. Suddenly he saw a dragon fly sitting on a plant. He observed the wings of it. He thought it looked similar to a wing of a crow. Is he correct? Give reason for your answer.**

   Yes, he is correct.

   Reason: The function of the wings of a crow (the wings of a bird) and wings of an insect are similar, but the basic structure is different.

2. **Imprints of fossils tell us about evolution How?**

   • Fossils are remains or impressions of organisms that lived in the remote past.

   • Fossil provide the evidence that the present animal have originated from previously existing ones through the process of continuous evolution.

3. **Octopus, cockroach and frog all have eyes. Can we group these animals together to establish a common evolutionary origin. Justify your answer**

   • Octopus, cockroach and frog all have eyes.

   • Octopus-belongs to mollusc which have simple eye without lens.

   • Cockroach are invertebrate have compound eyes.

   • Frog which is vertebrate, have highly specialised lens.

   • However, all of them perform the same function that is vision.

   • Thus a common evolutionary origin can be established on the basis of eye.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Biogenesis was speculated by**
   a) Oparin
   b) Louis Pasteur
   c) Haldane
   d) All the above

2. **Example for Analogous organ**
   a) Wings of a bird
   b) Human hand
   c) Flipper of a whale
   d) Front leg of a cat

3. **Darwin worked for a period of _____ to develop the theory of natural selection.** ✳
   a) 10 years
   b) 20 years
   c) 30 years
   d) 40 years

4. **Competition among the individuals of same species called _____**
   a) struggle for existence
   b) environmental struggle
   c) interspecific struggle
   d) intraspecific struggle

5. The study of a regions plants and their practical uses is called _____
   a) Astrobiology   b) Exobiology
   c) Ethnobotany   d) Biobotany

6. The first form of life could have come from pre.existing inorganic molecules. This theory is called as _____ ✳
   a) Spontaneous generation (Abiogenesis)
   b) Biogenesis
   c) Chemical Evolution of life
   d) Special creation.

7. Presence of rudimentary tail in new born babies is an example of _____
   a) Homologous organs
   b) Analogous organs
   c) Vestigial Organ
   d) Atavism or reappearance of ancestral characters.

8. _____ is called the Father of palaeontology. ✳
   a) Oparin   b) Leonardo da Vinci
   c) Lamarck   d) Haldane

9. _____ published the book Origin of species
   a) Lamarck   b) Oparin
   c) Darwin   d) Haldane

10. _____ variations are not heritable
    a) Somatic variation
    b) Germinal Variation
    c) Continuous variation.
    d) Discontinuous Variation

11. Father of paleobotany is _____
    a) Birbal Sahani
    b) Kaspar Maria Von Sternberg
    c) Darwin
    d) Lamarck

12. Most bones and wood fossils are _____ ✳
    a) petrified   b) Mold and cost
    c) Carbonization   d) preservation

13. _____ is the only planet is the Goldilock Zone for life.
    a) Mercury   b) Earth   c) Mars   d) Venus.

14. In Tamil Nadu Fossil Wood Park is situated in _____ District
    a) Madurai   b) Chennai
    c) Nellai   d) Villupuram

15. _____ is the raw material which plays an important role in evolution.
    a) variations.   b) Sudden Changes
    c) Homologous organs   d) None of the above

Ans:

1.	b)	Louis pasteur	2.	a)	wings of a bird
3.	b)	20 years	4.	d)	Intraspecific struggle
5.	c)	Ethnobotany	6.	c)	Chemical Evolution of life
7.	d)	Atavism	8.	b)	Leonardo da Vinci
9.	c)	Darwin	10.	a)	Somatic Variation
11.	b)	Kaspar Maria Von Sternberg	12.	a)	petrified
13.	b)	Earth	14.	d)	Villupuram
15.	a)	Variations			

II. Fill in the blanks

1. The Big Bang Theory explains the _____. ✴

2. The_____ of their special characters appear in the later stage of development.

3. Fossil bird was an early bird like form found in the _____ period.

4. Lamarcks theory of evolution was published in _____ in the year 1809. ✴

5. _____ is the father of Indian Paleobotany.

Ans:

1.	Origin of universal	2.	differentiate
3.	Jurassic	4.	Philosophic Zoology
5.	Birbal Sahani		

III. State true or false. Correct the false statements

1. The reappearance of ancestral characters in some individuals is called Atavism
   True

2. The acquired characters are not transmitted to the offspring by the process of inheritance **False**

   The acquired characters are transmitted to the offspring by the the process of inheritance.

3. Kaspar Maria Von Sternbery is the Father of Indian Paleobotany. ✴ **False**

   Birbal Sahani is the father of Indian Paleobotany (or) Kaspar Maria Von Sternbery is the father of Paleobotany.

IV. Match the following

1. 1) Special creation   - a) Lifeless matter   (b)

   2) Spontaneous creation   - b) Study of a region's plants   (d)

   3) Palaeontology   - c) Divine creation   (a)

   4) Ethnobotany   - d) Study of fossils   (c)

V. Assertion and Reason

a) Both assertion and reason are true a reason is correct explanation of assertion

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

c) Assertion is true but reason is false.

d) Both assertion and reason are false.

1. **Assertion:** During their life time, in response, the environmental changes are called acquired character.

   Reason: The acquired characters are transmitted to the offspring by the process of inheritance.

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

2. **Assertion:** Living beings have the ability to reproduce more individuals and their own progeny. ✱

   Reason: Due to over production, a geometric ratio of increase in population occurs

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

VI. Answer in a word or sentence

1. **Give an example for living fossils.**

   Ginko biloba.

2. **What are the events involved in the process of evolution?**

   Mutation and variation.

3. **Which is the study of science that deals with recovery and identification of plant remains of geological past?** ✱

   Paleobotany

VII. Short answers questions

1. **What is vestigial organ?**

   The **degenerated** and **non – functional organs** of animals are called vestigial organ.

2. **State use and disuse theory.** ✱

   • If an **organ is used** constantly, the organ develops well and gets strengthened.

   • When an **organ is not used** for a long time it gradually degenerates.

3. **Write the types of struggle for existence.**

   • Intraspecific struggle

   • Inter specific struggle

   • Environmental struggle.

4. **What is the geologic time scale?** ✱

   The geological time scale is a **system** of **chronological dating** that relates geological rock strata of time and in used by geologists, palaeontologists and other earth scientists to describe the timing and relationships of events that have occurred during Earth's history.

5. What is Astrobiology?

Astrobiology is the science which looks for the **presence** of **extra-terrestrial** life in the universe.

6. What are extremophiles?

The organisms which live in **extreme environmental conditions** on earth are called extremophiles.

VIII. Long answer questions

1. Write flow chart showing the postulates of Lamarckism.
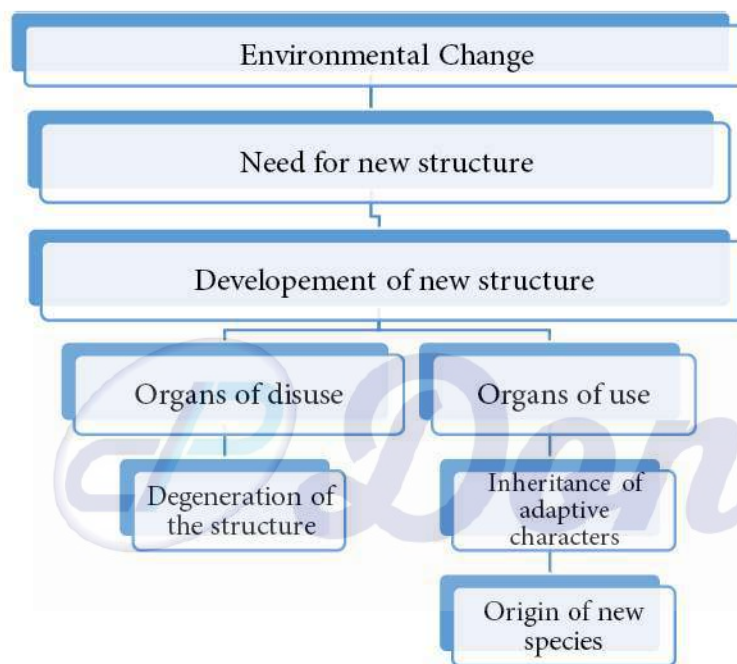
2. What is called variation and explain its types? ✳

- Sexual reproduction, which involves meiois helps in **recombination of genes** during gametic fusion.
- This leads to differences in the phenotype of the off spring from its parents.
- These differences are called variation.

Types of variation:

- Somatic variation
- Germinal variation

Somatic variation:

These are the variation which **affect the body cells** of the organisms, which are non -heritable.

Germinal variation:

These variation are produced in **germ cells of an organisms** which are inherited. They are classified into two type

- Continuous variation.
- Discontinuous variation.

Continuous variation:

These are **small variation** which **occur** among **individuals of a population** they are called fluctuating variation. (eg) skin colour, height, weight of an individual

Discontinuous variation:

These are **sudden changes** which **occur in an organism** due to mutations (eg) Short Legged Ancon sheep. Six or more digits in human etc.

3. **Draw the flow chart showing the postulates of Darwinsm.**

Flow chart showing the postulates of Darwinism

4. **What is known as fossilization? Give the methods of fossilization and explain.** ✶

Fossilization:
- The process of formation of fossil in the rocks is called fossilization.
- Common methods of fossilization includes petrifaction, moulds and cast, carbonization, preservation, compression and infiltration.

Petrifaction:
- Minerals like silica slowly penetrate in and replace the original organic tissue and forms a rock like fossil.
- This method of fossilization can preserve hard and soft parts.
- Most bones and wood fossils are petrified.

Mould and Cast:
- A replica of a plant or animal is preserved in sedimentary rocks.
- When the organism gets buried in sediment it is dissolved by underground water leaving a hollow depression called a mould.
- It shows the original shape but does not reveal the internal structure.
- Minerals or sediment fill the hollow depression and forms a cast.

Preservation:
- Original remains can be preserved in ice or amber (tree sap).
- They protect the organisms from decay. The entire plant or animal is preserved.

Compression:
- When an organism dies, the hard parts of their bodies settle at the bottom of the sea bed and are covered by sediment.
- The process of sedimentation goes on continuously and fossils are formed.

Infiltration or Replacement:
- The precipitation of minerals takes place which later on infiltrate the cell wall.
- The process is brought about by several mineral elements such as silica, calcium carbonate and magnesium carbonate.
- Hard parts are dissolved and replaced by these minerals.

IX. Higher Order Thinking Skills (HOTS)

1. How does the creation of variations in a species promote survival?
- Sometimes for a species, the environmental conditions change so drastically that their survival becomes difficult.
- e.g: if the temperature of water increases suddenly, most of the bacteria living in that water would die, only few variants resistants to heat would be able to survive.
- However not all variation are useful. Therefore these are not necessarily beneficial for the individual organisms

2. Only variations confer an advantage to an individual organism's population. Do you agree with this statement? Why or why not?
- No, depending on the nature of variations different individuals have different kind of advantages.
- However, when a drastic change occurs in environment only those organism in the population will survive which have an advantageous variation in that population to survive in changed environments.

◀◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶▶

Unit Test - 19

Origin and Evolution of Life

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer. $5 \times 1 = 5$

1. The 'use and disuse theory' was proposed by _____.
   a) Charles Darwin   b) Ernst Haeckel
   c) Jean Baptiste Lamarck   d) Gregor Mendel

2. Paleontologists deal with
   a) Embryological evidences   b) Fossil evidences
   c) Vestigial organ evidences   d) All the above

3. The best way of direct dating fossils of recent origin is by
   a) Radio-carbon method   b) Uranium lead method
   c) Potassium-argon method   d) Both a and c

4. Example for Analogous organ
   a) Wings of a bird   b) Human hand
   c) Flipper of a whale   d) Front leg of a cat

5. Darwin worked for a period of...............to develop the theory of natural selection.
   a) 10 years   b) 20 years
   c) 30 years   d) 40 years

II. Answer the following questions in one or two lines. $5 \times 2 = 10$

1. How can you determine the age of the fossils?
2. State use and disuse theory.
3. Write the types of struggle for existence.
4. What is Astrobiology?
5. What are extremophiles?

III. Answer the following questions in brief. $2 \times 4 = 8$

1. Define Abiogenesis.
2. Draw the embryonic development stages of vertebrates.

IV. Answer the following questions in detail. $1 \times 7 = 7$

1. i) What is fossilization? and explain its methods.
   ii) How does fossilization occur in plants?

POINTS TO REMEMBER

Plant breeding	:	It is the art of developing economically important plant with superior quality.
Exotic species	:	Plant / animal specis introduced from other countries.
Polyploid	:	An organism having more than two sets of chromosomes is called polyploid.
Mutagen	:	Factors which induce mutation.
Triticale	:	First man made cereal hybrid by crossing rye and wheat.
Hybridization	:	Hybridization may be defined as the process of crossing two or more types of plants for bringing their desired characters together into one progeny called hybrid.
Inbreeding	:	Inbreeding refers to the mating of closely related animals within the same breed for about 4-6 generations.
Outbreeding	:	Breeding of unrelated animals.
Heterosis/hybrid vigour	:	The superiority of the hybrid obtained by cross breeding is called as heterosis or hybrid vigour.
rDNA	:	Recombinant DNA got by combining DNA from two different sources by genetic engineering.
Restriction enzyme	:	Enzymes which cut or break DNA at specific sites.
DNA ligase	:	Enzymes which help to join the broken DNA fragments.

MIND MAP

Animal Breeding and Biotechnology

Applications of Biotechnology
- Pharmaceutical products
- Gene therapy
- DNA fingerprinting
- Stem cell technology
- Genetically modified plants and animals (Transgenics)

Genetic Engineering Requirements
- Desired gene
- Cloning vector (Plasmid)
- Restriction endonucleases
- DNA ligases
- Recombinant DNA (rDNA)

Animal Breeding
- Inbreeding
- Outbreeding
- Heterosis or Hybrid vigour

Plant Breeding

Crop Improvement

Green Revolution
- High yield
- Disease resistance
- Insects/pests resistance
- Improved nutritional quality

Methods
- Hybridization
- Mutation breeding
- Polyploidy breeding
- Selection
  - Natural
  - Artificial
    - Mass selection
    - Pureline selection
    - Clonal selection

Gene therapy	:	Gene therapy refers to the replacement of defective gene by the direct transfer of functional genes into humans to treat genetic disease or disorder.
Stem cells	:	They are undifferentiated or unspecialised cells and have the ability to give rise to specialised cells.
DNA fingerprinting	:	A technique to compare genetic differences among two individuals by analysing unique DNA sequences of an individual.
Genetically modified organisms	:	Genetic modification refers to the alteration or manipulation of genes in the organisms using rDNA techniques in order to produce the desired characteristics.
Transgenic organisms	:	Plants or animals expressing a modified endogenous gene or a foregin gene are also known as transgenic organisms.
Bio fortification	:	Crops to increase their nutritional value by conventional selective breeding
Mass selection	:	Desired characters - collected mixed population
Pureline selection	:	Self breeding
Mutation	:	Sudden heritable change

Scienctists and Inventions:

Dr. Norman E. Borlaug	- Father of the Green Revolution
Dr. M.S. Swaminathan	- Green Revolution. (Father of Indian Green Revolution)
Dr. Ian Wilmut - Dolly	- First cloned female sheep.
Eli Lilly and company	- Human insulin
Alec. Jeffrey	- DNA fingerprinting

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Which method of crop improvement can be practised by a farmer if he is inexperienced?**

   a) Clonal selection   b) Mass selection   c) Pureline selection   d) Hybridisation

2. **Pusa Komal is a disease resistant variety of _____.** ✳✳
   - **a)** Sugarcane
   - **b)** Rice
   - **c)** Cow pea
   - **d)** Maize

3. **Himgiri developed by hybridisation and selection for disease resistance against rust pathogens is a variety of _____.**
   - **a)** Chilli
   - **b)** Maize
   - **c)** Sugarcane
   - **d)** Wheat

4. **The miracle rice which saved millions of lives and celebrated its 50th birthday is**
   - **a)** IR 8
   - **b)** IR 24
   - **c)** Atomita 2
   - **d)** Ponni ✳✳

5. **Which of the following is used to produce products useful to humans by biotechnology techniques?**
   - **a)** Enzyme from organism
   - **b)** Live organism
   - **c)** Vitamins
   - **d)** Both (a) and (b)

6. **We can cut the DNA with the help of** ✳✳
   - **a)** scissors
   - **b)** restriction endonucleases
   - **c)** knife
   - **d)** RNAase

7. **rDNA is a**
   - **a)** Vector DNA
   - **b)** Circular DNA
   - **c)** Recombinant of vector DNA and desired DNA
   - **d)** Satellite DNA

8. **DNA fingerprinting is based on the principle of identifying _____ sequences of DNA.**
   - **a)** single stranded
   - **b)** mutated
   - **c)** polymorphic
   - **d)** repetitive

9. **Organisms with modified endogenous gene or a foregin gene are also known as**
   - **a)** transgenic organsims
   - **b)** genetically modified
   - **c)** mutated
   - **d)** both a and b

10. **In a hexaploid wheat (2n = 6 x = 42) the haploid (n) and the basic(x) number of chromosomes respectively are**
    - **a)** n = 7 and x = 21
    - **b)** n = 21 and x = 21
    - **c)** n = 7 and x = 7
    - **d)** n = 21 and x = 7

Ans:					
1)	d)	Hybridisation	2)	c)	Cow pea
3)	d)	Wheat	4)	a)	IR 8
5)	d)	Both a and b	6)	b)	Restriction endonucleases
7)	c)	Recombinant of vector DNA and desired DNA	8)	d)	Repetitive
9)	a)	transgenic organisms	10)	a)	N = 7 and x= 21

II. Fill in the blanks

1. Economically important crop plants with superior quality are raised by _____.
2. A protein rich wheat variety is _____. ✴ ✴
3. _____ is the chemical used for doubling the chromosomes. ✴
4. The scientific process which produces crop plants enriched with desirable nutrients is called _____.
5. Rice normally grows well in alluvial soil, but _____ is a rice variety produced by mutation breeding that grows well in saline soil. ✴ ✴
6. _____ technique made it possible to genetically engineer living organism.
7. Restriction endonucleases cut the DNA molecule at specific positions known as _____.
8. Similar DNA fingerprinting is obtained for _____.
9. _____ cells are undifferentiated mass of cells.
10. In gene cloning the DNA of interest is integrated in a _____.

Ans:

1.	Plant breeding	2.	Atlas 66
3.	Colchicine	4.	Bio fortification
5.	Atomita-2	6.	Recombinant DNA
7.	Molecule scissors	8.	Identical twins
9.	Stem	10.	Suitable vector (Plasmid)

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

1. *Raphano brassica* is a man-made tetraploid produced by colchicine treatment.
   Raphano brassica is an allotetraploid by colchicine treatment. **False**

2. The process of producing an organism with more than two sets of chromosome is called mutation. ✴ ✴
   An organism having more than two sets of chromosome is called Polyploid. **False**

3. A group of plants produced from a single plant through vegetative or asexual reproduction are called a pureline. **False**
   A group of plants produced from a single plant through vegetative or asexual reproduction are called clones.

4. Iron fortified rice variety determines the protein quality of the cultivated plant **True**

5. Golden rice is a hybrid. ✴ ✴ **True**

6. Bt gene from bacteria can kill insects. **True**

7. Invitro fertilisation means the fertilisation done inside the body. **False**
   Invitro fertilisation means the fertilisation done outtside the body.

8. DNA fingerprinting technique was developed by Alec Jeffrey. **True**

9. Molecular scissors refers to DNA ligases. **False**
   Molecular scissors refers to restriction endonucleus.

IV. Match the following

1)

Column A		Column B	
1. Sonalika	-	a) *Phaseolus mungo*	(c)
2. IR 8	-	b) Sugarcane	(e)
3. *Saccharum*	-	c) Semi-dwarf wheat	(b)
4. Mung No. 1	-	d) Ground nut	(a)
5. TMV – 2	-	e) Semi-dwarf Rice	(d)
6. Insulin	-	f) *Bacillus thuringienesis*	(h)
7. Bt toxin	-	g) Beta carotene	(f)
8. Golden rice	-	h) First hormone produced using rDNA technique	(g)

V. 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 is correct
d) Both assertion and reason is wrong.

1. **Assertion:** Hybrid is superior than either of its parents.
   Reason: Hybrid vigour is lost upon inbreeding.
   Ans: a) Assertion is correct and reason is wrong

2. **Assertion:** Colchicine reduces the chromosome number.
   Reason: It promotes the movement of sister chromatids to the opposite poles.
   Ans: d) Both assertion and reason is wrong.

3. **Assertion:** rDNA is superior over hybridisation techniques
   Reason: Desired genes are inserted without introducing the undesirable genes in target organisms.
   Ans: c) Both assertion and reason is correct

VI. Answer in a sentence

1. **Give the name of wheat variety having higher dietary fibre and protein.** ✴✴
   Bulgur-wheat variety having higher dietary fibre Atlas-66, a protein rich wheat variety.

2. **Semi-dwarf varieties were introduced in rice. This was made possible by the presence of dwarfing gene in rice. Name this dwarfing gene.**
   Dee-geo-woo-gen

3. **Define genetic engineering.** ✴✴✴
   Genetic engineering is the manipulation and transfer of genes from one organism to another organism to create a new DNA.

4. **Name the types of stem cells.**
   Embryonic stem cells, Adult stem cell or somatic stem cell.

5. What are transgenic organisms? ✷ ✷

Plants or animals expressing a modified endogenous gene or a foreign gene is also known as transgenic organism.

6. State the importance of biofertiliser.

Bio-fertiliser increase soil fertility without causing any damage to the soil.

7. Give an example for mass selection.

Groundnut varieties TMV – 2 and AK – 10

8. How the factors that induce mutations are known as?

The factors which induce mutations are known as mutagens or mutagenic agents.

9. What is called r DNA?

As a result of Genetic engineering a new DNA called as recombinant DNA or r DNA is formed.

VII. Short answers questions

1. Discuss the method of breeding for disease resistance.
- Introduction of new varieties of plants.
- Selection
- Polyploidy breeding
- Mutation breeding
- Hybridization

2. Name three improved characteristics of wheat that helped India to achieve high productivity.

Semi dwarf nature high yield, disease resistance, early maturity

3. Name two maize hybrids rich in amino acid lysine . ✷ ✷ ✷

Protina, shakti and Rathna are lysine rich maize hybrids.

4. Distinguish between ✷ ✷
a. somatic gene therapy and germ line gene therapy

Somatic gene therapy	Germ line gene therapy
It is the replacement of defective gene in **somatic cells.**	It is replacement of defective gene in **germ cell.**

b. undifferentiated cells and differentiated cells

Undifferentiated cells	differentiated cells
Undifferentiated cells **continuously proliferate** throughout the life time of the organism. E.g: Umbilical cord	Differentiated cells some are **unable** to **proliferate.** E.g: Pancreatic cells to secrete insulin.

5. State the applications of DNA fingerprinting technique. ✷ ✷
- DNA fingerprinting technique is used in **forensic applications** like crime investigation.
- It is also used for **paternity testing** in case of disputes.
- It also helps in the study of genetic diversity of population, evolution an speciation.

6. How are stem cells useful in regenerative process?

- Sometimes cells, tissues and organs in the body may be permanently **damaged** or **lost** due to genetic to disease or injury.
- In such situations stem cells are used for the **treatment of disease** which is called stem-cell therapy.

7. Differentiate between outbreeding and inbreeding. ✸ ✸

Outbreeding	Inbreeding
Cross between two **different species** (unrelated) with desirable features of economic value are mated.	Mating of closely related animals within the **same breed** for about **4 - 6** generations.
The hybrids are **stronger** and **vigorous** than their parents. E.g: Mule	It helps in the accumulation of **superior genes** and elimination of genes which are **undesirable**. E.g: Hissardale

VIII. Long answers questions

1. What are the effects of hybrid vigour in animals?

- Increased production of **milk** by cattle.
- Increased production of egg by poultry.
- High quality of meat is produced.
- Increased growth rate in domesticated animals.

2. Describe mutation breeding with an example. ✸ ✸

Mutation:

- Mutation is defined as the sudden **heritable change** in the nucleotide sequence of DNA in an organism.
- It is a process by which **genetic variations** are created which in turn brings about changes in the organism.
- The organism which undergoes mutation is called a **mutant**.
- The factors which induce mutations are known as mutagens or mutagenic agents.
- Mutagens are two types namely physical mutagens and chemical mutagens.

i. Physical mutagens:

- **Radiations** like X - rays, α,β and γ - rays, UV rays, temperature etc., which induce mutations are called physical mutagens.

ii. Chemical mutagens:

- **Chemical substances** that induce mutations are called chemical mutagens.
  E.g: Mustard gas and nitrous acid.
- The utilisation of induced mutation in crop improvement is called mutation breeding.

Achievements of mutation breeding:

- **Sharbati Sonora** wheat produced from Sonora - 64 by using gamma rays.
- Atomita 2 rice with saline tolerance and pest resistance.
- Groundnuts with thich shells.

3. Biofortification may help in removing hidden hunger. How?

- Biofortification is the scientific process of developing crop plants enriched with **high levels** of **desirable** nutrients like vitamins, proteins and minerals.

- Production of Bio fortification crops help in removing hidden hunger.

Examples:

- Protina, shakti and Rathna are **lysine** rich maize hybrids (developed in India)

- Atlas 66, a **protein** rich wheat variety.

- **Iron** rich fortified rice variety.

- **Vitamin A** enriched carrots, pumpkin and spinach.

  So in this way, Biofortification may help in removing hidden hunger.

4. With a neat labelled diagram explain the techniques involved in gene cloning.

Gene cloning: ✳ ✳ ✳

- The carbon copy of an individual is often called a clone. However, more appropriately, a clone means to make a genetically exact copy of an organism.

- In gene cloning, a gene or a piece of DNA fragment is inserted int a bacterial cell where DNA will be multiplied (copied) as the cell divides.
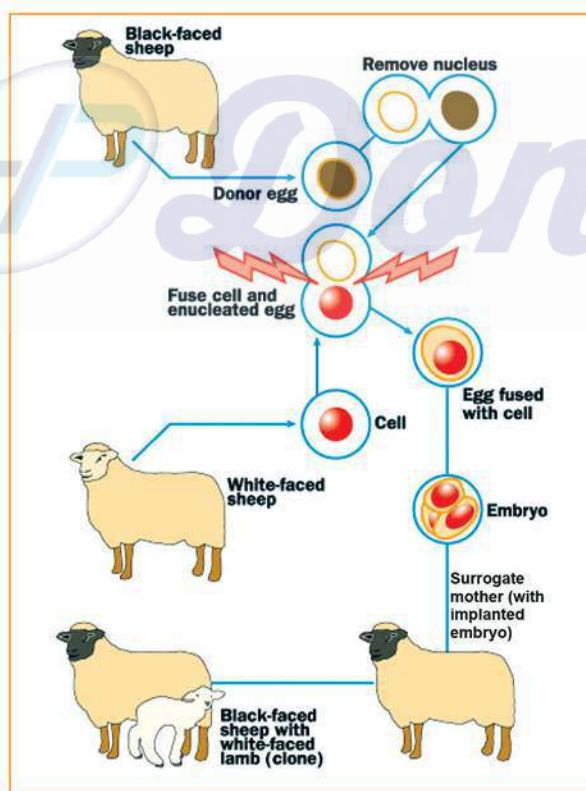
Development of Dolly

Techniques involved in gene cloning:

- To produce cloned sheep Dr. Ian Wilmut took the udder cell which is a somatic cell with diploid number of chromosomes.

- An egg cell was also removed from a donar sheep.

- The egg cell cannot grow into a new sheep on its own because it has only half a set of chromosomes (n).

- The body cell cannot grow into a new sheep on its own because it is not a reproductive cell an udder cell nucleus (2n) was removed.
- Similarly the egg cell nucleus (n) was also removed.
- The nucleus of the somatic cell was injected into the enucleated egg.
- The egg after the nuclear transplantation comes to possess full set of chromosomes the 2n diploid.
- The egg was then transplanted back into the uterus of the sheep from which it was removed.
- The egg also can be transplanted to a new surrogate mother for development.
- The egg cell grew and developed into a sheep (Dolly)

5. **Discuss the importance of biotechnology in the field of medicine.** ✳ ✳
   - Insulin used in the treatment of **diabetes**.
   - Human growth hormone used for treating children with **growth deficiencies**.
   - Blood clotting factors are developed to treat **haemophilia**.
   - Tissue plasminogen activator is used to dissolve **blood clots** and prevent **heart attack.**
   - Development of **vaccines** against various disease like Hepatitis B and rabies.

IX. Higher Order Thinking Skills (HOTS)

1. **A breeder wishes to incorporate desirable characters into the crop plants. Prepare a list of characters he will incorporate.**
   A breeder will incorporate the following characters:
   - Tallness and profuse branching are desirable characters for fodder crops.
   - Dwarfness is desirable in cereals, so that less nutrients are consumed by these crops.

2. **Organic farming is better than Green Revolution. Give reasons**
   Reason:
   - No chemicals fertilisers are used on the soil.
   - No pesticides are sprayed on the plants.
   - The seeds used to produce plants have not been genetically altered.

3. **Polyploids are characterised by gigantism. Justify your answer.**
   Polyploidys are characterised by gigantism

   An organism having more than two sets of chromosomes is called polyploid. It causes increase in size. Polys = Many **+** aploos = One fold + eidos = Form
   (E.g) Watermelon

4. **'P' is a gene required for the synthesis of vitamin A it is integrated with genome of 'Q' to produce genetically modified plant. 'R'**

   i. What is P, Q and R?
   - P - Beta Carotene gene .
   - Q - improved variety of rice with best nutritional value .
   - R - prevent vitamin A deficiency synthesis of Beta carotene.

   ii. State the importance of 'R' in India.
   - R - The transgenic plants are much stable with improved nutritional value.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. In Cow pea, Pusa Komal - Resistance to disease is a
   a) Hill bunt
   b) Black rot
   c) Bacterial blight
   d) Leaf and stipe rust

2. Dee-geo-woo, gen is a dwarf variety from ✳
   a) India
   b) Japan
   c) Indonesia
   d) China

3. Atlas 66 is a _____ rich wheat variety.
   a) protein
   b) fat
   c) carbohydrate
   d) vitamin

4. The tool, which is not involved in Genetic engineering
   a) Restriction enzymes
   b) DNA ligases
   c) Lysosome
   d) Plasmid

5. _____ wheat is produced from Sonora – 64 using gamma rays.
   a) Triticale
   b) Sharbati Sonora
   c) Atomitta
   d) AK-10

Ans:

1)	c)	Bacterial blight	2)	d)	China
3)	a)	protein	4)	c)	Lysosome
5)	b)	Sharbati Sonora			

II. Fill in the blanks

1. _____ was a Tamil agricultural scientist.

2. _____ is a protein rich wheat variety. ✳

3. _____ saline tolerance and pest resistance.

4. _____ are the enzymes which help in joining the broken DNA fragments.

5. Stem cells are _____ mass of cells.

6. _____ is a concept in which the atomic energy is used for the crop improvement

7. _____ is the first man made cereal hybrid . ✳

8. _____ is a new breed of sheep developed in Punjab by crossing Bikaneri ewes and Australian Marino rams.

9. _____ is developed by crossing a male donkey and female Horse.

10. The superiority of the hybrid obtained by cross breeding is called as _____.

11. _____ is making of genetically exact copy of an organism.

12. The first cloned female sheep was developed by _____.

Ans:

1.	Dr. G.Nammalvar	2.	Atlas 66
3.	Atomita 2 rice	4.	DNA ligase
5.	Undifferentiated	6.	Gamma Garden or Atomic garden
7.	Triticale	8.	Hissardale
9.	Mule	10.	Heterosis or hybrid vigour
11.	Cloning	12.	Dr. Ian Wilmut

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

1. **Progeny from pureline selection, Progeny is dissimilar both genotypically and phenotypically.** **False**

   Progeny from pureline selection, Progeny is similar both genotypically and phenotypically.

2. **Triticale is a hybrid of wheat and rice which has higher dietary fibre and protein** **True**

3. **The cross between different breeds is called inbreeding.** **False**

   The cross between same breeds is called inbreeding.

IV. Match the following

1) **Column A**   **Column B**

   1. Father of the Green Revolution - a) Bacterial blight   (d)
   2. Father of Indian Green Revolution - b) Black rot   (c)
   3. Pusa shubhra - c) Dr, M.S.Swaminathan   (b)
   4. Pusa Komal - d) Dr.Norman E.Bork   (a)

2) **Column A**   **Column B**

   1. Mass selection - a) Drought tolerance   (c)
   2. Pureline selection - b) TMV-2   (a)
   3. TV-29 - c) Self breeding   (b)

3) **Column A**   **Column B**

   1. Physical mutagen - a) Nitrous acid   (b)
   2. Tritical - b) UV-rays   (c)
   3. Chemical mutagen - c) Man-made cereal   (a)

V. 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 is correct
   d) Both assertion and reason is wrong.

1. **Assertion:** Introducing high yielding varieties of plants from one place to another called exotic speceis.

Reason: (E.g) *Phaseolus mungo* was introduced in China

Ans: c) Both assertion and reason is correct

2. **Assertion:** We want to compare the genetic difference among the two individuals is called DNA fingerprinting

Reason: It helps in the study of genetic diversity of population, evolution and speciation.

Ans: c) Both assertion and reason is correct

VI. Short answers questions

1. **Define Green Revolution?**

Green Revolution is the process of **increasing food production** through high yielding crop varities and modern agricultural technique in under developed and developing nations.

2. **What are pathogens?**

Plant disease are caused by pathogens like Viruses, Bacteria and Fungi.

3. **What is Biofortification?** ✷

Biofortification is the scientific process of **developing crop plants** enriched with high levels of desirable nutrients.

4. **What is Polyploid?**

An organism having **more than two sets of chromosomes** is called Polyploid.

5. **What is mutation breeding?** ✷

The utilisation of **induced mutation** in crop improvements is called mutation breeding.

6. **Define Heterosis.**

The **superiority** of the **hybrid** obtained by cross breeding is called heterosis.

7. **What is meant by Gene therapy?**

Gene therapy is the **replacement of defective gene** by the direct transfer of functional genes into humans to treat genetic disease or disorder.

8. **Name two disease that are treated by stem cell therapy.**

Parkinson's disease and Alzheimer's disease.

9. **What is transgenic organisms?**

Plants or animals expressing a **modified endogenous gene** or a foreign gene are also known as transgenic organisms.

10. **What is Golden rice?**

Genetically modified rice can produce beta carotene, that can prevent Vitamin A deficiency.

11. **Give the importance of stem cell therapy.**

Stem - cell therapy:

• Sometimes cells, tissues and organs in the body may be permanently damaged or lost due to genetic condition or disease or injury.

- In such situations stem cells are used for the treatment of diseases which is called stem-cell therapy.
- In treating neurodegenerative disorders likeParkinson's disease and Alzheimer's disease neuronal stem cells can be used to replace the damaged or lost neurons.

12. DNA finger printing technique is used to identify a person. Justify . ✳

- 1% DNA sequence differs from one individual to another.
- This is known as satellite DNA.
- The number of copies of the repeat sequence also called as VNTRs differs from one individual to another and results in variation in the size of DNA segment.

VII. Long answers questions

1. Write about methods of selection.

There are three methods of selection. They are

- Mass selection
- Pureline selection
- Clonal selection

Mass selection:

- Seeds of best plants showing desired characters are collected from a mixed populations.
- The collected seeds are allowed to rise the second generation.

Pureline selection:

- Pureline is the progeny of a single individual obtained by self breeding.
- This is also called an individual plant selection.

Clonal selection:

- Selection of desirable clones from the mixed population of vegetatively propagation crop is called clonal selection.

2. Write basic steps involved in gene cloning.

- **Isolation** of **desired DNA** fragment by using restriction enzymes.
- **Insertion** of the **DNA** fragment into a suitable vector (Plasmid) to make rDNA.
- **Transfer** of **rDNA** into bacterial host cell.
- **Selection** and **multiplication of recombinant host cell** to get a clone.
- **Expression** of **cloned gene** in host cell

3. Write an account on genetically modified animals

- Transgenic sheep (genetically modified animals) when inserted the genes for synthesis of aminoacid, Cysteine, then produce improved wool quality and production.
- Transgenic fish (genetically modified animals) when inserted with growth hormone gene then produce increased growth in fishes which is of commercial value.

VIII. Higher Order Thinking Skills (HOTS)

1. What are the main effects of heterosis?

Heterosis leads to increase in yield, reproductive ability, adaptability, general vigour, quality, etc.

2. How does somatic gene theraphy differ from Germline gene theraphy?

Gene theraphy conducted till date has targeted only somatic (non-reproductive) cells. Correction of genetic defects in somatic cells may be beneficial to the patient but the corrected gene may not be carried to the next generation.

3. How does DNA base, sequence differes in human beings?

- In human beings 99% of the DNA base sequences are the same and this is called as bulk genomic DNA.

- The remaining 1% DNA sequence differs from one individual to another. This 1% DNA sequence is present as small stretch of repeated sequence and is called satellite DNA.

- The number of copies of the repeat sequence also called as VNTRs differs from one individual to another and results in variation in the size of the DNA segment.

◀◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶▶

| Unit Test - 20 |

Breeding and Bio Technology

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. Himgiri developed by hybridisation and selection for disease resistance against rust pathogens is a variety of _____.

   a) Chilli   b) Maize   c) Sugarcane   d) Wheat

2. The miracle rice which saved millions of lives and celebrated its 50th birthday is

   a) IR 8   b) IR 24   c) Atomita 2   d) Ponni

3. We can cut the DNA with the help of

   a) scissors   b) restriction endonucleases
   c) knife   d) RNAase

4. DNA fingerprinting is based on the principle of identifying _____ sequences of DNA

   a) Single stranded   b) Mutated   c) Polymorphic   d) Repetitive

5. In Cow pea, Pusa Komal - Resistance to disease is a

   a) Hill bunt   b) Black rot   c) Bacterial blight   d) Leaf and stipe rust

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. Discuss the method of breeding for disease resistance.
2. Differentiate between outbreeding and inbreeding.
3. What are pathogens?
4. What is mutation breeding?
5. What is meant by Gene theraphy?

III. Answer the following questions in brief.   2 × 4 = 8

1. Write an account on genetically modified animals
2. Write basic steps involved in gene cloning.

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Discuss the importance of biotechnology in the field of medicine.
   ii) Write the achievements of polyploidy breeding.
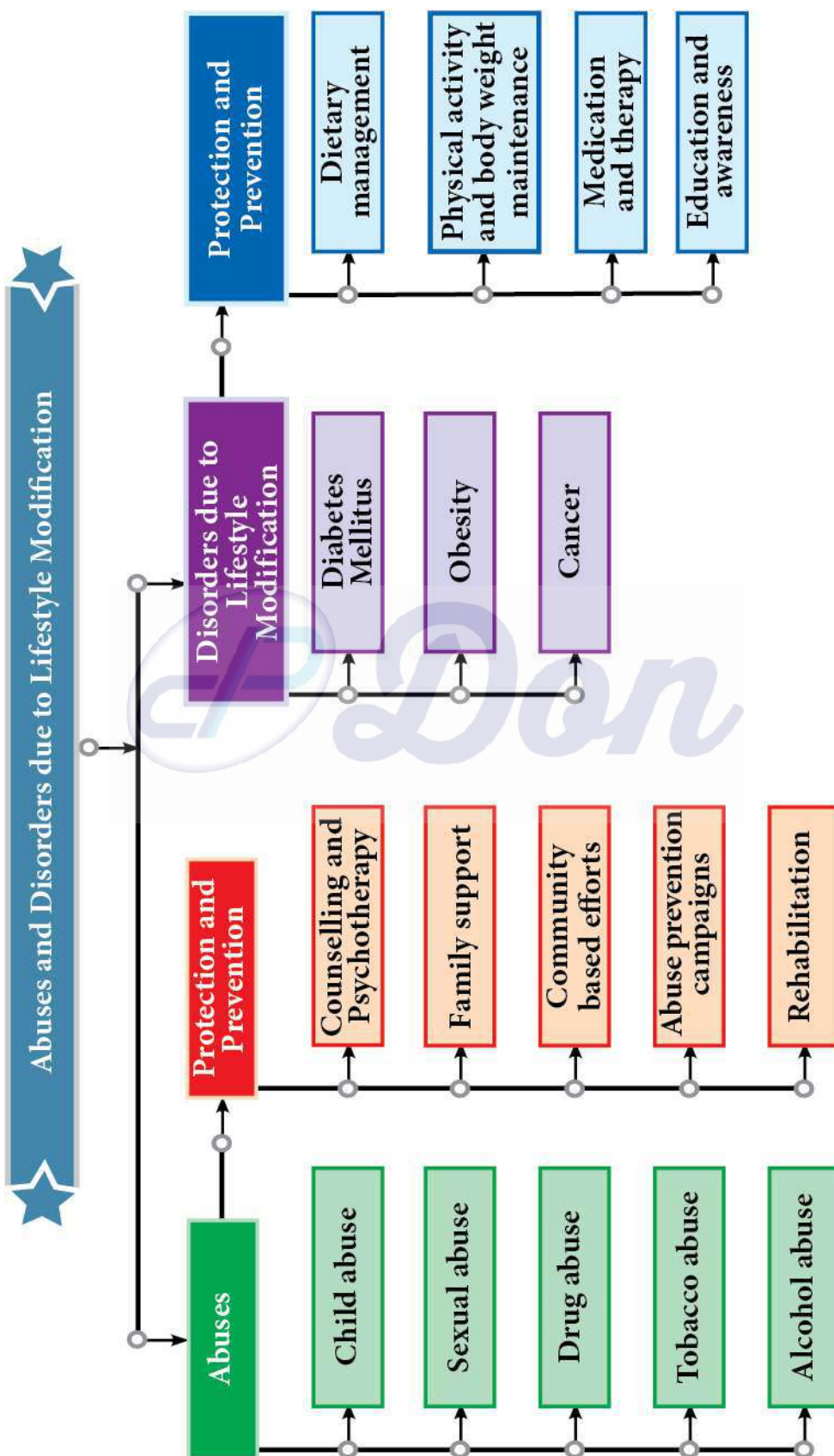
POINTS TO REMEMBER

- A person who is habituated to a drug due to its prolonged use is called **drug addict.** This is called drug addiction or drug abuse.

- There are certain drugs called **psychotropic drugs** which acts on the brain and alter the behaviour, consciousness, power of thinking and perception.

- **Abuse** refers to cruel, violent harmful or injurious treatment of another Human being.

- **Tobacco** is obtained from the tobacco plant Nicotiana tobaccum and Nicotiana rustica.

- '**Nicotine**' is an alkaloid present in tobacco. Nicotine is a stimulant which is highly harmful and a poisonous substance.

- Powdered tobacco is taken through nose, it is called **snuffing**.

- The dependence of alcohol is called alcoholism and the addict is termed as alcoholic. It is called **alcohol abuse**.

- **Diabetes mellitus** is a chronic metabolic disorder.

- **Hyperglycemia** is increased blood glucose level, resulting from inadequate insulin secretion.

- **Polyurea:** Increased urine output

- **Polydipsia:** Loss of water leads to thirst

- **Glycosuria:** Excessive glucose excreted in urine

- **Polyphagia:** Excess hunger

- **Obesity** is abnormal increase in body weight

- **Hypercholesterolemia** (High blood cholesterol) and high blood pressure (Hypertension)

MIND MAP

Abuses and Disorders due to Lifestyle Modification

Disorders due to Lifestyle Modification

- Diabetes Mellitus
- Obesity
- Cancer

Protection and Prevention

- Dietary management
- Physical activity and body weight maintenance
- Medication and therapy
- Education and awareness

Abuses

- Child abuse
- Sexual abuse
- Drug abuse
- Tobacco abuse
- Alcohol abuse

Protection and Prevention

- Counselling and Psychotherapy
- Family support
- Community based efforts
- Abuse prevention campaigns
- Rehabilitation

- **Ischemia** (deficient blood supply to heart muscle) and myocardial infarction is death of the heart muscle tissue

- **Coronary heart disease** (CHD) is caused by deposition of cholesterol in the blood vessels

- **Atherosclerosis** is a disease in which plaque builds up inside your arteries.

- The study of cancer is called **Oncology.**

- The cancerous cells migrate to distant parts of the body and affect new tissues. This process is called **metastasis.**

- The presence of **HIV virus** can be confirmed by Western Blot analysis or Enzyme Linked Immunosorbent Assay (ELISA)

- International Day against Drug Abuse and Illicit Trafficking - **June 26.**

- Narcotic Drugs and Psychotropic Substances **Act** was introduced in **1985.**

- **POCSO** – Protection of Children from Sexual Offences

- **NCPCR** – National Commission for Protection of Child Rights

- **Emphysmea** is the reduction of the gaseous exchange area of the lungs.

- **Metastasis** is the cancerous cells migrate to dis tant parts of the body and effect new tissues. This process is called **metastasis.**

- **Psychotropic drugs** act on the brain and alter the behaviour, consciousness and power of thinking perception. (mood altering drugs)

- **Hyperglycemia** means elevated blood glucose levels.

- **Insulin** is the hormone produced by pancreas which controls blood sugar levels.

- **Oncology** study of cancer is called Oncology.

- **Carcinogen** cancer causing agents are called carcinogen.

- **Retrovirus** is the group to which HIV belongs to.

- **Detoxification** : The firs t phase of treatment in drug de-addiction is detoxification. The drug is stopped gradually and the addict is helped to overcome the withdrawal symptoms.

- **Chemotherapy** is the administration of anti cancerous drugs to treat cancer.

- Interferons are the biological response modifiers used to activate immune system and destroy tumours.

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Tobacco consumption is known to stimulate secretion of adrenaline. The component causing this could be** ✶✶
   a) Nicotine b) Tannic acid c) Curcumin d) Leptin

2. **World 'No Tobacco Day' is observed on**
   a) May 31 b) June 6 c) April 22 d) October 2

3. **Cancer cells are more easily damaged by radiations than normal cells because they are** ✶✶
   a) Different in structure b) Non-dividing
   c) Mutated Cells d) Undergoing rapid division

4. **Which type of cancer affects lymph nodes and spleen?** ✶✶
   a) Carcinoma b) Sarcoma c) Leukemia d) Lymphoma

5. **Excessive consumption of alcohol leads to** ✶
   a) Loss of memory b) Cirrhosis of liver
   c) State of hallucination d) Supression of brain function

6. **Coronary heart disease is due to**
   a) Streptococci bacteria b) Inflammation of pericardium
   c) Weakening of heart valves d) Insufficient blood supply to heart muscles

7. **Cancer of the epithelial cells is called**
   a) Leukemia b) Sarcoma c) Carcinoma d) Lipoma

8. **Metastasis is associated with**
   a) Malignant tumour b) Benign tumour c) Both (a) and (b) d) Crown gall tumour

9. **Polyphagia is a condition seen in**
   a) Obesity b) Diabetes mellitus c) Diabetes insipidus d) AIDS

10. **Where does alcohol effect immediately after drinking?** ✶✶
    a) Eyes b) Auditory region
    c) Liver d) Central Nervous System

Ans:					
1.	a)	Nicotine	6.	d)	Insufficient blood supply to heart muscles
2.	a)	May 31	7.	c)	Carcinoma
3.	d)	Undergoing rapid division	8.	a)	Malignant tumour
4.	d)	Lymphoma	9.	b)	Diabetes mellitus
5.	b)	Cirrhosis of liver	10.	d)	Central Nervous System

II. State whether True or False, if false write the correct statement

1. AIDS is an epidemic disease. ✶✶ — **True**
2. Cancer causing genes are called Oncogenes. ✶✶ — **True**
3. Obesity is characterized by tumour formation. — **False**
   Cancer is characterized by tumour formation.
4. In leukemia both WBCs and RBCs increase in number. — **False**
   In leukemia only WBCs increase in number.
5. Study of cause of disease is called etiology. — **True**
6. AIDS is not transmitted by contact with a patient's clothes. — **True**
7. Type 2 diabetes mellitus results due to insulin deficiency. ✶✶ — **False**
   Type 1 diabetes mellitus results due to insulin deficiency.
8. Carcinogens are cancer causing agents. — **True**
9. Nicotine is a narcotic drug. — **False**
   Nicotine is not a narcotic drug.
10. Cirrhosis is associated with brain disorder. — **False**
    Cirrhosis is associated with liver disorder.

III. Expand the following abbreviations ✶✶✶

1) 1. IDDM   2. HIV   3. BMI
    4. AIDS   5. CHD   6. NIDDM

1. IDDM	- Insulin Dependent Diabetes Mellitus
2. HIV	- Human Immunodeficiency Virus
3. BMI	- Body Mass Index
4. AIDS	- Acquired Immuno Deficiency Syndrome
5. CHD	- Coronary Heart Disease
6. NIDDM	- Non-Insulin Dependent Diabetes Mellitus

IV. Match the following

1) Sarcoma	-	a) Stomach cancer	(e)
2) Carcinoma	-	b) Excessive thirst	(a)
3) Polydipsia	-	c) Excessive hunger	(b)
4) Polyphagia	-	d) Lack of blood flow to heart muscle	(c)
5) Myocardial infarction	-	e) Connective tissue cancer	(d)

V. Fill in the blanks

1. Cirrhosis is caused in liver due to excessive use of _____ . ✶✶
2. A highly poisonous chemicals derived from tobacco is _____ .
3. Blood cancer is called _____ . ✶✶
4. Less response of a drug to a specific dose with repeated use is called _____.
5. Insulin resistance is a condition in _____ diabetes mellitus. ✶✶

Ans:

1.	Alcohol	4.	Drug addiction (or) drug abuse
2.	Nicotin	5..	Type-2 non-insulin dependent
3.	Leukaemia		

VI. Assertion and Reasoning

In each of the following questions, a statement of Assertion is given and a corresponding Statement of Reason is given just below it. Of statements given below mark the correct answer as

a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

b) If both Assertion and Reason are true that Reason is not the correct explanation of Asssertion

c) Assertion is true but Reason is false

d) Both Assertion and Reason are false

1. **Assertion:** All drugs act on the brain.
   Reason: Drugs disturb the functioning of the body and mind.

   Ans. b) If both Assertion and Reason are true that Reason is not the correct explanation of Asssertion

2. **Assertion:** Excretion of excess glucose in urine is observed in a person with diabetes mellitus.
   Reason: Pancreas is unable to produce sufficient quantity of insulin.

   Ans. a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

VII. Analogy type questions.

Identify the first words and their relationship and suggest a suitable word for the fourth blank

1. **Communicable: AIDS: Non communicable: Diabetes Mellitus**

2. **Chemotherapy: Chemicals: Radiation therapy: Rays**

3. **Hypertension: Hypercholesterolomia: Glycosuria: Hyperglycemia**

VIII. Answer in a sentence

1. **What are psychotropic drugs ?**

   Psychotropic drugs acts on the brain and alters the behaviour, consciousness, power of thinking and perception.

2. **Mention the diseases caused by tobacco smoke.** ✦ ✦

   Lung cancer, bronchitis and pulmonary tuberculosis, emphysema, Hypoxia, increased blood pressure, gastric and duodenal ulcers.

3. **What are the contributing factors for obesity?**

   Obesity is due to genetic factors, physical inactivity, eating habits (overeating) and endocrine factors.

4. What is adult onset diabetes?

Type-2 Non-Insulin Dependent diabetes.

5. What is metastasis? ✶ ✶

The cancerous cells migrate to distant parts of the body and affect new tissues. This process is called metastasis.

6. How does insulin deficiency occur? ✶ ✶

Insulin deficiency occurs due to destruction of β-cells of the pancreas.

IX. Short answer questions

1. What are the various routes by which transmission of human immuno deficiency virus takes place? ✶ ✶

HIV is transmitted generally by

- **Sexual contact** with infected person.
- Use of **contaminated needles** or syringes especially in case of intravenous drug abusers.
- By transfusion of **contaminated** / infected **blood** or blood products.
- From infected **mother to** her **child** through placenta.

2. How is a cancer cell different from a normal cell? ✶ ✶

- Cancer is an abnormal and uncontrolled division of cells that invade and destroy surrounding tissues forming a tumor neoplasm (new growth).
- It is a heterogenous group of cells that do not respond to the normal cell division.
- The cancerous cells migrate to distant parts of the body and affect new tissues.

3. Differentiate between Type-1 and Type-2 diabetes mellitus ✶ ✶

Factors	Type-I Insulin dependent diabetes mellitus (IDDM)	Type-II Non-insulin dependent diabetes mellitus (NIDDM)
Prevalence	10 - 20%	80 - 90 %
Age of onset	Juvenile onset ($<$ 20 years)	Maturity onset ($>$ 30 years)
Body weight	Normal or underweight	Obese
Defect	Insulin deficiency due to destruction of β-cells	Target cells do respond to insulin
Treatment	Insulin administration is necessary	Can be controlled by diet, exercise and medicine

4. Why is a dietary restriction recommended for an obese individual ?

- Low calorie, normal protein, vitamins and mineral, restricted carbohydrate and fat, high fibre diet can prevent overweight.
- Calorie restriction for weight reduction is safe and most effective.

5. What precautions can be taken for preventing heart diseases? ✶ ✶

Diet management:

- Reduction in the intake of calories, low saturated fat and cholesterol rich food, low carbohydrates and common salt are some of the dietary modifications.

- Diet rich in polyunsaturated fatty acids (PUFA) is essential.
- Increase in the intake of fibre diet, fruits and vegetables, protein, minerals and vitamin are required.

Physical activity:

Regular exercise, walking and yoga are essential for body weight maintenance.

Addictive substance avoidance:

Alcohol consumption and smoking are to be avoided.

X. Long answer questions

1. Suggest measures to overcome the problems of an alcoholic.

Education and counselling:

Education and proper counselling will help the alcoholics to overcome their problems and stress, to accept failures in their life.

Physical activity:

Individuals undergoing rehabilitation should be channelized into healthy activities like reading, music, sports, yoga and meditation.

Seeking help from parents and peer groups:

- When a problematic situation occurs, the affected individuals should seek help and guidance from parents and peers.
- This would help them to share their feeling of anxiety, wrong doing and get rid of the habit.

Medical assistance:

- Individual should seek help from psychologists and psychiatrists to get relieved from this condition and to lead a relaxed and peaceful life.
- Alcohol de-addiction and rehabilitation programmes are helpful to the individual so that they could get rid of the problem completely and can lead a normal and healthy life.

2. Changes in lifestyle is a risk factor for occurrence of cardiovascular diseases. Can it be modified? If yes, suggest measures for prevention ✶ ✶ ✶

Yes, lifestyle can be modified by the following measures:

Diet management:

- Reduction in the intake of calories, low saturated fat and cholesterol rich food, low carbohydrates and common salt are some of the dietary modifications.
- Diet rich in poly unsaturated fatty acids (PUFA) is essential.
- Increase in the intake of fibre diet, fruits and vegetables, protein, minerals and vitamin are required.

Physical activity:

Regular exercise, walking and yoga are essential for body weight maintenance

Addictive substance avoidance:

Alcohol consumption and smoking are to be avoided.

XI. Higher Order Thinking Skills (HOTS)

1. What is the role of fat in the cause of atherosclerosis ?

- Atherosclerosis is a disease in which plaque builds up inside your arteries.

- Plaque is made up of fat, cholesterol, calcium, and other substances found in the blood.

- Over time, plaque hardens and narrows your arteries.

- It leads to sudden ischemia (deficient blood supply to heart muscle) and myocardial infarction (death of the heart muscle tissue).

2. Eating junk food and consuming soft drinks results in health problems like obesity, still children prefer. What are the suggestions you would give to avoid children eating junk food/ consumption of soft drinks?

- These foods are high in sugar and fats and low in nutritional value. It is important to eat more balanced, whole foods and avoid junk food.

- These healthy eating habits will improve their physical, emotional and mental growth and development now and even in their adult years.

3. Regular physical exercise is advisable for normal functioning of human body. What are the advantages of practising exercise in daily life?

- Reduce the risk of heart attack.

- Manage your weight better.

- Have a lower blood cholesterol level.

- Lower the risk of type 2 diabetes and some cancer.

- Have lower blood pressure.

- Have stronger bones, muscles and joints and lower risk of developing disorders.

4. A leading weekly magazine has recently published a survey analysis which says that number of AIDS patient in the country is increasing day by day. The report says that the awareness among the people about AIDS is still very poor. You are discussing the magazine report in your class and a team of your class decides to help people to fight against the dreadful disease.

a) What problem do you face when trying to educate the people in your village near by your school?

b) How do you overcome the problem?

- We are all trained enough to see things objectively and not emotionally.

- People think that we are still not matured enough to talk about sex.

- Girls especially feel embarrassed to talk to people as they are abused by words and looks, while spreading the knowledge of awareness on AIDS.

- Based on structural training in seeing the cause and result of AIDS objectively, it is possible to overcome the issue.

- Ignorance will be more dangerous to adolescent people than knowledge of cause and effects of deadly disease AIDS.

XII. Value based questions

1. **Once a person starts taking drugs or alcohol it is difficult to get rid of the habit. Why?**

   Persons who consume these drugs become fully dependent on them, they cannot live without drugs.

   - It does by switching on brain circuits that makes one feel wonderful or feel good.
   - Physical addiction occurs once a person is unable to stop drinking because of anxiety, shakiness and on the more extreme end, seizures, severe shaking, confusion and hallucinations.
   - At a chemical level, it hits multiple areas in the brain and at a psychological level, they are unable to function without it.

2. **Men addicted to tobacco lead to oxygen deficiency in their body. What could be the possible reason?**

   Carbon monoxide of tobacco smoke binds to haemoglobin of RBC and decreases its oxygen carrying capacity causing hypoxia in body tissues.

3. **Name any three foods that are to be avoided and included in the diet of a diabetic patient. Why should it be followed?**

   - Flax seeds containing insoluble fibre, Guavas, Tomatoes and Spinach are foods which help reduce blood sugar levels.
   - Refined sugars (sucrose and glucose) should be avoided. Diet comprising whole grains, millets (jowar, bajra, ragi), green leafy vegetables, wheat and unpolished rice should be included in diet regularly.
   - Saturated fat intake should be reduced.

4. **How can informational efforts change people's HIV knowledge and behaviour?**

   - By screening of blood from blood banks for HIV before transfusion.
   - Ensuring the use of disposable needles and syringes in hospitals and clinics.
   - Having safe sex and using condoms.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **This is the most common pancreatic endocrine disorder.**
   a) AIDS
   b) Carcinoma
   c) Cancer
   d) Diabetes mellitus

2. **It spreads through contact of body fluids or blood.** ✳
   a) Diabetes mellitus
   b) Obesity
   c) Carcinomas
   d) AIDS

3. **Lack of co-ordination of body organs is due to**
   a) Diabetes mellitus
   b) Alcohol consumption
   c) Drug addiction
   d) Tobacco smoking

4. **Bronchitis and pulmonary tuberculosis is due to**
   a) Tobacco smoking
   b) Alcohol consumption
   c) Drug addiction
   d) Diabetes mellitus

5. **Emphysema is caused due to _____**
   a) Diabetes mellitus
   b) Alcohol consumption
   c) Drug addiction
   d) Tobacco smoking

6. **Liver cirrhosis is due to** ✶
   a) Diabetes mellitus
   b) Alcohol consumption
   c) Drug addiction
   d) Tobacco smoking

7. **Destruction of β-cells of the pancreas causes**
   a) Drug addiction
   b) Alcohol consumption
   c) Type-1 diabetes mellitus
   d) Type-2 diabetes mellitus

8. **_____ or "good" cholesterol lowers risk of heart disease.** ✶
   a) HDL
   b) LDL
   c) Salt
   d) Sugar

9. **_____ can be controlled by diet, exercise and medicine.**
   a) Drug addiction
   b) Alcohol consumption
   c) Type-1 diabetes mellitus
   d) Type-2 diabetes mellitus

Ans:

1.	d)	Diabetes mellitus	6.	b)	Alcohol consumption
2.	d)	AIDS	7.	c)	Type-1 diabetes millitus
3.	b)	Alcohol consumption	8.	a)	HDL
4.	a)	Tobacco smoking	9.	d)	Type - 2 diabetes mellitus.
5.	d)	Tobacco smoking			

II. State whether True or False, if false write the correct statement

1. **May 31st is observed as No Tobacco Day.** ✶   **True**

2. **Cardiovascular disease (CVD) is associated with diseases of the Liver.**   **False**
   Cardiovascular disease (CVD) is associated with diseases of the heart and blood vessels.

3. **Low calorie, normal protein, vitamins and mineral, restricted carbohydrate and fat, high fibre diet can prevent cancer.**   **False**
   Low calorie, normal protein, vitamins and mineral, restricted carbohydrate and fat, high fibre diet can prevent obesity.

4. **Obesity results from inadequate insulin secretion.** ✶   **False**
   Hyperglycemia results from inadequate insulin secretion

5. **UV rays cause DNA damage leading to cancer.**   **True**

6. **Desirable level for blood sugar should be less than 200 mg/dl.**   **False**
   Desirable level for blood cholesterol should be less than 200 mg/dl

7. **Malignant tumours are the cells which grow very rapidly and invade the surrounding cells.**   **True**

III. Match the following

1) Hypercholesterolemia	– a) Interferons	(c)
2) Hypertenstion	– b) AIDS	(d)
3) Oncology	– c) High cholesterol	(e)
4) Immunotherapy	– d) High blood pressure	(a)
5) ELISA	– e) Cancer	(b)

IV. Fill in the blanks

1. The dependence of alcohol is called _____ .

2. Plaque leads to the narrowing of blood vessels leading to _____. ✳

3. Heavy smoking causes _____ cancer.

4. Excessive exposure to sunlight may cause _____ cancer.

5. Cancer causing viruses are called _____viruses.

6. _____ arise from epithelial and glandular tissues.

7. _____ occur in the connective and muscular tissue.

8. _____ are called blood cancers.

9. _____ are characterized by an increase in the formation of white blood cells in the bone marrow and lymph nodes.

10. Cancer causing agents are called _____.

11. Excess hunger is called as _____.

12. Polydipsia is increased _____. ✳

13. Increased urine output is called as _____ .

14. Insulin production by the pancreas is normal but its action is impaired is seen in _____.

15. _____ is abnormal increase in body weight.

Ans:

1.	Alcoholism	9.	Leukaemia
2.	Atherosclerosis	10.	Carcinogens
3.	Lung	11.	Polyphagia
4.	Skin	12.	Thirst
5.	Oncogenic	13.	Polyurea
6.	Carcinomas	14.	Type-2 Non-Insulin Dependent Diabetes mellitus.
7.	Sarcomas	15.	Obesity
8.	Leukaemia		

Don

V. Assertion and Reasoning

In each of the following questions, a statement of Assertion is given and a corresponding Statement of Reason is given just below it. Of statements given below mark the correct answer as

  a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

  b) If both Assertion and Reason are true that Reason is not the correct explanation of Asssertion

  c) Assertion is true but Reason is false

  d) Both Assertion and Reason are false

1. **Assertion:** When tobacco smoke is inhaled, the chemicals get absorbed by tissues and causes harmful effects.

    Reason: Benzopyrene and polycyclic hydrocarbons present in tobacco smoke carcinogenic causing lung cancer.

      Ans. a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

2. **Assertion:** Obesity is abnormal increase in body weight.

    Reason: Obesity is a complex multi factorial chronic disease developing from the influence of social, behavioural, Psychological, Metabolic and cellular factors.

      Ans. a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion

VI. Answer in a sentence

1. **What is snuffing?**

    When **powdered tobacco** is taken **through nose**, it is called snuffing.

2. **Name the plant from which the tobacco plant is obtained.**

    Tobacco is obtained from the tobacco plant *Nicotiana tobaccum* and *Nicotiana rustica.*

3. **Name the radiations which cause cancer.**

    Ionizing radiations like X-rays, gamma- rays, radioactive substances and non-ionising radiations like UV rays cause DNA damage leading to cancer.

4. **Name the chemical agents which cause cancer.**

    Nicotine, caffeine, products of combustion of coal and oil, pesticides, asbestos, nickel, certain dyes and artificial sweetners induce cancer.

5. **Name the tests for AIDS.**

    Western Blot analysis or Enzyme Linked Immunosorbent Assay (ELISA)

6. **How is coronary heart disease formed?**

    Coronary heart disease is formed by the **deposition of cholesterol** in the blood vessels.

7. **What is AIDS?**

    AIDS is a severe viral disease and is caused by Human Immunodeficiency Virus **(HIV).**

8. **What is the desirable cholesterol level?**

Desirable level for blood cholesterol should be **less than 200 mg/dl** for Indians.

VII. Short answer questions

1. **What are the objectives of POCSO Act?**
   - Objectives of the POCSO Act, 2012
       - a. To **protect children** from the offences of sexual assault
       - b. Sexual harassment
       - c. Pornography
   - To **establish Special Courts** for speedy trial of such offences.

2. **What is addictive drug?** ✶
   - A drug that modifies the physical, biological, psychological or social behaviour of a person by stimulating, depressing or disturbing the functions of the body and the mind is called addictive drug.
   - These drugs interact with the central nervous system and affect the individual physically and mentally.

3. **What are psychotropic drugs?**
   - There are certain drugs called psychotropic drugs which acts on the brain and alter the behaviour, consciousness, power of thinking and perception.
   - They are referred as mood altering drugs.

4. **What is detoxification?**
   - The drug is stopped gradually and the addict is helped to overcome the withdrawl symptoms.
   - The addict undergoes severe physical and emotional disturbance.
   - This is taken care by specific medication.

5. **What is drug dependence? Mention the types.** ✶
   - Persons who consume these drugs become fully dependent on them, they **cannot live without drugs.** This condition is referred as drug dependence.
   - **Physical and mental dependence:** Dependence on the drug for normal condition of well being and to maintain physiological state.
   - **Psychological dependence:** It is a feel that drugs help them to reduce stress.

6. **What is Psychotherapy?**

Individual and group counselling is given by psychologists and counsellors to the addicts. The treatment includes efforts to reduce the addict's stress, taught new ways to solve everyday's problems, adequate diet, rest and relaxation.

7. **What is Rehabilitation?**

Addicts are given proper vocational training so that they can lead a healthy life and become useful members of the society.

8. **Write short notes on carcinoma.**

Carcinomas arise from **epithelial and glandular tissues**. They include cancers of skin, lung, stomach and brain. About **85%** of the **tumours** are **carcinomas.**

9. What is Sarcoma? ✶

- Sarcoma is a type of cancer which occurs in the connective and muscular tissue.
- They include the cancer of bones, cartilage, tendons, adipose tissue and muscles.
- These form **1%** of all tumours.

10. What is Leukaemia?

- Leukaemia are characterized by an **increase** in the formation of **white blood cells** in the bone marrow and lymph nodes.
- Leukaemia are called blood cancers.
- Most common type of cancer which also affect children **below 15 years** of age.

11. What is carcinogen? Mention their types.

Cancer causing agents are called carcinogens. They are physical, chemical agents, ionizing radiations and biological agents.

12. What is immunotherapy?

Interferons are used to **activate the immune system** and help in destroying the tumours.

13. What is Benign tumour?

Benign tumours or Non malignant tumours which remain confined in the organ affected and do not spread to other parts of the body.

14. What is Malignant tumour? ✶

Malignant tumours are mass of proliferating cells which grow very rapidly invading and damaging the surrounding normal tissues.

15. What is chemotherapy?

Chemotherapy involves **administration of anticancerous drugs** which prevent cell division and are used to kill cancer cells.

16. What is radiation therapy?

Tumour cells are irradiated by lethal doses of radiation while protecting the surrounding normal cells.

17. How is the presence of HIV confirmed?

The presence of HIV virus can be confirmed by **Western Blot analysis** or **Enzyme Linked Immunosorbent Assay** (ELISA).

18. What is cancer? ✶

Cancer is an abnormal and uncontrolled division of cells that invade and destroy surrounding tissue forming a tumour or neoplasm.

19. What is obesity?

Obesity is the state in which there is an **accumulation** of **excess body fat** with an abnormal increase in body weight.

VIII. Long answer questions

1. What are the adverse effects of drug on adolescents?

Adverse effects of drug use among adolescents are:

- Drop in academic performance, absence from school or college.
- Lack of interest in personal hygiene, isolation, depression, fatigue and aggressive behaviour.
- Deteriorating relationship with family and friends.
- Change in food and sleeping habits.

- Fluctuation in body weight and appetite.
- Always looking out for an easy way to get money for obtaining drugs.
- Prone infections like AIDS and Hepatitis-B.

2. Explain the harmful effects of tobacco. ✴

When smoke is inhaled, the chemicals get absorbed by the tissues and cause the following harmful effects:

- Benzopyrene and polycyclic hydrocarbons present in tobacco smoke is carcinogenic causing lung cancer.
- Causes inflammation of throat and bronchi leading to conditions like bronchitis and pulmonary tuberculosis.
- Inflammation of lung alveoli, decrease surface area for gas exchange and cause emphysema.
- Carbon monoxide of tobacco smoke binds to haemoglobin of RBC and decreases its oxygen carrying capacity causing hypoxia in body tissues.
- Increased blood pressure caused by smoking leads to increased risk of heart disease.
- Causes increased gastric secretion which leads to gastric and duodenal ulcers.
- Tobacco chewing causes oral cancer (mouth cancer).

3. What are the harmful effects of alcohol?

Prolonged use of alcohol depresses the nervous system, by acting as a sedative and analgesic substance. Some of the harmful effects are:

- Nerve cell damage resulting in various mental and physical disturbances.
- Lack of co-ordination of body organs.
- Blurred or reduced vision, results in road accidents.
- Dilation of blood vessels which may affect functioning of the heart.
- Liver damage resulting in fatty liver which leads to cirrhosis and formation of fibrous tissues.
- Body loses its control and consciousness eventually leading to health complications and ultimately to death.

4. What are the symptoms of AIDS?

- Infected individuals become immunodeficient.
- The person becomes more susceptible to viral, bacterial, protozoan and fungal infections.
- Swelling of lymph nodes, damage to brain, loss of memory, lack of appetite and weight loss, fever, chronic diarrhoea, cough, lethargy, pharyngitis, nausea and headache.

5. How will you control and prevent the spreading of HIV? ✴

The following steps may help in controlling and prevent the spreading of HIV infection.

- Screening of blood from blood banks for HIV before transfusion.
- Ensuring the use of disposable needles and syringes in hospitals and clinics.
- Advocating safe sex and advantages of using condoms.
- Creating awareness campaign and educating people on the consequences of AIDS.
- Persons with HIV/AIDS should not be isolated from the family and society

◀◀◀◀◀◀ ◉ ▶▶▶▶▶▶

Unit Test - 21

Health and Diseases

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. Tobacco consumption is known to stimulate secretion of adrenaline. The component causing this could be
   a) Nicotine   b) Tannic acid   c) Curcumin   d) Leptin

2. Cancer cells are more easily damaged by radiations than normal cells because they are
   a) Different in structure   b) Non-dividing
   c) Mutated Cells   d) Undergoing rapid division

3. Cancer of the epithelial cells is called
   a) Leukemia   b) Sarcoma   c) Carcinoma   d) Lipoma

4. Metastasis is associated with
   a) Malignant tumour   b) Benign tumour
   c) Both (a) and (b)   d) Crown gall tumour

5. Bronchitis and pulmonary tuberculosis is due to
   a) Tobacco smoking   b) Alcohol consumption
   c) Drug addiction   d) Diabetes mellitus

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. What are the objectives of POCSO Act?
2. What are psychotropic drugs?
3. Write short notes on carcinoma?
4. What is immunotherapy?
5. What is AIDS and how is it caused?

III. Answer the following questions in brief.   2 × 4 = 8

1. What is drug dependence? Mention the types.
2. What is carcinogen? Mention their types.

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Suggest measures to overcome the problems of an alcoholic.
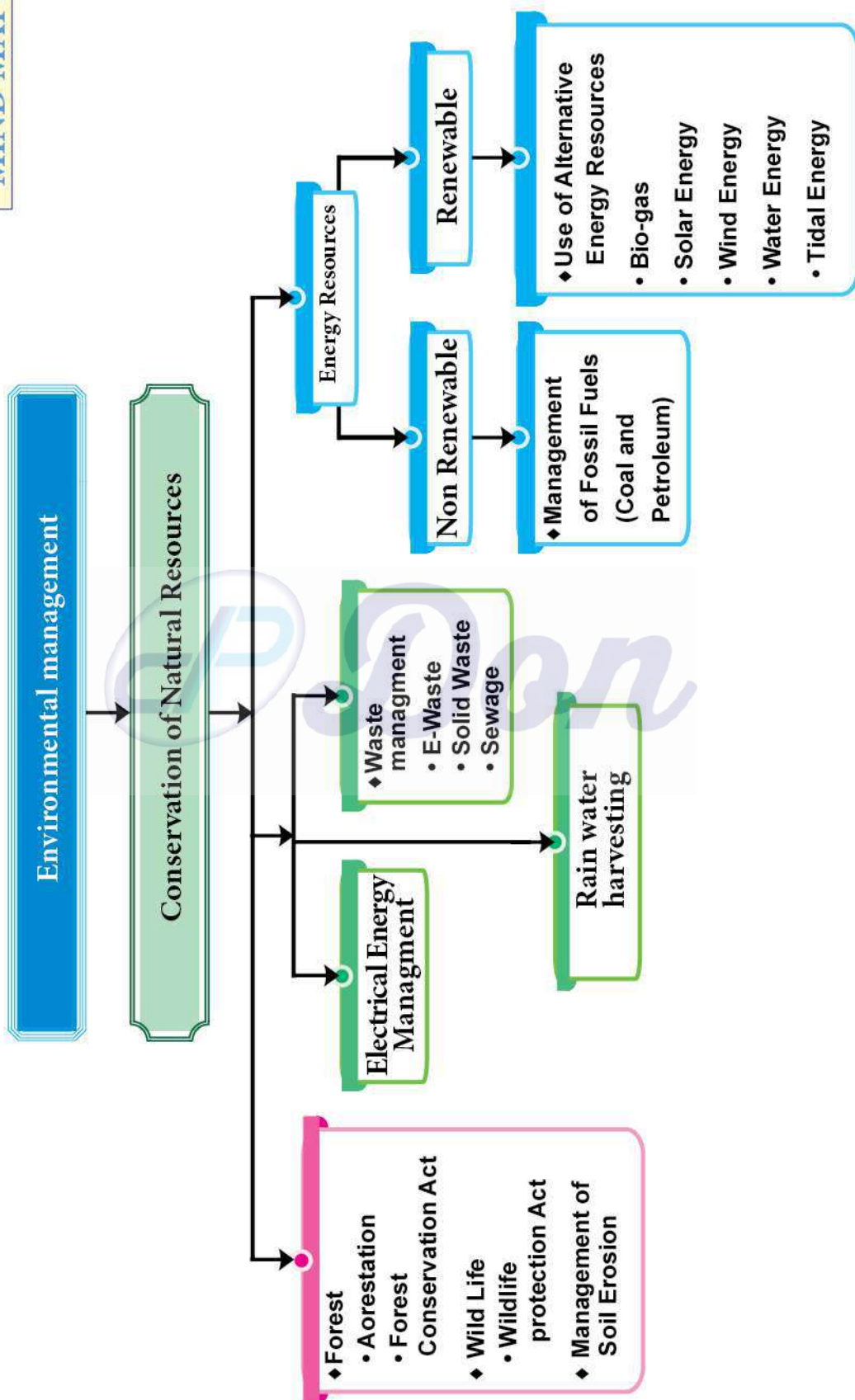   ii) What is the role of fat in the cause of atherosclerosis ?

Non-renewable energy resource	:	Limited - short period
Renewable energy resource	:	Unlimited amount
Fossil fuels	:	Anaerobic decomposition of buried organisms
Alternative energy sources	:	1. Solar energy, 2. Biogas, 3. Wind energy, 4. Water energy, 5. Tidal energy
Sewage management	:	Sewage water results in agriculture contamination and environmental degradation.
Solid waste management	:	Segregation, sanitary landfill, incineration composting
3R approach	:	Reduce, Reuse, Recycle
Habitat	:	The natural home of an animal, plant or other organism.
Resources	:	All the land, forests, energy sources and minerals existing naturally in a place that can be used by people.
Conservation	:	Protection of plants and animals, natural areas, important buildings from the damaging effects of human activity.
Soil erosion	:	Displacement of upper layer of soil from one place to another.
Shale	:	Soft finely stratified sedimentary rock that is formed from the comtraction of small old rocks containing mud and minerals.
Solar cells	:	Solar energy device for harvesting sun's energy
Biogas or Gobar gas	:	Gas produced by decomposition of animal wastes (cow dung) and plant wastes in the absence of oxygen.
Afforestation	:	Planting and protecting trees.

MIND MAP

Don

Environmental management

Conservation of Natural Resources

Energy Resources

Renewable

- Use of Alternative Energy Resources
  - Bio-gas
  - Solar Energy
  - Wind Energy
  - Water Energy
  - Tidal Energy

Non Renewable

- Management of Fossil Fuels (Coal and Petroleum)

Waste managment
- E-Waste
- Solid Waste
- Sewage

Electrical Energy Managment

Rain water harvesting

Forest
- Aorestation
- Forest Conservation Act
- Wild Life
- Wildlife protection Act
- Management of Soil Erosion

Wild life	:	Wild life refers to the undomesticated animals living in their natural habitats (forests, grasslands and deserts) an area without human habitation.
Solar energy	:	Energy obtained from the sun.
Wind energy	:	The energy got by converting the kinetic energy of wind into mechanical power by wind turbines.
Tidal energy	:	Tidal energy is the energy obtained from the bulk movement of water due to ocean tides.
Rainwater harvesting	:	Rain water harvesting is a techique of collecting and storing rainwater for future use.
Ooranis	:	These are small ponds to collect rainwater.
Incineration	:	It is the buring of non-biodegradable solid wastes (medical wastes) in properly constructed furnace at high temperature.
National Park	:	National park is a reserved area for the conservation of entire wildlife including plants and animals.
Sanctuary	:	Sanctuary is a place reserved exclusively for the use of animals.

Scienctists and Inventions:

Rathika Ramasamy - First Indian woman to strike an International reputation as Wildlife photographer

Textbook Evaluation

I. Fill in the blanks

1. Deforestation leads to _____ in rainfall. ✶✶

2. Removal of soil particles from the land is called _____. ✶

3. Chipko movement is initiated against _____ .

4. _____ is a biosphere reserve in Tamilnadu.

5. Tidal energy is _____ type of energy.

6. Coal, petroleum and natural gas are called _____ fuels.

7. _____ is the most commonly used fuel for the production of electricity. ✶✶

Ans:

1.	Decrease	4.	Nilgiris	6.	Fossil
2.	Soil erosion	5.	Electrical	7.	Bio-gas
3.	Deforestation				

II. State whether True or False. Correct the statements which are false

1. **Biogas is a fossil fuel.** ✹✹ **False**
   Bio-gas is produced by the decomposition of animal wastes and plant wastes in the absence of oxygen.

2. **Planting trees increases the groundwater level.** **True**

3. **Habitat destruction cause loss of wild life.** **True**

4. **Nuclear energy is a renewable energy.** ✹✹ **True**

5. **Overgrazing prevents soil erosion.** **False**
   Overgrazing causes soil erosion.

6. **Poaching of wild animals is a legal act.** **False**
   Poaching of wild animals is an illegal act

7. **National park is a protected park.** **True**

8. **Wild life protection act was established in 1972.** **True**

III. Match the following

1) Soil erosion	- a) Energy saving	(c)
2) Bio gas	- b) Acid rain	(d)
3) Natural gas	- c) Removal of vegetation	(f)
4) Green house gas	- d) Renewable energy	(b)
5) CFL bulbs	- e) O_2	(a)
6) Wind	- f) Non-renewable energy	(e)
7) Solid waste	- g) Lead and heavy metals	(g)

IV. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **Which of the following is / are a fossil fuel?**
   i. Tar   ii. Coal   iii. Petroleum
   a) i only   **b)** i and ii   **c)** ii and iii   **d)** i, ii and iii

2. **What are the steps will you adopt for better waste management?**
   a) reduce the amount of waste formed   **b)** reuse the waste
   c) recycle the waste   **d)** all of the above

3. **The gas released from vehicles exhaust are** ✹✹
   i. carbon monoxide   ii. Sulphur dioxide   iii. Oxides of nitrogen
   a) i and ii   **b)** i and iii   **c)** ii and iii   **d)** i, ii and iii

4. **Soil erosion can be prevented by**
   a) deforestation
   b) afforestation
   c) over growing
   d) removal of vegetation

5. **A renewable source of energy is**
   a) petroleum
   b) coal
   c) nuclear fuel
   d) trees

6. **Soil erosion is more where there is**
   a) no rain fall
   b) low rainfall
   c) rain fall is high
   d) none of these

7. **An inexhaustible resources is**
   a) wind power
   b) soil fertility
   c) wild life
   d) all of the above

8. **Common energy source in village is**
   a) electricity
   b) coal
   c) biogas
   d) wood and animal dung

9. **Green house effect refers to** ✴ ✴
   a) cooling of earth
   b) trapping of UV rays
   c) cultivation of plants
   d) warming of earth

10. **A cheap, conventional, commercial and inexhaustible source of energy is**
    a) hydropower
    b) solar energy
    c) wind energy.
    d) thermal energy

11. **Global warming will cause**
    a) raise in level of oceans
    b) melting of glaciers
    c) sinking of islands
    d) all of these

12. **Which of the following statement is wrong with respect to wind energy?**
    a) Wind energy is a renewable energy
    b) The blades of wind mill are operated with the help of electric motor
    c) Production of wind energy is pollution free
    d) Usage of wind energy can reduce the consumption of fossil fuels

Ans:

1.	c)	ii and iii	2.	d)	All of the above	3.	d)	i, ii, and iii
4.	a)	afforestation	5.	d)	Trees	6.	b)	High rainfall
7.	d)	All of the above	8.	c)	bio-gas	9.	d)	Warming of earth
10.	b)	Wind energy	11.	d)	All of these.			
12.	b)	The blades of windmill are operated with the help of electric motor						

V. Assertion and Reasoning

1. **In each of the following question a statement of assertion(A) is given and a corresponding statement of reason (R). Of the four statements given below mark the correct answer.**

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

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

   c) Assertion is true but reason is false.

   d) Both assertion and reason are false.

1. **Assertion:** Rainwater harvesting is to collect and store rain water.
   Reason: Rainwater can be directed to recharge the underground water source.
   > **Ans:** (a) Both assertion and reason are true and reason is correct explanation of assertion.

2. **Assertion:** Energy efficient bulbs like CFL must be used to save electric energy.
   Reason: CFL bulbs are costlier than ordinary bulbs, hence using ordinary bulbs can save our money.
   > **Ans:** (a) Both assertion and reason are true and reason is correct explanation of assertion.

VI. Answer in a sentence

1. What will happen if trees are cut down?

Floods, drought, soil erosion loss of wild life and desertification will be caused by cutting down of trees.

2. What would happen if the habitat of wild animals is disturbed? ✸ ✸

If the habitat of wild animals is disturbed it affects the biological diversity and revenue through tourism.

3. What are the agents of soil erosion? ✸ ✸ ✸

Agents of soil erosion are high velocity of wind, air currents, flowing water, landslide, human activities, overgrazing by cattle.

4. Why fossil fuels are to be conserved?

1. Non – renewable energy.
2. Formation of these fuels is a very slow process and takes very long period of time for renewal.

5. Solar energy is a renewable energy. How? ✸ ✸

The sun gets its energy through nuclear fusion. In this reaction Hydrogen atoms fused to form Helium atom. As a result huge energy is radiated on the surface of the sun. This reaction is repeated again and again resulting in the energy output continuously.
$$4H^1 \rightarrow {}_2He^4 + 2 + {}_1e^0 + energy.$$
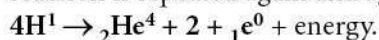
6. How are e-wastes generated?

Electronic wastes are generated from the spoiled, outdated, non – repairable electrical and electronic devices such as computers, calculator, toys etc.

VII. Short answer questions

1. What is the importance of rainwater harvesting? ✸ ✸ ✸

- Overcome the rapid depletion of **ground water levels**.
- To meet the increase demand of water.
- **Reduce flood** and **soil erosion.**
- Used for **drinking purpose.**

2. What are the advantages of using biogas?

- It burns without smoke and therefore causes **less pollution**.
- An excellent way to get rid of organic wastes like **bio-waste** and sewage material.
- Left over slurry is a good manure **rich** in **nitrogen** and **phosphorus.**
- It is safe and **convenient** to use.
- It can reduce the amount of **green house gases** emitted.

3. **What are the environmental effect caused by sewage?**
   - Untreated sewage or wastewater generated from domestic ad industrial process is the leading polluter of water sources in India.
   - Sewage pollute water source in India. Sewage water results in **agricultural contamination** and **environmental degradation**

4. **What are the consequences of deforestation?** ✷ ✷
   Deforestation gives rise to ecological problems like floods, drought, soil erosion, loss of wild life, extinction of species, imbalance of biogeochemicals, alternation of climatic conditions and desertification.

X. Long answer questions

1. **How does rainwater harvesting structures recharge ground water?** ✷ ✷ ✷
   Methods of Rain water harvesting:

   i) Roof top rainwater harvesting:
   - Roof tops are excellent rain catches.
   - The rain water that falls on the roof of the houses, apartments commercial buildings, etc is collected and stored domestic purpose.

   ii) Recharge pit:
   - In this method, the rainwater is first collected from the roof tops or open spaces and is directed into the percolation pits through pipes for filtration.
   - After filtration the rainwater enters the recharge pits or ground wells.

2. **How will you prevent soil erosion?**
   Prevent soil erosion:
   - Retain vegetation cover, so that soil is not exposed.
   - Cattle grazing should be controlled.
   - Crop rotation and soil management.
   - Reforestation, terracing and contour ploughing
   - Wind speed can be controlled by planting trees of a shelter belt

3. **What are the sources of solid wastes? How are solid wastes managed?**
   Sources of solid wastes:
   1. Municipal wastes
   2. Hospital wastes
   3. Industrial wastes
   4. e - wastes

   Solid waste management:
   Solid-waste management involves the **collection, treatment** and **proper disposing** of solid material that is discarded from the household and industrial activities.

   Methods of solid wastes disposal:

   i) Segregation:
   It is the separation of different type of waste materials like biodegradable and non biodegradable wastes.

   ii) Sanitary landfill:
   - Solid wastes are dumped into low lying areas.
   - The layers are compacted by trucks to allow settlement.

- The waste materials get stabilized in about 2 -12 months.
- The organic matter undergoes decomposition.

iii) Incineration:

It is the **burning** of **nonbiodegradable** solid wastes (medical wastes) in properly constructed furnace at high temperature.

iv) Composting:

Biodegradable matter of solid wastes is digested by microbial action or earthworms and converted into **humus.**

4. Enumerate the importance of forest. ✳ ✳ ✳

- Forests are an important component of our environment.
- Forest is dominated by
    - i) microorganisms
    - ii) flowering plants
    - iii) shurubs
    - iv) climbers
    - v) dense trees
    - vi) provide a vast habitat for wild animals.
- Forests also contribute to the economic development of our country.
- Forests are vital for human life.
- It is a source for a wide range of renewable natural resource.
- They provide wood, food, fodder, fibre and medicine.
- Forest are major factor of environment concern like,
    - i) carbon sink
    - ii) regulae climatic conditions
    - iii) increase rainfall
    - iv) reduce global warming
    - v) prevent natural hazards like food and landslides
    - vi) protect wildlife
    - vii) act as catchments for water conservation.
- They also play a vital role in maintaining the ecological balance.

5. What are the consequences of soil erosion? ✳ ✳

- The top layers of soil contain humus and mineral salts, which are vital for the growth of plants.
- Removal of upper layer of soil by wind and water is called soil erosion.
- Soil erosion causes a significant loss of humus, nutrients and decrease the fertility of soil.
- The direct and primary effect of soil erosion is soil loss and nutrient leaching resulting in reduction of land productivity.
- Annual floods causes damages to crops, property and lives.
- Deforested rain forest soil becomes dry and nutrient- deficient as there is no longer vegetation to hold water and nutrients in place.
- Heavy rains further erode soil and saturate waterways with excess nutrients, distrupting the food chains of tropical ecosystems.
- Eroded sediments can even change the course of rivers, which suffer from huge deposits of silt from deforestation.
- Desertification is another possible consequence of erosion.

6. **Why is the management of forest and wildlife resource considered as a challenging task?** ✴

   • Management of forest and wild life resource is considered as a challenging task.
   • Now-a-days people are continuously cutting down trees and it causes deforestation and it results in lack of oxygen.
   • People kill animals for making cloth designs and thus harm wildlife.

XI. Higher Order Thinking Skills (HOTS)

1. **Although coal and petroleum are produced by degradation of biomass, yet we need to conserve them. Why?**

   • Coal and petroleum are natural resource, formed from the degradation of biomass buried deep under the earth millions of years ago.
   • The formation of these fossil fuels is a very slow process and takes very long period and for renewal. So we need to conserve them.

2. **What are the objectives for replacing non-conventional energy resources from conventional energy resources?**

   • The objective of this kind of energy is to replace the use of fossil fuels which are mainly made of hydrocarbons and hence result in pollution.
   • Renewable source of energy do not result in pollution and we can reuse them.
   • We all need to shift to these resource of energy and try to avoid usage of fossil fuels.

3. **Why is the Government imposing ban on the use of polythene bags and plastics? Suggest alternatives. How is this ban likely to improve the environment?**

   Problems associated with plastic bags, use of non-renewable resources, causes difficulties during disposal and affects environmental impacts:

   Alternatives:

   • Wooden Cutlery
   • Muslin pouches
   • Glass Bottles
   • Canvas Bag
   • Metal straws

   Ban plastic in order to save and preserve the environment and reduce the production of Green house gases.

XII. Value based questions

1. **Why is it not possible to use solar cells to meet our energy needs? State three reason to support your answer.**

   • In the solar cells, the solar panels convert solar energy into electricity which is stored in storage battery.
   • These can be installed in remote and inacessible areas (forest and hilly region) where setting up of power plant is expensive.

2. **How would you dispose the following wastes?**
   a.Domestic wastes like vegetable peels,
   b.Industrial wastes like metallic cans, Can the disposal protect the environment? How?

   a) For domestic wastes- we can have a compost pit. As vegetable waste is dumped in the pit, they rot and become manure.

b) Metallic can - method - Recycle

c) Yes, this disposal method protects the environment because recycling saves energy. It also reduce green house gas emissions which helps to tackle climate change.

3. List any three activities based on 3R approach to conserve natural resources.

The 3R approach such as Reduce, Reuse and Recycle are followed for effective waste management.

Additional Questions

I. Fill in the blanks

1. There are _____ biosphere reserves in India.

2. Removal of _____ by wind and water is called soil erosion. ✴

3. When the tides hit the turbine, the turbine rotates and converts the _____ energy into electrical energy.

4. _____ is a source for a wide range of renewable natural resource.

5. _____ was a non – violent agitation that was aimed at protection and conservation of trees and forest.

6. _____ includes planting and protecting trees which help in restoration of green forest. ✴

7. The first established National Park in India is _____.

8. _____ is the first Indian woman wild life photographer.

9. _____ is used in artificial satellites and space props.

10. _____ can reduce the amount of green house gases emitted.

11. The world's largest and tallest wind turbine is in _____.

12. _____ is the e - waste that affect brain development in children. ✴

Ans:

1.	15	5.	Chipko movement	9.	Solar cell
2.	Upper layer of soil	6.	Van mahotsav	10.	bio gas
3.	tidal	7.	Jim Corbett National park	11.	Hawaii
4.	Forest	8.	Rathika Ramasamy	12.	Lead

III. Match the following

1. 1) Forest conservation Act - a) 1972 ✴ (c)
    2) The wildlife protection Act - b) 215.1 lakhs hectare (a)
    3) Reserved forests - c) 1980 (d)
    4) Protected forests - d) 752.3 lakhs hectare (b)

2. 1) Lead   - a) Chronic damage to brain   (d)
    2) Chromium   - b) Accumulates in kidney and liver   (c)
    3) Cadmium   - c) Asthmatic bronchitis   (b)
    4) Mercury   - d) Damages central and   (a)
                                peripheral nervous system

IV. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. **India is losing about _____ hectare of forest cover every year.**
    a) 1 Million   b) 1.5 Million   c) 2 Million   d) 2.5 Million

2. **Wild life refers to the undomesticated animals living in their natural habitats**
    a) forests   b) grasslands   c) deserts   d) all the above

3. **_____ is a biosphere reserves in Tamilnadu.**
    a) Nilgiris   b) Covai   c) Ooty   d) Chennai

4. **E-waste include computer components which may be_____.** ✴
    a) 12%   b) 7%   c) 66%   d) 5%

5. **Medical wastes are disposed by _____ method.**
    a) Segregation   b) Sanitary landfill   c) Incineration   d) Composting

6. **The fourth oldest dam in the world is _____.**
    a) Methur Dam   b) Kallanai Dam
    c) Manimutharu Dam   d) Papanasam Dam

7. **Solar cells are made up of _____ that converts sunlight directly into electricity**
    a) Silicon   b) copper   c) Lead   d) Iron ✴✴

8. **_____ causes chronic damage to brain and respiratory system.**
    a) Lead   b) Chromium   c) Mercury   d) Polyvinyl chloride

Ans:

1.	b)	1.5 Million	4.	c)	66%	7.	a)	Silicon%
2.	d)	all the above	5.	c)	Incineration	8.	c)	Mercury
3.	a)	Nilgiris	6.	b)	Kallanai Dam			

V. Assertion and Reasoning

1. **In each of the following question a statement of assertion(A) is given and a corresponding statement of reason (R). Of the four statements given below mark the correct answer.**
    a) Both assertion and reason are true and reason is correct explanation of assertion.
    b) Both assertion and reason are true but reason is not the correct explanation of assertion.
    c) Assertion is true but reason is false.
    d) Both assertion and reason are false.

3. **Assertion:** Energy obtained from sources that cannot renew themselves over a short period of time.

    Reason: These are available in limited amount in nature

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

4. **Assertion:** Petrol and diesel which are used to run automobiles.

    Reason: Using pressure cooker can reduce the consumption of kerosene.

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

VI. Answer in a sentence

1. **Name the gases which pollute the air that affect the Taj Mahal**
    Sulphur and nitrogen Oxides.

2. **How can we reduce the use of Kerosene and LPG?** ✱
    - by using pressure cooker.
    - using solar cooker and heater wherever possible.

3. **In India what are the main agents of water pollution?**
    Household activities and industrial wastage of water.

4. **How are the suspended particles removed from the waste water?**
    By sedimentation process

5. **What is called 3 R method?** ✱
    For effective waste management the 3 R's are
    - Reduce
    - Reuse
    - Recycle

6. **How is biogas produced?**
    Bio gas is produced by the **anaerobic decomposition** of cow dung.

VII. Short answer questions

1. **Define Deforestation.**
    Deforestation is the **destruction** of large area of forests.

2. **What is afforestation?** ✱
    It includes **planting and protecting** trees with multiple uses.

3. **Write the aims of wildlife management.**
    - To control and limit exploitation of species.
    - Preserve the endangered species.

4. **What are the agents of soil erosion?**
    High velocity of wind, air currents, flowing water, landslides, human activities.

5. **What is solar energy?**

Solar energy is the energy obtained from the sun.

6. **Write the advantages of wind energy.** ✳
   - It does not cause pollution.
   - Expenses on periodic maintenance is low when compared to the other power sources.

7. **Write about E-wastes.**

E-wastes are electronic wastes which includes the spoiled, outdated, non-repairable electrical and electronic devices.

8. **Why are fossil fuels to be conserved?**

The formation of these fossil fuels is a **very slow process** and takes very long period of time for renewal.

9. **What is meant by hydroelectricity?** ✳

Hydropower plants converts the **kinetic energy** of flowing water into **electricity.** This is called hydroelectricity.

10. **What are the sources of sewage/ waste water?**

Domestic purpose or household activities, dye and textile industries, leather industries, sugar and breweries industries, paper and pulp industries.

VIII. Long answer questions

1. **Write about some solar energy devices.** ✳

   Solar Cells
   - Solar cells (Photovoltaic devices) is made up of silicon that converts sunlight directly into electricity.
   - Solar cell produces electricity without polluting the environment.

   Solar Panel
   - Arrangement of many solar cells side by side connected to each other is called solar panel.
   - The capacity to provide electric cuurent is much increased which is very expensive.

   Solar Cooker
   - It consist of an insulated metal box or wooden box which is painted from inside so as to absorb maximum solar radiations.
   - A thick glass sheet forms the cover over the box. The reflector is the plane mirror which is attached to the box.
   - The food is cooked by energy radiated by the sun.

   Solar thermal power plant
   - In solar thermal power plants, many solar panels are used to concentrate sun rays, to heat up water into steam.
   - The steam is used to run the turbines to produce electricity.

2. **You are a student how will you save electricity at home and school.**

   I can take the following measures to save electricity at home and school.
   - Use energy efficient appliances to save electricity like compact fluorescent lamps (CFL), LED bulbs and other electrical equipments

- Switch off the lights and fans, television and other electrical appliances when not in use.
- Minimize the use of air conditioners.
- Switch of the mobile phone chargers when not in use.
- Maximize the use of solar radiations

3. Write the steps involved in waste water treatment methods.

1. Pre-screening: Wastewater generated from domestic and industrial activities is screened to remove soil and solid particulates.

2. Aeration: Screened wastewater is then pumped to an aeration tank.

3. Sedimentation process: In this process, the solid particles in suspension form are allowed to settle. The particles that settle out from the suspension is known as sludge.

4. Sludge removal: The sludge generated by the degradation process is transferred periodically from the tank for safe disposal.

5. Disinfection: Chlorination and ultraviolet (UV) radiation of treated water is required to remove any micro - organism contamination.

6. Water recycling: The water will then be supplied for domestic or industrial purposes.

IX. Higher Order Thinking Skills (HOTS)

1. If recycling is not done in the environment what will be the condition?
- Harmful chemicals and greenhouse gases are released from rubbish in land fill sites.
- Recycling helps to reduce the pollution caused by waste.
- Recycling reduces the necessity for raw materials so that the rain forest can be preserved.

2. Why is e-waste bad?
- Informal processing of e-waste in developing countries can lead to adverse human health effects and environmental pollution.
- Electronic scrap components such as CPUs contain lead, cadmium, etc.

3. Are wind turbines more efficient than solar panels?
- On smaller scale system, turbines can be a good alternative to solar power but more often than not is achievements their best when implemented together with a solar system.
- A small wind turbines can generate electricity in a breeze even when the sun is not shining, while the solar modules can generate electricity.

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Unit Test - 22
Environmental Management

Time : 1 hr   **Marks : 30**

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. The gas released from vehicles exhaust are
   i. Carbon monoxide   ii. Sulphur dioxide   iii. Oxides of nitrogen
   a) i and ii   b) i and iii   c) ii and iii   d) i, ii and iii

2. Soil erosion can be prevented by
   a) deforestation   b) afforestation
   c) over growing   d) removal of vegetation

3. A renewable source of energy is
   a) petroleum   b) coal   c) nuclear fuel   d) trees

4. Green house effect refers to
   a) cooling of earth   b) trapping of UV rays
   c) cultivation of plants   d) warming of earth

5. A cheap, conventional, commercial and inexhaustible source of energy is
   a) hydropower   b) solar energy   c) wind energy.   d) thermal energy

II. Answer the following questions in one or two lines.   5 × 2 = 10
1. What are the advantages of using biogas?
2. What are the environmental effect caused by sewage?
3. What are the consequences of deforestation?
4. Write the aims of wildlife management?
5. What are the agents of soil erosion?

III. Answer the following questions in brief.   2 × 4 = 8
1. Enumerate the importance of forest.
2. Why is the management of forest and wildlife resource considered as a challenging task?

IV. Answer the following questions in detail.   1 × 7 = 7
1. i) What are the consequences of soil erosion?
   ii) Although coal and petroleum are produced by degradation of biomass, yet we need to conserve them. Why?
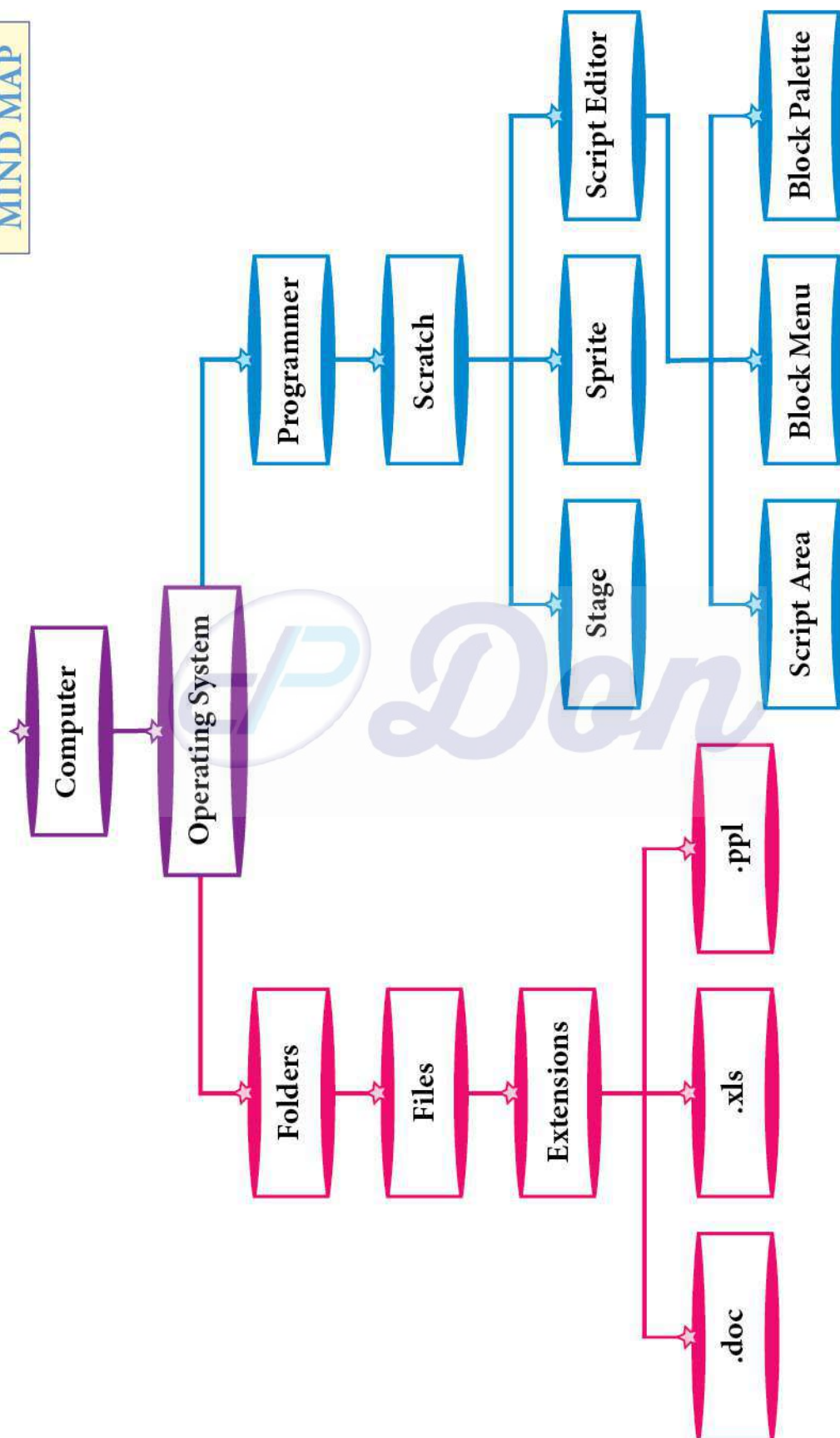
23

Visual Communication

- Computer is an electronic device.

- Computer is a combination of hardware and software.

- Different kinds of files graphic and text.

- A folder also called directory.

- A folder does not have extension like a file.

- Scratch is a computer programming language.

- Scratch is one of the easiest computer applications.

- Sound block is used to add sound in the project.

- It was developed in the MIT.

- The scratch editor has three main parts, stage, sprite, script editor.

- Stage is a working area. It is a term for the background of the project.

- Sprite is images on the scratch computer program screen.

- Script editor is used to edit the program.

- Script area assembles the script.

- To import the sound editor click the import button, only use mp3 and wav files.

Scratch history.

Scratch is developed by the LIFELONG KINDER GARTEN group of media lab of MIT, which was leaded by Mitchel Resnick released in 2003.

MIND MAP

Computer — Operating System

Operating System — Programmer — Scratch

Scratch — Stage
Scratch — Sprite — Script Editor
Sprite — Block Menu — Block Palette
Block Menu — Script Area

Operating System — Folders — Files — Extensions

Extensions — .doc
Extensions — .xls
Extensions — .ppl

Textbook Evaluation

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Which software is used to create animation? ✵ ✵
   a) Paint   b) PDF   c) Ms Word   d) Scratch

2. All files are stored in the _____
   a) folder   b) box   c) pai   d) scanner

3. Which is used to build scripts?
   a) Script area   b) Block palette   c) Stage   d) Sprite

4. Which is used to edit programs? ✵ ✵
   a) Inkscape   b) Script editor   c) Stage   d) Sprite

5. Where will you create category of block?
   a) Block palette   b) Block menu   c) Script area   d) Sprite

Ans:

1.	d)	Scratch	4.	b)	Script editor
2.	a)	Folder	5.	b)	Block menu
3.	a)	Script area			

II. Match the following.

1.
   1) Script area   -   a) Type notes   (e)
   2) Folder   -   b) Animation software   (d)
   3) Scratch   -   c) Edit programs   (b)
   4) Costume editor   -   d) Store files   (c)
   5) Notepad   -   e) Build scripts   (a)

III. Short Answer questions:

1. What is Scratch? ✵ ✵

Scratch is a software used to **create animations, cartoons** and **games** easily. Scratch, on the other hand, is a **visual programming language**. It is developed in the Massachusetts Institute of Technology (MIT). Media Lab to make **programming easier** and more fun to learn.

2. Write a short note on editor and its types? ✵ ✵

The script editor where you **edit programs** or your sprites pictures. The script editor has three main parts l. Script area 2. Block menu 3. Block palette.

3. What is Stage?

Stage is the **background** appearing when we open the **scratch window.** The background will most often be white. You can change the background colour as you like.

4. What is Sprite?

The **characters** on the **background** of a Scratch window are known as Sprite. Usually a cat appears as a sprite when the Scratch window is opened. The software provides facilities to make alternations in sprite.

Additional Questions

I. Choose the most suitable answer from the given four alternatives and write the option code and corresponding answer:

1. Stage is the _____
   a) Block palette   b) Block menu   c) Script area   d) Background area

2. Click the green flag at the top _____ corner.
   a) right   b) left   c) down   d) up

3. From _____ menu choose the save option.
   a) File->Save   b) Edit -> Save   c) Home -> Save   d) Insert-> Save

4. The right pane also contains _____ additional tabs. ✳
   a) One   b) Two   c) Three   d) Four

5. The costume editor has _____ panes.
   a) One   b) Two   c) Three   d) Four

6. MIT means _____ ✳
   a) Massachusetts Institute Technology
   b) Management Institute Technology
   c) Message Institute Technology.
   d) Massachusetts Indian Technology.

Ans:

1.	d)	Background area	4.	b)	Two
2.	a)	right	5.	c)	Three
3.	a)	File->save	6.	a)	Massachusetts Institute Technology

II. Match the following.

1) Accept date	- a) Ctrl+s	(e)
2) Linux	- b) Visual animation	(d)
3) Save	- c) x: 0 y: 0	(a)
4) Scratch	- d) Operating system	(b)
5) Drag a go to	- e) Input	(c)

III. Short Answer questions:

1. What is file? ✳
   The output we get from any application is commonly referred as file.

2. What is file or folder?
   A folder is a **storage space** that contains multiple files.

3. What is block palette?
   Where you choose the block to use. When the costumes tab is chosen, the costume editor is shown (outlined in red).

4. **What are Scratch Environment Editor types?**

The scratch editor has **three** main parts. They are Stage, Sprite, Script editor.

5. **What are the various parts of costume editor?** ✴

The **costume editor** has three main parts. They are Script area, Block menu, Block palette,

IV. Long answer questions:

1. Explain the scratch? ✴

- Scratch is a software used to **create animations cartoons** and **games** easily.
- Scratch on the other hand is a **visual programming language.**
- It was developed in the Massachusetts Institute Technology (MIT).
- Media Lab to make **programming easier** and more fun to learn.
- Scratch Environment Editor.

The Scratch editor has three main types. They are

1. **Stage**
2. **Sprite**
3. **Script editor**

STAGE:

- Stage is the **background** appearing when we open the **scratch window.**
- The background will most often be white. You can change the background colour as you like.

SPRITE:

- The **characters** on the **background** of a Scratch window are known as Sprite.
- Usually acat appears as a Sprite when the Scratch window is opened.
- The software provides facilities to make alternations in sprite.

Script editor :

- Where you **edit** your **programs** or your sprites pictures .
- A single window with at least the following three panes : the Stage (top left), the Sprite list bottom left and the Script tab (right), the right plane also contains two additional tabs. Costumes and Sounds.

The script editor has **three** main parts.

1. **Script area.**
2. **Block menu.**
3. **Block palette.**

Script area:

Where you **build** scripts.

Block menu:

Where you choose the **category of block** (programming statements) to use.

Block palette:

Where you choose the block to use. Where the costumes tab is chosen, the Costume editor is shown (Out lined in red)

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Unit Test - 23

Visual communication

Time : 1 hr   Marks : 30

I. Choose the most suitable answer and write the code with the corresponding answer.   5 × 1 = 5

1. Which software is used to create animation?
   a) Paint   b) PDF   c) Ms Word   d) Scratch

2. All files are stored in the............
   a) Folder   b) Box   c) Pai   d) Scanner

3. Which is used to edit programs?
   a) Inscape   b) Script editor   c) Stage   d) Sprite

4. Where you will create category of block?
   a) Block palette   b) Block menu   c) Script area   d) Sprite

5. Stage is the..............
   a) Block palette   b) Block menu   c) Script area   d) Background area

II. Answer the following questions in one or two lines.   5 × 2 = 10

1. What is Scratch?
2. Write a short note on editor and its types.
3. What is Stage?
4. What is Sprite?
5. What is file?

III. Answer the following questions in brief.   2 × 4 = 8

1. Expand the following i) .PDF, ii) .DLC
2. How can we save data and information in computer?

IV. Answer the following questions in detail.   1 × 7 = 7

1. i) Write a short notes on script editor.

   ii) Which is important Hardware or Software?