1 Laws of Motion

CONCEPT MAP

Motion

Related to

Law of Motion | **Displacement, Speed, Velocity, Acceleration**

Law of Motion:
- **Newton's First Law of Motion** — describes → **Inertia**
- **Newton's Second Law of Motion** — explains → **Rate of change of momentum**
- **Newton's Third Law of Motion** — Relation between → **Action and Reaction force**

Law of conservation of momentum — corollary

Displacement, Speed, Velocity, Acceleration:
- **Uniform Motion**
- **Non Uniform Motion** — can be:
  - **Uniform Acceleration**
  - **Non Uniform Acceleration**

Uniform Acceleration — Calculated using → **Newton's Equation of Motion**

Newton's Equation of Motion:

I	II	II
$v = u + at$	$s = ut + \dfrac{1}{2}at^2$	$v^2 = u^2 + 2as$

MASTER KEY QUESTION SET - 1

Q.1. Fill in the blanks and rewrite the complete statements:

(1) .... is a relative concept.

(2) A body is said to be in motion if it changes its .... with respect to its surroundings.

(3) A body is said to be at .... if it does not change its position with respect to its surroundings.

(4) .... is the length of the actual path travelled by an object in motion while going from one point to another.

(5) The distance covered by a body in unit time is called its ....

(6) S.I. unit of speed is .... and C.G.S unit is ....

(7) The distance travelled in a particular direction by an object in unit time is called its ....

(8) Unit of speed and velocity are the ....

(9) .... is related to distance, while .... is related to displacement.

(10) If an object covers equal distances in equal time intervals, it is said to be moving with .... speed.

(11) If an object covers unequal distances in equal time intervals, it is said to be moving with .... speed.

(12) The rate of change of velocity is called ....

(13) Speed of light in dry air is .... m/s.

(14) When velocity of a body increases its .... is positive.

(15) When velocity of a body .... , its acceleration is negative .

(16) Negative acceleration is also called .... or ....

(17) In case of .... motion, object travels equal .... in equal intervals of time.

(18) Motion of an object was studied by ....

(19) When an object moves in a circular path with uniform speed, its motion is .... motion.

(20) When a coin moves along a circular path, the direction of its motion at every point is ....

(21) For all uniformly accelerated motions, the velocity-time graph is a ....

(22) In the distance-time graph, the slope of the straight line indicates ....

(23) The first equation of motion gives relation between .... and time.

(24) Newton's first law explains the phenomenon of ....

(25) .... causes a change in the state of an object at rest or in uniform motion.

(26) To describe momentum we must specify its .... and ....

(27) .... is the product of mass and velocity of an object.

(28) The rate of change of momentum is proportional to the applied ....

(29) S.I. unit of momentum is ....

(30) .... is always conserved in a collision.

(31) When a bullet is fired from the gun, the gun moves in backward direction. This motion is called as ....

(32) In CGS, the unit of force is ....

Ans. *(1) Motion (2) position (3) rest (4) distance (5) speed (6) m/s , cm/s (7) velocity (8) same (9) speed, velocity (10) uniform (11) non-uniform (12) acceleration (13) 3 × 10⁸ (14) acceleration (15)*

decreases (16) deceleration, retardation (17) uniform, distances (18) Newton (19) uniform circular (20) tangential (21) straight line (22) velocity (23) velocity (24) inertia (25) unbalanced forces (26) mass, velocity (27) Momentum (28) unbalanced force (29) kg m/s (30) Total momentum (31) recoil (32) dyne

Q.2. Rewrite the following statements by selecting correct options given below:

(1) Even if the displacement of an object is zero, the actual distance traversed by it ....

    (a) may not be zero.   (b) will be zero

    (c) will be constant   (d) will be infinity

(2) The displacement that occurs in unit time is called ....

    (a) displacement   (b) distance

    (c) velocity   (d) acceleration

(3) If the velocity changes by equal amounts in equal time intervals, the object is said to be in ....

    (a) uniform acceleration

    (b) uniform velocity

    (c) non-uniform acceleration

    (d) non-uniform motion

(4) The unit of velocity in the SI system is ....

    (a) cm/s (b) m/s^2 (c) cm/s^2 (d) m/s

(5) $v^2 = u^2 + 2as$ is the relation between .... and ....

    (a) speed and velocity

    (b) distance and acceleration

    (c) displacement and velocity

    (d) speed and distance

(6) If an object is moving with a uniform velocity ....

    (a) its speed remains the same, but direction of motion changes

    (b) its speed changes but direction of motion is same

    (c) its speed and direction both change

    (d) its speed and direction both remain the same

(7) .... is the relation between displacement and time.

    (a) $v = u + at$ (b) $v^2 = u^2 + 2as$

    (c) $s = ut + \dfrac{1}{2}at^2$ (d) $v = u + 2as$

(8) ....is an example of positive acceleration.
(a) A stone is thrown vertically upwards
(b) A stone falls freely towards the earth
(c) Brakes are applied by the truck driver
(d) The train arriving at the station

(9) An object continues to remain at rest or in a state of uniform motion along a straight line unless an .... acts on it.
(a) internal unbalanced force
(b) external unbalanced force
(c) internal balanced force
(d) external balanced force

(10) The .... is proportional to the applied force and it occurs in the direction of the force.
(a) change of momentum
(b) rate of change of velocity
(c) change of velocity
(d) rate of change of momentum

(11) The force necessary to cause an acceleration of 1 m/s² in an object of mass 1 kg is called ....
(a) 1 dyne   (b) 1 m/s   (c) 1 newton   (d) 1 cm/s

Ans. *(1) may not be zero (2) velocity (3) uniform acceleration (4) m/s (5) displacement and velocity (6) its speed and direction both remain the same (7) $s = ut + \dfrac{1}{2} at^2$ (8) A stone falls freely towards the earth (9) external unbalanced force (10) rate of change of momentum (11) 1 newton.*

Q.3. **State whether the following statements are true or false and if false, write the correct statement:**

(1) The velocity of a body is given by the distance covered by it in unit time in a given direction.

Ans. **True**

(2) Displacement is a scalar quantity.

Ans. **False,** Displacement is a vector quantity as it has both magnitude and direction.

(3) Uniform acceleration means that the body is moving with a uniform velocity.

Ans. **False,** In uniform acceleration, velocity changes by equal amounts in equal time interval.

(4) The direction of acceleration can be opposite to that of velocity.

Ans. **True**

(5) Work is a vector quantity.

Ans. **False,** work is a scalar quantity as it doesn't depend upon direction.

(6) Displacement is always greater than distance.

Ans. **False,** dispalcement is equal to or less than distance covered.

(7) The distance and displacement are equal only if motion is along a straight path.

Ans. **True**

(8) If an object experiences acceleration, a force is acting on it.

Ans. **True**

(9) A train pulling out from a station is in uniform motion.

Ans. **False,** A train pulling out from station is in non- uniform motion.

(10) If a bus in motion is suddenly stopped, the passengers fall backwards.

Ans. **False,** If bus is stopped , passengers will fall in the front.

(11) If a single force is acting on an object, it will always accelerate.

Ans. **True**

(12) In circular motion, direction of motion is tangential.

Ans. **True**

(13) The inertia of a body is measured in terms of its mass.

Ans. **True**

*Q.4. **(A) Match the first column with appropriate entries in the second and third columns and remake the table:**

Column 'I'	Column 'II'	Column 'III'
(1) Negative acceleration	The velocity of the object remains constant	A car, initially at rest reaches a velocity of 50 km/hr in 10 seconds.
(2) Positive acceleration	The velocity of the object decreases	A vehicle is moving with a velocity of 25 m/s.
(3) Zero acceleration	The velocity of the object increases	A vehicle moving with the velocity of 10 m/s, stops after 5 seconds.

Ans.

Column 'I'	Column 'II'	Column 'III'
(1) Negative acceleration	The velocity of the object decreases	A vehicle moving with the velocity of 10 m/s, stops after 5 seconds.
(2) Positive acceleration	The velocity of the object increases	A car, initially at rest reaches a velocity of 50 km/hr in 10 seconds.
(3) Zero acceleration	The velocity of the object remains constant	A vehicle is moving with a velocity of 25 m/s.

(B) Complete the following table:

Column 'I'	Column 'II'	Column 'III'
(1) Newton's first law of motion	Describes the relationship between the forces on two interacting object.	In a high jump athletic event, the athletes are made to fall on a sand bed.
(2) Newton's second law of motion	Gives an idea of effects of force	Motion of rocket
(3) Newton's third law of motion	Also called as law of inertia	Only the carrom coin at the bottom of a pile is removed when a fast moving stricker hits it.

Ans.

Column 'I'	Column 'II'	Column 'III'
(1) Newton's first law of motion	Also called as law of inertia	Only the carrom coin at the bottom of a pile is removed when a fast moving striker hits it.
(2) Newton's second law of motion	Gives an idea of effects of force	In a high jump athletic event, the athletes are made to fall on a sand bed.
(3) Newton's third law of motion	Describes the relationship between the forces on two interacting object.	Motion of rocket

(C) Match the following:

(1)	Column 'A'	Column 'B'
(1)	Speed zero	(a) Distance
(2)	Negative acceleration	(b) Body at rest
(3)	Displacement	(c) Retardation
(4)	Always positive	(d) vector quantity

Ans. *(1-b), (2-c), (3-d), (4-a)*

(2)	Column 'A'	Column 'B'
(1)	When body comes to rest at the end of the motion	(a) Acceleration is zero
(2)	When body is at rest at the starting of motion	(b) Initial velocity is zero
(3)	Uniform circular motion	(c) Final velocity is zero
(4)	Uniform velocity	(d) Electrons revolve around the nucleus

Ans. *(1-c), (2-b), (3-d), (4-a)*

(3)	Column 'A'	Column 'B'
(1)	Inertia	(a) Newton's second law
(2)	Rate of change of momentum	(b) Body at rest
(3)	Balanced force	(c) Newton's first law
(4)	Force equation	(d) Mass × velocity
		(e) Mass × acceleration

Ans. *(1-c), (2-a), (3-b), (4-e)*

*(D) Complete the following table:

u(m/s)	a(m/s²)	t(sec)	$v = u + at$ (m/s)
2	4	3	-
-	5	2	20

u(m/s)	a(m/s²)	t(sec)	$s = ut + \dfrac{1}{2}at^2$ (m)
5	12	3	-
7	-	4	92

u(m/s)	a(m/s²)	s(m)	$v^2 = u^2 + 2as$ (m/s)²
4	3	-	8
-	5	8.4	10

Ans.

u(m/s)	a(m/s²)	t(sec)	$v = u + at$ (m/s)
2	4	3	**14**
10	5	2	20

u(m/s)	a(m/s²)	t(sec)	$s = ut + \dfrac{1}{2}at^2$ (m)
5	12	3	**69**
7	**8**	4	92

u(m/s)	a(m/s²)	s(m)	$v^2 = u^2 + 2as$ (m/s)²
4	3	**8**	8
4	5	8.4	10

Q.5. Name the following:

(1) The scientist who summarized motion in a set of equations of motion.

Ans. Isaac Newton

(2) Motion of an object along a circular path with uniform speed.

Ans. Uniform circular motion

(3) What is the backward motion of the gun called?

Ans. Recoil

(4) The motion in which the object covers equal distance in equal intervals of time.

Ans. Uniform motion

(5) S. I. unit of acceleration.

Ans. m/s²

(6) CGS unit of momentum

Ans. g cm/s

*Q.6. Complete the sentences and explain them:

*(1) The minimum distance between the start and finish points of the motion of an object is called the .... of the object.

Ans. Displacement: The minimum distance between the start and finish points of the motion of an object is called the Displacement of the object.

*(2) Deceleration is .... acceleration.

Ans. Negative : In deceleration the velocity of the body goes on decreasing, hence it is called as negative acceleration.

*(3) When an object is in uniform circular motion, its .... changes at every point.

Ans. Direction : In uniform circular motion the speed is constant along the circumference but its direction at every point is tangential.

*(4) During collision .... remains constant.

Ans. Total momentum : Law of conservation of momentum : Total final momentum is equal to total initial momentum.

*(5) The working of a rocket depends on Newton's .... law of motion.

Ans. Third : The escaping gases exerts an equal and opposite reaction on the rocket so that it gets propelled in the forward direction.

Q.7. Answer the following in one or two sentences:

(1) When is acceleration said to be positive?

Ans. When the velocity of a body increases, the acceleration is in direction of velocity and hence acceleration is said to be positive.

(2) What is negative acceleration?

Ans. When the velocity of a body decreases, the acceleration is in opposite direction of velocity and hence acceleration is said to be negative acceleration.

(3) What is the direction of velocity of an object performing uniform circular motion?

Ans. The direction of velocity of an object performing uniform circular motion is along the tangential direction to its position.

(4) Give the mathematical expression used to determine velocity of an object moving with uniform circular motion.

Ans. Velocity = $\dfrac{\text{circumference}}{\text{time}}$

$\therefore\ v = \dfrac{2\pi r}{t}$ is the expression used to determine velocity of a body moving with uniform circular motion.

(5) What kind of force keeps the body at rest?

Ans. Balanced force keeps the body at rest.

(6)   Which law of motion gives the measure of force?

Ans.   Newton's second law of motion gives the measure of force.

Q.8.   Define the following / state the laws:

(1)   Displacement:

Ans.   Displacement is the minimum distance between the starting and finishing points.

(2)   Velocity:

Ans.   The displacement that occurs in unit time is called velocity.

(3)   Acceleration:

Ans.   The rate of change of velocity is called acceleration.

(4)   Retardation:

Ans.   When velocity of a body decreases, acceleration is negative. Negative acceleration is called deceleration or retardation.

(5)   Newton's first law of motion:

Ans.   'An object continues to remain at rest or in a state of uniform motion along a straight line unless an external unbalanced force acts on it.'

(6)   Newton's second law of motion:

Ans.   'The rate of change of momentum of a body is proportional to the applied force and this change in momentum occurs in the direction of the applied force.'

(7)   Newton's third law of motion:

Ans.   'Every action force has an equal and opposite reaction force which acts simultaneously.'

(8)   Momentum:

Ans.   It is the product of mass and velocity of an object.

(9)   Law of conservation of momentum:

Ans.   'When two objects collide, the total momentum before collision is equal to the total momentum after collision.'

(10)   1 newton:

Ans.   The force necessary to cause an acceleration of 1 m/s^2 in an object of mass 1 kg is called 1 newton. 1 N = 1 kg × 1 m/s^2

(11)   1 dyne:

Ans.   The force necessary to cause an acceleration of 1 cm/s^2 in an object of mass 1 gm is called 1 dyne. 1 dyne = 1 g × 1 cm/s^2

Q.9.   Distinguish between:

*(1)   Distance and Displacement:

Distance	Displacement
(1) Distance is the length of the actual path travelled by an object in motion while going from one point to another.	(1) Displacement is the minimum distance between the starting and finishing points.
(2) It is a scalar quantity.	(2) It is a vector quantity.
(3) It is either equal to or greater than displacement.	(3) It is either equal to or less than distance.
(4) Distance travelled is always positive.	(4) Displacement may be positive or negative or zero.

*(2)   Uniform motion and non-uniform motion.

Uniform motion	Non-uniform motion
(1) If an object covers equal distances in equal intervals of time it is said to be in uniform motion.	(1) If an object moves unequal distances in equal intervals of time, its motion is said to be non-uniform.
(2) Distance - time graph for uniform motion is a straight line.	(2) Distance - time graph for uniform motion is not a straight line.
(3) In uniform motion, acceleration is zero.	(3) In non-uniform motion, acceleration is non zero.

(3)   Speed and velocity.

Speed	Velocity
(1) Speed is the distance covered by a body per unit time.	(1) The displacement that occurs in unit time is called velocity.
(2) It is a scalar quantity.	(2) It is a vector quantity.
(3) Speed is always positive.	(3) Velocity can be positive or negative.
(4) Speed = $\dfrac{distance}{time}$	(4) Velocity = $\dfrac{displacement}{time}$

(4) **Balanced force and Unbalanced force.**

Balanced force	Unbalanced force
(1) Two equal forces applied on a body in the opposite direction.	(1) Two unequal forces applied on a body.
(2) This force does not change the state of rest or the state of uniform motion	(2) This force can change the state of rest or the state of uniform motion of a body in a straight line.

Q.10. **Obtain the equations of motion by graphical method:**

(a) **Equation for velocity-time relation.**

Ans.

Velocity-time graph: shows the change in velocity with time of a uniformly accelerated object. The object starts from the point D in the graph with velocity v. Its velocity keeps increasing and after time t. It reaches the point B on the graph.

The initial velocity of the object = u = OD
The final velocity of the object = v = OC
Time = t = OE
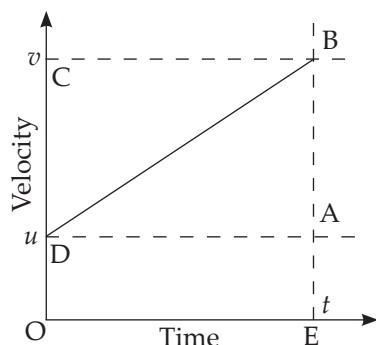
Acceleration (a) = $\dfrac{\text{Change in velocity}}{\text{Time}}$

$= \dfrac{\text{(Final velocity – Initial velocity)}}{\text{Time}}$

$= \dfrac{\text{(OC – OD)}}{t}$

$\therefore$ CD = at \qquad ...(i) (OC – OD = CD)

From the graph \qquad ... BE = AB + AE

$\therefore$ v = CD + OD \qquad ...(AB = CD and AE = OD)

$\therefore$ v = $at + u$ \qquad ... (from i)

$\therefore$ v = $u + at$

This is the first equation of motion.

(b) **Equation for displacement-time relation.**

Ans.

Suppose that on object in uniform acceleration 'a' and it has covered the distance 's' within

time 't'. Form the graph the distance covered by the object during time 't' is given by the area of quadrangle DOEB.

$\therefore$ s = area of quadrangle DOEB

$\quad$ = area (rectangle DOEA) + area of triangle (DAB)

$\therefore$ $\quad = (AE \times OE) + (\dfrac{1}{2} \times [AB \times DA])$

But, AE = u, OE = t and (OE = DA = t)

AB = at ...(AB = CD) ..... from (CD = at)

$\therefore$ $s = u \times t + \dfrac{1}{2} \times at \times t$

$\therefore$ Newton's second equation of motion is

$s = ut + \dfrac{1}{2} at^2$.

(c) **Equation for displacement-velocity relation.**

Ans.

We can determine the distance covered by the object time t from the area of the quadrangle DOEB. DOEB is a trapezium. So we can use the formula for its area.

$\therefore$ s = area of trapezium DOEB

$\therefore$ $s = \dfrac{1}{2} \times$ sum of lengths of parallel sides $\times$ distance between the parallel sides

$\therefore$ $s = \dfrac{1}{2} \times (OD + BE) \times OE$
$\quad\quad$ But, OD = u, BE = v, and OE = t

$\therefore$ $s = \dfrac{1}{2} \times (u + v) \times t$ \qquad ...(ii)

But, $a = \dfrac{(v - u)}{t}$

$\therefore$ $t = \dfrac{(v - u)}{a}$ \qquad ...(iii)

$\therefore$ $s = \dfrac{1}{2} \times (u + v) \times \dfrac{(v - u)}{a}$

$\therefore$ $s = \dfrac{(u + v)(v - u)}{2a}$

$\therefore$ $2as = (u + v)(v - u) = v^2 - u^2$

$\therefore$ $v^2 = u^2 + 2as$

this is Newton's third equation of motion.

Q.11. **Give scientific reasons:**

*(1) **When an object falls freely to the ground, its acceleration is uniform.**

Ans.

(i) When the body falls freely on the ground, there are equal changes in velocity of body in equal intervals of time.

(ii) Thus the acceleration of the body is constant.

(iii) Hence, it possesses uniform acceleration.

* **(2)** **Even though the magnitudes of action force and reaction force are equal and their directions are opposite, their effects do not get cancelled.**

Ans.

(i) Action and reaction forces act on different bodies.

(ii) They don't act on the same body, hence they cannot cancel each other's effect.

(iii) Hence, even though the magnitudes of action force and reaction force are equal, they do not cancel each other.

* **(3)** **It is easier to stop a tennis ball as compared to a cricket ball, when both are travelling with the same velocity.**

Ans.

(i) Momentum of an object depends on its mass as well as its velocity.

(ii) Cricket ball is heavier than a tennis ball. Although they are thrown with the same velocity, cricket ball has more momentum than a tennis ball.

(iii) Hence, force required to stop a cricket ball is more than a tennis ball.

(iv) Hence, it is easier to stop a tennis ball than a cricket ball moving with same velocity.

* **(4)** **The velocity of an object at rest is considered to be uniform.**

Ans.

(i) When a body is in a state of rest, it attains a constant velocity.

(ii) A body with constant velocity is said to be in uniform motion.

(iii) Hence, the state of rest is an example of uniform motion.

(5) **Motion is Relative.**

Ans.

(i) A body is said to be in motion if it changes its position with respect to its surrounding.

(ii) Motion of an object depends on the observer, hence a body may appear moving for one person and at the same time at rest for other.

(iii) Hence, motion is relative.

(6) **Newton's first law of motion is called as law of inertia. OR**

Heavier objects offer more inertia.

Ans.

(i) As mass is the quantity of matter in a body, we

need to exert more force to push a heavier body.

(ii) Inertia is related to the mass of the object.

(iii) Hence heavier objects offer more inertia.

(iv) As the same property is described by Newton's first law of motion, so it is called as law of inertia.

(7) **The launching of a rocket is based on Newton's third law of motion.**

Ans.

(i) Newton's third law of motion states that 'Every action force has an equal and opposite reaction force which acts simultaneously.'

(ii) When the fuel in a rocket is ignited, it burns as a result of chemical reaction.

(iii) The exhaust gases escape with a great force through a small opening at the tail end of the rocket.

(iv) It exerts an equal and opposite reaction force on the rocket, due to which the rocket moves in the forward direction. Thus, the principle of launching of rocket is based on Newton's third law of motion.

Q.12. Answer in short:

(1) **Explain the three different ways to change the velocity.**

Ans. As velocity is related to speed and direction, it can be changed by :

(i) changing the speed while keeping the direction constant.

(ii) changing direction while keeping speed constant.

(iii) changing both speed as well as direction of motion.

(2) **Explain what is positive, negative and zero acceleration.**

Ans.

(i) **Positive Acceleration:** When the velocity of an object increases, the acceleration is positive. In this case, the acceleration is in the direction of velocity.

(ii) **Negative Acceleration:** When the velocity of an object decreases with time, it has negative acceleration. Negative acceleration is also called deceleration. Its direction is opposite to the direction of velocity.

(iii) **Zero Acceleration:** If the velocity of the object does not change with time, it has zero acceleration.

(3) **What inference do we draw from the velocity-time graph for a uniformly accelerated motion?**

Ans.

(i) From velocity-time graph we can infer whether velocity changes by equal amounts in equal intervals of time or not.

(ii) Thus, for all uniformly accelerated motion, the velocity - time graph is a straight line and slope of the line gives the acceleration.

(iii) For non-uniformly accelerated motion, velocity-time graph can have any shape according to variation in velocity with respect to time.

(4) **State the three equations of motion and give the relationship explained by them.**

Ans.

(i) $v = u + at$: This is the relation between velocity and time.

(ii) $s = ut + \dfrac{1}{2} at^2$: This is the relation between displacement and time

(iii) $v^2 = u^2 + 2as$: This is the relation between displacement and velocity.

(5) **What are the implications of Newton's Third Law of motion?**

Ans.

(i) Action and reaction are terms that express force.

(ii) These forces act in pairs. One force cannot exist by itself.

(iii) Action and reaction forces act simultaneously.

(iv) Action and reaction forces act on different objects. They do not act on the same object and hence cannot cancel each other's effect.

(6) **Explain recoil and recoil velocity and derive its expression.**

Ans.

(i) Let os consider the example of a bullet fired from a gun. When a bullet of mass m_1 is fired from a gun of mass m_2, its velocity becomes v_1, and its momentum becomes m_1v_1. Before firing the bullet both the gun and the bullet are at rest. Hence, total initial momentum is zero.

(ii) According to the above law, the total final momentum also has to be zero. Thus, the forward moving bullet causes the gun to move backward after firing.

(iii) This backward motion of the gun is called its recoil. The velocity of recoil, v_2, is such that.,
$m_1v_1 + m_2v_2 = 0$ or $v_2 = \dfrac{-m_1}{m_2} \times v_1$

Q.13. **Answer the following in detail:**

(1) **What is speed? State its units and types. Explain instantaneous speed and avg. speed.**

Ans.

(i) The speed of a body is the distance travelled in unit time. The units of speed in CGS systen is cm / s and in SI system is m / s.

(ii) Speed = $\dfrac{\text{distance}}{\text{time}}$

There are two types of speed :

(a) **Uniform speed :** When a body moves equal distance in equal interval of time throughout its motion, it is said to have uniform speed.

(b) **Non-uniform or variable speed :** A body is said to move with variable speed if it covers unequal distances in equal intervals of time.

(iii) The speed of the body at any instant is called instantaneous speed. Average speed is ratio of total distance covered to total time taken.

(2) **What is velocity? State its units and types.**

Ans.

(i) The velocity of a body is the distance travelled by a body in a particular direction in unit time. Thus, rate of change of displacement is called velocity.

(ii) $v = \dfrac{s}{t}$

where : s = displacement; t = time taken;

v = velocity

(MKS units : m/s   CGS units : cm/s)

There are two types of velocities :

(a) **Uniform velocity :** If there is equal displacement taking place in equal interval of time, it is uniform velocity.

(b) **Non-uniform velocity or variable velocity:** If there is unequal displacement in equal intervals of time, it is non-uniform velocity.

(3) **What is acceleration? State its units and types.**

Ans. Acceleration is a rate of change in velocity. It is a vector quantity.

$a = \dfrac{v - u}{t}$

where : v = final velocity; u = initial velocity;

a = acceleration

Units of acceleration in SI system is m / s^2 and CGS system is cm / s^2.

Types of acceleration :

(i) **Uniform acceleration :** If the change in velocity is equal in equal interval of time, the acceleration is uniform acceleration.

(ii) **Non-uniform acceleration :** If the change in velocity is unequal in equal intervals of time, the acceleration is a non-uniform acceleration.

Kinds of acceleration:

(a) Positive acceleration : When the velocity of an object goes on increasing, it is said to have Positive acceleration.

(b) Negative acceleration : When the velocity of an object goes on decreasing, it is said to have negative acceleration or retardation or deceleration.

(c) zero acceleration : If the velocity of the object does not change with time, it has zero acceleration.

(4) Explain Newton's second law of motion and derive the formula .

Ans. Newton's second law explains about change in momentum. It states that 'The rate of change of momentum is proportional to the applied force and the change of momentum occurs in the direction of the force.'

(i) Suppose an object of mass 'm' has an initial velocity 'u'. When a force 'F' is applied in the direction of its velocity for time 't', its velocity becomes 'v'. Then, the total initial momentum of the body = 'mu'. Its final momentum after time t = 'mv'.

(ii) So, the rate of change of momentum

$$= \frac{\text{Change in momentum}}{\text{time}}$$

$$= \frac{mv - mu}{t}$$

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

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

(iii) Hence by Newton's second law of motion, the rate of change of momentum is proportional to the applied force.

$$\therefore \quad ma \propto F$$

$$\therefore \quad F \propto ma$$

$$\therefore \quad F = kma \ (k = \text{Constant of proportionality and it's value is 1).}$$

$$\therefore \quad F = ma$$

(5) State the law of conservation of momentum and derive the formula.

Ans.

(i) Let mass of objects A & B be m_1 & m_2

Let their initial velocity be u_1 & u_2

Let their final velocity be v_1 & v_2

(ii) We know,

$$P = mv$$

Let their initial momentum m_1u_1 and m_2u_2

Let their final momentum m_1v_1 and m_2v_2

(iii) Total initial momentum = $(m_2u_2 + m_1u_1)$

Total final momentum = $(m_2v_2 + m_1v_1)$

(iv) If F_2 is the force that acts on object B,

$$F_2 = -F_1$$

$$\therefore \quad m_2a_2 = -m_1a_1 \qquad ..... \ \because F = ma$$

$$\therefore \quad m_2 \times \frac{v_2 - u_2}{t} = -m_1 \times \frac{v_1 - u_1}{t} \quad ..... \ \because a = \frac{(v-u)}{t}$$

$$\therefore \quad m_2(v_2 - u_2) = -m_1(v_1 - u_1)$$

$$\therefore \quad m_2v_2 - m_2u_2 = -m_1v_1 + m_1u_1$$

$$\therefore \quad (m_2v_2 + m_1v_1) = (m_2u_2 + m_1u_1)$$

i.e. The magnitude of total final momentum = the magnitude of total initial momentum.

Q.14. Graph based questions:

*(1) **Draw the distance-time graph from the table showing the distances covered by a car in fixed time intervals taking 'time' along the X-axis and 'distance' along the Y-axis.**

Time (seconds)	Distance (metres)
0	0
10	15
20	30
30	45
40	60

50	75
60	90
70	105

Ans.

Scale : X axis 1 cm = 10 seconds
Y axis 1 cm = 20 meters
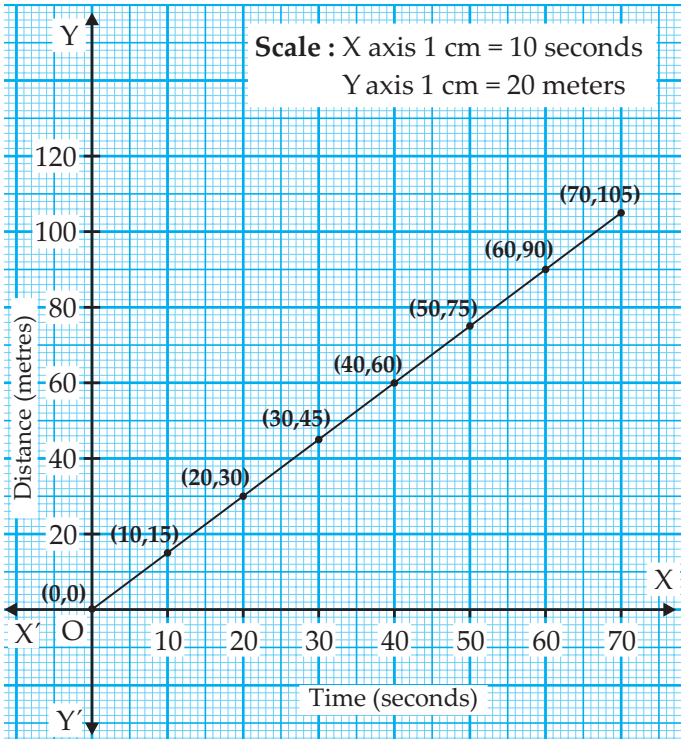
* **(2)** **Draw the distance-time graph from the table showing the distances covered by a bus in fixed time intervals taking 'time' along the X-axis and 'distance' along the Y-axis.**

Does the graph show a direct proportionality between distance and time?

Time (seconds)	Distance (metres)
0	0
5	7
10	12
15	20
20	30
25	41
30	50
35	58

Ans.

Scale : X axis 1 cm = 5 sec
Y axis 1 cm = 10 m
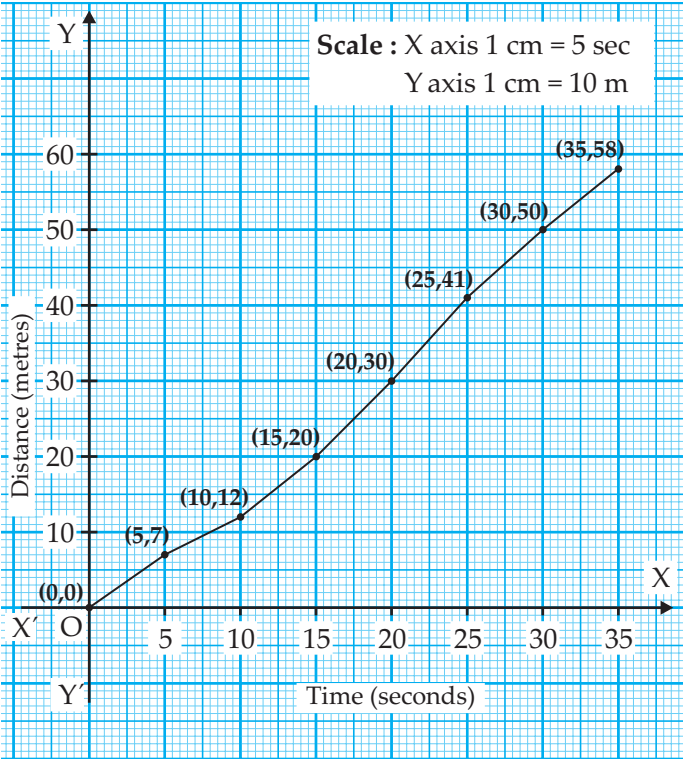
No, the graph does not show a direct proportionality between distance and time. Here, the distance changes non-uniformly with time. Thus the bus is having non-uniform motion.

* **(3)** **A train is moving with a uniform velocity of 60 km/hour for 5 hours. The velocity-time graph for this uniform motion is shown in figure.**

(i) With the help of the graph, how will you determine the distance covered by the train between 2 and 4 hours?

(ii) Is there a relation between the distance covered by the train between 2 and 4 hours and the area of a particular quadrangle in the graph? What is the acceleration of the train?

Velocity - time graph

Time (seconds)	Distance (metres)
0	0
5	8
10	16
15	24
20	32
25	40
30	48
35	56

Ans.
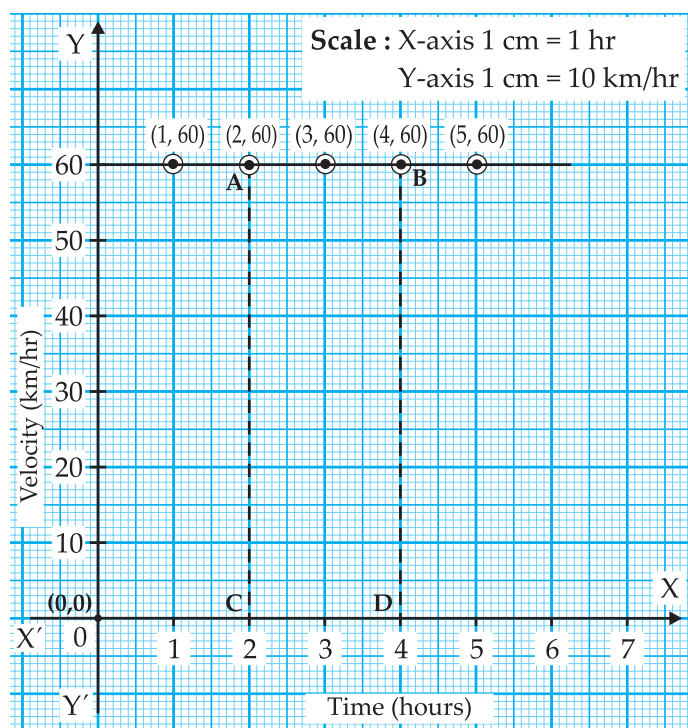
Ans.

(i)   Distance covered   = Velocity × time

                         = 60 × 2

                         = 120 km

Distance covered by the train between 2 and 4 hours is 120 km.

(ii)   Yes, there is a relation between the distance covered by the train between 2 and 4 hours and the area of quadrangle in the graph.

Distance covered = Area of quadrangle (ABDC)

$$= l \times b$$

$$= 60 \times 2$$

$$= 120 \text{ km}$$

$$\text{Acceleration} = \frac{(\text{Final velocity} - \text{Initial velocity})}{\text{time}}$$

$$= \frac{(60 - 60)}{2}$$

$$= \frac{0}{2}$$

$$= 0 \text{ m/s}^2$$

*(4) **In the velocity-time graph for uniform acceleration. The changes in the velocity of a car in specific time intervals are given in the following table.**

(a) **The above graph represents which type of motion?**

Ans. In the above graph, the velocity changes by equal amounts in equal time intervals. Thus, this is uniformly accelerated motion.

(b) **How much does the velocity change in every 5 minutes?**

Ans. The velocity changes by 8m/s in every 5 minutes.

(c) **For all uniformly accelerated motions, what is the shape for velocity-time graph?**

Ans. For all uniformly accelerated motions, the velocity-time graph is a straight line.

(d) **For non-uniformly accelerated motions, what is the shape for velocity-time graph?**

Ans. For non-uniformly accelerated motions, the velocity-time graph may have any shape

depending on how the acceleration changes with time.

(e) **Calculate the distance covered by the car between the 10th and the 20th seconds.**

Ans. For all uniformly accelerated motions, the velocity-time graph is a straight line.

Q.15. Solve the following:

Type - A

Formulae :

(i)   Average speed $= \dfrac{\text{(Total distance covered)}}{\text{Total time taken}}$

(ii)   Average velocity $= \dfrac{\text{(Total displacement)}}{\text{Total time taken}}$

---

*(1) **An athlete is running on a circular track. He runs a distance of 400m in 25 s before returning to his original position. What is his average speed and velocity?**

Ans. **Given :**

Total distance travelled = 400 m

Total displacement = 0, as he returns to his original position.

Total time = 25 seconds.

To find :

Average speed = ?

Average velocity = ?

Formula :

Average speed $= \dfrac{\text{Total distance covered}}{\text{Total time taken}}$

Average velocity $= \dfrac{\text{Total displacement}}{\text{Total time taken}}$

Solution :

Average speed $= \dfrac{\text{Total distance covered}}{\text{Total time taken}}$

$= \dfrac{400}{25}$ = 16 m/s

Average velocity $= \dfrac{\text{Total displacement}}{\text{Total time taken}}$

$= \dfrac{0}{25}$ = 0 m/s

*(2) **A person swims 100 m in the first 40 s, 80 m in the next 40 s and 45 m in the last 20 s. What is the average speed?**

Ans. **Given :**

Total distance (d) = 100 + 80 + 45 = 225 m

Total time taken (t) = 40 + 40 + 20 = 100 sec

To find :

Average speed = ?

Formula :

Average speed $= \dfrac{\text{(Total distance covered)}}{\text{Total time taken}}$

Solution :

Average speed $= \dfrac{\text{(Total distance covered)}}{\text{Total time taken}}$

$= \dfrac{225}{100}$

= 2.25 m/s

Ans: The person swims with an average speed of 2.25 m/s.

*(3) **An object moves 18 m in the first 3 sec, 22 m in the next 3 sec and 14 m in the last 3 sec. What is its average speed?**

Ans. **Given :**

Total distance (d) = 18 + 22 + 14 = 54 m

Total time taken (t) = 3 + 3 + 3 = 9 sec

To find :

Average speed = ?

Formula :

Average speed $= \dfrac{\text{(Total distance covered)}}{\text{Total time taken}}$

Solution :

Average speed $= \dfrac{\text{(Total distance covered)}}{\text{Total time taken}}$

$= \dfrac{54}{9}$

= 6 m/s

Ans: The object moves with an average speed of 6 m/s.

(4) **A person travels a distance of 72 km in 4 hours. Calculate average speed in m/s.**

Ans. **Given :**

Total distance (d) = 72 km

$= 72 \times 1000$

= 72000m

Total time taken (t) = 4 hours

$= 4 \times 3600$ ($\because$ 1hr = 3600 sec)

= 14400 s

To find :

Average speed = ?

Formula :

Average speed $= \dfrac{\text{Total distance covered}}{\text{Total time taken}}$

Solution :

$$\text{Average speed} = \frac{\text{Total distance covered}}{\text{Total time taken}}$$

$$= \frac{72000}{14400}$$

$$= \frac{720}{144} \text{ m/s}$$

$$= \frac{10}{2} \text{ m/s}$$

$$= 5 \text{ m/s}$$

Ans: The person travels with average speed of 5 m/s

NUMERICAL FOR PRACTICE

(1) A person runs 100m in the first 50s. 80 m in the next 30 s and 45 m in the last 35 s.

What is the average speed?

Ans. 1.95 m/s

(2) An object moves 26 m in first 3 seconds and 16 m in the next 3 seconds while it travels 18 m in the last 3 seconds. Calculate average speed.

Ans. 6.67 m/s

Type - B

Formulae :

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

(ii) $s = ut + \dfrac{1}{2}at^2$

(iii) $v^2 = u^2 + 2as$

*(1) An aeroplane taxies on the runway for 30 s with an acceleration of 3.2 m/s^2 before taking off. How much distance would it have covered on the runway?

Ans. **Given :**

$a = 3.2$ m/s^2, $t = 30$ s, $u = 0$,

To find :

$s = ?$

Formula :

$s = ut + \dfrac{1}{2}at^2$

Solution :

$$s = ut + \frac{1}{2}at^2$$

$$= 0 \times 30 + \frac{1}{2} \times 3.2 \times 30^2$$

$$= 1440\text{m}$$

Ans. The distance covered on the runway is 1440 m.

*(2) **Kangaroo can jump 2.5 m vertically. What must be the initial velocity of the kangaroo?**

Ans. **Given :**

$a = 9.8$ m/s^2, $s = 2.5$ m, $v = 0$,

To find :

$u = ?$

Formula :

$v^2 = u^2 + 2as$

Solution :

$$v^2 = u^2 + 2as$$

$$0^2 = u^2 + 2 \times (-9.8)\,(2.5) \quad : \text{(Negative sign}$$
is used as the acceleration is in the direction opposite to that of velocity.)

$$0 = u^2 - 49$$

$$u^2 = 49$$

$$u = 7 \text{ m/s}$$

Ans: The initial velocity of the kangaroo must be 7 m/s.

*(3) **A motorboat starts from rest and moves with uniform acceleration. if it attains the velocity of 15 m/s in 5s, calculate the acceleration and the distance travelled in that time.**

Ans. **Given :**

Initial velocity, $u = 0$

Final velocity, $v = 15$ m/s

time, $t = 5$ s.

To find :

Acceleration $(a) = ?$

Distance $(s) = ?$

Solution:

From the first equation of motion

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

$$= \frac{15 - 0}{5}$$

$$a = 3 \text{ m/s}^2$$

From the second equation of motion, the distance covered will be

$$s = ut + \frac{1}{2}at^2$$

$$s = 0 \times 5 + \frac{1}{2} \times 3 \times 5^2$$

$$= \frac{0 + 72}{2}$$

$$= 37.5 \text{ m}$$

Ans: The acceleration is 3 m/s^2 and distance travelled is 37.5 m.

NUMERICAL FOR PRACTICE

(4) A car starting form rest acquires a speed of 20 m/s in covering a distance of 100m. Calculate the acceleration of the car.

Ans. 2 m/s^2

(5) A train starting from a railway station attains a speed of 40 km/hr in 10 min. Find its acceleration.

Ans. 0.018 m/s^2

(6) A car acquires a velocity of 72 km/hr in 10 seconds starting from rest. Find the acceleration, average velocity and distance travelled in this time.

Ans. 2 m/s^2 , 10 m/s, 100 m

(7) A car starts from rest and moves with a uniform acceleration of 2 m/s^2. How much time will it take to cover the distance of 49 m?

Ans. 7 s

Type - C

Formulae :

(i) $F = m \cdot a$

(ii) $P = m \cdot v$

(iii) $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

***(1)** The mass of a cannon is 500kg and it recoils with a speed of 0.25 m/s. What is the momentum of the cannon?

Ans. **Given :**

mass of the cannon = 50 kg

recoil speed = 0.25 m/s

To find :

Momentum = ?

Formula :

Momentum = $m \times v$

Solution :

Momentum = $m \times v$

$$= 500 \times 0.25$$

$$= 125 \text{ kg m/s}$$

Ans: The momentum of cannon is 125 kg m/s

***(2)** 2 balls have masses of 50 gm and 100 gm and they are moving along the same line in the same direction with velocities of 3 m/s respectively. They collide with each other and after the collision, the first ball moves with a velocity of 2.5 m/s. Calculate the velocity of the other ball after collision.

Ans. **Given :**

The mass of first ball (m_1) = 50 g = 0.05kg,

The mass of second ball (m_2) = 100 g = 0.1kg

Initial velocity of the first ball (u_1) = 3 m/s,

Initial velocity of the second ball (u_2) = 1.5 m/s,

Final velocity of the first ball (v_1) = 2.5 m/s,

To find :

Final velocity of the second ball (v_2) = ?

Formula :

$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

Solution :

According to the law of conservation of momentum, total initial momentum = Total final momentum

$$m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$$

$$(0.05 \times 3) + (0.1 \times 1.5) = (0.05 \times 2.5) + (0.1 \times v_2)$$

$$(0.15) + (0.15) = 0.125 + 0.1 v_2$$

$$0.3 = 0.125 + 0.1 v_2$$

$$0.1 \, v_2 = 0.3 - 0.125$$

$$v_2 = \frac{0.175}{0.1} = 1.75 \text{ m/s}$$

***(3)** An object of mass 16 kg is moving with an acceleration of 3 m/s^2. Calculate the applied force. If the same force is applied on an object of mass 24 kg, how much will be the acceleration?

Ans. **Given :**

Mass of 1st body (m_1) = 16 kg

Acceleration of 1st body (a_1) = 3 m/s^2

Mass of 2nd body (m_2) = 24 kg

To find :

Force on 1st body (F_1) =?

Acceleration of 2nd body (a_2) = ?

Formula :

$F = m \cdot a$

Solution :

$F_1 = m_1 \cdot a_1$

$F_1 = 16 \times 3$

$F_1 = 48$ N

$$a_2 = \frac{F_2}{m_2}$$

$$a_2 = \frac{48}{24}$$

$a_2 = 2$ m/s^2

Ans: The force acting on the 1st body is 48 N and the acceleration of the 2nd body is 2 m/s^2

*(4) **A bullet having a mass of 10 g and moving with a speed of 1.5 m/s, penetrates a thick wooden plank of mass 90 g. The plank was initially at rest. The bullet gets embedded in the plank and both move together. Determine their velocity.**

Ans. **Given :**

Mass of bullet (m_1) = 10 g = $\dfrac{10}{1000}$ kg = 0.010 kg

Mass of plank (m_2) = 90 g = 0.090 kg

Initial velocity of bullet (u_1) = 1.5 m/s

Initial velocity of plank (u_2) = 0 m/s

To find :

Common velocity (v) = ?

Formula :

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

Solution :

Let v_1 and v_2 be the common velocities of the bullet and plank

$v_1 = v_2 = v$

$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$

$(0.01 \times 1.5) + (0.09 \times 0) = (0.01 \times v) + (0.09 \times v)$

$0.015 + 0 = v (0.01 + 0.09)$

$0.015 = 0.1v$

$v = \dfrac{0.015}{0.1}$

$v = 0.15$ m/s

Ans: The plank moves with a velocity of 0.15 m/s.

> **NUMERICAL FOR PRACTICE**

(5) **A bullet has a muzzle velocity of 300 m/s. The gun of mass 3 kg has a recoil velocity of 'v'. Calculate 'v'. Mass of the bullet is 30 grams.**

Ans. 3 m/s

(6) **A force of 10 N acts on a body of mass 2 kg for 3s, initially at rest. Calculate : (i)Velocity acquired by the body. (ii) Change in momentum of the body.**

Ans. (i) 15 m/s (ii) 30 kg m/s

(7) **If the momentum of a body of mass 10 kg is 20 kg m/s. Find its velocity.**

Ans. 2 m/s

(8) **A body of mass 5 kg moves with an acceleration of 4 m/s^2. Calculate its change in momentum in 3 seconds.**

Ans. 60 kg m/s

(9) **A shell of mass 6 kg is fired from a gun of mass 600 kg. If the recoil velocity of the gun is 3 m/s. Find the muzzle velocity of the shell.**
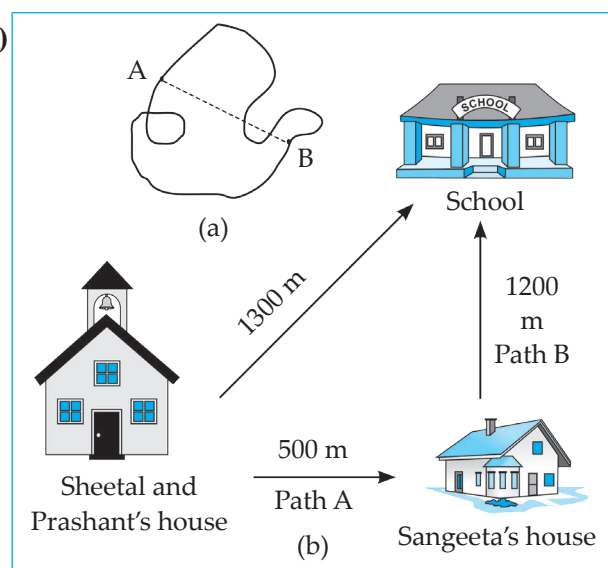
Ans. 300 m/s

(10) **A body of mass 5 kg moves with an acceleration of 2m/s^2. Find the change in momentum of the body in 2 seconds.**

Ans. 20 kg m/s

*Q.16. Activity based question:

*(A)

Location of the school and houses

(1) **Measure the distance between points A and B in different ways as shown in figure (a).**

**Ans.** Distances measured may be of different lengths depending on the path taken.

(2) **Now measure the distance along the dotted line. Which distance is correct according to you and why?**

Ans. Dotted line shows the shortest way of reaching from A to B.

(3) **Sheetal first went to her friend Sangeeta's house on her way to school (see figure (b). Prashant went straight from home to school. Both are walking with the same speed. Who will take less time to reach the school and why?**

Ans. Prashant will take less time as the path followed by him is the shortest.

(B) (a)
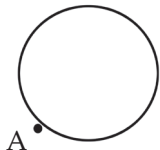
Distance and displacement

(1) Every morning, Swaralee walks round the edge of a circular field having a radius of 100 m. As shown in figure (a), if she starts from the point A and takes one round, how much distance has she walked and what is her displacement?

Ans. Radius (r) = 100m

Distance covered = Circumference of the circle

$$= 2\,\pi r$$
$$= 2 \times 3.14 \times 100$$
$$= 628 \text{ m}$$

Displacement = 0 m (Shortest distance between initial and final position is zero)

(b)

P   360 metres   Q
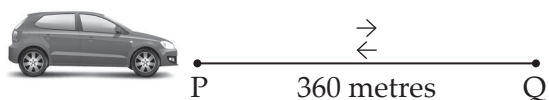
(2) If a car, starting from point P, goes to point Q (see figure b) and then returns to point P, how much distance has it travelled and what is its displacement?

Ans. Distance covered = PQ + QP

$$= 360 + 360$$
$$= 720 \text{ m}$$

Displacement = 0 m (Shortest distance between initial and final position is zero)

(C) Amar, Akbar and Anthony are travelling in different cars with different velocities. The distances covered by them during different time intervals are given in the following table.

Time in the clock	Distance covered by		
	Amar in km	Akbar in km	Anthony in km
5.00	0	0	0
5.30	20	18	14
6.00	40	36	28
6.30	60	42	42
7.00	80	70	56
7.30	100	95	70
8.00	120	120	84

(1) What is the time interval between the notings of distances made by Amar, Akbar and Anthony?

Ans. The time intervals are of 30 minutes.

(2) Who has covered equal distances in equal time intervals?

**Ans.** Amar and Anthony have covered equal distances in equal intervals of time.

(3) Are all the distances covered by Akbar in the fixed time intervals the same?

Ans. No, the distances covered by Akbar is not the same in the fixed time intervals.

(4) Considering the distances covered by Amar, Akbar and Anthony in fixed time intervals, what can you say about their speeds?

Ans. Amar and Anthony are travelling with uniform speed while Akbar is travelling with non-uniform speed.

(D) Observe the following figures. If you increase the number of sides of the polygon and make it infinite, how many times will you have to change the direction? What will be the shape of the path?
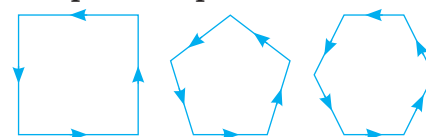
Changes in direction

Ans. If we increase the number of sides of the polygon and make it infinite, then we will have to change the direction an infinite number of times. The shape of the path thus obtained will be a circle.

(E) Observe the velocity of the ball as it rolls down along the channel. Is its velocity the same at all points?
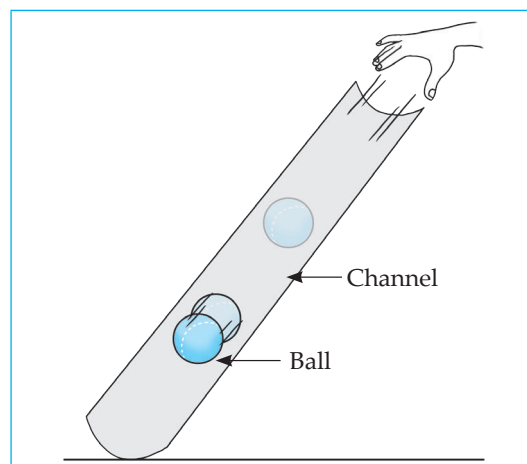
Change in velocity

Ans. No, its velocity is not the same at all the points. Its velocity increases as it rolls down.

(F) In which of the following examples can you sense motion? How will you explain presence and absence of motion

(i) The flight of a bird

(ii) A stationary train

(iii) Leaves flying through air

(iv) A stone lying on a hill

Ans. In example 1 and 3 we can see motion. If the body is moving in a certain interval of time then we can say that it is in motion.

(G) You are travelling in a bus. Is the person sitting next to you in motion? What do you take into consideration to decide if an objects is moving or not?

Ans. The person sitting in the bus is at rest if I am the observer, and is in motion for an observer outside the bus. The observer is considered to decide if an objects is moving or not

(H) When an object is at rest in the beginning of its motion, what is its initial velocity?

Ans. $u = 0$

(I) When an object comes to rest at the end of its motion, what is its final velocity?

Ans. $v = 0$

(J) Take 5 examples from your surrounding and give explanation based on Newtons laws of motion.

Ans.

(i) An electric fan keeps on rotating for some time after being switched off due to inertia (Newton's 1st law)

(ii) Fruits on a tree fall down when the branches are shaken (Newtons 1st law).

(iii) Athletes jump on a bed of sand during long jump (Newtons 2nd law).

(iv) A fielder moves his hands backward while catching a fast moving ball (Newtons 2nd law).

(v) While firing a gun, the gun recoils backwards (Newtons 3rd law)

(K) Why is there a thick bed of a sand for a high jumper to fall on after his jump?
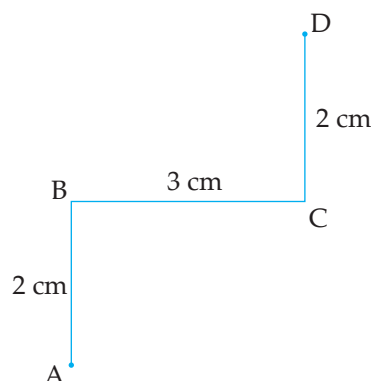
Ans.

(i) By using a sand bed, the rate of change of momentum is less.

(ii) Hence, impact is less.

(iii) The force experienced by the high jumper is less.

Brain Power

Q.1. An object travels from point A to point D along the path shown in the figure. What is the distance and displacement of the object?.
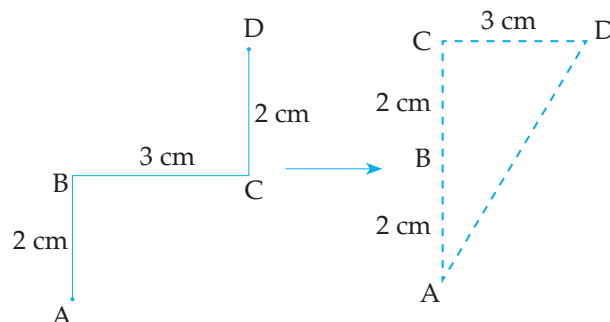

Ans :

(i) Total distance = $2 + 3 + 2 = 7$ cm

(ii) Total displacement = shortest path between A and D

Redrawing the above figure, we get

Length AD = Hypotenuse of Δ ACD

Using Pythagoras theorem,

$AD^2 = AC^2 + CD^2$

$= 4^2 + 3^2$

$= 16 + 9$

$AD^2 = 25$

$AD = \sqrt{25}$

$AD = 5$ cm

Hence, displacement = 5 cm

❖ ❖ ❖

ASSIGNMENT - 1

Time : 1 Hr	Marks : 30

Q.1. (A) Choose the correct alternatives and rewrite the complete sentences: **(4)**

(1)   Retardation means .... acceleration.

(a) zero   (b) positive   (c) uniform   (d) negative

(2)   When body is performing uniform circular motion, its .... changes at every point.

(a) speed   (b) direction   (c) velocity   (d) acceleration

(3)   The tendency of a body to resist acceleration is called ....

(a) acceleration   (b) position of rest   (c) inertia   (d) kilogram

(4)   In a collision .... is always conserved.

(a) mass   (b) momentum   (c) inertia   (d) acceleration

(B) Rewrite the Column II to match Column I and Column III: **(3)**

Column 'I'	Column 'II'	Column 'III'
(1) Negative acceleration	(a) Body has constant velocity	(a) A car initially at rest acquires velocity 50km/hr in 10 seconds
(2) Positive acceleration	(b) Velocity of the body decreases	(b) A vehicle moving with a velocity of 25 m/s
(3) Zero acceleration	(c) Velocity of the body increases	(c) A vehicle moving with a speed of 10 m/s stops after 5 seconds

(C) State whether the statements are True or False and if false write correct statement: **(1)**

(1)   Displacement is a scalar quantity.

Q.2. (A) Answer the following: **(6)**

(1)   Explain with proper examples : Motion is Relative.

(2)   Give scientific reasons : Distance and displacements are different concepts.

(3)   Give scientific reasons: Action and reaction forces do not cancel each other even though they have equal magnitude and opposite direction.

(B) Answer in one sentence : **(4)**

(1)   Define uniform motion.

(2)   When is a body said to be in motion?

(3)   The velocity with which a gun moves in the opposite direction of firing of bullet.

(4)   What is momentum?

Q.3. Solve the following numerical: **(4)**

(1)   An object moves 18 m in the first 3 seconds and 22 m in the next 3 seconds while it travels 14 m in the last 3 seconds. Calculate average speed.

(2)   Calculate momentum of a field gun of mass 500 kg when it recoils with velocity of 0.25 m/s after firing a shell from it.

Q.4. Answer in brief: **(8)**

(1)   State five examples of uniform circular motion.
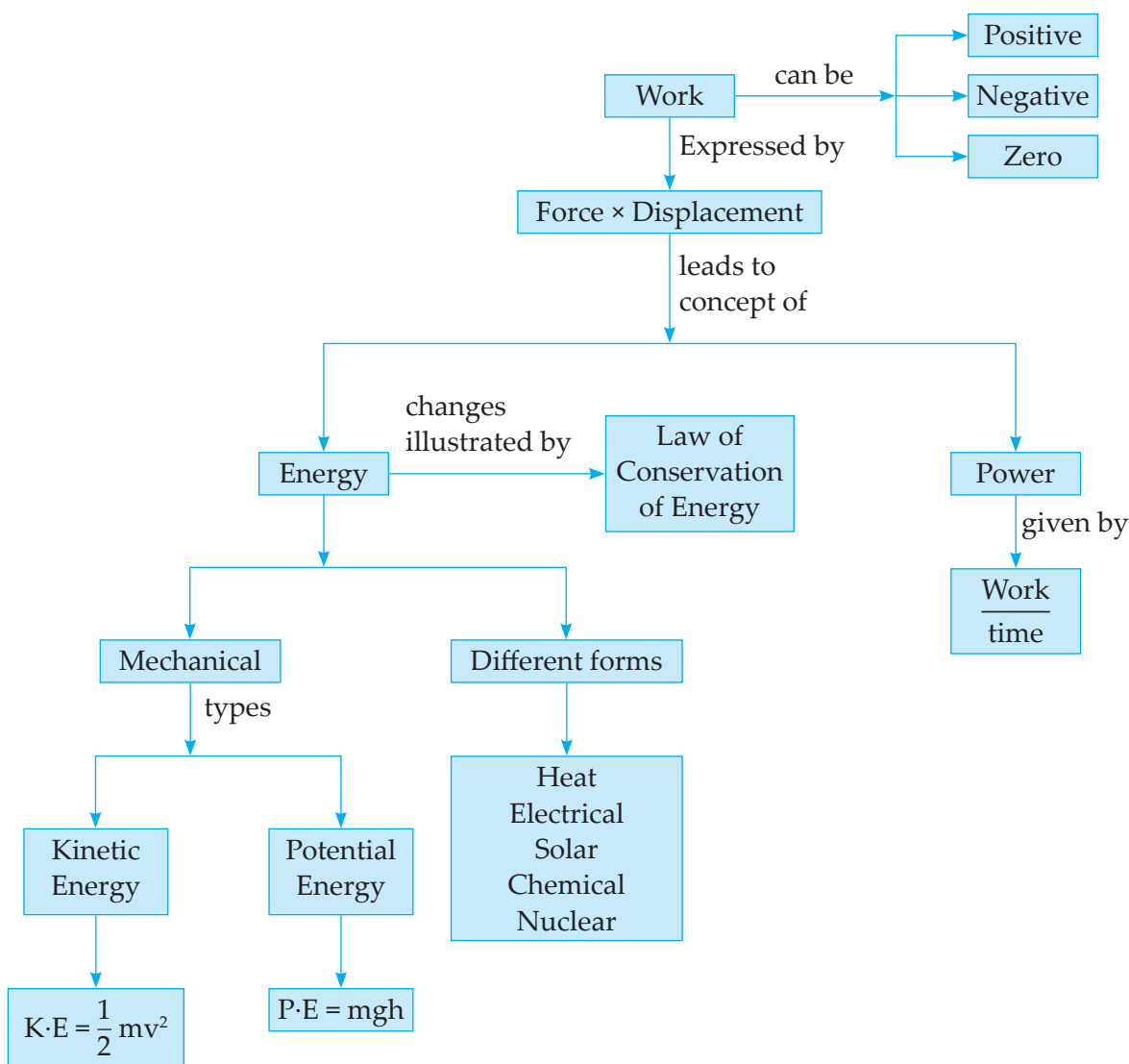
(2)   State the principle of conservation of momentum.

❖ ❖ ❖

2 Work and Energy

CONCEPT MAP

```
                                              ┌──→ Positive
                        can be               │
            Work ──────────────────→ ─────────┼──→ Negative
              │                               │
         Expressed by                         └──→ Zero
              ↓
      Force × Displacement
              │
           leads to
          concept of
              │
      ┌───────┴──────────────────────────────┐
      ↓                                       ↓
             changes
             illustrated by    Law of        Power
   Energy ──────────────────→ Conservation     │
      │                        of Energy     given by
      ↓                                         ↓
  ┌───────────┬─────────────┐               Work
  ↓           ↓             ↓                ────
Mechanical              Different forms      time
  │
 types
  │
  ┌──────────┬──────────┐
  ↓          ↓          ↓
Kinetic   Potential    Heat
Energy    Energy       Electrical
  │          │          Solar
  ↓          ↓          Chemical
              P·E = mgh  Nuclear

K·E = ½ mv²
```

$$K \cdot E = \frac{1}{2}mv^2$$

$$P \cdot E = mgh$$

MASTER KEY QUESTION SET - 2

Q.1. (A) Fill in the blanks and rewrite the complete statements:

(1) The energy stored in the dry cell is in the form of ....

(2) The work done is zero if there is no ....

(3) Flowing water has .... energy.

(4) By stretching the rubber strings of a catapult, we store .... energy in it.

(5) .... is the unit of force.

(6) For a freely falling body, kinetic energy is .... at the ground level.

(7) Energy can neither be .... nor ....

(8) Work and .... have the same unit.

(9) S.I. unit of energy is ....

Ans. *(1) chemical energy (2) displacement (3) kinetic (4) potential (5) newton (6) maximum (7) created, destroyed (8) Energy (9) joule*

*(B) Choose one or more correct alternatives:

(1) For work to be performed, energy must be........

(a) transferred from one place to another.

(b) concentrated

(c) transferred from one type to another

(d) destroyed

(2)   joule is the unit of ....

(a) force   (b) work

(c) power   (d) energy

(3)   Which of the forces are involved in dragging a heavy object on a smooth, horizontal surface and have the same magnitude?

(a) the horizontal applied force

(b) gravitational force

(c) reaction force in vertical direction

(d) force of friction.

(4)   Power is the measure of the ....

(a) rapidity with which work is done

(b) amount of energy required to perform the work

(c) slowness with which work is performed

(d) length of time.

(5)   While dragging or lifting an object, negative work is done by ....

(a) the applied force   (b) gravitational force

(c) frictional force   (d) reaction force

Ans.   *(1) (a) transferred from one place to another. (c) transferred from one type to another (2) (b) work (d) energy (3) (a) the horizontal applied force (b) gravitational force (c) reaction force in vertical direction (d) force of friction (4) (a) rapidity with which work is done (c) the slowness with which work is performed (5) (b) gravitational force (c) frictional force*

(C) Rewrite the following statements by selecting correct options given below:

(1)   Work is the product of ....

(a) force and distance

(b) displacement and velocity

(c) kinetic and potential energy

(d) force and displacement

(2)   SI unit of work is ....

(a) dyne   (b) newton-metre or erg

(c) N/m² or joule   (d) newton-metre or joule

(3)   The work done by a force is said to be .... when the applied force does not produce displacement.

(a) positive   (b) negative

(c) zero   (d) none of these

(4)   ....is the capacity to do work

(a) Energy   (b) Force

(c) Power   (d) Momentum

(5)   Kinetic energy of a body (KE) = ...

(a) mv^2 (b) $\frac{1}{2}mv^2$

(c) mgh   (d) Fs

(6)   Potential energy of a body is given by (P.E) = ...

(a) Fs (b) mgh

(c) ma   (d) mv^2

(7)   When some unstable atoms break up they release tremendous amount of .... energy.

(a) chemical   (b) potential

(c) nuclear   (d) mechanical

(8)   1 hp = ...

(a) 476 watts   (b) 746 watts

(c) 674 watts   (d) 764 watts

(9)   ....is the commercial unit of power.

(a) kilowatt second   (b) dyne

(c) kilowatt   (d) erg

(10)   1 kWh = ...joules.

(a) 3.6×10^3J   (b) 3.6×10^6J

(c) 6.3×10^6J   (d) 6.3×10^3J

Ans.   *(1) force and displacement (2) newton-metre or joule (3) zero (4) Energy (5) $\frac{1}{2}mv^2$ (6) mgh (7) nuclear (8) 746 watts (9) kilowatt (10) 3.6×10^6J*

*(D) Rewrite the following statement using proper alternative.

(1)   The potential energy of your body is least when you are ....

(a)   sitting on a chair

(b)   sitting on the ground

(c)   sleeping on the ground

(d)   standing on the ground

(2)   The total energy of an object falling freely towards the ground ....

(i)   decreases

(ii)   remains unchanged

(iii) increases

(iv) increase in the beginning and then decreases.

(3) If we increase the velocity of a car moving on a flat surface to 4 times its original speed, its potential energy ....

   (a) will be twice its original energy

   (b) will not change

   (c) will be 4 times its original energy

   (d) will be 16 times its original energy.

(4) The work done on an object does not depend on ....

   (a) displacement

   (b) applied force

   (c) initial velocity of the object

   (d) the angle between force and displacement.

Ans. *(1) sleeping on the ground (2) increases (3) will not change (4) initial velocity of the object*

Q.2. State whether the following statements are true or false and if false, write the correct statement:

(1) The potential energy of a body of mass 1 kg kept at height 1 m is 1 J.

Ans. False, potential energy is mgh = 1 × 9.8 × 1 = 9.8 J.

(2) Water stored at some height has potential energy.

Ans. True

(3) Unit of power is joule.

Ans. False, unit of power is watt.

(4) Mechanical energy can be converted into electrical energy.

Ans. True

(5) Work is a vector quantity.

Ans. False, work is a scalar quantity.

Q.3. (1) Match the column:

Column 'I'	Column 'II'	Column 'III'
(1) Potential Energy	(a) can be positive, negative or zero	(i) $\frac{1}{2}mv^2$
(2) Power	(b) energy possessed by an athlete	(ii) mgh
(3) Work	(c) water raised at some height	(iii) $P = \frac{W}{t}$
(4) Kinetic energy	(d) depends on work and time	(iv) W = Fs

Ans. *(1 - c - ii), (2 - d - iii), (3 - a - iv), (4 - b - i)*

(2)

Column 'I'	Column 'II'	Column 'III'
(1) Positive work	(a) θ = 180°	(i) W = 0
(2) Negative work	(b) θ = 90°	(ii) W = Fs
(3) Zero work	(c) θ = 0°	(iii) W = –Fs

Ans. *(1 - c - ii), (2 - a - iii), (3 - b - i)*

Q.4. Give two examples in each of the following cases:

(1) Potential energy

Ans.

(i) water stored in a dam

(ii) a compressed spring

(2) Kinetic energy

Ans.

(i) water flowing

(ii) bullet fired from a gun

(3) Zero work done

Ans.

(i) A stone tied to a string and whirled in a circular path

(ii) motion of the earth and other planets moving around the sun

(4) Negative work done

Ans.

(i) A cyclist applies brakes to his bicycle, but the bicycle still covers some distance

(ii) When a body is made to slide on a rough surface, the work done by the frictional force.

(5) Positive work done

Ans.

(i) A boy moving from the ground floor to the first floor

(ii) A fruit falling down from the tree

Q.5. Answer the following in one or two sentences:

(1) Name unit of energy used for commercial purpose.

Ans. kilowatt hour is the unit of energy used for commercial purpose.

(2) Name unit used in industry to measure power.

Ans. Horse power (hp) is the unit used in industry to express power.

(3)   State the SI unit of energy.

Ans.   joule is the SI unit of energy.

(4)   Name the two types of mechanical energy.

Ans.   Potential energy and kinetic energy are the two types of mechanical energy.

(5)   Give an example where force acting on an object does not do any work.

Ans.   In a simple pendulum the gravitational force acting on the bob does not do any work as there is no displacement.

(6)   Give the relationship between 1 joule and 1 erg.

Ans.   1 joule = 10^7 erg.

(7)   What is free fall?

Ans.   An object falling solely under the influence of gravitational force is said to be in free fall or to be falling freely.

(8)   State the various forms of energy

Ans.   The various forms of energy are mechanical, heat, light, sound, electro-magnetic, chemical, nuclear and solar.

Q.6.   Define the following:

(1)   Work

Ans.   Work is said to be done on a body when a force applied on an object causes displacement of the object.

(2)   Energy

Ans.   The capacity of a body to perform work is termed as energy.

(3)   Power

Ans.   Power is the rate at which work is done.

(4)   1 joule

Ans.   If a force of 1 newton displaces an object through 1 metre in the direction of the force, the amount of work done on the object is 1 joule.

(5)   1 erg

Ans.   If a force of 1 dyne displaces an object through 1 centimetre in the direction of the force, the amount of work done on the object is 1 erg.

(6)   Law of conservation

Ans.   Energy can neither be created nor destroyed. It can be converted from one form to another. The total amount of energy in the universe remains constant.

(7)   Kinetic energy

Ans.   The energy which an object has because of its motion is called its kinetic energy.

(8)   Potential energy

Ans.   The energy stored in an object because of its specific state or position is called its potential energy.

Q.7.   Give reasons:

(1)   A moving ball hits a stationary ball and displaces it.

Ans.

(i)   The moving ball has certain energy.

(ii)   When it hits the stationary ball the energy is transferred to the stationary ball.

(iii)   Because of which it moves.

(iv)   Hence, a moving ball hits a stationary ball and displaces it.

(2)   Flowing water from some height can rotate a turbine.

Ans.

(i)   Flowing water has certain energy.

(ii)   When it hits the turbine, energy is transferred to the turbine.

(iii)   Because of which it rotates.

(iv)   Hence, flowing water from some height can rotate a turbine.

(3)   A stretched rubber band when released regains its original length.

Ans.

(i)   When we stretch the rubber band we give energy to it.

(ii)   This energy is which is stored in it.

(iii)   Hence, when we release it, it regains its original length.

(4)   Wind can move the blades of a wind mill.

Ans.

(i)   Wind has certain energy.

(ii)   When it hits the wind mill energy is transferred to the wind mill

(iii)   Because of which it moves.

(iv)   Hence, wind can move the blades of a wind mill.

(5)   An exploding firecracker lights as well as make sound.

Ans.

(i)   The exploding firecracker convert the chemical energy stored in it into light and sound respectively.

(ii) Here energy is converted from one type to another.

(iii) Hence, an exploding firecracker lights as well as make sound.

(6) Work done on an artificial satellite by gravity is zero while moving around the earth.

Ans.

(i) When the artificial satellite moves around the earth in a circular orbit, gravitation force acts on it.

(ii) The gravitational force acting on the satellite and its displacement are perpendicular to each other. i.e. $\theta = 90°$

(iii) For $\theta = 90°$, work done is zero.

(iv) Hence, work done on an artificial satellite by gravity is zero while moving around the earth.

Q.8. Answer in short:

(1) Derive the expression for potential energy.

Ans. To carry an object of mass 'm' to a height 'h' above the earth's surface, a force equal to 'mg' has to be used against the direction of the gravitational force. The amount of work done can be calculated as follows.

Work = force × displacement

∴ W = mg × h

∴ W = mgh

∴ The amount of potential energy stored in the object because of its displacement

P.E = mgh (W = P.E)

∴ Displacement to height *h* causes energy equal to mgh to be stored in the object.

(2) When can you say that the work done is either positive, negative or zero?

Ans.

(i) When the force and the displacement are in the same direction, the work done by the force is positive.

(ii) When the force and displacement are in the opposite directions, the work done by the force is negative.

(iii) When the applied force does not cause any displacement or when the force and the displacement are perpendicular to each other, the work done by the force is zero.

(3) Explain the relation between, the commercial and SI unit of energy.

Ans. The commercial unit of energy is kilowatt-hour (kWh) while the SI unit of energy is joule. Their relation is

1 kWh = 1 kW × 1hr

= 1000 W × 3600 s

= 3600000 J

1 kWh = 3.6 × 10^6 J.

*(4) If an object has 0 momentum, does it have kinetic energy? Explain your answer.

Ans. No, it does not have kinetic energy if it does not have momentum.

Momentum is the product of mass and velocity. If it is zero, it implies that $v = 0$ (since mass can never be zero).

Now K.E = $\frac{1}{2}$ mv^2 So if $v = 0$ then K.E also will be zero.

Thus, if an object has no momentum then it cannot possess kinetic energy.

*(5) Why is the work done on an object moving with uniform circular motion zero?

Ans.

(i) When a body performs uniform circular motion, then the force acting on it is along the radius of the circle.

(ii) While its displacement is along the tangent to the circle. Thus, they are perpendicular to each other.

Hence $\theta = 90°$ and cos 90 = 0

∴ W = Fs cos θ = 0

*(6) Determine the amount of work done when an object is displaced at an angle of 30° with respect to the direction of the applied force.

Ans. When object is displaced by displacement 'S' and by applying force 'F' at an 'angle' 30°.

work done can be given as

W = Fs cos θ

∴ W = Fs cos 30 (∵ θ = 30°)

∴ **W = Fs** $\left(\dfrac{\sqrt{3}}{2} \right)$ (∵ cos 30 = $\dfrac{\sqrt{3}}{2}$)

(7) How is work calculated if the direction of force and the displacement are inclined to each other?

Ans. If the direction of force and the displacement are inclined to each other then, we must

convert the applied force into the force acting along the direction of displacement.

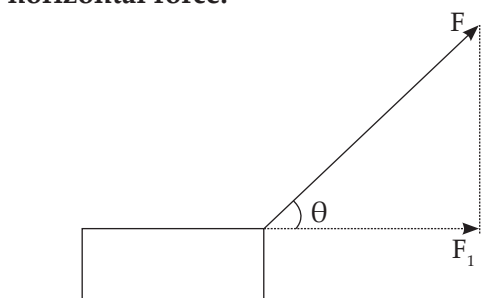If θ is angle between force and displacement, then force (F_1) in direction of displacement is F cos θ.

∴   W = F_1 × s

∴   W = F cos θ × s

∴   W = Fs cos θ

Q.9. Answer in brief:

(1)   **State the expression for work done when displacement and force makes an angle θ OR State the expression for work done when force is applied making an angle θ with the horizontal force.**

Force used for the displacement

Ans. Let F be the applied force and F_1 be its component in the direction of displacement. Let *s* be the displacement.

The amount of work done is given by

W = F_1s ....   (1)

The force F is applied in the direction of the string i. e. at an angle with the horizontal.

Let θ be the angle that the string makes with the horizontal. We can determine the component F_1, of this force F, which acts in the horizontal direction by means of trigonometry.

$$\cos θ = \frac{base}{hypotenuse}$$

∴ $\cos θ = \dfrac{F_1}{F}$

∴ F_1 = F cos θ

Substituting the value of F_1 in equation 1

Thus, the work done by F_1 is

W = F cos θ s

∴   W = F s cos θ

*(2)   **Derive the formula for the kinetic energy of an object of mass m, moving with velocity v.**

Ans. Suppose a stationary object of mass m moves because of an applied force. Let u be its initial

velocity (here u = 0). Let the applied force be F. This generates an acceleration a in the object, and, after time t, the velocity of the object becomes equal to v. The displacement during this time is *s*. The work done on the object

W = Fs

W = F × s

According to Newton's second law of motion,

F = ma   .... (1)

Similarly, using Newton's second equation of motion

$$s = ut + \frac{1}{2}at^2$$

However, as initial velocity is zero, u = 0

∴ $s = 0 + \dfrac{1}{2}at^2$

∴ $s = \dfrac{1}{2}at^2$ .... (2)

∴ $W = ma × \dfrac{1}{2}at^2$ ....using equations (1) and (2)

∴ $W = \dfrac{1}{2}m × (at)^2$ .... (3)

Using Newton's first equation of motion

v = u + at

∴   v = 0 + at

∴   v = at

∴ $v^2 = a^2t^2 = (at)^2$ .... (4)

∴ $W = \dfrac{1}{2}mv^2$ .... using equations (3) and (4)

The kinetic energy gained by an object is the amount of work done on the object.

∴   K.E = W

∴ $K.E = \dfrac{1}{2}mv^2$

(3)   **When a body is dropped on the ground from some height its P.E is converted into K.E but when it strikes the ground and it stops, what happens to the K.E?**

Ans. When a body is dropped on the ground, its K.E appears in the form of:

(i)   Heat (collision between the body and the ground).

(ii)   Sound (collision of the body with the ground).

(iii) Potential energy of configuration of the body and the ground.

(iv)   Kinetic energy is also utilized to do work i.e. the ball bounces to certain height and moves to a certain distance vertically and horizontally till K.E becomes zero.

(v) The process in which the kinetic energy of a freely falling body is lost in an unproductive chain of energy is called dissipation of energy.

(4) **Explain the statement "Potential Energy is relative".**

Ans.

(i) Potential energy of an object is determined and calculated according to height of the object with respect to the observer.

(ii) So, the person staying on 6th floor will have more potential energy then those staying on 3rd floor.

(iii) But, if another observer staying on 8th floor will have more potential energy then those on the 6th floor. Hence, potential energy is relative.

*(5) **Prove that the kinetic energy of a freely falling object on reaching the ground is nothing but the transformation of its initial potential energy.**

Ans. Let us look at the kinetic and potential energies of an object of mass, falling freely from height h, when the object is at different heights.

As shown in the figure, the point A is at a height h from the ground. Let the point B be at a distance x, vertically below A. Let the point C be on the ground directly below A and B. Let us calculate the energies of the object at A, B and C.

(1) When the object is stationary at A, its initial velocity is u = 0

$\therefore$ K.E = $\frac{1}{2}$ mass × velocity²

       = $\frac{1}{2}$ mu²

K.E = 0

P.E = mgh

$\therefore$ Total energy = K.E + P.E
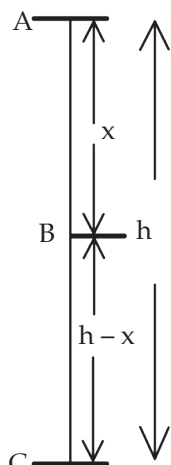
              = 0 + mgh

Total Energy = mgh. - - - - (1)

(2) Let the velocity of the object be v_B when it reaches point B, having fallen through a distance x.

u = 0, s = x, a = g

v² = u² + 2as

v_B^2 = 0 + 2gx

v_B^2 = 2gx

$\therefore$ K.E = $\frac{1}{2}$ mv² = $\frac{1}{2}$ m(2gx)

K.E = mgx

Height of the object when at B = h-x

$\therefore$ P.E = mg (h-x)

P.E = mgh – mgx

$\therefore$ Total Energy T.E. = K.E + P.E

                          = mgx + mgh – mgx

$\therefore$ T.E. = mgh ---------- (2)

(3) Let the velocity of the object be v_C when it reaches the ground, near point C.

U = 0, s = h, a = g

       v² = u² + 2as

       v_C^2 = 0 + 2gh

$\therefore$ K.E = $\frac{1}{2}$ mv_C^2 = $\frac{1}{2}$ m(2gh)

       K.E = mgh

The height of the object from the ground at point C is h = 0

$\therefore$ P.E = mgh = 0

$\therefore$ T.E. = K.E + P.E

T.E. = mgh ------ (3)

From equations (1) and (3) we see that the total potential energy of the object at its initial position is the same as the kinetic energy at the ground.

Q.10. Difference between

*(1) **Kinetic energy and Potential energy:**

Kinetic Energy	Potential Energy
(1) Kinetic energy is the energy possessed by the body due to its motion.	(1) Potential energy is the energy possessed by the body because of its shape or position.
(2) Kinetic energy is given by the formula : K.E = $\frac{1}{2}$ mv²	(2) Potential energy is given by the formula : P.E = mgh
(3) e.g. flowing water, such as when falling from a waterfall.	(3) e.g. water at the top of a waterfall, before the drop.

(2) Work and Power:

Work	Power
(1) Work is the product of force and displacement.	(1) Power is rate of doing work.
(2) Work is given by the formula : W = Fs	(2) Power is given by the formula : $P = \dfrac{W}{t}$
(3) MKS unit - joule CGS unit - erg	(3) MKS unit - joule/sec CGS unit - erg/sec

Q.11. Solve the following:

TYPE – A

Formula :

W = Fs cos θ

- If Force and displacement are in same direction then 0° , and cos θ = 1
- If Force and displacement are in opposite direction then θ = 180° , and cos θ = –1
- If Force and displacement are perpendicular then θ = 90° , and cos θ = 0

*(1) Pravin has applied a force of 100 N on an object, at an angle of 60° to the horizontal. The object gets displaced in the horizontal direction and 400 J work is done. What is the displacement of the object? (cos 60° = $\dfrac{1}{2}$)

Ans. **Given :**

θ = 60°

Force (F) = 100 N

Work (W) = 400 J

To Find :

Displacement (s) = ?

Formula :

W = Fs cos θ

Solution :

W = Fs cos θ

∴ $400 = 100 \times s \times \dfrac{1}{2}$

∴ $\dfrac{400}{100} = \dfrac{1}{2} \times s$

∴ $4 \times 2 = s$

∴ $s = 8$ m

The object will be displaced through 8 m.

*(2) Ravi applied a force of 10 N and moved a book 30 cm in the direction of the force. How much was the work done by Ravi?

Ans. **Given :**

Force (F) = 10 N

θ = 0°,   (Since force and displacement are in same direction)

Displacement (s) = 30 cm = $\dfrac{30}{100}$ m

To Find :

Work (W) = ?

Formula :

W = Fs cos θ

Solution :

W = Fs cos θ

$= 10 \times \dfrac{30}{100} \times \cos 0$

$= \dfrac{30}{10} \times 1$ ..... (cos 0 = 1)

= 3 J

The work done by Ravi is 3 J

NUMERICAL FOR PRACTICE

(3) A force of 50 N acts on an object and displaces it by 2 m. If the force acts at an angle of 60° to the direction of its displacement, find the work done.

Ans. 50 J

(4) Raj applied a force of 20 N and moved a book 40 cm in the direction of the force. How much was the work done by Raj?

Ans. 8 J

TYPE – B

Formulae :

1) $W = K.E = \dfrac{1}{2} mv^2$

2) W = P.E = mgh

- W = P.E , W = K.E

*(1) A stone having a mass of 250 gm is falling from a height. How much kinetic energy does it have at the moment when its velocity is 2 m/s?

Ans. **Given :**

Mass (m) = 250 g

$= \dfrac{250}{1000}$ kg

Velocity (v) = 2 m/s

To Find :

Kinetic energy (K.E) = ?

Formula :

K.E = $\frac{1}{2}$ mv²

Solution :

K.E = $\frac{1}{2}$ mv²

$= \frac{1}{2} \times \frac{250}{1000} \times (2)^2$

$= \frac{25}{100} \times 2$

$= \frac{50}{100} = 0.5$ J

The kinetic energy of the stone is 0.5 J

*(2) **500 kg water is stored in the overhead tank of a 10 m high building. Calculate the amount of potential energy stored in the water.**

Ans. **Given :**

Mass (m) = 500 kg

Height (h) = 10 m

Acceleration due to gravity (g) = 9.8 m/s²

To Find :

Potential energy (P.E) = ?

Formula :

P.E = mgh

Solution :

P.E = mgh

$= 500 \times 10 \times 9.8$

$= 500 \times 98$

$= 49000$ J

The P.E of the stored water is 49000 J

*(3) **The velocity of a car increases from 54 km/hr to 72 km/hr. If the mass of the car is 1500 kg, find the work done to increase the velocity.**

Ans. **Given :** Mass (m) = 1500 kg

$\left[1 \text{ km/hr} = \frac{1000}{3600} \text{ m/sec} = \frac{5}{18} \text{ m/sec} \right]$

Initial velocity (u) = 54 km/hr

$= 54 \times \frac{5}{18}$

$= 15$ m/s

Final velocity (v) = 72 km/hr

$= 72 \times \frac{5}{18}$

$= 20$ m/s

To Find :

Work done to increase the velocity = ?

Formula :

Work done to increase velocity = Change in K.E

Change in K.E = $\frac{1}{2}$ mv² $- \frac{1}{2}$ mu²

Solution :

Change in K.E = $\frac{1}{2}$ mv² $- \frac{1}{2}$ mu²

$= \frac{1}{2}$ m (v² $-$ u²)

$= \frac{1}{2} \times 1500 \,[(20)^2 - (15)^2]$

$= 750 \times [400 - 225]$

$= 750 \times 175$

$= 131250$ J

Work done to increase the velocity = 131250 J

*(4) **Calculate the work done to take an object of mass 20 kg to a height of 10 m. (g = 9.8 m/s²)**

Ans. **Given :**

Mass (m) = 20   kg

Acceleration due to gravity (g) = –9.8 m/s²

Displacement (s) = (h) = 10 m.

To Find :

Work done (W) = ?

Formula :

(i) W = P.E = mgh

Solution :

W = mgh

$= 20 \times -9.8 \times 10$

$= -1960$ J

The work done to take an object of mass 20 kg to a height of 10 m is –1960 J.

(5) **A body of 0.5 kg thrown upwards reaches a maximum height of 5 m. Calculate the work done by the force of gravity during this vertical displacement.**

Ans. **Given :**

Mass (m) = 0.5 kg

Acceleration due to gravity (g) = –9.8 m/s²

Displacement (s) = 5 m.

To Find :

Work done (W) = ?

Formula :

W = P.E = mgh

Solution :

W = mgh

$= 0.5 \times -9.8 \times 5$

$= -24.5$ J

The work done by the force of gravity is –24.5 joule.

(6) **1 kg mass has a kinetic energy of 2 joule. Calculate its velocity.**

Ans. **Given :**

Mass (m) = 1 kg

Kinetic Energy (K.E) = 2 J

To Find :

Velocity (v) = ?

Formula :

$K.E = \dfrac{1}{2} mv^2$

Solution :

$K.E = \dfrac{1}{2} mv^2$

$2 = \dfrac{1}{2} \times 1 \times (v)^2$

$4 = (v)^2$

$(v)^2 = 4$

$v = \sqrt{4}$

$= 2$ m/s

The velocity is 2 m/s

(7) **A rocket of mass 100 tonnes is propelled with a vertical velocity 1 km/s. Calculate kinetic energy**

Ans. **Given :**

Mass (m) = 100 tonnes,

$= (100 \times 1000)$ kg

Velocity (v) = 1 km/s

$= 1000$ m/s

To Find :

Kinetic Energy (K.E) = ?

Formula :

$K.E = \dfrac{1}{2} mv^2$

Solution :

$K.E = \dfrac{1}{2} mv^2$

$= \dfrac{1}{2} \times 100 \times 1000 \times (1000 \times 1000)$

$= 50 \times 10^9$ J

$= 5 \times 10^{10}$ J

The kinetic energy of the rocket is 5×10^{10} J

*(8) **If the energy of a ball falling from a height of 10 metres is reduced by 40%, how high will it rebound?**

Ans. **Given :** Initial height (h_1) = 10 m

Initial P.E = $P.E_1$

Final P.E = $P.E_2$

$P.E_2 = 60\%$ of $P.E_1 = 0.6$ $P.E_1$

To Find :

Final height (h_2) = ?

Formula :

P.E = mgh

Solution :

$P.E_1 = mgh_1$ .... (i)

$P.E_2 = mgh_2$ .... (ii)

Dividing (ii) by (i)

$\dfrac{P.E_2}{P.E_1} = \dfrac{mgh_2}{mgh_1}$

$\dfrac{0.6\,P.E_1}{P.E_1} = \dfrac{h_2}{h_1}$

$0.6 = \dfrac{h_2}{h_1}$

$h_2 = 0.6 \times h_1$

$= 0.6 \times 10$

$= 6$ m

The ball will rebound by 6 m.

NUMERICAL FOR PRACTICE

(9) **1 kg mass has a kinetic energy of 2 joule. Calculate its velocity.**

Ans. 2 m/s

(10) **A ball of mass 1 kg slows down from a speed of 5 m/s to that of 3 m/s. Calculate the change in kinetic energy of the ball.**

Ans. 8 joule

(11) **An energy of 2J is used to lift a block of 0.5 kg. How high will it rise? (Take g = 10 m/s²)**

Ans. 0.4 m

(12) **An object of mass 10 kg is lying 10 m above the ground. Calculate the potential energy possessed by the object. (Take g = 9.8 m/s²)**

Ans. 980 J

TYPE – C

Formulae :

1) Power = $\dfrac{\text{work}}{\text{time}}$ = $\dfrac{\text{mgh}}{\text{t}}$

2) Electric power = $\dfrac{\text{Electric energy consumed}}{\text{time}}$

- Power should be expressed in kW
- Time should be expressed in hours
- 1 kWh = 1 unit

*(1) **Swaralee takes 20 s to carry a bag weighing 20 kg to a height of 5 m. How much power has she used?**

Given :

Mass (m) = 20 kg

Height (h) = 5 m

Time (t) = 20 s

Acceleration due to gravity (g) = 9.8 m/s^2

To Find :

Power (P)= ?

Formula :

P = $\dfrac{\text{mgh}}{\text{t}}$

Solution :

P = $\dfrac{\text{mgh}}{\text{t}}$

   = $20 \times 9.8 \times \dfrac{5}{20}$

   = 9.8×5

   = 49 W

Power used by Swaralee is 49 W

*(2) **An electric pump has 2 kW power. How much water will the pump lift every minute to a height of 10 m?**

Ans. **Given :**

Power (P)   = 2 kW = 2000 W

Height (h) = 10 m

Time (t)   = 1 min = 60 s

Acceleration due to gravity (g) = 9.8 m/s^2

To find :

Mass of water (m)= ?

Formula :

P = $\dfrac{\text{mgh}}{\text{t}}$

Solution :

P = $\dfrac{\text{mgh}}{\text{t}}$

m = $\dfrac{\text{Pt}}{\text{gh}}$

   = $\dfrac{2000 \times 60}{9.8 \times 10}$

   = $\dfrac{120000}{98}$

m = 1224.5 kg

Water lifted by the pump is 1224.5 kg

*(3) **If a 1200 W electric iron is used daily for 30 minutes, how much total electricity is consumed in the month of April?**

Ans. **Given :**

Power of electric iron (P) = 1200 W

   = $\dfrac{1200}{1000}$ kW = 1.2 kW

Time (t) = 30 min × 30 days

   = 0.5 hr × 30 days

   = 15 hr

To find :

Energy consumed = ?

Formula :

Electric power = $\dfrac{\text{Electric energy consumed}}{\text{time}}$

Solution :

Electric power = $\dfrac{\text{Electric energy consumed}}{\text{time}}$

Electric energy consumed = Electric power × time

   = 1.2 × 15

   = 18 kWh

   = 18 units

The units of energy consumed in the month of April by the iron is 18 units.

*(4) **A 25 W electric bulb is used for 10 hours every day. How much electricity does it consume each day?**

Given:

Power (P) = 25 W

   = $\dfrac{25}{1000}$ kW

   = 0.025 kW

To Find :

Electric energy consumed

Formula :

Electric energy consumed   = power × time

Solution :

Electric energy consumed   = power × time

                                = 0.025 × 10

                                = 0.25 kWh

The electric bulb consumes 0.25 kWh of electricity each day.

NUMERICAL FOR PRACTICE

(5) If a 60 W electric bulb is lighted for 6 hours how much electrical energy is consumed?

Ans. 0.36 kWh

(6) A man draws a bucket of water from a well which is 10 m deep in 20 secs. If the mass of the water drawn is 20 kg, find the power used by the man. Can the power be calculated if mass of water is not known? (g = 9.8 m/s²)

Ans. 98 W

(7) An electric pump is used to lift water to a height of 60 m in 2 minutes. If the mass of the water raised is 800 kg, find the power of pump. (g = 9.8 m/s²)

Ans. 3920 W

(8) An electric motor is used to lift the water stored in a tank at the ground level to an overhead tank at a height of 20 m. If the power of the motor is 1 HP how much time will be required to pump 746 kg of water? (Take g = 10 m/s²)

Ans. 2000 sec

*Q.12. Activity based question:

*(1) Study the following activity and answer the questions.

(i) Take two aluminium channels of different lengths.

(ii) Place the lower ends of the channels on the floor and hold their upper ends at the same height.

(iii) Now take two balls of the same size and weight and release them from the top end of the channels. They will roll down and cover the same distance.

Questions

(i) At the moment of releasing the balls, which energy do the balls have?

(ii) As the balls roll down which energy is converted into which other form of energy?

(iii) Why do the balls cover the same distance on rolling down?

(iv) What is the form of the eventual total energy of the balls?

(v) Which law related to energy does the above activity demonstrate? Explain.

Ans.

(i) At the moment of releasing the ball they possess P.E as they are at a height above the ground.

(ii) As the balls roll down, the P.E is converted into K.E since they are now in motion.

(iii) Since they have been released from the same height, they will cover the same distance.

(iv) The eventual form of the total energy of the balls is "Mechanical Energy" i.e a combination of P.E and K.E.

(v) The above activity demonstrates the "Law of Conservation of Energy"

As the balls roll down, the value of 'h' decreases due to which P.E also decreases as P.E = mgh. At the same time, the velocity of the balls increases as they roll down due to which

their K.E increases as K.E = $\frac{1}{2}$ mv²

Thus, we find that P.E decreases while K.E increases. But energy can neither be created nor destroyed. Thus, the P.E that decrease is in fact being converted to K.E.

*(2) Study the pictures given below and answer the questions:

Various activities
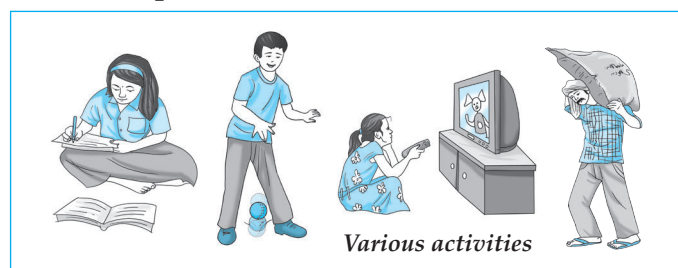
(i) In which of the pictures above has work been done?

(ii) From scientific point of view, when do we say that no work was done?

Ans.

(i) Girl studying : No work done
Boy playing with ball : Work is done
Girl watching T.V. : No work done
Person lifting sack of grains : Work is done

(ii) No work is said to be done when force is applied but there is no displacement.

*(3) Discuss the directions of force and of displacement in each of the following cases.

(i) Pushing a stalled vehicle

(ii) Catching the ball which your friend has thrown towards you.

(iii) Tying a stone to one end of a string and swinging it round and round by the other end of the string.

(iv) Walking up and down a staircase; climbing a tree.

(v) Stopping a moving car by applying brakes.

Ans.

(i) Force and displacement are in the same direction.

(ii) Force and displacement are in the opposite direction.

(iii) Force and displacement are perpendicular to each other.

(iv) Force and displacement are in the same direction.

(v) Force and displacement are in the opposite direction.

*(4) Minakshee wants to displace a wooden block from point A to point B along the surface of a table as shown. She has used force F for the purpose.

(i) Has all the energy she spent been used to produce acceleration in the block?

(ii) Which forces have been overcome using that energy?

Ans.

(i) Only part of the energy applied by Minakshee is used in accelerating the block

(ii) Force of friction has been overcome using the energy

*(5) You have learnt how to calculate the work done on an object when the displacement is in the direction of the applied force. But if the displacement is not in the direction of the applied force, how do we calculate the amount of work done?

Ans.

(i) If the displacement is not in the direction of the applied force,

Then amount of work done can be calculated as, $W = Fs \cos \theta$: θ = angle formed between force and displacement.

(ii) Where $\theta = 180°$ or $90°$

*(6) Ajay and Atul have been asked to determine the potential energy of a ball of mass m kept on a table as shown in the figure. What answers will they get? Will they be different? What do you conclude from this?

Ans.
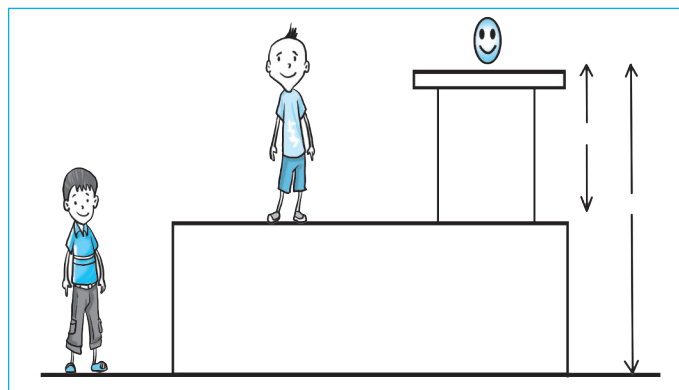
(i) Potential energy is relative.

(ii) The heights of the ball with respect to Ajay and Atul are different. So the potential energy with respect to them will be different.

*(7) (i) An arrow is released from a stretched bow.

(ii) Water kept at a high flows through a pipe into the tap below.

(iii) A compressed spring is released.

(a) Which words describe the state of the object in the above examples?

(b) Where did the energy required to cause the motion of the objects come from?

**(c) If the objects were not brought in those states, would they have moved?**

Ans.

(a) Words such as stretched bow, water kept at a height and compressed spring describes the state of the object.

(b) The energy required for the objects came from its specific state or motion in the form of potential energy.

(c) No, if the objects were not brought in those states, they would have not moved.

*(8) **Study the activity and figure 2.4 on textbook page 21 and answer the following questions.**

(i) **Figure A - Why does the cup get pulled?**

(ii) **Figure B - What is the relation between the displacement of the cup and the force applied through the ruler?**

(iii) **In Figure C - Why doesn't the cup get displaced?**

(iv) **What is the type of work done in figures A, B and C?**

(v) **In the three actions above, what is the relationship between the applied force and the displacement?**

Ans.

(i) The cup get pulled as the force of the nut and the displacement of the cup is in the same direction.

(ii) The displacement of the cup and the force applied through the ruler is in the opposite direction.

(iii) The cup does not get displaced as two equal forces are working in opposite direction.

(iv) The work done in figure A is positive, figure B is negative and in figure C is zero.

(v) In figure A the applied force and the displacement is in the same direction, in figure B the applied force and the displacement is in the opposite direction and in figure C the applied force and displacement is perpendicular to each other.

*(9) **Make two pendulums of the same length with the help of thread and two nuts. Tie another thread in the horizontal position.**

Tie the two pendulums to the horizontal thread in such a way that they will not hit

each other while swinging. Now swing one of the pendulums and observe. What do you see?
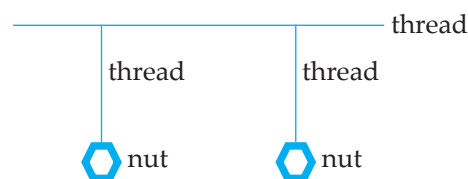
Ans.

You will see that as the speed of oscillation of the pendulum slowly decreases, the second pendulum which was initially stationary, begins to swing. Thus, one pendulum transfers its energy to the other.

*(10) **Mention the type of energy used in the following examples.**

(i) Stretched rubber string.

(ii) Fast moving car

(iii) The whistling of a cooker due to steam

(iv) A fan running on electricity

(v) Drawing out pieces of iron from garbage, using a magnet.

(vi) Breaking of a glass window pane because of a loud noise.

(vii) The crackers exploded in Diwali

Ans.

(i) Potential energy   (ii) Kinetic energy

(iii) Sound energy   (iv) Electrical energy

(v) Kinetic energy   (vi) Mechanical energy

(vii) Sound energy, light energy and heat energy

*(11) **What are different types of forces? Give examples.**

Ans. The different types of force are

(a) Gravitational force e.g.: The force exerted by the earth on all objects.

(b) Frictional force

*(12) **Why is the work done on an object moving with uniform circular motion zero?**

Ans.

(a) In uniform circular motion, the direction of the applied force and the also displacement are perpendicular to each other.

(b) The work done by a force is given by $W = Fs \cos \theta$. Since $\theta = 90°$, $\cos 90° = 0$ the work done is zero.

*(13) **Form the following activities find out whether work is positive, negative or zero. Give reasons for your answers.**

(a) **A boy is swimming in a pond.**

(b) **A coolie is standing with a load on his head**

(c) **Stopping a moving car by applying brakes**

(d) **Catching the ball which you friend has thrown towards you**

Ans.

(a) **A boy is swimming in a pond :** The work done is positive because the direction of applied force and displacement are the same.

(b) **A coolie is standing with a load on his head:** The work done is zero because the applied force does not cause any displacement.

(c) **Stopping a moving car by applying brakes:** The work done is negative because the fore applied by the brakes acts in a direction opposite to the direction of motion of car.

(d) **Catching the ball which you friend has thrown towards you :** Negative force because the force required to stop the ball, acts opposite the displacement of the ball.

*(14) **Find whether work is positive, negative or zero.**

(a) **Person moving along circle from A to B.**

Ans. Work done is zero because the direction of applied force and displacement are perpendicular to each other.

(b) **Person completing one circle and returns to position A.**

Ans. Work done is zero because there is no displacement for the person.

*(15) **Why does it happen ?**

(a) **If a pot having a plant is kept in the dark, the plant languishes.**

Ans.

(i) During photosynthesis plants convert solar energy into chemical energy and use it for their growth.

(ii) Since the plant is kept in dark, photosynthesis i.e. the energy production does not occur.

(iii) Hence, plant grow feeble due to absence of energy.

(b) **On increasing the volume of a music system or TV beyond a limit, the vessels in the house start vibrating.**

Ans. The magnitude of sound energy increases and it gets transferred from place to another. since energy can do work, on increasing the volume of a music system or TV beyond a limit, the vessels in the house start vibrating.

(c) **Collecting sunlight on a paper with the help of a convex lens burns the paper.**

Ans.

(i) While collecting sunlight on a paper through a convex lens, solar energy is converted into heat energy.

(ii) Hence, the paper burns converting heat energy into light energy.

*(16) **What will happen in the following cases?**

(a) **A fast cricket ball strikes the stumps.**

Ans. When a fast moving cricket ball strikes the stationary stumps then the stumps move and fall. Thus, the moving ball shares its kinetic energy with stumps thereby making the stumps to fall.

(b) **The striker hits a coin on the carom board.**

Ans. When the striker hits the coin on the carom board then the coins move in thereby making the coins to move.

(c) **One marble strikes another in a game of marbles.**

Ans. When one marble strikes the other marbles then the kinetic energy of the marble makes the other stationary marble to move.

*(17) **If the mass of a moving body is doubled, how may times will the kinetic energy increase?**

Ans. Mass is doubled without changing velocity.

If mass is doubled, kinetic energy will also be doubled.

Since mass is directly proportional to kinetic energy.

$$K.E = \frac{1}{2}mv^2$$

K.E α m if v is constant.

Brain Power

(1) **If a TV of rating 100W is operated for 6 hrs per day, find the amount of energy consumed in any leap year?**

Ans. **Given :**

Power (P) = 100 W

$$= \frac{100}{1000} \text{ kW}$$

$$= 0.1 \text{ kW}$$

Time (t) = 6 × 366

$$= 2196 \text{ hrs.}$$

To Find :

Electric energy consumed

Formula :

Electric energy consumed = power × time

Solution :

Electric energy consumed = power × time

$$= 0.1 × 2196$$

$$= 219.6 \text{ kWh}$$

The amount of energy consumed is 219.6 kWh

(2) **A ball is thrown vertically upwards, what will be its velocity when it reaches the maximum height?**

Ans. The velocity of the ball when it reaches the maximum height will be zero.

(3) **A girl is walking on a horizontal leveled road, the work done by the gravitational force on her will be?**

Ans. Zero, since force and displacement are perpendicular to each other.

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ASSIGNMENT - 2
Time : 1 Hr.   Marks : 30

Q.1. (A) Choose the correct alternatives and rewrite the complete sentences: (6)

(1)   The work done is zero if there is no ....

(a) displacement   (b) change of state   (c) acceleration   (d) change in velocity

(2)   By stretching the rubber strings of a catapult we store .... energy in it.

(a) kinetic   (b) mechanical   (c) chemical   (d) potential

(3)   A bullet fired from a gun possesses .... energy.

(a) potential   (b) kinetic   (c) power   (d) mechanical

(4)   S.I unit of work is ....

(a) joule   (b) newton   (c) pascal   (d) dyne

(5)   1 kWh = ... joules.

(a) 3.6×10^3 J   (b) 3.6×10^6 J   (c) 6.3×10^6 J   (d) 6.3×10^3 J

(6)   The work done by a force is said to be .... when the applied force does not produce displacement.

(a) Positive   (b) Negative   (c) Zero   (d) None of these

(B) Match the following: (2)

Column 'A'	Column 'B'
(1) Potential Energy	(a) Can be positive, negative or zero
(2) Power	(b) Energy possessed by an athlete
(3) Work	(c) Water raised at some height
(4) Kinetic energy	(d) Depends on work and time

Q.2. (A) Give scientific reasons: (6)

(1)   Flowing water from some height can rotate a turbine.

(2)   A stretched rubber band when released regains its original length.

(3)   Work done on an artificial satellite by gravity is zero while moving around the earth.

(B) Define or state : (4)

(1)   Energy   (2) Potential energy.

(3)   Law of conservation of energy.   (4) Work.

Q.3. Solve the following numerical: (4)

(1)   Calculate the potential energy acquired by a 10 kg hammer when it is raised to a height of 10 m.

(2)   The velocity of a car increases from 54 km/hr to 72 km/hr. If the mass of the car is 1500 kg, find the work done to increase the velocity.
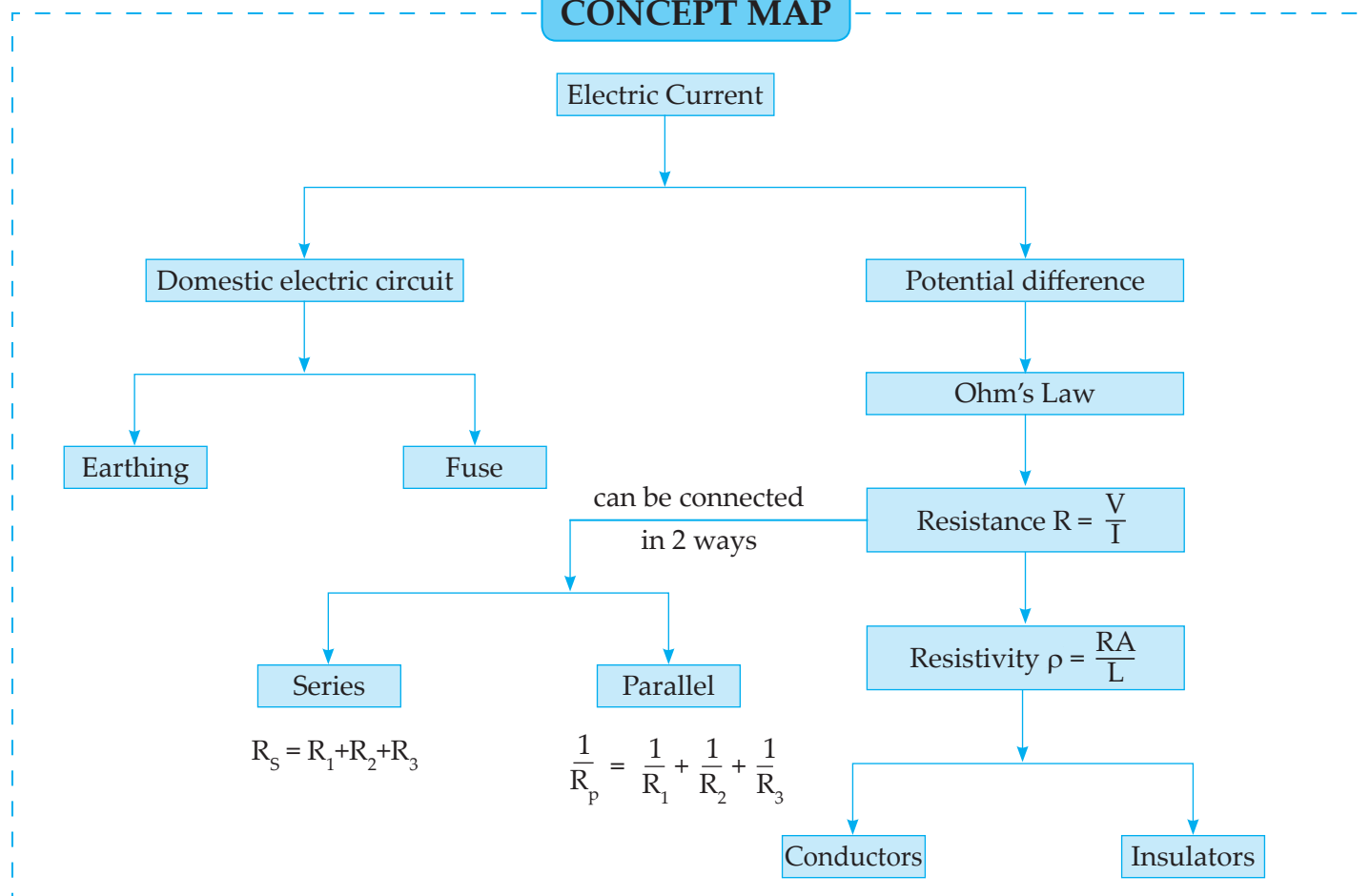
Q.4. Answer in brief: (8)

(1)   (i)   Derive the expression for work done when the displacement is in the direction of the force.

(ii) Distinguish between Kinetic Energy and Potential Energy.

(2)   Derive the expression for kinetic energy.

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3 Current Electricity

CONCEPT MAP

Electric Current

Domestic electric circuit

Potential difference

Earthing   Fuse

Ohm's Law

can be connected
in 2 ways

Resistance R = $\dfrac{V}{I}$

Series   Parallel

Resistivity $\rho = \dfrac{RA}{L}$

$R_S = R_1 + R_2 + R_3$

$\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

Conductors   Insulators

MASTER KEY QUESTION SET - 3

Q.1. **(A) Rewrite the following statements by selecting the correct options given below:**

(1)   1 mA = ... A.
(a) 10^3 (b) 10^{-3} (c) 10^6 (d) 10^{-6}

(2)   To increase the effective resistance in a circuit the resistors are connected in ....
(a) series   (b) parallel
(c) both ways   (d) none of these

(3)   1 kilowatt hr = ... joules.
(a) 4.6×10^6 (b) 3.6×10^6
(c) 30.6×10^6 (d) 3.6×10^5

(4)   If a P.D. of 12 V is applied across a 3 Ω resistor then the current passing through it is ....
(a) 36 A   (b) 4 A   (c) 0.25 A (d) 15 A

(5)   In order to measure the electric current flowing through a circuit, we connect .... with the circuit.
(a) a voltmeter in parallel
(b) a voltmeter in series
(c) an ammeter in parallel
(d) an ammeter in series

(6)   P and Q are two wires of same length and different cross sectional areas and made of same material. Name the property which is same for both the wires.
(a) Resistivity   (b) Resistance
(c) current   (d) Both (a) and (b)

(7)   The voltage difference in India between the live and neutral wires is about ....
(a) 110 V   (b) 220 V   (c) 440 V   (d) 60 V

(8)   Following is true for identical bulbs connected in parallel.

(41)

(a) All bulbs glow with unequal brightness

(b) If one bulb is non functional, all will stop working

(c) All bulbs glow with equal brightness

(d) Bulbs function for longer time

(9) Resistivity is the specific property of a ....

(a) Area of cross section   (b) temperature

(c) length   (d) material

(10) The .... wire is either yellow or green in colour.

(a) live   (b) neutral (c) earth   (d) fuse

Ans. *(1) 10^{-3} (2) series (3) 3.6×10^6 (4) 4 A. (5) an ammeter in series (6) Resistivity (7) 220 V (8) All bulbs glow with equal brightness (9) material (10) earth*

(B) Fill in the blanks and rewrite the complete statements:

(1) A current flows through a circuit due to the difference in .... between two points in the conductor.

(2) .... is the amount of charge flowing through a particular cross sectional area in unit time.

(3) The flow of .... constitutes the electric current in a wire.

(4) The conventional direction of flow of current is from .... terminal to .... terminal.

(5) Current stops flowing when potential difference between two ends of a wire becomes ....

(6) Resistances are connected in .... so as to pass the same current through them.

(7) To decrease effective resistance in circuit, the resistances are connected in ....

(8) $1\mu V$ = ... V

(9) Good conductors contain a large number of ....

(10) Electrons flow from .... terminal to .... terminal in a conductor when potential difference is applied.

Ans. *(1) potential (2) Electric current (3) electrons (4) positive, negative (5) zero (6) series (7) parallel (8) 10^{-6} (9) free electrons (10) negative, positive*

Q.2. State whether the following statements are true or false and if false, write the correct statement:

(1) The SI unit of charge is volt.

Ans. **False,** The SI unit of charge is coulomb.

(2) Voltmeter is always connected in series with the device.

Ans. **False,** Voltmeter is always connected in parallel with the device.

(3) The conventional direction of flow of current is from positive terminal to negative terminal.

Ans. **True**

(4) Silver and copper are good conductors.

Ans. **True**

(5) Resistivity of pure metals is more than alloys.

Ans. **False,** Resistivity of pure metals is less than alloys.

(6) Resistance in series arrangement is used to decrease resistance of circuit.

Ans. **False,** Resistance in series arrangement is used to increase resistance of circuit.

(7) A conducting wire offers less resistance to flow of electrons.

Ans. **True**

(8) Charges are measured in ampere.

Ans. **False,** Charges are measured in coulomb.

(9) The unit of potential difference is ampere.

Ans. **False,** The unit of potential difference is volt.

(10) Resistance of a conductor is inversely proportional to the length of the conductor.

Ans. **False,** Resistance of a conductor is directly proportional to the length of the conductor.

(11) Ammeter is connected in parallel to the cell to measure current.

Ans. **False,** Ammeter is connected in series to the cell to measure current.

(12) Fuse is made of wire having high melting point.

Ans. **False,** Fuse is made of wire having low melting point.

Q.3. Match the columns:

(A) Column 'A'	Column 'B'
(1) Electric current	(a) joule
(2) Electric charge	(b) ampere
(3) Electric resistance	(c) ohm
(4) Potential difference	(d) coulomb
	(e) volt

Ans. *(1 - b), (2 - d), (3 - c), (4 - e)*

(B)	Column 'A'	Column 'B'
(1)	Electric current	(a) It
(2)	Electric charge	(b) Q/t
(3)	Potential difference	(c) *mgh*
(4)	Electric resistance	(d) IR
		(e) V/I

Ans. *(1 - b), (2 - a), (3 - d), (4 - e)*

*(C)	Column 'A'	Column 'B'
(1)	Free electrons	(a) V/ R
(2)	Current	(b) Increases the resistance in the circuit
(3)	Resistivity	(c) Weakly attached
(4)	Resistances in series	(d) VA/LI

Ans. *(1 - c), (2 - a), (3 - d), (4 - b)*

Q.4. Answer the following in one or two sentences:

(1) Which is the unit used to measure large voltages?

Ans. Kilovolts and Megavolts are the units used to measure large voltages.

(2) What is the SI unit of potential difference?

Ans. The SI unit of Potential difference is volt (V).

(3) What is lightning?

Ans. Lightning is the electric discharge travelling from clouds at high potential to earth surface which is at zero potential.

(4) What is the unit of resistivity.

Ans. The unit of resistivity is ohm metre (Ωm).

(5) Which substances are called conductors of electricity?

Ans. Those substances which have very low electrical resistance are called conductors of electricity.

(6) What is Earth wire?

Ans. Earth wire is generally yellow or green colour, it is connected to a metal plate buried deep underground near the house and is for safety purpose.

(7) What are Non-ohmic conductors?

Ans. Conductors which do not obey Ohm's Law are called non-ohmic conductors.

(8) What are superconductors?

Ans. The resistance of some conductors becomes nearly zero if their temperature is decreased upto a certain value close to 0 K. Such conductors are called superconductors.

Q.5. Define the following:

(1) Electric current

Ans. An electric current is the flow of electrons through a conductor. Quantitatively, current (I) is defined as the charge passing through a conductor in unit time.

(2) 1 ampere

Ans. One ampere current is said to flow in a conductor if one coulomb charge flows through it every second.

$$1 \, A = \frac{1 \, C}{1 \, s}$$

(3) 1 volt

Ans. The potential difference between two points is said to be 1 volt if 1 joule of work is done in moving 1 coulomb of electric charge from one point to another.

$$1 \, V = \frac{1 \, J}{1 \, C}$$

(4) Potential Difference

Ans. The amount of work done to carry a unit positive charge from point A to point B is called the electric potential difference between the two points.

(5) Conductor

Ans. Those substances which have very low resistance are called conductors. Current can flow easily through such materials.

(6) Insulators

Ans. Those substances which have extremely high resistance and through which current cannot flow are called insulators.

(7) 1 ohm

Ans. If one ampere current flows through a conductor when one volt potential difference is applied between its ends, then the resistance of the conductor is one ohm.

$$\frac{1 \, volt}{1 \, ampere} = 1 \, ohm \, (Ω)$$

(8) Potential

Ans. The level of electric charge present is known as potential.

(9) Ohm's Law

Ans. If the physical state of a conductor remains constant, the current (I) flowing through it is directly proportional to the potential difference (V) between its two ends.

Q.6. **Give scientific reasons:**

(1) **Free electrons are required for conduction of electricity.**

Ans.

(i) Every atom of a metallic conductor has one or more outermost electrons which are very weakly bound to the nucleus.

(ii) These are called free electrons. These electrons can easily move from one part of a conductor to its other parts. The negative charge of the electrons also gets transferred as a result of this motion.

(iii) The free electrons in a conductor are the carriers of negative charge. Hence free electrons are required for conduction of electricity.

(2) **Wood and glass are good insulators.**

Ans.

(i) Those substances which have infinitely high electrical resistance are called insulators.

(ii) Wood and rubber have high resistance and negligible free electrons for conduction of electricity.

(iii) Hence wood and rubber are good insulators.

(3) **Connecting wires in a circuit are made of copper and aluminium.**

Ans.

(i) Copper and aluminium are good conductors of electricity.

(ii) They have low electrical resistance.

(iii) As they are malleable and ductile, they can be drawn into thin wires. Hence connecting wires in a circuit are made of copper or aluminium.

(4) **A thick wire has a low resistance.**

Ans.

(i) The resistance (R) of a wire is inversely proportional to the cross sectional area (A) of a wire. i.e. .R $\propto \dfrac{1}{A}$

(ii) Thus, greater is the cross sectional area of a conductor (wire), lower is its resistance. Hence a thick wire has a low resistance.

(5) **A series combination of resistances is used to increase the resistance of a circuit.**

Ans.

(i) When resistances are connected in series , the effective resistance of the resistors is equal to the sum of their individual resistances. $R_S = R_1 + R_2 ...$

(ii) The effective resistance is larger than each of the individual resistances. Hence, This arrangement is used to increase the resistance in a circuit.

(6) **A parallel combination of resistances decreases the effective resistance of the circuit.**

Ans.

(i) In a parallel combination, the inverse of the effective resistance is equal to the sum of the inverses of individual $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$ resistances.

(ii) The effective resistance of resistors connected in parallel is less than the individual resistors.

(iii) Due to this, any addition of an individual resistance in parallel combination will decrease the overall resistance of the circuit. Hence a parallel combination of resistance decreases the effective resistance of the circuit.

(7) **Lightning occurs from sky to earth.**

Ans.

(i) Lightning is the electric discharge travelling from clouds at high potential to the earth surface, which is at zero potential.

(ii) The earth is always at lower potential as compared to the clouds.

(iii) Hence, lightning occurs from sky to earth.

(8) **In street lights bulbs are connected in parallel.**

Ans .

(i) Even if any one of the several bulbs connected in parallel becomes non-functional because of some damage to its filament, the circuit does not break as the current flows through the other paths, and the rest of the bulbs light up.

(ii) When several bulbs are connected in parallel, they emit the same amount of light as when they are connected individually in the circuit, while bulbs connected in series emit less light than when connected individually. Hence street lights are connected in parallel.
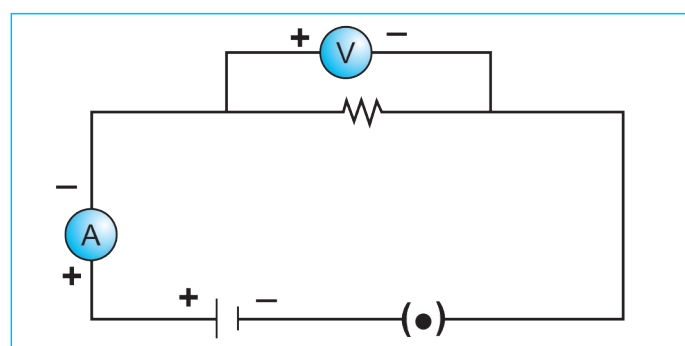
Q.7. **Answer in brief:**

*(1) **The following figure shows the symbols for components used in the accompanying electrical circuit.**
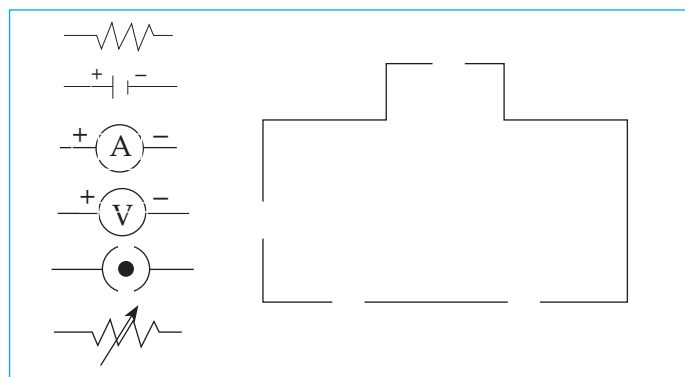
(A) Place them at proper places and complete the circuit.

(B) Which law can you prove with the help of the above circuit?

Ans. (A)

(B) This circuit can be used to prove Ohm's law.

*(2) **Umesh has two bulbs having resistances of 15 Ω and 30 Ω. He wants to connect them in a circuit, but if he connects them one at a time the filament gets burnt. Answer the following.**

(A) Which method should he use to connect the bulbs?

(B) What are the characteristics of this way of connecting the bulbs depending on the answer of A above?

(C) What will be the effective resistance in the above circuit?

Ans.

(A) Umesh should connect the bulbs in series combination.

(B) (i) Bulbs are connected in series. (ii) Overall resistance will increase and hence current will decrease. (iii) So the filament of the bulb will not get burnt.

(C) The effective resistance in the circuit will be $R_S = R_1 + R_2 = 15 + 30 = 45\ \Omega$.

*(3) **The following table shows current in amperes and potential difference in volts.**

V (volts)	I (Amp)
4	9
5	11.25
6	13.5

(A) Find the average resistance.

(B) What will be the nature of the graph between the current and potential difference? (Do not draw a graph.)

(C) Which law will the graph prove? Explain the law.

Ans.

(A) $V_1 = 4V$, $V_2 = 5V$, $V_3 = 6V$

$I_1 = 9A$, $I_2 = 11.25A$, $I_3 = 13.5A$

$R_1 = \dfrac{V_1}{I_1} = \dfrac{4}{9} = 0.44\ \Omega$

$R_2 = \dfrac{V_2}{I_2} = \dfrac{5}{11.25} = 0.44\ \Omega$

$R_3 = \dfrac{V_3}{I_3} = \dfrac{6}{13.5} = 0.44\ \Omega$

Average resistance $= \dfrac{R_1 + R_2 + R_3}{3}$

$= \dfrac{(0.44 + 0.44 + 0.44)}{3}$

$= 0.44\ \Omega$

(B) Graph will be linear as current and potential difference are directly proportional.

(C) The graph proves Ohm's Law. It states that "If the physical state of a conductor remains constant, the current (I) flowing through it is directly proportional to the potential difference (V) between its two ends".

*(4) **The resistance of a conductor of length x is r. If its area of cross-section is a, what is its resistivity? What is its unit?**

Ans. Resistance (R) = r Length (L) = x

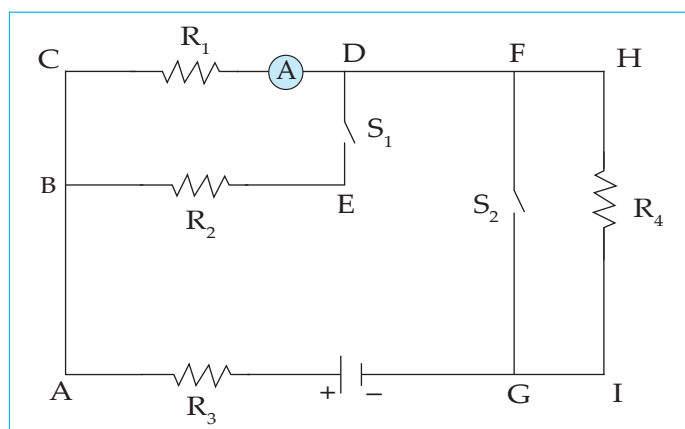Area of cross section (A) = a Resistivity (ρ) = ?

We know that,

$R = \dfrac{\rho L}{A}$

$\therefore\ \ \rho = \dfrac{RA}{L}$

$\rho = \dfrac{ra}{x}\ \Omega\,m$

Its unit is ohm-metre ($\Omega\,m$)

*(5) **Resistances R_1, R_2, R_3 and R_4 are connected as shown in the figure. S_1 and S_2 are two keys. Discuss the current flowing in the circuit in the following cases.**

(A) Both S_1 and S_2 are closed.

(B) Both S_1 and S_2 are open.

(C) S_1 is closed but S_2 is open.

Ans.

(A) When both S_1 and S_2 are closed, the effective resistance of the circuit decreases and hence current will increase.

(B) When both S_1 and S_2 are open, the effective resistance of the circuit increases and hence current will decrease.

(C) When S_1 is closed and S_2 is open, the effective resistance of the circuit decreases and hence current will increase. [current will be more than case (b) but less than in case (a)]

*(6) Three resistances x_1, x_2 and x_3 are connected in a circuit in different ways. x is the effective resistance. The properties observed for these different ways of connecting x_1, x_2 and x_3 are given below. Write the way in which they are connected in each case. (I-current, V-potential difference, x-effective resistance)

(A) Current I flows through x_1, x_2 and x_3

(B) x is larger than x_1, x_2 and x_3

(C) x is smaller than x_1, x_2 and x_3

(D) The potential difference across x_1, x_2 and x_3 is the same

(E) $x = x_1 + x_2 + x_3$

(F) $x = \dfrac{1}{\dfrac{1}{x_1} + \dfrac{1}{x_2} + \dfrac{1}{x_3}}$

Ans.

(A) If I is total current and same current I flows through x_1, x_2 and x_3 , then the three resistors are connected in series combination.

(B) As x is larger than x_1, x_2 and x_3 , they are connected in series. As effective resistance in series is greater than individual resistance.

(C) As x is smaller than x_1, x_2 and x_3, they are connected in parallel. As effective resistance in parallel is smaller than individual resistance.

(D) As the potential difference across x_1, x_2 and x_3 is the same, they are connected in parallel.

(E) $x = x_1 + x_2 + x_3$ is the formula for effective resistance in the circuit when resistances are connected in series.

(F) $x = \dfrac{1}{\dfrac{1}{x_1} + \dfrac{1}{x_2} + \dfrac{1}{x_3}}$

This can also be expressed as,

$\dfrac{1}{x} = \dfrac{1}{x_1} + \dfrac{1}{x_2} + \dfrac{1}{x_3}$

This is the formula for the effective resistance of the circuit when resistors are connected in parallel.

(7) P and Q are the two wires of same length and different cross sectional areas and made of same metal. Name the property which is same for both the wires and different for both the wires.
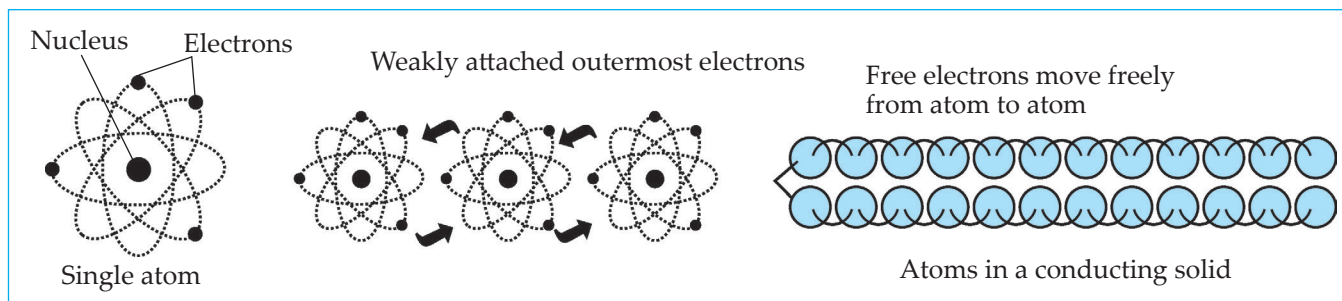
Ans.

(i) Resistivity of the wire is dependent upon the material of the wire, hence, resistivity of both the wires is same.

(ii) Resistance is inversely proportional to the cross sectional area. As the cross sectional areas of the two wires are different, their resistances will be different.

(8) Resistivity of some materials is given below. State which one will be the best conductor and the best insulator.

Material	Copper	Nichrome	Diamond
Resistivity Ω m	1.7×10^{-8} Ω m	1.1×10^{-6} Ω m	1.62×10^{13} to 1.62×10^{18} Ω m

Ans.

(i) Copper has the lowest resistivity i.e. 1.7×10^{-8} Ω m , hence it will be the best conductor.

(ii) Diamond has the highest resistivity i.e. 1.62×10^{13} to 1.62×10^{18} Ω m , hence it will be the best insulator.

(9)

Nucleus   Electrons   Weakly attached outermost electrons   Free electrons move freely from atom to atom

Single atom   Atoms in a conducting solid

Ans.

(i) Every atom of a metallic conductor has one or more outermost electrons which are very weakly bound to nucleus.

(ii) These are called free electrons.

(iii) These electrons can easily move from one part of a conductor to its other parts.

(10) Explain the function and working of a fuse.

Ans.

(i) Fuse wire is used to protect domestic appliances.

(ii) It is made of a mixture of substances and has a specific melting point.

(iii) It is connected in series to the electric appliances. If for some reason, the current in the circuit increases excessively, the fuse wire gets heated up and melts. The circuit gets broken and the flow of current stops, thus protecting the appliance.

(iv) This wire is fitted in a groove in a body of porcelain - like non-conducting material. For domestic use, fuse wires with upper limits of 1 A, 2 A, 3 A, 4 A, 5 A and 10 A are used.

Q.8. Distinguish between:

(1) Voltmeter and Ammeter

Voltmeter	Ammeter
(1) It is an instrument used to measure the potential difference between the two terminals of a cell.	(1) It is an instrument to measure the electric current flowing through the circuit.
(2) It is connected in parallel with the cell.	(2) It is connected in series with the cell.
(3) It has a very high resistance.	(3) It has a very low resistance.

(2) Conductors and Insulators

Conductors	Insulators
(1) Substances which have very low electrical resistances are called conductors.	(1) Substances which have extremely high electrical resistances are called Insulators.
(2) They contain a large number of free electrons.	(2) They contain practically no free electrons.
(3) Conductors are mostly metals.	(3) Insulators are mostly non metals.

(3) Resistance and Resistivity

Resistance	Resistivity
(1) The hindrance to the flow of electrons is called resistance.	(1) Resistivity is the specific property of the material of a conductor.
(2) The S.I unit of resistance is ohm (Ω).	(2) The S.I unit of resistivity is ohm-metre ($\Omega - m$).
(3) It depends on temperature, area of cross section, length of conductor and material of the conductor.	(3) It depends on material of the conductor.

**(4) Resistance in Series and Resistance in Parallel**

Resistance in Series	Resistance in Parallel
(1) Effective resistance of the resistors is equal to the sum of their individual resistances.	(1) Inverse of the effective resistances is equal to the sum of the inverse of individual resistances.
(2) The same current flows through each resistor.	(2) The total current flowing through the circuit is the sum of the currents flowing through individual resistors.
(3) The effective resistance is larger than each of the individual resistances.	(3) The effective resistance of resistors connected in parallel is less than the least resistance of individual resistors.
(4) This arrangement is used to increase the resistance in a circuit.	(4) This arrangement is used to decrease the resistance in a circuit.

Q.9. Answer in detail:

(1) Find the expression (i.e., derive the expression) for the resistors connected in series.

Ans. Expression for the resistance connected in series:

(i) Let R_1, R_2 and R_3 be three resistances connected in series between C and D.

(ii) Let R_S be the effective resistance in circuit and V_1, V_2 and V_3 be the potential difference across R_1, R_2 and R_3 respectively.

(iii) Let the potential difference across CD be V.
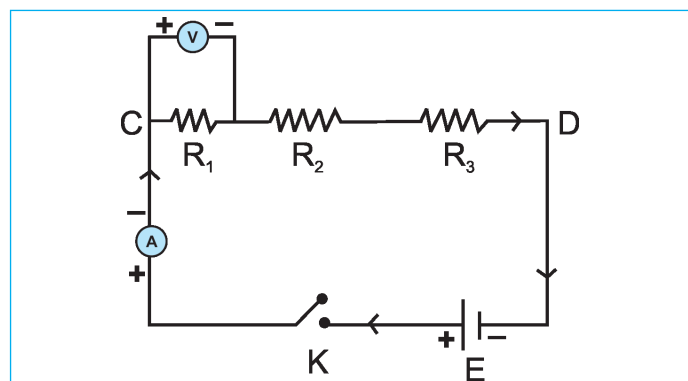
Resistors in series

(iv) In series combination.

$$V = V_1 + V_2 + V_3 \qquad \text{.... (i)}$$

By using Ohm's law

$$V = IR_S$$

$$\therefore \quad V_1 = IR_1, \ V_2 = IR_2 \text{ and } V_3 = IR_3$$

Substituting these values in equation (i) we get

$$IR_S = IR_1 + IR_2 + IR_3$$

$$\therefore \quad R_S = R_1 + R_2 + R_3$$

For 'n' number of resistors connected in series we get

$$R_S = R_1 + R_2 + R_3 + R_4 + R_5 + R_6 + \text{........} + R_n$$

(2) Find the expression (i.e., derive the expression) for the resistors connected in parallel.

Ans. Expression for the resistance connected in parallel.

(i) Let R_1, R_2 and R_3 be the three resistances connected in parallel combination between points C and D and let R_p be their effective resistance.

(ii) Let I_1, I_2 and I_3 be the currents flowing through resistances R_1, R_2 and R_3 respectively.

Let I be the current flowing through the circuit and V be the potential difference of the cell.
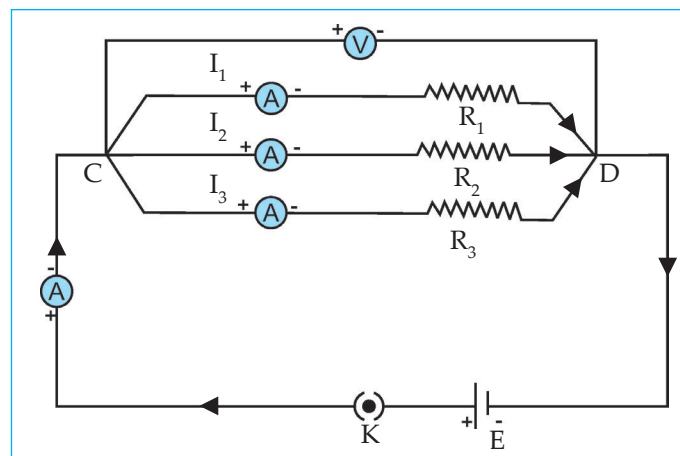
Resistors in Parallel

(iii) For parallel combination of resistances,

$$I = I_1 + I_2 + I_3 \qquad \text{...... (i)}$$

According to Ohm's law,

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

Therefore,

$$I_1 = \frac{V}{R_1}, \ I_2 = \frac{V}{R_2}, \ I_3 = \frac{V}{R_3}$$

(iv) Substituting the values of (I, I_1, I_2 and I_3) in equation (i) we get

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

$$V\left(\frac{1}{R_p}\right) = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

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

For '*n*' number of resistances

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

(3) Find the expression for resistivity of a material.

Ans.

(i) At a given temperature, the resistance (R) of a conductor depends on its length (L), area of cross-section (A) and the material it is made of.
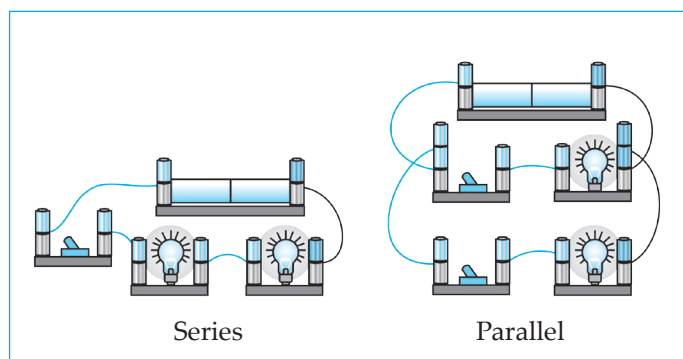
If the resistance of a conductor is R, then

$$R \propto L$$

Also, $R \propto \dfrac{1}{A}$

$\therefore \quad R \propto \dfrac{L}{A}$

$\therefore \quad R = \rho \dfrac{L}{A}$

(ii) ρ is the constant of proportionality and is called the resistivity of the material.

(iii) The unit of resistivity in SI units is ohm metre (Ω m).

(iv) Resistivity is a specific property of a material and different materials have different resistivity.

(4) In which arrangement will the bulbs be brighter? Why?

Series   Parallel

Ans.

(i) The amount of light given out by bulbs in parallel combination will be more than that in series combination.

(ii) In parallel combination the resistance of the overall circuit decreases whereas in series it increases, so the current flowing through the bulbs in parallel circuit is more.

(iii) Due to this intensity of light given out by bulbs in parallel combination is more than the bulbs in series combination.

(5) State some of the safety precautions to be taken while using electricity.

Ans:

(i) Electric switches and sockets should be fitted at a height at which small children cannot reach and put pins or nails inside. Plug wires should not be pulled while removing a plug from its socket.

(ii) Before cleaning an electrical appliance it should be switched off and its plug removed from the socket.

(iii) One's hands should be dry while handling an electrical appliance, and, as far as possible, one should use footwear with rubber soles. As rubber is an insulator, it prevents the current from flowing through our body, thereby protecting it.

(iv) If a person gets an electric shock, you should not touch that person. You should switch off the main switch or remove the plug from the socket if possible. If not, then you should use a wooden pole to push the person away from the electric wire.

(6) How are Domestic electrical connections made ?

Ans.

(i) The electricity in our homes is brought through the main conducting cable either from the electric pole or from underground cables.

(ii) Usually, there are three wires in the cable.

(a) **Live wire** which brings in the current. It has a red or brown insulation.

(b) **Neutral wire** through which the current returns. It is blue or black.

(c) **Earth wire** is of yellow or green colour. This is connected to a metal plate buried deep underground near the house and is for safety purposes.

(iii) In India, the voltage difference between the live and neutral wires is about 220 V.

(iv)   Live and neutral wires are connected to the electric meter through a fuse.

(v)   They are connected through a main switch, to all the conducting wires inside the home so as to provide electricity to every room.

(vi)   In each separate circuit, various electrical appliances are connected between the live and neutral wires.

(vii) The different appliances are connected in parallel and the potential difference across every appliance is the same.

Q.10. Draw a neat labelled diagram of the following:

**(1)   Symbols for components of an electric circuit and their uses.**

Ans.

Component	Symbol	Use
Electric cell		To apply a potential difference between two ends of a conductor
Battery (collection of a number of cells)		To apply a larger potential difference between two ends of a conductor
Open top key or plug key		To stop the flow of current in a circuit by disconnecting two ends of a wire.
Close top key or plug key		To start the flow of current in a circuit by connecting two ends of a wire.
Connecting (conducting) wires		To connect various components in the circuit
Crossing wires		To show wires which cross but are not connected
Light bulb		To test the flow of electricity; Lighted: current is flowing; Unlighted: current is not flowing
Resistance	R	To control the flow of current in the circuit

Variable resistance		To change the resistance as required and thereby control the current
Ammeter		To measure the current flowing in the circuit
Voltmeter		To measure the potential difference between two points in the circuit

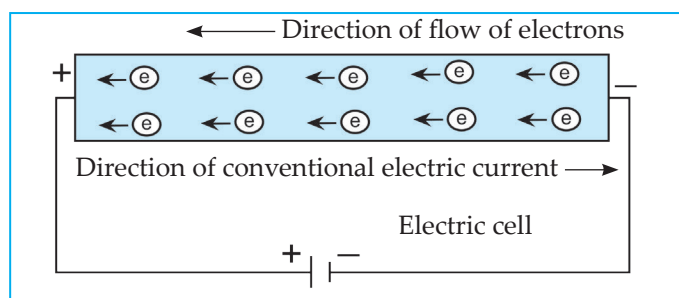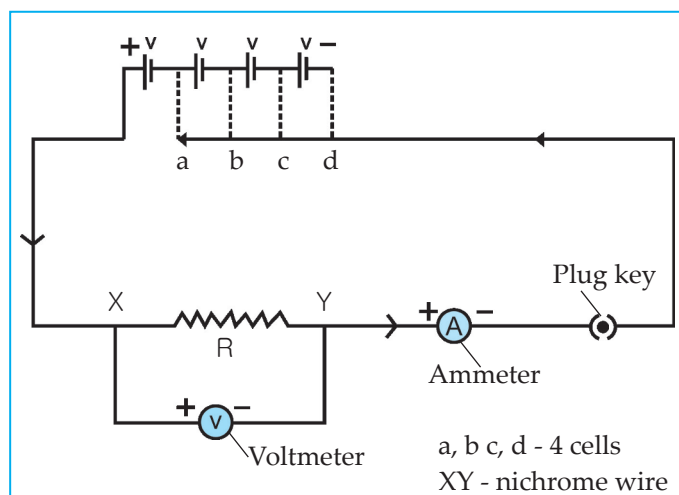**(2)   Random motion of free electrons in a metal wire.**

Ans.
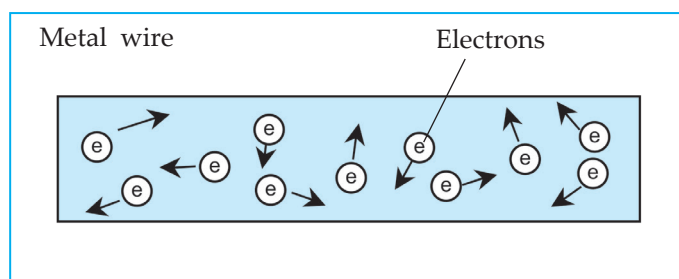
(3)   Motion of electrons after applying a potential difference to the two ends of a metal wire.

Ans.

(4)   Electrical circuit for experimental verification of Ohm's law.

Ans.

a, b c, d - 4 cells
XY - nichrome wire

Q.11. Numerical:

> **TYPE A**
> **Numericals based on the formulae:**
> **(1) Q = It (2) W = VQ**

*(1) A current of 0.4 A flows through a conductor for 5 minutes. How much charge would have passed through the conductor?

Ans.

Given:	Current (I) = 0.4 A
	Time (t) = 5 min = 5 × 60 = 300 s
To find:	Charge (Q) = ?
Formula:	Q = I × t
Solution:	Q = 0.4 × 300
	Q = 120 C.

Charge passing through the conductor is 120 C.

*(2) If a charge of 420 C flows through a conducting wire in 5 minutes. What is the value of the current?

Ans.

Given : Electric charge (Q) = 420 C
Time (t) = 5 min = 5 × 60
= 300 sec.

To find: Electric current (I) = ?

Formula: $I = \dfrac{Q}{t}$

Solution: $I = \dfrac{Q}{t}$

∴ $I = \dfrac{420}{300}$

∴ I = 1.4 A

∴ The current in the circuit is 1.4 A.

(3) Find the amount of work done if 3 C of charge is moved through a potential difference of 9 V.

Ans.

Given : Electric charge (Q) = 3 C
P. D. = (V) = 9 (V)

To find: Work done (W) = ?

Formula: $V = \dfrac{W}{Q}$

Solution: $V = \dfrac{W}{Q}$

∴ W = VQ

∴ W = 9 × 3

∴ W = 27 J

∴ The work done is 27 joule.

> **NUMERICAL FOR PRACTICE**

(4) The potential difference between any two points in a circuit is 60 V. If a charge of 24 C is transferred between these two points, find the work done in joules.

Ans. 1440 joule

(5) If 100 J of work is done in moving a charge of 5 C from one point to another, find the potential difference between the two points.

Ans. 20 volt

> **TYPE B**
> **Numericals based on the formulae:**
> **(1) V = IR (2) R = ρL/A**

*(1) If the resistance of the filament of a bulb is 1000 Ω. It is drawing a current from a source of 230 V. How much current is flowing through it?

Ans.

Given : Resistance (R) = 1000 Ω
P. D. = (V) = 230 (V)

To find: Current (I) = ?

Formula: $\dfrac{V}{I} = R$

Solution: $\dfrac{V}{I} = R$

$I = \dfrac{V}{R}$

∴ $I = \dfrac{230}{1000}$

∴ I = 0.23 A

∴ The current flowing through the filament of bulb is 0.23 A.

*(2) The length of a conducting wire is 50 cm and its radius is 0.5 mm. If its resistance is 30 Ω, what is the resistivity of its material?

Ans.

Given : L = 50 cm = 50 × 10⁻²m,
r = 0.5 mm = 0.5 × 10⁻³ m = 5 × 10⁻⁴m
R = 30 Ω

To find : Resistivity (ρ) of wire = ?

Formula : $\rho = \dfrac{RA}{L}$

Solution : $\rho = \dfrac{RA}{L}$ and A = πr^2

$= \dfrac{R \times \pi r^2}{L}$

$$\therefore \quad \rho = \frac{30 \times 3.14 \times (5 \times 10^{-4})^2}{50 \times 10^{-2}}$$

$$\therefore \quad \rho = \frac{30 \times 3.14 \times 25 \times 10^{-8}}{50 \times 10^{-2}}$$

$\therefore \quad \rho = 47.1 \times 10^{-6}$ Ωm

$\therefore \quad \rho = 4.71 \times 10^{-5}$ Ωm

The resistivity of the wire is 4.71×10^{-5} Ωm.

*(3) **A current of 0.24 A flows through a conductor when a potential difference of 24 V is applied between its two ends. What is its resistance?**

Ans.

Given : Current (I) = 0.24 A

P. D. (V) = 24 V

To find: Resistance (R) = ?

Formula: V = IR
Solution: V = IR

$\therefore \qquad R = \dfrac{V}{I}$

$\therefore \qquad R = \dfrac{24}{0.24}$

$\therefore \qquad R = 100$ Ω

$\therefore$ The resistance of conductor is 100 Ω.

*(4) **Determine the current that will flow when a potential difference of 33 V is applied between two ends of an appliance having a resistance of 100Ω. If the same current is to flow through an appliance having a resistance of 500Ω, how much potential difference should be applied across its two ends?**

Ans.

Given : P. D. (V_1) = 33V

Resistance (R_1) = 110 Ω

Resistance (R_2) = 500 Ω

To find: (i) Current (I) = ?

(ii) P.D. (V_2) for Resistance R_2 =?

Formula: V = IR

Solution:

(i) $V_1 = IR_1$

$\therefore \quad I = \dfrac{V_1}{R_1}$

$\therefore \quad I = \dfrac{33}{110} = 0.3$ A

(ii) $V_2 = IR_2$

$\therefore \quad V_2 = 0.3 \times 500$

$\therefore \quad V_2 = 150$ V

$\therefore$ The current is 0.3 A and potential difference to be applied is 150 V.

*(5) **Determine the resistance of a copper wire having a length of 1 km and diameter of 0.5 mm.**

Ans. **Given :** Resistivity of copper (ρ)

$= 1.7 \times 10^{-8}$ Ω m

Converting all measures into metres.

Length of wire (L) = 1 km

$= 1000$ m $= 10^3$ m

Diameter of wire (d) = 0.5 mm

$= 0.5 \times 10^{-3}$m

To find: Resistance of wire (R) = ?

Formula: $R = \rho \dfrac{L}{A}$

If r is the radius of the wire then, its area of cross-section

Solution:

$A = \pi/4 \times (0.5 \times 10^{-3})^2$ m$^2 = 0.2 \times 10^{-6}$ m^2

$R = \rho \dfrac{L}{A}$

$R = 1.7 \times 10^{-8}$ Ω-m $\times (10^3$m$) / 0.2 \times 10^{-6}$ m$^2 = 85$ Ω

Ans. Resistance of a copper wire is 85 Ω.

*(6) **The resistance of a 1 m long nichrome wire is 6 Ω. If we reduce the length of the wire to 70 cm, what will its resistance be?**

Ans. Case - I   Case - II

$R_1 = 6$ Ω $\rho = 6A$ ...(From (i))

$L_1 = 1$ m $L_2 = 70$ cm = 0.7 m

ρ and A are the same in both cases.

$R_1 = \dfrac{\rho L_1}{A}$ $R_2 = \dfrac{\rho L_1}{A}$

$6 = \dfrac{\rho \times 1}{A}$ $R_2 = \dfrac{6A \times 0.7}{A}$ ..(From (i)

$\rho = 6$ A   ..... (i) $= 6 \times 0.7$

$= 4.2$ Ω

NUMERICAL FOR PRACTICE

(7) Calculate the potential difference across a 7 Ω resistor carrying a current of 0.2 A.

Ans. **1.4 volt**

(8) A negligibly small current is passed through a wire of length 15 m and of uniform cross-section 6.0×10^{-7} m² and its resistance is measured to be 5.0 Ω. What is the resistivity of the material?

Ans. 2.0×10^{-7} Ωm

(9) A copper wire of length 2m and area of cross-section 1.7×10^{-6} m² has a resistance of 2×10^{-2} ohms. Calculate the resistivity of copper.

Ans. 1.7×10^{-8} Ωm

TYPE C

Numericals based on the formula:

(1) $R_S = R_1 + R_2 + R_3$ (2) $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

---

(1) If three resistors 15 Ω, 3 Ω and 4 Ω each are connected in series, what is the effective resistance in the circuit?

Ans.

Given: $R_1 = 15 \, \Omega$

$R_2 = 3 \, \Omega$

$R_3 = 4 \, \Omega$

To find: Effective resistance in series $(R_s) = ?$

Formula: $R_s = R_1 + R_2 + R_3$

Solution: $R_s = 15 + 3 + 4$

$\therefore \quad R_s = 22 \, \Omega$

The effective resistance in the circuit is 22 Ω.

*(2) Two resistors having resistance of 16 and 14 are connected in series. if a potential difference of 18 V is applied across them, calculate the current flowing through the circuit and the potential difference across each individual resistor.

Ans.

Given: $R_1 = 16 \, \Omega$

$R_2 = 14 \, \Omega$

$V = 18$ V

To find: Current $(I) = ?$

Potential across each resistance

i.e. $V_1, V_2 = ?$

Formula: $R_s = R_1 + R_2$

$I = \dfrac{V}{R}$

Solution: $R_s = R_1 + R_2$

$\therefore \qquad R_s = 16 + 14$

$\therefore \qquad R_s = 30 \, \Omega$

$V = IR_s$

$\therefore \qquad I = \dfrac{V}{R_S}$

$\therefore \qquad I = \dfrac{18}{30}$

$\therefore \qquad I = 0.6$ A

Also, $V_1 = IR_1$

$\therefore \qquad V_1 = 0.6 \times 16$

$\therefore \qquad V_1 = 9.6$ volt

$V_2 = IR_2$

$\therefore \qquad V_2 = 0.6 \times 14$

$\therefore \qquad V_2 = 8.4$ volt

The current in the circuit is 0.6 A and potential across 16 Ω resistor is 9.6 volt and 14 Ω resistor is 8.4 volt.

*(3) Three resistances 15 Ω, 20 Ω and 10 Ω are connected in parallel. Find the effective resistance of the circuit.

Ans.

Given: $R_1 = 15 \Omega$

$R_2 = 20 \, \Omega$

$R_3 = 10 \, \Omega$

To find: Effective resistance in parallel $(R_p) = ?$

Formula: $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

Solution: $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

$\therefore \qquad \dfrac{1}{R_p} = \dfrac{1}{15} + \dfrac{1}{20} + \dfrac{1}{10}$

$\therefore \qquad \dfrac{1}{R_p} = \dfrac{(4 + 3 + 6)}{60}$

$\therefore \qquad \dfrac{1}{R_p} = \dfrac{13}{60}$

$\therefore \qquad R_p = \dfrac{60}{13}$

$\therefore \qquad R_p = 4.615 \, \Omega$

The effective resistance of the circuit is 4.615 Ω. It is less than the least of the three i.e. 10 Ω.

*(4) If the resistors 5 Ω, 10 Ω and 30 Ω are connected in parallel to battery of 12 V, find the effective resistances of a circuit. Calculate the total current and current in each resistor.

Ans.

Given: $R_1 = 5 \Omega$

$R_2 = 10 \, \Omega$

$R_3 = 30\ \Omega$

$V = 12\ V$

To find: (i) Total current and current in each resistor i.e. I, I_1, I_2 and I_3?

(ii) Effective resistance $(R_p) = ?$

Formula: (i) $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$ (ii) $V = IR$

Solution: (1) $I_1 = \dfrac{V}{R_1}$

$\therefore$ $I_1 = \dfrac{12}{5}$

$\therefore$ $I_1 = 2.4\ A$

$I_2 = \dfrac{V}{R_2}$

$\therefore$ $I_2 = \dfrac{12}{10}$

$\therefore$ $I_2 = 1.2\ A$

$I_3 = \dfrac{V}{R_3}$

$\therefore$ $I_2 = \dfrac{12}{30}$

$\therefore$ $I_3 = 0.4\ A$

$I = I_1 + I_2 + I_3$

$\therefore$ $I = 2.4 + 1.2 + 0.4$

$\therefore$ $I = 4\ A$

(ii) $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

$\therefore$ $\dfrac{1}{R_p} = \dfrac{1}{5} + \dfrac{1}{10} + \dfrac{1}{30}$

$\therefore$ $\dfrac{1}{R_p} = \dfrac{6 + 3 + 1}{30}$

$\therefore$ $R_p = \dfrac{30}{10}$

$\therefore$ $R_p = 3\Omega.$

(i)   The total current is 4 A and current in each resistor is 2.4 A, 1.2 A and 0.4 A respectively.

(ii)   The effective resistance in parallel is 3Ω.

* (5)   **If two resistors are connected in series the total resistance is 80 Ω and if the same resistors are connected in parallel the total resistance becomes 20 Ω. Find the individual resistors.**

Ans.   Let R_1 and R_2 be the two resistances.

$\therefore$ $R_1 + R_2 = 80$

$\therefore$ $R_2 = (80 - R_1)$ .... (i)

Also, $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2}$

$\therefore$ $\dfrac{1}{R_p} = \dfrac{(R_1 + R_2)}{R_1 \times R_2}$

$\therefore$ $R_p = \dfrac{R_1 \times R_2}{(R_1 + R_2)}$

$\therefore$ $20 = \dfrac{R_1 \times (80 - R_1)}{80}$

$\therefore$ $1600 = 80R_1 - R_1^2$

$\therefore$ $R_1^2 - 40R_1 - 40R_1 + 1600 = 0$

$R_1(R_1 - 40) - 40(R_1 - 40) = 0$

$\therefore$ $(R_1 - 40)(R_1 - 40) = 0$

$\therefore$ $R_1 = 40$ OR $R_1 = 40$

$\therefore$ Hence the values of the two resistances R_1 and R_2 are 40 Ω and 40 Ω.

NUMERICAL FOR PRACTICE

(6)   Three resistances of 20 Ω, 40 Ω and 60 Ω are connected (i) in series (ii) in parallel.

Find their resultant resistance in each case.

Ans.   **(i) 120 Ω, (ii) 10.9 Ω**

(7)   Two resistances each of 20 Ω are connected in parallel. The combination is connected in series with a resistance of 20 Ω. Find the equivalent resistance of the combination.

Ans.   **30 Ω**

(8)   If two resistors are connected in series the total resistance is 9 Ω and if the same resistors are connected in parallel the total resistance becomes 2 Ω. Find the individual resistors.

Ans.   **6 Ω and 3 Ω**

*Q.12. Activity based questions:

(1)   **The accompanying figure shows some electrical appliances connected in a circuit in a house. Answer the following questions.**
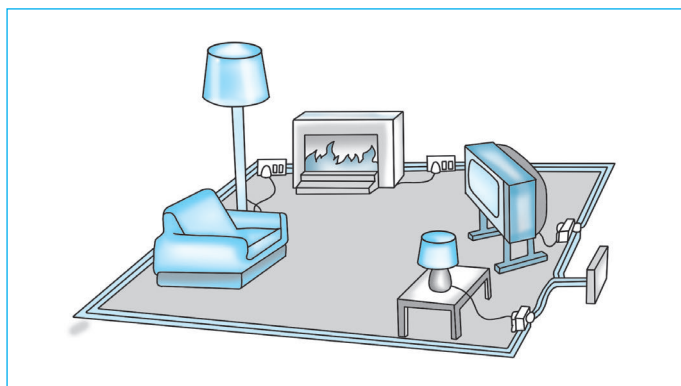
(i) By which method are the appliances connected?

Ans. Appliances are connected in parallel.

(ii) What must be the potential difference across individual appliances.

Ans. The potential difference across all appliances is same in parallel connection.

(iii) Will the current passing through each appliance be the same? Justify your answer.

Ans. No, as every appliance has a different load (resistance), current flowing through each appliance will be different.

(iv) Why are the domestic appliances connected in this way?

Ans. The appliances are connected in parallel as the potential difference remains same.

(v) If the T.V. stops working, will the other appliances also stop working? Explain your answer.

Ans. No, the other devices will not stop working as the current flowing through them is along different paths.

(2) Think about it.

How will you prove that the unit of resistivity is Ω m?

Ans. $R = \dfrac{\rho L}{A}$

$\therefore \quad \rho = \dfrac{RA}{L}$

$\therefore \quad \rho = \dfrac{\Omega m^2}{m}$

$\therefore \quad \rho = \Omega\, m$

(3)
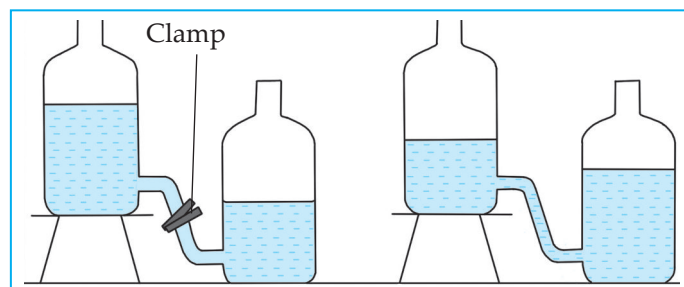
Level of water and direction of flow

Set up the experiment as shown in figure. Then remove the clamp from the rubber tube.

(i) What happens when the clamp is removed?

Ans. When the clamp is removed, water flows from higher level to lower level.

(ii) Does the water stop flowing? Why?

Ans. Yes, the water stops flowing. This happens when the level of water becomes equal in both the bottles, i.e.; there is no difference in the water levels.

(iii) What will you do to keep the water flowing for a longer duration?

Ans. The difference in the water level has to be maintained till that time. The difference must never be zero.

(4)
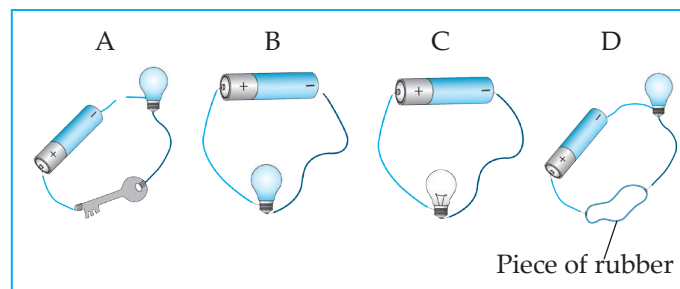
Point out the mistakes in the figure above.

Ans. A: Wire is broken at negative terminal. Bulb will not glow as circuit is incomplete.

B: Wire is disconnected at negative terminal. Bulb will not glow as circuit is incomplete.

C: Circuit is complete. Therefore bulb will glow.

D: Rubber is a bad conductor of electricity. Hence it will not allow current to flow and the bulb will not glow.

(5)
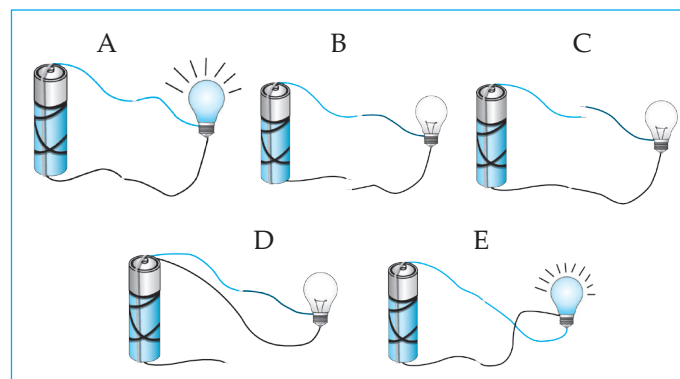
Why are the bulbs in Figures B, C and D not lighting up ?

Ans.

(i) In B, the blue wire is broken. Hence circuit is incomplete and current does not flow. Therefore bulb will not light up.

(ii) In C, the red wire is broken. Hence circuit is incomplete and current does not flow. Therefore bulb will not light up.

(iii) In D, both wires are connected to the same terminal. Hence there is no potential difference and current does not flow. Therefore bulb will not light up.

Brain Power

(1) Ramesh connected number of bulbs with a nichrome wire whereas Suresh connected all the bulbs with copper wire of same length and thickness. In whose case will the bulbs be brighter?

Ans.

(a) The resistance offered by copper is less and so more current passes through the wire.

(b) In nichrome, the resistance is more and less current passes through the wire.

(c) Thus the bulbs which Suresh connected will be brighter.

(2) If the length of a copper wire is doubled and its radius is halved, what is the effect on its resistivity?

Ans. As the resistivity depends only on the material used for the conductor, the resistivity remains the same.

(3) A fuse is always connected in series. Why?

Ans.

(a) Fuse protects circuits and electrical appliances by stopping the flow of excess of current.

(b) Fuse is connected in series. so that whatever current is passing through appliances has to pass through fuse.

❖ ❖ ❖

ASSIGNMENT - 3

Time : 1 hr. **Marks : 30**

Q.1. (A) Fill in the blanks by choosing the correct alternative from the brackets given below: **(2)**

(1) To increase the effective resistance in a circuit the resistors are connected in ....

(2) If a P.D. of 12 V is applied across a 3 Ω resistor then the current passing through it is ....

(B) State whether the following statement is true or false: **(2)**

(1) The SI unit of resistance is ohm-metre.

(2) Voltmeter is always connected in series with the device.

(B) Match the columns: **(2)**

Column 'A'	Column 'B'
(1) Electric current	(a) Coulomb
(2) Electric Charge	(b) Volt
	(c) Ampere

Q.2. (A) Define / State: **(4)**

(1) Ohm's law (2) Potential difference (3) 1 Ohm (4) 1 volt

(B) Answer the following: **(6)**

(1) Distinguish between Voltmeter and Ammeter.

(2) Wood and glass are good insulators. Why?

(3) Distinguish between : Resistance and Resistivity.

Q.3. Solve / Explain the following: **(9)**

(1) Umesh has two bulbs having resistance of 15 Ω and 30 Ω. He wants to connect them in a circuit, but if he connects them one at a time the filament gets burnt. Answer the following.

(A) Which method should he use to connect the bulbs?

(B) What are the characteristics of this way of connecting the bulbs depending on the answer of A above?

(C) What will be the effective resistance in the above circuit?

(2) The resistance of a conductor of length x is r. If its area of cross-section is a, what is its resistivity? What is its unit?

(3) Find the total resistance in the circuit.
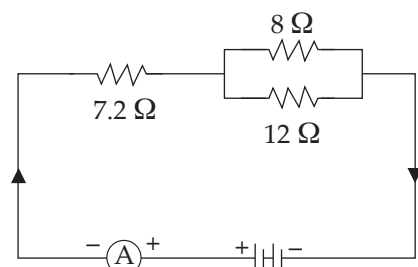
Q.4. Answer the following in brief: **(5)**

(1) Find the expression for the resistance connected in parallel.

❖ ❖ ❖

CONCEPT MAP

Atoms

have → Size

measured as → Atomic radius in nanometres

have → Mass

which determines → Atomic Mass and Molecular Mass — measured in Daltons

also expressed in grams called as → Moles

Also determines the number of molecules using → Avagadro's number

which are unstable, such → Atoms combine

according to → Laws of chemical combination

related to mass → Laws of Conservation of matter

related to proportion of atoms → Laws of Constant proportion

where compounds are represented by → Chemical Formulae

Written using → Valency of Elements

electrons in the outermost orbit of atoms determine

MASTER KEY QUESTION SET - 4

Q.1. Fill in the blanks and rewrite the complete statements:

(1) Compounds are formed by chemical combination of ....

(2) An important principle of Dalton's atomic theory is that molecules of a .... are formed by joining atoms of different elements.

(3) According to Law of Conservation of Matter, in a chemical reaction the total weight of the .... is same as the total weight of the ....formed due to chemical reactions.

(4) The French Scientist .... inferred from his research that 'There is no rise or drop in the weight of the matter during a chemical reaction'.

(5) The proportion by weight of hydrogen and oxygen in water is ....

(6) The proportion by weight of carbon and oxygen in carbon dioxide is ....

(7) A nucleus of an atom is made up of positively charged .... and electrically neutral ....

(8) The size of at atom is determined by its ....

(9) Atomic radius is expressed in ....

(10) 1 m = ... nm.

(11) The atomic size depends on the number of .... in the atom.

(12) The mass of an atom is concentrated in its ....

(13) The total number of protons and neutrons in the atomic nucleus is called the ....

(14) Protons and neutrons are together called ....

(15) The relative mass of hydrogen atom is ....

(16) A reference atom was required for expressing the .... of an atom.

(17) .... has been accepted as unit of atomic mass.

(18) Unified mass is called ....

(19) Symbol of atomic mass is ....

(20) 1 u = ... kg.

(21) The molecular mass of substance is the sum of the .... of all the atoms in single molecule of that substance.

(22) A .... is that quantity of a substance whose mass in grams is equal in magnitude to the molecular mass of that substance in Daltons.

(23) The number of molecules in one mole of only substance is called .... number.

(24) Avogadro's number is denoted by the symbol ....

(25) The value of Avogadro's number is ....

(26) A mole of any substance stands for .... molecules.

(27) The number of molecules in a given quantity of substance is determined by its ....

(28) .... quantities of different substances have different masses measured in grams.

(29) The capacity of an element to combine is called its ....

(30) Electronic configuration of sodium atom is ....

(31) Electronic configuration of chlorine atom is ....

(32) Positively charged ions are called as ....

(33) Negatively charged ions are called as ....

(34) The property of elements exhibiting more than one valency is called ....

(35) Iron (Fe) exhibits the variable valencies ....

(36) Cationic radicals are called as .... radicals.

(37) Anionic radicals are called as .... radicals.

(38) The magnitude of charge on any radical is its ....

(39) The force of attraction between a cation and an anion constitutes the ....

(40) Sodium chloride is an .... compound.

Ans. *(1) elements (2) compound (3) reactants; products (4) Antoine Lavoisier (5) 1 : 8 (6) 3 : 8 (7) protons; neutrons (8) radius (9) nanometres (10) 10^9 (11) electron orbits (12) nucleus (13) atomic mass number (14) nucleons (15) 1 (16) relative mass (17) Unified mass (18) Dalton (19) u (20) 1.66053904 × 10^{-27} (21) atomic masses (22) Mole (23) Avogadro's (24) N_A (25) 6.022 × 10^{23} (26) 6.022 × 10^{23} (27) molecular mass (28) one mole (29) valency (30) 2,8,1 (31) 2,8,7 (32) cations (33) anions (34) variable valency (35) 2 and 3 (36) basic (37) acidic (38) valency (39) ionic bond (40) ionic*

(B) Rewrite the following statements by selecting correct options given below:

(1) The unit Dalton is used to express ....

(a) atomic mass   (b) atomic radius

(c) atomic number   (d) mass number

(2) The valency of element with electronic configuration .... is 2.

(a) (2, 5)   (b) (2, 4)

(c) (2, 6)   (d) (2, 7)

(3) Iron (Fe) exhibits the variable valencies as ....

(a) 1 and 2   (b) 2 and 3

(c) 1 and 3   (d) 2 and 4

(4) A mole of any substance stands for .... molecules.

(a) 6.022 × 10^{23} (b) 6.022 × 10^{22}

(c) 60.22 × 10^{23} (d) 60.22 × 10^{22}

(5) The mass of an atom is concentrated in its ....

    (a) nucleus   (b) electrons

    (c) extra nuclear part   (d) protons

(6) The symbol of Avogadro's number is ....

    (a) N_D (b) N_O

    (c) N_B (d) N_A

(7) .... is a bicarbonate radical.

    (a) HCO_3^{2-} (b) CO_3^-

    (c) HCO_3^- (d) CO_3^{2-}

(8) Molecular formula of sodium sulphate is ....

    (a) $Na(SO_4)_2$ (b) Na_2SO_4

    (c) $Na_2(SO_4)_2$ (d) $NaSO_4$

(9) .... is a composite radical.

    (a) Fe^{3+} (b) Ca^{2+}

    (c) NH_4^+ (d) S^{2-}

(10) .... g of water make 1 mole of water.

    (a) 32   (b) 33

    (c) 16   (d) 18

Ans. *(1) atomic mass (2) (2, 6) (3) 2 and 3*

(4) 6.022×10^{23} (5) nucleus (6) N_A (7) HCO_3^-

(8) Na_2SO_4 (9) NH_4^+ (10) 18

Q.2. **State whether the following statements are true or false and if false, write the correct statement:**

(1) Molecular state of oxygen is monoatomic.

Ans. **False**, Molecular state of oxygen is diatomic.

(2) The capacity of an element to combine is called its valency.

Ans. **True**

(3) Anionic radicals are basic radicals.

Ans. **False**, Anionic radicals are acidic radicals.

(4) The magnitude of charge of any radical is its atomic number.

Ans. **False**, Magnitude of charge of any radical is its valency.

(5) In a chemical reaction, mass of original matter and mass of matter newly formed as a result of chemical change are equal.

Ans. **True**

(6) The proportion by weight of carbon and oxygen in carbon dioxide is 3 : 5.

Ans. **False**, The proportion by weight of carbon and oxygen in carbon dioxide is 3 : 8.

(7) Relative mass of hydrogen is 1.

Ans. **True**

(8) The number of molecules in a given quantity of a substance is determined by its atomic mass.

Ans. **False**, The number of molecules in a given quantity of a substance is determined by its molecular mass.

(9) Avogadro's number is 6.022×10^{23}

Ans. **True**

(10) Valency of sodium is 2.

Ans. **False**, Valency of sodium is 1.

Q.3. **Write the correlated terms:**

(1) Electron : extra nuclear particle : : Neutron : ....

(2) Sodium : (2, 8, 1) : : Chlorine : : ....

(3) K^+ : basic radical : : Br^- : ....

(4) Cu^+ : simple radical : : NH_4^+ : ....

(5) Sodium sulphate : Na_2SO_4 : : Potassium Sulphate : ....

(6) Mercurous : Hg^+ : : Mercuric : ....

(7) Positively charged ion : cation : : Negatively charged ion : ....

(8) 12 : 1 dozen : : 144 : ....

(9) Hydrogen : ⊙ : : copper : ....

(10) Law of constant proportions : J. L. Proust : : Law of conservation of mass : ....

Ans. *(1) nucleus   (2) (2, 8, 7)   (3) acidic radical (4) composite radical (5) K_2SO_4 (6) Hg^{2+} (7) anion (8) 1 gross (9) ⓒ (10) Antoine Lavoisier.*

*Q.4. **(A) Match the columns:**

(1) Column 'A'	Column 'B'
Example	Atomic radius (in metres)
(1) Water molecule	(a) 10^{-10}
(2) Haemoglobin molecule	(b) 10^{-9}
(3) Hydrogen molecule	(c) 10^{-8}

Ans. *(1 – b), (2 – c), (3 – a)*

(2)	Column 'A'	Column 'B'
	Element	Atomic mass
	(1) Neon	(a) 35.5
	(2) Silicon	(b) 32
	(3) Chlorine	(c) 28
	(4) Sulphur	(d) 20

Ans. *(1 - d), (2 - c), (3 - a), (4 - b)*

(3)	Column 'A'	Column 'B'
	Molecule	Molecular mass
	(1) H_2	(a) 32 g
	(2) H_2O	(b) 34 g
	(3) O_2	(c) 2 g
	(4) H_2O_2	(d) 18 g

Ans. *(1 - c), (2 - d), (3 - a), (4 - b)*

(4)	Column 'A'	Column 'B'
	Radicals	Names
	(1) $Cr_2O_7^{2-}$	(a) Carbonate
	(2) ClO_3^-	(b) Chromate
	(3) CO_3^{2-}	(c) Dichromate
	(4) CrO_4^{2-}	(d) Chlorate

Ans. *(1 - c), (2 - d), (3 - a), (4 - b)*

Q.5. **Name the following.**

(1) **Scientist who gave Law of Conservation of Mass.**

Ans. Antoine Lavoisier

(2) **Scientist who gave Law of Constant Proportion.**

Ans. J. L. Proust

(3) **What are protons and neutrons present in nucleus together called as?**

Ans. Nucleons

(4) **Unit used to express atomic radius.**

Ans. Nanometre

(5) **The number (p + n) in the atomic nucleus is called as.**

Ans. Atomic mass number

(6) **Name the unit of atomic mass.**

Ans. Dalton (u)

(7) **Write molecular formula of two ionic compounds containing chlorine.**

Ans. $NaCl$, $MgCl_2$

(8) **Give two monoatomic radicals.**

Ans. Na^+, Cl^-

(9) **Give two examples of simple radicals.**

Ans. Ag^+, O^{2-}

(10) **Give two composite radicals.**

Ans. SO_4^{2-}, NH_4^+

(10) **Give two examples of positive radicals.**

Ans. Na^+ - Sodium, K^+ - Potassium

(11) **Give two examples of basic radicals.**

Ans. Na^+ - Sodium, K^+ - Potassium, Ag^+ - Silver

(12) **Give two examples of metals with variable valency.**

Ans.

(i) Iron (Ferrum)

(a) Fe^{2+} - Ferrous [Iron - II]

(b) Fe^{3+} - Ferric [Iron - III]

(ii) Copper (Cuprum)

(a) Cu^+ - Cuprous [Copper - I]

(b) Cu^{2+} - Cupric [Copper - II]

(iii) Mercury (Hydragyrum)

(a) Hg^+ - Mercurous [Mercury - I]

(b) Hg^{2+} - Mercuric [Mercury - II]

(13) **Give three examples of Bivalent Acidic Radicals.**

Ans. O^{2-} - Oxide, S^{2-} - Sulphide, CO_3^{2-} - Carbonate

(14) **Give three examples of Trivalent Basic radicals.**

Ans. Al^{3+} - Aluminium, Cr^{3+} - Chromium, Fe^{3+} - Ferric.

Q.6. **State and Define the following:**

(1) **Law of Conservation of Matter.**

Ans. In a chemical reaction, the total weight of the reactants is same as the total weight of the products formed due to chemical reactions.

(2) **Law of Constant proportion.**

Ans. The proportion by weight of the constituents elements in the various samples of compound is fixed.

(3) **Molecular Mass:**

Ans. The molecular mass of the substance is the sum of the atomic masses of all the atoms in a single molecule of that substance.

(4) Mole

Ans. A mole is that quantity of a substance whose mass in grams is equal in magnitude to the molecular mass of that substance in Daltons.

(5) Valency

Ans. The capacity of an element to combine is called its valency.

(6) Electronic definition of Valency

Ans. The number of electrons that an atom of an element gives away or takes up while forming an ionic bond is called valency of that element.

(7) Radicals

Ans. The positively or negatively charged ions that take part independently in chemical reactions are called radicals.

Q.7. Answer the following in one or two sentences:

(1) How is atomic size determined?

Ans. The size of an atom is determined by its radius. The atomic radius of an isolated atom is the distance between the nucleus of an atom and its outermost orbit.

(2) What is atomic mass number?

Ans. The number of protons and neutrons in the atomic nucleus is called the atomic mass number.

(3) What is unified mass? Give its value in kg.

Ans. Unified mass is the standard unit of atomic mass that quantifies mass on an atomic or molecular scale. Its symbol is 'u'.

$1 \, 'u' = 1.660539094 \times 10^{-27}$ kg.

(4) What is molecular mass of a substance?

Ans. The molecular mass of a substance is the sum of the atomic masses of all the atoms in a single molecule of that substance. Like atomic mass, molecular mass is also expressed in the unit Dalton (u).

(5) What are valence electrons?

Ans. The electrons present in the outermost orbit of an atom are called valence electrons.

(6) Give the formula to determine the number of moles of a substance.

Ans. The formula to determine the number of moles of a substance is as given below.

$$\text{Number of moles of a substance (n)} = \frac{\text{Mass of substance in grams}}{\text{Molecular mass of substance}}$$

(7) What are basic radicals? Give examples.

Ans. The radicals which are formed by removal of electrons from the atoms of metals are called as basic radicals. e.g. Na^+, Cu^{2+}

(8) What are acidic radicals? Give examples.

Ans. The radicals which are formed by adding electrons to the atoms of non-metals are called as acidic radicals. e.g. Cl^-, S^{2-}

Q.8. Write symbols of the following elements and the radicals obtained from them and indicate the charge on the radicals.

Ans.

Elements	Symbols	Radicals	Charge of Radicals
Mercury	Hg	Hg^+ (Mercurous)	+1
		Hg^{2+} (Mercuric)	+2
Potassium	K	K^+ (Potassium)	+1
Nitrogen	N	N^{3-} (Nitride)	−3
Copper	Cu	Cu^+ (Cuprous)	+1
		Cu^{2+} (Cupric)	+2
Sulphur	S	S^{2-} (Sulphide)	−2
Carbon	C	−	−
Chlorine	Cl	Cl^- (Chloride)	−1
Oxygen	O	O^{2-} (Oxide)	−2

Q.9. **Write the steps in deducing the chemical formulae of the following compounds.**

Ans. In order to write the chemical formulae of compounds, it is necessary to know the symbols and valency of various radicals.

*(1) **Sodium Sulphate:**

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Na SO_4

Step - 2 : To write the valency below the respective radical.

Na SO_4
1   2

Step - 3 : To cross - multiply as shown by arrows the number of radicals.

Na SO_4
1   2

Step - 4 : To write down the chemical formula of the compound.

Na_2SO_4

(Sodium Sulphate)
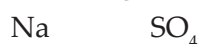
*(2) **Potassium Nitrate:**

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

K NO_3

Step - 2 : To write the valency below the respective radical.

K NO_3
1   1

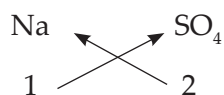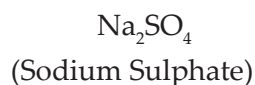**Step - 3 :** To cross - multiply as shown by arrows the number of radicals.

K NO_3
1   1

Step - 4 : To write down the chemical formula of the compound.

KNO_3

(Potassium Nitrate)

*(3) **Ferric phosphate:**

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Fe PO_4

Step - 2 : To write the valency below the respective radical.

Fe PO_4
3   3
1   1

(Dividing valency by common factor)

Step - 3 : To cross - multiply as shown by arrows the number of radicals.

Fe PO_4
1   1

Step - 4 : To write down the chemical formula of the compound.

$FePO_4$

(Ferric phosphate)

*(4) **Calcium oxide:**

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Ca   O

Step - 2 : To write the valency below the respective radical.

Ca   O
2   2
1   1

(Dividing valency by common factor)

Step - 3 : To cross - multiply as shown by arrows the number of radicals.

Ca   O
1   1

Step - 4 : To write down the chemical formula of the compound.

CaO

(Calcium oxide)

*(5) **Aluminium hydroxide:**

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Al   OH

Step - 2 : To write the valency below the respective radical.

Al   OH
3   1

Step - 3 : To cross - multiply as shown by arrows the number of radicals.

Al ⤬ OH
3   1

Step - 4 : To write down the chemical formula of the compound.

$$Al(OH)_3$$
(Aluminium hydroxide)
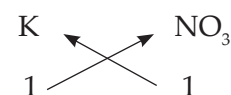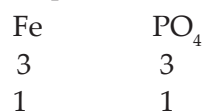
(6) Calcium Carbonate:

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Ca CO_3

Step - 2 : To write the valency below the respective radical.

Ca CO_3
2   2   ...... Dividing by
1   1   common factor

Step - 3 : To cross - multiply as shown by arrows the number of radicals.

Ca ⤬ CO_3
1   1
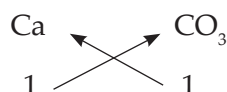
Step - 4 : To write down the chemical formula of the compound.

$$CaCO_3$$
(Calcium Carbonate)

(7) Sodium Dichromate:

Step - 1 : To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

Na Cr_2O_7
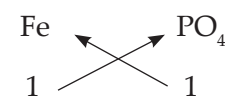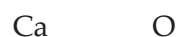
Step - 2 : To write the valency below the respective radical.

Na Cr_2O_7
1   2

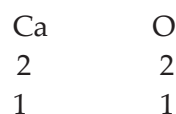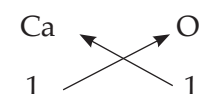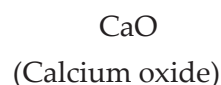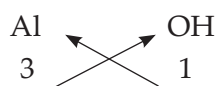**Step - 3 :** To cross multiply as shown by arrows the number of radicals.

Na ⤬ Cr_2O_7
1   2
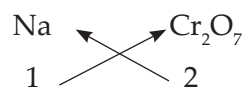
Step - 4 : To write down the chemical formula of the compound.
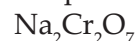
$$Na_2Cr_2O_7$$
(Sodium Dichromate)

*Q.10. (A) Write the names of the following compounds and deduce their molecular masses.

Na_2SO_4, K_2CO_3, CO_2, $MgCl_2$, NaOH, $AlPO_4$, $NaHCO_3$

Ans. In order to deduce the molecular masses of given compounds, we require atomic masses of the following elements in Daltons.

Atomic masses : H(1), O(16), N(14), C(12), K(39), S(32), Ca(40), Na(23), Cl(35.5), Mg(24), Al(27), P(31)

(a) Molecular mass of Na_2SO_4

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Sodium Sulphate	Na_2SO_4	Sodium	23	2	23 × 2	46
		Sulphur	32	1	32 × 1	32
		Oxygen	16	4	16 × 4	64
Molecular mass = Sum of constituent atomic masses						Molecular Mass
Molecular mass of (Na_2SO_4) = (Atomic mass of Na) × 2 + (Atomic mass of Sulphur) × 1 + (Atomic mass of Oxygen) × 4						142

(b) Molecular mass of K_2CO_3

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Potassium Carbonate	K_2CO_3	Potassium	39	2	39 × 2	78
		Carbon	12	1	12 × 1	12
		Oxygen	16	3	16 × 3	48
Molecular mass = Sum of constituent atomic masses						Molecular Mass
Molecular mass of (K_2CO_3) = (Atomic mass of K) × 2 + (Atomic mass of C) × 1 + (Atomic mass of Oxygen) × 3						138

(c)   Molecular mass of CO_2

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Carbon Dioxide	CO_2	Carbon	12	1	12 × 1	12
		Oxygen	16	2	16 × 2	32
Molecular mass = Sum of constituent atomic masses Molecular mass of (CO_2) = (Atomic mass of C) × 1 + (Atomic mass of Oxygen) × 2						Molecular Mass 44

(d)   Molecular mass of $MgCl_2$

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Magnesium Chloride	$MgCl_2$	Magnesium	24	1	24 × 1	24
		Chlorine	35.5	2	35.5 × 2	71
Molecular mass = Sum of constituent atomic masses Molecular mass of $(MgCl_2)$ = (Atomic mass of Mg) × 1 + (Atomic mass of Cl) × 2						Molecular Mass 95

(e)   Molecular mass of NaOH

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Sodium hydroxide	NaOH	Sodium	23	1	23 × 1	23
		Oxygen	16	1	16 × 1	16
		Hydrogen	1	1	1 × 1	1
Molecular mass = Sum of constituent atomic masses Molecular mass of (NaOH) = (Atomic mass of Na) × 1 + (Atomic mass of O) × 1 + (Atomic mass of H) × 1						Molecular Mass 40

(f)   Molecular mass of $AlPO_4$

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Aluminium phosphate	$AlPO_4$	Aluminium	27	1	27 × 1	27
		Phosphorus	31	1	31 × 1	31
		Oxygen	16	4	16 × 4	64
Molecular mass = Sum of constituent atomic masses Molecular mass of $(AlPO_4)$ = (Atomic mass of Al) × 1 + (Atomic mass of P) × 1 + (Atomic mass of O) × 4						Molecular Mass 122

(g)   Molecular mass of $NaHCO_3$

Name of compound	Molecule	Constituent element	Atomic mass (u)	Number of atoms in molecule	Atomic mass × number of atoms	Mass of the constituents u
Sodium bicarbonate	$NaHCO_3$	Sodium	23	1	23 × 1	23
		Hydrogen	1	1	1 × 1	1
		Carbon	12	1	12 × 1	12
		Oxygen	16	3	16 × 3	48
Molecular mass = Sum of constituent atomic masses Molecular mass of $(NaHCO_3)$ = (Atomic mass of Na) × 1 + (Atomic mass of H) × 1 + (Atomic mass of C) × 1 + (Atomic mass of O) × 3						Molecular Mass 84

(B) Deduce the number of molecules of the following compounds in the given quantities.

32g of oxygen, 90g of water, 8.8g carbon dioxide, 7.1g chlorine.

Ans.

(i) 32g oxygen

Given : Mass of oxygen = 32g

To find : Number of molecules in 32g of oxygen.

Solution : Atomic mass of oxygen (O) = 16

∴ Molecular mass of oxygen (O_2) = 16 × 2 = 32

According to the formula,

Number of moles in the given O_2 (*n*)

$$= \frac{\text{Mass of } O_2 \text{ in grams}}{\text{Molecular mass of } O_2}$$

$$= \frac{32}{32} = 1$$

∴ *n* = 1 mol

∴ 1 mol of O_2 contains $6.022 × 10^{23}$ molecules that is 32 g of O_2 contains $6.022 × 10^{23}$ molecules of O_2.

32g of oxygen contains $6.022 × 10^{23}$ molecules of oxygen.

(ii) 90g water

Given : Mass of water (H_2O) = 90g.

To find : Number of molecules in 90g of water.

Solution : Molecular mass of (H_2O)

= (Atomic mass of H) × 2 + (Atomic mass of O) × 1

∴ Molecular mass of H_2O = 1 × 2 + 16

∴ Molecular mass of H_2O = 18

According to the formula,

Number of moles in the given H_2O (*n*)

$$= \frac{\text{Mass of } H_2O \text{ in grams}}{\text{Molecular mass of } H_2O}$$

$$= \frac{90}{18} = 5$$

∴ *n* = 5 mol

∴ 1 mol of H_2O contains $6.022 × 10^{23}$ molecules.

∴ 5 mol of H_2O contains $5 × 6.022 × 10^{23}$ molecules.

= $30.11 × 10^{23}$ molecules.

that is 90g of H_2O contains $30.11 × 10^{23}$ molecules of H_2O.

90g of water contains $30.11 × 10^{23}$ molecules of water.

(iii) 8.8g carbon dioxide

Given : Mass of Carbon dioxide (CO_2) = 8.8g.

To find : Number of molecules in 8.8g of carbon dioxide.

Solution : Molecular mass of (CO_2)

= (Atomic mass of C) × 1 + (Atomic mass of O) × 2

∴ Molecular mass of CO_2 = 12 × 1 + 16 × 2

= 12 + 32

Molecular mass of CO_2 = 44

According to the formula,

Number of moles in the given CO_2 (*n*)

$$= \frac{\text{Mass of } CO_2 \text{ in grams}}{\text{Molecular mass of } CO_2}$$

$$= \frac{8.8}{44} = 0.2$$

∴ *n* = 0.2 mol

∴ 1 mol of CO_2 contains $6.022 × 10^{23}$ molecules.

∴ 0.2 mol of CO_2 contains $0.2 × 6.022 × 10^{23}$ molecules.

= $1.2044 × 10^{23}$ molecules.

that is 8.8g of CO_2 contains $1.2044 × 10^{23}$ molecules of CO_2.

8.8g of CO_2 contains $1.2044 × 10^{23}$ molecules of CO_2.

(iv) 7.1g chlorine

Given : Mass of Chlorine (Cl_2) = 7.1g.

To find : Number of molecules in 7.1g of chlorine.

Solution : Atomic mass of (Cl) = 35.5

∴ Molecular mass of chlorine (Cl_2) = 35.5 × 2 = 71

According to the formula,

Number of moles in the given Cl_2 (*n*)

$$= \frac{\text{Mass of } Cl_2 \text{ in grams}}{\text{Molecular mass of } Cl_2}$$

$$= \frac{7.1}{71}$$

$$= 0.1$$

∴ *n* = 0.1 mol

∴ 1 mol of Cl_2 contains $6.022 × 10^{23}$ molecules.

∴ 0.1 mol of Cl_2 contains $0.1 × 6.022 × 10^{23}$ molecules.

= $0.6022 × 10^{23}$ molecules.

that is 7.1g of Cl_2 contains $0.6022 × 10^{23}$ molecules of Cl_2.

7.1g of Cl_2 contains $0.6022 × 10^{23}$ molecules of chlorine.

Q.11. **Give scientific reasons:**

(1) **An atom is electrically neutral though it contains charged particles.**

Ans.

(i) An atom is made up of a nucleus and an extra-nuclear part. Protons and neutrons are present in the nucleus.

(ii) The nucleus is positively charged. The extra nuclear part is made up of negatively charged electrons.

(iii) Protons are positively charged, electrons are negatively charged and neutrons are without any charge.

(iv) The magnitude of their charges is same when they are equal in number.

(v) Hence, the negative charge on all the extra, nuclear electrons together balances the positive charge on the nucleus.

(vi) Therefore, an atom is electrically neutral though it contains charged particles.

(2) **Neon is chemically inert element.**

Ans.

(i) Atomic number of neon is 10, so its electronic configuration is (2, 8). There are 8 electrons in its 2nd shell, fulfilling its capacity.

(ii) Thus, neon has a complete octet.

(iii) It has a stable orbit therefore, it does not indulge in chemical reactions. Hence, Neon is a chemically inert element.

(3) **The valency of sodium (Na) is one.**

Ans.

(i) The electronic configuration of sodium (Na) is (2, 8, 1). It has 1 electron in its 3rd orbit.

(ii) It tends to give this electron so that it is left up with (2, 8), having 8 electrons in the second orbit, with a stable state.

(iii) The loss of one electron leads to the formation of sodium ion (Na^+) which is positively charged as it has lost one electron.

(4) **The valency of chlorine (Cl) is one.**

Ans.

(i) The electronic configuration of chlorine (Cl) is (2, 8, 7). It has 7 electrons in its 3rd orbit.

(ii) It tends to take one electron from another atom so that it has 8 electrons in the outermost orbit with electronic configuration (2, 8, 8) with stable state.

(iii) The gaining of one electron leads to formation of chloride ion (Cl^-) which is negatively charged as it has gained one electron.

(5) **The valency of Magnesium (Mg) is two.**

Ans.

(i) The electronic configuration of Magnesium (Mg) is (2, 8, 2), it has 2 electrons in its 3rd orbit.

(ii) It tends to give this electrons so that it is left up with (2, 8), having 8 electrons in the second orbit, with a stable state.

(iii) The loss of two electrons leads to the formation of Magnesium ion (Mg^{2+}) which is double positively charged as it has lost two electrons.

Q.12. **Answer the following questions:**

*(1) **Explain how the element sodium is monovalent.**

Ans.

(i) The number of protons or electrons (atomic number) in Sodium (Na) atom is 11. Therefore the electronic configuration of sodium atom is (2, 8, 1).

(ii) In chemical reaction, sodium atom has the capacity to give away $1e^-$ from its outermost orbit to form Na^+ ion with stable electronic configuration (2, 8).

(iii) As sodium atom gives away $1e^-$ and a cation of sodium is formed, hence the valency of sodium is 1 and therefore the element sodium is monovalent.

*(2) **M is a bivalent metal. Write down the steps to find the chemical formulae of its compounds formed with the radicals, sulphate and phosphate.**

Ans. M is a bivalent metal. Following are the steps to find the chemical formulae of its compounds formed with the radicals, sulphate and phosphate:

(i) Compound of metal 'M' with radical sulphate

Step - 1: To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

M SO_4

Step - 2: To write the valency below the respective radical

M	SO_4	
2̸	2̸	[Dividing valency
1	1	by common factor]

Step - 3: To cross multiply as shown by arrows the number of radicals

M ⤡ SO_4
1   1

Step - 4: To write down the chemical formula of the compound.

    $M SO_4$

(ii) Compound of metal 'M' with radical phosphate.

Step - 1: To write the symbols of the radicals (Basic radicals on the left and acidic radicals on the right)

M PO_4

Step - 2: To write the valency below the respective radical

M PO_4
2   3

Step - 3: To cross multiply as shown by arrows the number of radicals.

M ⤡ PO_4
2   3

Step - 4: To write down the chemical formula of the compound

    $M_3 (PO_4)_2$
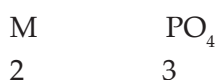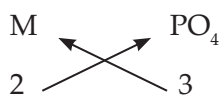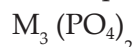
*(3) **Explain the need for a reference atom for atomic mass. Give some information about two reference atoms.**

Ans.

(i) The mass of an atom is concentrated in its nucleus and it is due to the protons (p) and neutrons (n) in it.

(ii) An atom is very very tiny. It was not possible to measure atomic mass accurately. Therefore, the concept of relative mass of an atom was formed.

(iii) To express relative mass of an atom, reference of atom is considered. The two reference atoms were as follows:

(a) **Hydrogen (H) atom**: The hydrogen atom is the lightest. The relative mass of a hydrogen atom is 1 which has only 1 proton in its nucleus. On this scale, the relative atomic mass of many elements comes out to be fractional. Therefore, carbon is selected as a reference atom.

(b) **Carbon (C) atom** : The carbon atom is selected as reference atom. In this scale, the relative mass of a carbon atom is accepted as 12.

(iv) The relative atomic mass of 1 hydrogen (H) atom compared to the carbon (C) atom becomes $12 \times \dfrac{1}{12}$ i.e. '1' .

*(4) **What is meant by Unified Atomic Mass?**

Ans.

(i) During earlier time, relative mass of an atom was considered for measuring the mass of an atom directly. But since the founding of unified mass, relative mass is not accepted henceforth.

(ii) Unified atomic mass is the unit of atomic mass called as Dalton.

(iii) Its symbol is 'u'. $1u = 1.66053904 \times 10^{-27}$ kg.

*(5) **Explain with examples what is meant by a 'mole' of a substance.**

Ans.

(i) A mole is that quantity of a substance whose mass in grams is equal in magnitude to the molecular mass of that substance in Daltons.

(ii) For example: (a) Atomic mass of oxygen atom (O) is 16u. Thus the molecular mass of oxygen molecule (O_2) is $16 \times 2 = 32$u. Therefore 32 g of oxygen is 1 mole of oxygen.

(6) **What is variable valency?**

Ans.

(i) Under the different conditions the atoms of some elements give away or take up different number of electrons.

(ii) In such cases those elements exhibit more than one valency.

(iii) This property of elements is called variable valency.

*Q.13. **If 0.2 mol of the following substances are required how many grams of those substances should be taken?**

Sodium chloride, Magnesium oxide, Calcium carbonate

Ans.

(i) **Sodium Chloride:**

Given: Number of moles of sodium chloride (NaCl) = 0.2 mol

To find: Mass in grams of 0.2 mol of NaCl

Solution:

Molecular mass of NaCl

= (Atomic mass of Na) × 1 + (Atomic mass of Cl) × 1

= 23 × 1 + 35.5 × 1

= 23 + 35.5

Molecular mass of NaCl = 58.5

According to the formula,

Number of moles in the given NaCl (n)

$$= \frac{\text{Mass of NaCl in grams}}{\text{Molecular mass of NaCl}}$$

$$\therefore 0.2 = \frac{\text{Mass of NaCl in grams}}{58.5}$$

∴ Mass of NaCl in grams = 0.2 × 58.5

∴ Mass of NaCl in grams = 11.7 g

> **Mass of 0.2 mole of NaCl is 11.7g**

(ii) Magnesium Oxide:

Given : Number of moles of Magnesium oxide (MgO) = 0.2 mol

To find : Mass in grams of 0.2 mol of MgO

Solution :

Molecular mass of MgO

= (Atomic mass of Mg) × 1 + (Atomic mass of O) × 1

= 24 × 1 + 16 × 1

= 24 + 16

Molecular mass of MgO = 40

According to the formula

Number of moles in the given MgO (n)

$$= \frac{\text{Mass of MgO in grams}}{\text{Molecular mass of MgO}}$$

$$\therefore 0.2 = \frac{\text{Mass of MgO in grams}}{40}$$

∴ Mass of MgO in grams = 0.2 × 40

∴ Mass of MgO in grams = 8 g.

> **Mass of 0.2 mole of MgO is 8 g**

(iii) Calcium Carbonate:

Given : Number of moles of Calcium carbonate (CaCO$_3$) = 0.2 mol

To find : Mass in grams of 0.2 mol of CaCO$_3$

Solution:

Molecular mass of CaCO$_3$

= (Atomic mass of Ca) × 1 + (Atomic mass of C) × 1 +(Atomic mass of O) × 3

= (40 × 1) + (12 × 1) + (16 × 3) = 40 + 12 + 48

Molecular mass of CaCO$_3$ = 100

According to the formula

Number of moles in the given CaCO$_3$ (n)

$$= \frac{\text{Mass of CaCO}_3 \text{ in grams}}{\text{Molecular mass of CaCO}_3}$$

$$\therefore 0.2 = \frac{\text{Mass of CaCO}_3 \text{ in grams}}{100}$$

∴ Mass of CaCO$_3$ in grams = 0.2 × 100

∴ Mass of CaCO$_3$ in grams = 20 g

> **Mass of 0.2 mole of CaCO$_3$ is 20 g**

Q.14. Answer in brief:

*(1) Two samples 'm' and 'n' of slaked lime were obtained from two different reactions. The details about their composition are as follows:
'sample m' mass : 7 g.
Mass of constituent oxygen : 2g
Mass of constituent calcium : 5g
'sample n' mass : 1.4 g
Mass of constituent oxygen : 0.4g
Mass of constituent calcium : 1.0g

Which law of chemical combination does this prove? Explain.

Ans.

(i) The expected proportion by weight of the constituent elements of quick lime that is calcium oxide would be from its known molecular formula CaO. The atomic mass of Ca and O are 40 and 16 respectively. This means, the proportion by weight of the constituent elements Ca and O in the compound CaO is 40 : 16 which is 5 : 2.

(ii) Now, for the given sample 'm' of CaO = 5g

mass of given sample = 7g

mass of constituent Ca in sample 'm' = 5g

mass of constituent O in sample 'm' = 2g

(iii) This means that 7g of calcium oxide contains 5g of calcium (Ca) and 2g of oxygen (O); and the proportion by weight of calcium and oxygen in it is 5 : 2.

(iv) Now, for the given sample 'n' of CaO mass of given sample CaO = 1.4 g

Mass of constituent Ca in sample 'n' = 1.0 g

Mass of constituent O in sample 'n' = 0.4 g

This means that 1.4g of calcium oxide contains 1.0 g of calcium (Ca) and 0.4g of oxygen (O); and the proportion by weight of calcium and oxygen in it is 5 : 2.

(v) Above samples 'm' and 'n' of calcium oxide (CaO) shows that the proportion by weight of the constituent elements in different samples of a compound is always constant that is the proportion by weight of calcium (Ca) and oxygen (O) in different samples of calcium oxide (CaO) is constant.

(vi) The experimental value of proportion by weight of the constituent elements matched with the expected proportion calculated by molecular mass. This proves and verifies the law of constant proportion.

The law states that 'The proportion by weight of the constituent elements in the various samples of a compound is fixed'.

Q.15. Complete the following chart:

*(1)　Fill the following tables.

Element	Atomic Mass
Oxygen	
Sodium	
Aluminium	
Phosphorus	
Argon	
Potassium	

Ans. The relative atomic masses of the elements are given below.

Element	Atomic Mass
Oxygen	16
Sodium	23
Aluminium	27
Phosphorus	31
Argon	39
Potassium	40

*(2)　Complete the following chart.

Ans.

Element	Atomic number	Electronic Configuration	Valence Electrons	Valency
Lithium	3	2, 1	**1**	**1**
Beryllium	4	**2, 2**	2	2
Boron	5	2, 3	**3**	**3**
Carbon	**6**	2, 4	4	**4**
Nitrogen	7	**2, 5**	5	3
Oxygen	**8**	2, 6	6	**2**
Fluorine	9	**2, 7**	7	**1**
Neon	10	**2, 8**	8	**0**
Sodium	**11**	2, 8, 1	1	1
Magnesium	12	**2, 8, 2**	2	**2**
Aluminium	13	2, 8, 3	**3**	**3**
Silicon	14	**2, 8, 4**	4	**4**

*(3)　Write down the cations and anions obtained from the compounds in the following chart.

Base	Cation	Anion	Acid	Cation	Anion
NaOH			HCl		
KOH			HBr		
$Ca(OH)_2$			HNO_3		

Ans.

Base	Cation	Anion	Acid	Cation	Anion
NaOH	Na^+	OH^-	HCl	H^+	Cl^-
KOH	K^+	OH^-	HBr	H^+	Br^-
$Ca(OH)_2$	Ca^{2+}	OH^-	HNO_3	H^+	NO_3^-

Q.16. Can you tell?

*(1)　How is an element indicated in Chemistry?

Ans. In chemistry an element is indicated by its symbol.

*(2)　Write down the symbols of the elements you know.

Ans. Symbols of some elements are

(i) Hydrogen - H　　(ii) Helium - He

(iii) Boron - B　　(iv) Carbon - C

(v) Aluminium - Al

*(3)　Write down the symbols for the following elements.

Antimony, Iron, Gold, Silver, Mercury, Lead, Sodium

Ans. The symbols of given elements are as follows:

(i) Antimony - Sb   (ii) Iron   - Fe

(iii) Gold   - Au   (iv) Silver   - Ag

(v) Mercury - Hg   (vi) Lead   - Pb

(vii) Sodium   - Na

*(4) **Is it possible to weigh one molecule using a weighing balance?**

Ans. No, it is not possible to weigh one molecule using a weighing balance.

*(5) **Will the number of molecules be the same in equal weights of different substances?**

Ans. No, the number of molecules will not be the same in equal weights of different substances.

*(6) **Which are the basic radicals and which are the acidic radicals among the following?**

Ans.

Basic Radical	Acidic Radical
(i) Ag^+	(i) Cl^-
(ii) Cu^{2+}	(ii) I^-
(iii) Fe^{3+}	(iii) SO_4^{2-}
(iv) Ca^{2+}	(iv) NO_3^-
(v) NH^{4+}	(v) S^{2-}
(vi) K^+	(vi) MnO_4^-
(vii) Na^+	

Q.17. Use your brain power!

*(1) **Following are atomic masses of a few elements in Daltons and the molecular formulae of some compounds. Deduce the molecular masses of those compounds.**

Atomic masses - H(1), O(16), N(14), C(12), K(39), S(32) Ca(40), Na(23), Cl(35.5), Mg(24), Al(27)

Molecular formulae - NaCl, $MgCl_2$, KNO_3, H_2O_2, $AlCl_3$, $Ca(OH)_2$, MgO, H_2SO_4, HNO_3, NaOH

Ans.

(a) **NaCl**

Molecular mass of NaCl

= (Atomic mass of Na) × 1 + (Atomic mass of Cl) × 1

= (23 × 1) + (35.5 × 1)

= 23 + 35.5

= 58.5

∴ Molecular mass of NaCl = 58.5

(b) **$MgCl_2$**

Molecular mass of $MgCl_2$

= (Atomic mass of Mg) × 1 + (Atomic mass of Cl) × 2

= (24 × 1) + (35.5 × 2)

= 24 + 71

= 95

∴ Molecular mass of $MgCl_2$= 95

(c) **KNO_3**

Molecular mass of KNO_3

= (Atomic mass of K) × 1 + (Atomic mass of N) × 1 (Atomic mass of O) × 3

= (39 × 1) + (14 × 1) + (16 × 3)

= 39 + 14 + 48

= 101

∴ Molecular mass of KNO_3= 101

(d) **H_2O_2**

Molecular mass of H_2O_2

= (Atomic mass of H) × 2 + (Atomic mass of O) × 2

= (1 × 2) + (16 × 2)

= 2 + 32

= 34

∴ Molecular mass of H_2O_2 = 34.

(e) **$AlCl_3$**

Molecular mass of $AlCl_3$

= (Atomic mass of Al) × 1 + (Atomic mass of Cl) × 3

= (27 × 1) + (35.5 × 3)

= 27 + 106.5

= 133.5

∴ Molecular mass of $AlCl_3$ = 133.5

(f) **$Ca(OH)_2$**

Molecular mass of $Ca(OH)_2$

= (Atomic mass of Ca) × 1 + (Atomic mass of O + Atomic Mass of H) × 2

= (40 × 1) + (16 + 1) × 2

= 40 + (17 × 2)

= 40 + 34 = 74

∴ Molecular mass of $Ca(OH)_2$=74

(g) **MgO**

Molecular mass of MgO

= (Atomic mass of Mg) × 1 + (Atomic mass of O) × 1

$= (24 \times 1) + (16 \times 1)$

$= 24 + 16$

$= 40$

$\therefore$ Molecular mass of MgO $= 40$

(h) **H_2SO_4**

Molecular mass of H_2SO_4

$=$ (Atomic mass of H) $\times$ 2 + (Atomic mass of S) $\times$ 1 + (Atomic mass of O) $\times$ 4

$= (1 \times 2) + (32 \times 1) + (16 \times 4)$

$= 2 + 32 + 64$

$= 98$

$\therefore$ Molecular mass of $H_2SO_4 = 98$

(i) **HNO_3**

Molecular mass of HNO_3

$=$ (Atomic mass of H) $\times$ 1 + (Atomic mass of N) $\times$ 1 + (Atomic mass of O) $\times$ 3

$= (1 \times 1) + (14 \times 1) + (16 \times 3)$

$= 1 + 14 + 48$

$= 63$

$\therefore$ Molecular mass of $HNO_3 = 63$

(j) **NaOH**

Molecular mass of NaOH

$=$ (Atomic mass of Na) $\times$ 1 + (Atomic mass of O) $\times$ 1 + (Atomic mass of H) $\times$ 1

$= (23 \times 1) + (16 \times 1) + (1 \times 1)$

$= 23 + 16 + 1$

$= 40$

$\therefore$ Molecular mass of NaOH $= 40$

*(2) **How many molecules of water are there in 36g water?**

Ans. **Given** : Mass of water $(H_2O) = 36g$

To find : Number of molecules in 36g of water

Solution :

Molecular mass of $(H_2O) =$ (Atomic mass of H) $\times$ 2 + (Atomic mass of O) $\times$ 1

Molecular mass of $H_2O = (1 \times 2) + 16$

$\therefore$ Molecular mass of $H_2O = 18$

According to the formula,

Number of moles in the given H_2O (n)

$= \dfrac{\text{Mass of } O_2 \text{ in grams}}{\text{Molecular mass of } O_2}$

$= \dfrac{36}{18} = 2$

$\therefore$ $n = 2$ mol

$\therefore$ 1 mol of H_2O contains 6.022×10^{23} molecules.

$\therefore$ 2 mol of H_2O contains $2 \times 6.022 \times 10^{23}$ molecules.

$= 12.044 \times 10^{23}$ molecules.

that is 36g of H_2O contains 12.044×10^{23} molecules of H_2O.

36g of water contains 12.044×10^{23} molecules of water.

*(3) **How many molecules of H_2SO_4 are there in a 49g sample?**

Ans. **Given** : Mass of Sulphuric acid $(H_2SO_4) = 49g$

To find : Number of molecules in 49g of H_2SO_4

Solution :

Molecular mass of $H_2SO_4 =$ (Atomic mass of H) $\times$ 2 + (Atomic mass of S) $\times$ 1 + (Atomic mass of O) $\times$ 4

Molecular mass of $H_2SO_4 = (1 \times 2) + (32 \times 1) + (16 \times 4)$

$= 2 + 32 + 64$

$= 98.$

According to the formula,

Number of moles in the given H_2SO_4 (n)

$= \dfrac{\text{Mass of } H_2SO_4 \text{ in grams}}{\text{Molecular mass of } H_2SO_4}$

$= \dfrac{49}{98} = \dfrac{1}{2} = 0.5$

$\therefore$ $n = 0.5$ mol

$\therefore$ 1 mol of H_2SO_4 contains 6.022×10^{23} molecules.

$\therefore$ 0.5 mol of H_2SO_4 contains $0.5 \times 6.022 \times 10^{23}$ molecules.

$= 3.011 \times 10^{23}$ molecules.

that is 49g of H_2SO_4 contains 3.011×10^{23} molecules of H_2SO_4.

49g of Sulphuric acid contains 3.011×10^{23} molecules of H_2SO_4.

*(4) **How will the compounds, $MgCl_2$ and CaO be formed from their elements?**

Ans.

(1) **Magnesium Chloride ($MgCl_2$)**

Magnesium atom (Mg). Electron configuration $(2,8,2) \xrightarrow{-2e^-}$ Magnesium ion Mg^{2+} (2,8).

Chlorine atom (Cl). Electron configuration $(2,8,7) \xrightarrow{+1e^-}$ Chloride ion Cl^- (2,8,8).

$\therefore$ $Mg^{2+} + 2Cl^- \longrightarrow MgCl_2$ (Magnesium Chloride)

(i) A Magnesium atom gives away $2e^-$ and a cation of Magnesium (Mg^{2+}) is formed, hence, the valency of magnesium is two.

(ii) Two chlorine atoms takes $1e^-$ each and forms two anions of chlorine ($2Cl^-$) (chloride), and thus, the valency of chlorine is one.

(iii) After the give and take of electrons is over, the electronic configuration of all the resulting ions has a complete octet,

(iv) Due to the attraction between the unit but opposite charges on all the ions, one chemical bond is formed between Mg^{2+} and $2Cl^-$ each and the compound $MgCl_2$ is formed.

(2) Calcium Oxide (CaO)

Calcium atom (Ca). Electron configuration (2,8,8,2) $\xrightarrow{-2e^-}$ Calcium ion Ca^{2+} (2,8,8).

Oxygen atom (O). Electron configuration (2,6) $\xrightarrow{+2e^-}$ Oxygen ion O^{2-} (2,8).

$\therefore$ $Ca^{2+} + O^{2-} \longrightarrow CaO$
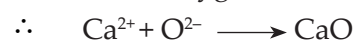
(i) A calcium atom gives away $2e^-$ and a cation of calcium (Ca^{2+}) is formed, hence, the valency of calcium is two.

(ii) An oxygen atom takes $2e^-$ and forms anions of oxygen (O^{2-}) (oxide), and thus, the valency of oxygen is two.

(iii) After the give and take of electrons is over, the electronic configuration of both the resulting ions has a complete octet.

(iv) Due to the attraction between the unit but opposite charges on the two ions, one chemical bond is formed between Ca^{2+} and O^{2-} and the compound CaO is formed.

(5) Classify the following radicals in to simple radicals and composite radicals.

Ag^+, Mg^{2+}, Cl^-, SO_4^{2-}, Fe^{2+}, ClO_3^-, NH_4^+, Br^-, NO_3^-, Na^+, Cu^+

Ans.

Simple radicals	Composite radicals
Ag^+	SO_4^{2-}
Mg^{2+}	ClO_3^-
Cl^-	
Fe^{2+}	NH_4^+
Br^-	NO_3^-
Na^+	
Cu^+	

(6) Using the chart of ions / radicals and the cross-multiplication method, write the chemical formulae of the following compounds:

(i) Calcium Carbonate

Ans. Symbol Ca $\quad$ CO$_3$

Valency 2 $\quad$ 2 $\quad$ Dividing by
$\quad$ 1 $\quad$ 1 $\quad$ common factor
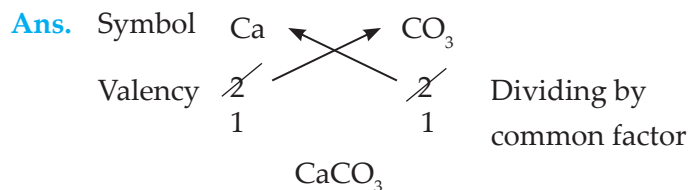
CaCO$_3$

$\therefore$ Chemical formula of Calcium carbonate is $CaCO_3$

(ii) Sodium bicarbonate

Ans. Symbol Na $\quad$ HCO$_3$

Valency 1 $\quad$ 1
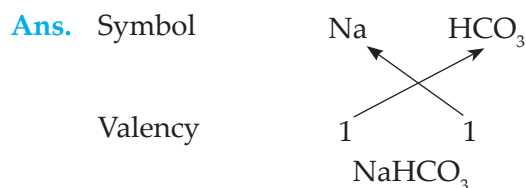
NaHCO$_3$

$\therefore$ Chemical formula of Sodium bicarbonate is $NaHCO_3$

(iii) Silver chloride

Ans. Symbol Ag $\quad$ Cl

Valency 1 $\quad$ 1
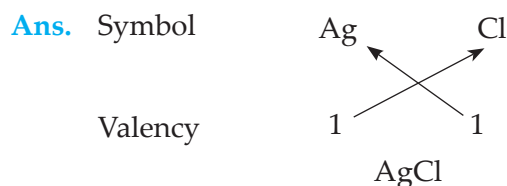
AgCl

$\therefore$ Chemical formula of Silver chloride is AgCl

(iv) Calcium hydroxide

Ans. Symbol Ca $\quad$ OH

Valency 2 $\quad$ 1
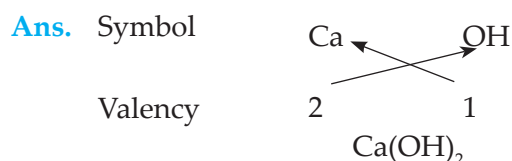
Ca(OH)$_2$

$\therefore$ Chemical formula of Calcium hydroxide is $Ca(OH)_2$

(v) Magnesium Oxide

Ans. Symbol Mg $\quad$ O

Valency 2 $\quad$ 2 $\quad$ Dividing by
$\quad$ 1 $\quad$ 1 $\quad$ Common factor

MgO
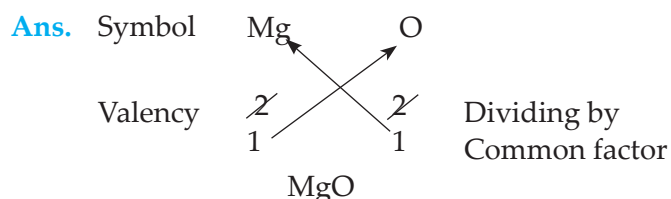
$\therefore$ Chemical formula of Magnesium oxide is MgO

(vi) Ammonium Phosphate

Ans. Symbol NH$_4$ $\quad$ PO$_4$

Valency 1 $\quad$ 3
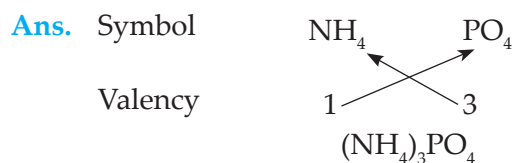
(NH$_4$)$_3$PO$_4$

$\therefore$ Chemical formula of Ammonium phosphate is $(NH_4)_3PO_4$

(vii) Cuprous bromide

Ans. Symbol Cu $\quad$ Br

Valency 1 $\quad$ 1
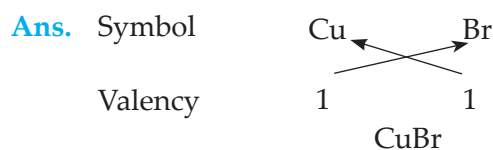
CuBr

$\therefore$ Chemical formula of Cuprous bromide is CuBr.

(viii) Copper Sulphate

Ans. Symbol   Cu SO_4

Valency $\cancel{2}$ $\cancel{2}$ Dividing by
        1   1   common factor
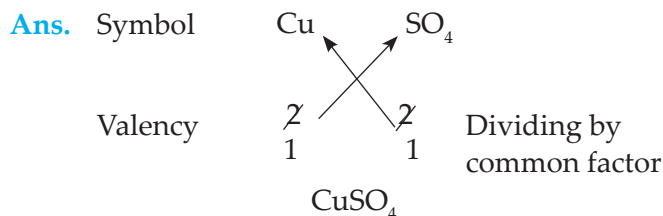
       $CuSO_4$

∴   Chemical formula of Copper sulphate is $CuSO_4$.

(ix) Potassium Nitrate

Ans. Symbol   K NO_3

Valency   1   1
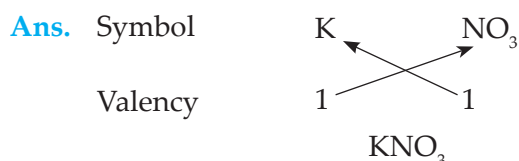
      KNO_3

∴   Chemical formula of Potassium nitrate is KNO_3.

(x) Sodium dichromate

Ans. Symbol   Na Cr_2O_7

Valency   1   2
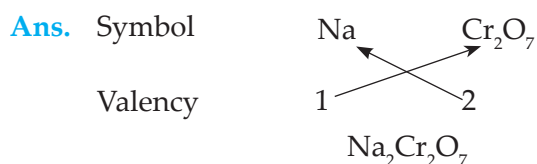
      $Na_2Cr_2O_7$

∴   Chemical formula of Sodium dichromate is $Na_2Cr_2O_7$.

*Q.18. Can you recall?

(1) What is the Dalton's atomic theory?

Ans. Dalton's Atomic theory-

(i) All matter is made of atoms. Atoms are indivisible and indestructible.

(ii) All atoms of a given element are identical in mass and properties.

(iii) Compounds are formed by a combination of two or more different kinds of atoms.

(iv) A chemical reaction is a rearrangement of atoms.

(2) How are compounds formed?

Ans. Compounds are formed by a combination of two or more different kind of atoms.

(3) What are the molecular formulae of salt, slaked lime, water, lime, limestone?

Ans. The molecular formulae for

Salt - Sodium Chloride - NaCl

Slaked lime - Calcium Hydroxide $Ca(OH)_2$

Water - H_2O

Lime - Calcium Oxide - CaO

Lime stone - Calcium Carbonate - $CaCO_3$

(4) From which experiments was it discovered that atoms have an internal structure? When?

Ans. In 1911 Earnest Rutherford conducted a well known experiment called as 'Gold foil experiment'. From this experiment it was discovered that atoms have internal structure.

(5) What are the two parts of an atom? What are they made up of?

Ans. The two parts of atoms are nucleus and extra nuclear part. Nucleus is made up of positively charged protons and electrically neutral neutrons and the extra nuclear part is made up of negatively charged electrons revolving around the nucleus in different orbits.

(6) Determine the valencies of H, Cl, O and Na from the molecular formulae H_2, HCl, H_2O and NaCl.

Ans.

(i) In the molecular formula HCl

Symbol   H   Cl
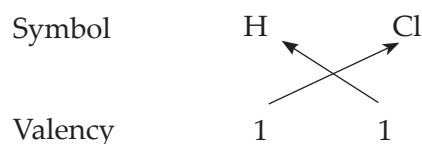
Valency   1   1

∴   The valency of H is 1 and Cl is 1.

(ii) In the molecular formula H_2O

Symbol   H   O
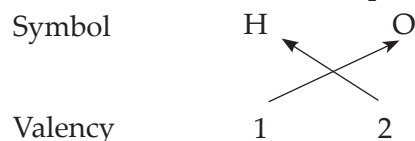
Valency   1   2

∴   The valency of H is 1 and O is 2.

(iii) In the molecular formula NaCl

Symbol   Na   Cl
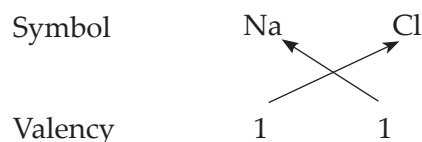
Valency   1   1

∴   The valency of Na is 1 and Cl is 1.

∴   From all the above, the valencies of the given elements are as follows : H = 1, Cl = 1, O = 2 and Na = 1.

(7) What is the type of chemical bond in NaCl and $MgCl_2$?

Ans.

(i) The type of chemical bond in NaCl and $MgCl_2$ is ionic bond.

Q.18 Activity based questions:

*ACTIVITY - 1

- Take 56 g calcium oxide in a large conical flask and put 18 g water in it.

- Observe what happens.

- Measure the mass of the substance formed.

- What similarity do you find? Write your inference.

Ans.

(i) When 18 g of water is added to 56 g of calcium oxide, calcium oxide combines with water to form calcium hydroxide $Ca(OH)_2$

(ii) The mass of calcium hydroxide formed is 74 g

(iii) In this activity the total mass of reactants, Calcium Oxide + Water = 56 g + 18 g = 74 g. It is equal to the mass of the product formed. $Ca(OH)_2 = 74g$
This activity verifies the Law of Conservation of Matter. i.e. In a chemical reaction the total weight of the reactants is same as the total weight of the products formed due to the chemical reactions.

*ACTIVITY - 2

- Take a solution of calcium chloride in a conical flask and a solution of sodium sulphate in a test tube.

- Tie a thread to the test tube and insert it in the conical flask.

- Seal the conical flask with an airtight rubber cork.

- Weigh the conical flask using a balance.

- Now tilt the conical flask so that the solution in the test tube gets poured in the conical flask.

- Now weigh the conical flask again.

Ans.

(i) In this activity a white precipitate is seen in the conical flask after the reaction.

(ii) There is no change in the weight of the flask before and after the reaction.

(iii) This activity verifies the Law of Conservation of Matter i.e. In a chemical reaction the total weight of the reactants is same as the total weight of the products formed due to the chemical reactions.

Ions/Radicals

Basic Radicals				Acidic Radicals			
H^+	Hydrogen	Al^{3+}	Aluminium	H^-	Hydride	MnO_4^-	Permanganate
Na^+	Sodium	Cr^{3+}	Chromium	F^-	Fluoride	ClO_3^-	Chlorate
K^+	Potassium	Fe^{3+}	Ferric	Cl^-	Chloride	BrO_3^-	Bromate
Ag^+	Silver	Au^{3+}	Gold	Br^-	Bromide	IO_3^-	Iodate
Cu^+	Cuprous	Sn^{4+}	Stannic	I^-	Iodide	CO_3^{2-}	Carbonate
Hg^+	Mercurous	NH_4^+	Ammonium	O^{2-}	Oxide	SO_4^{2-}	Sulphate
Cu^{2+}	Cupric/Copper			S^{2-}	Sulphide	SO_3^{2-}	Sulphite
Mg^{2+}	Magnesium			N^{3-}	Nitride	CrO_4^{2-}	Chromate
Ca^{2+}	Calcium					$Cr_2O_7^{-2}$	Dichromate
Ni^{2+}	Nickel			OH^-	Hydroxide	PO_4^{3-}	Phosphate
Co^{2+}	Cobalt			NO_3^-	Nitrate		
Hg^{2+}	Mercuric			NO_2^-	Nitrite		
Mn^{2+}	Manganese			HCO_3^-	Bicarbonate		
Fe^{2+}	Ferrous (Iron II)			HSO_4^-	Bisulphate		
Sn^{2+}	Stannous			HSO_3^-	Bisulphite		
Pt^{2+}	Platinum						

ASSIGNMENT - 4

Time : 1 Hr.   **Marks : 30**

Q.1. (A) Fill in the blanks: (2)

(1)   Protons and neutrons are together called as ....

(2)   The proportion by weight of hydrogen and oxygen in water is ....

(B) State True or False, and if false write the correct statement: (2)

(1)   Molecular state of oxygen is diatomic.

(2)   Anion radicals are basic radicals.

(C) Match the columns: (2)

Column 'A'	Column 'B'
Radicals	Names
(1) $Cr_2O_7^{2-}$	(a) Carbonate
(2) ClO_3^-	(b) Chromate
(3) CO_3^{2-}	(c) Dichromate
(4) CrO_4^{2-}	(d) Chlorate

Q.2. (A) Calculate the molecular mass of following compounds: (8)

(1)   Sulphuric acid (H_2SO_4)   (2)   Calcium hydroxide ($Ca(OH)_2$)

(3)   Magnesium chloride ($MgCl_2$)   (4)   Potassium Nitrate (KNO_3)

Atomic masses : H(1), S(32), O(16), Ca(40), Mg(24), Cl(35.5), K(39), N(14)

(B) Using the chart of ions / radicals and cross multiplication write the chemical formula of (6)
**   the following compounds.**

(1)   Calcium Carbonate   (2)   Sodium dicromate   (3)   Magnesium oxide

(4)   Ammonium phosphate   (5)   Ferric chloride   (6)   Calcium hydroxide

(Ions / Radicals : Mg^{2+}, Ca^{2+}, NH_4^+, Na^+, O^{2-}, PO_4^{3-}, CO_3^{2-}, $Cr_2O_7^{-2}$, OH^-, Cl^-, Fe^{3+})

Q.3. Answer in brief: (10)

(1)   Give reason : The valency of sodium (Na) is one.

(2)   Solve : Deduce the number of molecules in 8.8g of carbon dioxide. (Atomic Masses : C(12), O(16))

(3)   Solve : Find the mass in grams of 0.4 mol of magnesium oxide.

(Atomic Masses : Mg(24), O(16))

(4)   M is bivalent metal. Write down the steps to find the chemical formulae of its compounds formed with the radicals sulphate and phosphate.

(5)   State the following laws:

(i)   Law of conservation of matter.   (ii)   Law of constant proportion

❖ ❖ ❖

5 Acids, Bases and Salts

CONCEPT MAP

SUBSTANCES

Can be → **ACIDS**

Can be → **BASES**

→ **NEUTRAL SUBSTANCES**

ACIDS — strength represented by → pH range pH < 7

NEUTRAL SUBSTANCES → pH = 7

BASES — strength represented by → pH range pH > 7

detected using → **INDICATORS** ← detected using

Natural → Red litmus Cabbage, Beetroot

Synthetic → Phenolphthalein Methyl orange

React with → Metals | Oxides of Metals | Carbonates and Bicarbonates

React with → with each other | oxides of non-metal

to form → Salts

Salts → Carbonates | Bicarbonates | Salts with water of crystallization

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MASTER KEY QUESTION SET - 5

Q.1. Fill in the blanks and rewrite the complete statements:

(1) .... acid is present in lemon.

(2) Tamarind contains .... acid.

(3) Baking soda is .... in nature.

(4) Butter milk contains .... acid.

(5) Milk of Magnesia is .... in nature.

(6) Substances which are sour to taste are termed as ....

(7) Bases are .... to touch.

(8) If the basic radical is H^+ the type of compound is ....

(9) Anions are .... charged particles.

(10) The name of compound NH_3 is ....

(11) The bases which are soluble in water are called as ....

(12) HCl is a .... acid.

(13) H_3PO_4 is a .... acid.

(14) When the concentration of solute is low in the solution, it is called as .... solution.

(15) [NaCl] = 1M means the .... of common salt is 1M

(16) Accoring to pH scale pure water has a pH of ....

(17) With reference to neutralization, metallic oxides are .... in nature.

(18) CO_2 gas turns .... milky.

(19) Molecular formula of blue vitriol is ....

(20) Crystalline ferrous sulphate is .... in colour.

(21) molecular formula of crystalline alum is ....

Ans. *(1) Citric (2) tartaric (3) basic (4) butyric (5) basic (6) acids (7) soapy (8) acid (9) negatively (10) ammonia (11) alkalis (12) monobasic (13) tribasic (14) diluted (15) molarity (16) 7 (17) basic (18) lime water (19) $CuSO_4·5H_2O$ (20) green (21) $K_2SO_4·Al_2(SO_4)_3·24H_2O$*

Q.2. **Rewrite the statements by selecting correct options:**

(1) The solution turns blue litmus red, its pH is likely to be ....
(a) 7　　　　　　　　　　(b) 4
(c) 14　　　　　　　　　(d) 9

(2) An ionic compound NaCl is formed by ....
(a) Na^+ and Cl^-　　　(b) Na^+ and Cl^+
(c) Na^- and Cl^-　　　(d) Na^- and Cl^+

(3) Molecular formula for sodium oxide is ....
(a) Na_2O　　　　　　(b) NaO_2
(c) NaO　　　　　　　(d) Na_2O_2

(4) H_2CO_3 is .... acid.
(a) monobasic　　　　(b) dibasic
(c) tribasic　　　　　　(d) tetrabasic

(5) pH of strong acid is ....
(a) 0　　　　　　　　　(b) 7
(c) 8　　　　　　　　　(d) 14

(6) HCl + NaOH ⟶ NaCl + H_2O is a .... reaction.

(a) neutralisation (b) crystallisation
(c) electrolysis (d) dissociation

(7) Molecular formula of Red oxide is ....
(a) Fe_2O_3　　　　　　(b) CuO
(c) Fe_3O_4　　　　　　(d) Na_2O

(8) The positive terminal electrode is called as ....
(a) anode　　　　　　(b) cathode
(c) anion　　　　　　(d) cation

(9) .... produced in stomach helps in digestion.
(a) Hydrochloric acid (b) Oxalic acid
(c) Sulphuric acid (d) Nitric acid

(10) Adding water to acid is an .... reaction.
(a) endothermic reaction
(b) exothermic reaction
(c) neutralisation (d) crystallisation

Ans. *(1) 4　　　　　　(2) Na^+ and Cl^-*
(3) Na_2O　　　　(4) dibasic
(5) 0　　　　　　(6) neutralization
(7) Fe_2O_3　　　(8) anode
(9) Hydrochloric acid (10) exothermic

Q.3. **State whether the following statements are true or false and if false, write the correct statement:**

(1) The separation of H^+ and Cl^- in HCl is in absence of water.

Ans. **False**, The separation of H^+ and Cl^- in HCl is in presence of water.

(2) $NaOH(s) \xrightarrow[\text{dissociation}]{\text{Water}} Na^+ (aq) + OH^- (aq)$

Ans. **True**

(3) H_2SO_4 is a strong acid.

Ans. **True**

(4) NaCl is an ionic compound..

Ans. **True**

(5) Turmeric is synthetic indicator.

Ans. **False**, Turmeric is a natural indicator.

(6) Metal + Dilute acid forms salt and water.

Ans. **False**, Metal + Dilute acid forms salt and hydrogen gas.

(7) Copper oxide is called red primer.

Ans. **False**, Iron oxide is called red primer.

(8) Oxide of non-metal + Acid $\longrightarrow$ Salt + Water.

Ans. **False**, Oxide of non-metal + Base $\longrightarrow$ Salt + Water.

(9) Zinc oxide reacts with sodium hydroxide to form sodium zincate.

Ans. **True**

(10) Al_2O_3 is an amphoteric oxide.

Ans. **True**

(11) Blue vitriol is $ZnSO_4 \cdot 7H_2O$.

Ans. **False,** Blue Vitriol is $CuSO_4 \cdot 5H_2O$.

(12) Molecular formula for crystalline Ferrous sulphate is $FeSO_4 \cdot 5H_2O$.

Ans. **False,** Molecular formula for crystalline Ferrous sulphate is $FeSO_4 \cdot 7H_2O$.

(13) NaCl in water does not conduct electricity.

Ans. **False,** NaCl in water conducts electricity.

(14) Phenolphthalein is colourless in base.

Ans. **False,** Phenolphthalein is colourless in acid and pink in base.

Q.4. Find the odd one out and justify:

*(a) Chloride, nitrate, hydride, ammonium

Ans. Ammonium is the odd one out as it is a basic radical and rest all are acidic radicals. Generally, basic radicals are formed by removal of electrons from the atom of metals such as Na^+, Cu^{2+}. But there are some exceptions, such as NH_4^+.

*(b) Hydrogen chloride, sodium hydroxide, calcium oxide, ammonia

Ans. Hydrogen chloride is the odd one out. It is acidic and the rest are all basics.

*(c) Acetic acid, carbonic acid, hydrochloric acid, nitric acid

Ans. Carbonic acid is the odd one out. It is a dibasic acid and rest are all monobasic acids.

*(d) Ammonium chloride, sodium chloride, potassium nitrate, sodium sulphate

Ans. Ammonium chloride is the odd one out, as it is made up of a strong acid and weak base and rest all are formed from strong acid and strong base.

*(e) Sodium nitrate, sodium carbonate, sodium sulphate, sodium chloride.

Ans. Sodium carbonate is the odd one out, as it is made up of a weak acid and strong base, and rest all are formed from strong acid and strong base.

*(f) Calcium oxide, magnesium oxide, zinc oxide, sodium oxide.

Ans. Zinc oxide is the odd one out, as it is amphoteric oxide, and rest all are basic oxides.

*(g) Crystalline blue vitriol, crystalline common salt, crystalline ferrous sulphate, crystalline sodium carbonate.

Ans. Crystalline common salt is the odd one out, as it does not contain water of crystallisation. It is an ionic compound and ionic compounds are crystalline in nature and rest all have their crystalline structure because of their water of crystallization.

*(h) Sodium chloride, potassium chloride, acetic acid, sodium acetate.

Ans. Acetic acid is the odd one out.

It is an acid, the rest are all salts.

(i) Rose Petal, Turmeric, phenolphthalein, indigo.

Ans. Phenolphthalein is odd one out as rest are natural indicators while phenophthalein is a synthetic indicator.

(j) Lime water, Vinegar, Acetic acid, Tartaric acid.

Ans. Lime water is odd one out as this is basic in nature while rest are acidic.

(k) $NaHCO_3$, HCl, H_2SO_4, HNO_3

Ans. $NaHCO_3$ is odd one out as it is a basic while rest are acids.

(l) Oxalic acid, Nitric acid, Citric acid, acetic acid.

Ans. Nitric acid is odd one out as others are weak acids while Nitric acid is a strong acid.

(m) Crystalline, Liquid, Gases, Solid

Ans. Crystalline is odd one out as this is nature of a compound while others are physical states of compounds

(n) Ca$(OH)_2$, Mg$(OH)_2$, NaOH, NH_4OH.

Ans. NaOH is odd one out as all are bases but NaOH is highly soluble in water compared to others.

Q.5.   Match the columns:

(A)

Column 'A'	Column 'B'
(1) HNO_3	(a) Acetic acid
(2) H_3PO_4	(b) Carbonic acid
(3) CH_3COOH	(c) Phosphoric acid
(4) H_2CO_3	(d) Nitric acid

Ans.   *(1 - d), (2 - c), (3 - a), (4 - b)*

(B)

Column 'A'	Column 'B'
(1) NH_4OH	(a) Aluminium Hydroxide
(2) $Ca(OH)_2$	(b) Barium Hydroxide
(3) $Al(OH)_3$	(c) Calcium Hydroxide
(4) $Ba(OH)_2$	(d) Ammonium Hydroxide

Ans.   *(1 - d), (2 - c), (3 - a), (4 - b)*

(C)

Column 'A' Solution	Column 'B' pH
(1) Milk	(a) 1
(2) Milk of Magnesia	(b) 14
(3) 1 M HCl	(c) 10.5
(4) 1 M NaOH	(d) 6.5

Ans.   *(1 - d), (2 - c), (3 - a), (4 - b)*

(D)

Column 'A'	Column 'B'
(1) Urine	(a) Butyric acid
(2) Apples	(b) Uric Acd
(3) Orange	(c) Malic acid
(4) Butter	(d) Citric acid

Ans.   *(1 - b), (2 - c), (3 - d), (4 - a)*

(E)

Column 'A'	Column 'B'
(1) Crystalline blue vitriol	(a) $FeSO_4 \cdot 7H_2O$
(2) Crystalline green vitriol	(b) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
(3) Crystalline washing soda	(c) $CuSO_4 \cdot 5H_2O$
(4) Crystalline alum	(d) $Na_2CO_3 \cdot 10H_2O$

Ans.   *(1 - c), (2 - a), (3 - d), (4 - b)*

Q.6.   Answer the following in one or two sentences:

(1)   Name the three types of ionic compounds.

Ans.   The three types of ionic compounds are acids, bases and salts.

(2)   Name the two constituents of molecule of an ionic compound.

Ans.   The molecule of an ionic compound has two constituents, namely, cations (positive ion/ basic radical) and anion (negative ion/acidic radical).

(3)   Name any three acids with their molecular formulae.

Ans.   (i)   Hydrochloric acid - HCl
(ii) Sulphuric acid - H_2SO_4
(iii) Nitric acid - HNO_3

(4)   Name any three bases with their molecular formulae.

Ans.   (i)   Sodium hydroxide - NaOH
(ii) Potassium hydroxide - KOH
(iii) Calcium hydroxide - $Ca(OH)_2$

(5)   Name any three salts with their molecular formulae.

Ans.   (i)   Sodium chloride - NaCl
(ii) Potassium sulphate - K_2SO_4
(iii) Calcium chloride - $CaCl_2$

(6)   Name any two strong acids.

Ans.   (i)   Hydrochloric acid - HCl
(ii) Sulphuric acid - H_2SO_4

(7)   Name any two weak acids.

Ans.   (i)   Acetic acid - CH_3COOH
(ii) Carbonic acid - H_2CO_3

(8)   Name any two strong bases.

Ans.   (i)   Sodium hydroxide - NaOH
(ii) Potassium hydroxide - KOH

(9)   Name a weak base.

Ans.   Ammonium hydroxide - NH_4OH

(10) Name any two alkalis.

Ans.   (i)   Sodium hydroxide - NaOH
(ii) Potassium hydroxide - KOH

(11) Name any two acids with their basicity 1 (monobasic)

Ans.   (i)   Hydrochloric acid - HCl
(ii) Nitric acid - HNO_3

(12) Name any two acids with their basicity 2 (dibasic)

Ans. (i) Sulphuric acid - H_2SO_4

(ii) Carbonic acid - H_2CO_3

(13) Name any two acids with their basicity 3 (tribasic)

Ans. (i) Boric acid - H_3BO_3

(ii) Phosphoric acid - H_3PO_4

(14) Name any two bases with their acidity 1 (monoacidic)

Ans. (i) Sodium hydroxide - NaOH

(ii) Potassium hydroxide - KOH

(15) Name any two bases with their acidity 2 (diacidic)

Ans. (i) Calcium hydroxide - $Ca(OH)_2$

(ii) Barium hydroxide - $Ba(OH)_2$

(16) Name any two bases with their acidity 3 (triacidic)

Ans. (i) Aluminium hydroxide - $Al(OH)_3$

(ii) Ferric hydroxide - $Fe(OH)_3$

(17) Name the two units to express the concentration of the solution.

Ans. (i) The first unit is the mass of solute in gram dissolved in one litre of the solution (grams per litre, g/L)

(ii) The second unit is number of moles of the solute dissolved in one litre of the solution. This is called the molarity (M) of the solution.

(18) What is the molarity of a solution? How is it written?

Ans. The number of moles of the solute dissolved in one litre of the solution is called the molarity of that solution. The molarity of a solute is indicated by writing its molecular formula inside a square bracket. For example, [NaCl] = 1 means the molarity of the solution of common salt is 1 M (1 molar)

(19) What are acid-base indicators?

Ans. Some natural and synthetic dyes show two different colours in acidic and base solution, and such dyes are acid-base indicators.

*Q.7. State the difference:

(1) Acids and bases

Ans.

	Acids	Bases
(i)	A substance which liberates H^+ ions when dissolved in water is an acid	A substance which liberates OH^- ions in water is called a base.
(ii)	Blue litmus turns red in an acid.	Red litmus turns blue in a base
(iii)	The pH of an acid is less than 7.	The pH of a base is greater than 7.
(iv)	Acids are sour to taste e.g. HCl, H_2SO_4	Bases are bitter to taste. e.g. NaOH, KOH.

(2) Cations and anions

Ans.

	Cations	Anions
(i)	Cations are ions with a net positive charge .	Anions are ions with a net negative charge.
(ii)	Cations are generally formed by metals. When metals donate electrons, they have excess of protons, hence they form cations.	Anions are generally formed by non-metals. When non-metals accept electrons, they have excess of electrons, hence they form anions.
(iii)	Cations are attracted towards the cathode which are negatively charged electrodes.	Anions are attracted towards the anode which are positively charged electrodes.
(iv)	e.g.: Na^+, Ca^{2+}, Mg^{2+}, K^+ etc.	e.g.: O^{2-}, S^{2-}, Cl^-, Br^- etc.

(3) Negative electrode and positive electrode

Ans.

	Negative Electrode	Positive Electrode
(i)	Negative electrodes are called as cathode.	Positive electrodes are called as Anode.
(ii)	Positively charged cations move towards the cathode or negative electrode.	Negatively charged anions move towards the anode or positive electrode.

Q.8. **Define the following:**

(1) **Acid**

Ans. An acid is a substance which on dissolving in water gives rise to H^+ ion as the only cation. For example, HCl, H_2SO_4, H_2CO_3

$$HCl_{(g)} \xrightarrow[\text{(dissociation)}]{\text{Water}} H^+_{(aq)} + Cl^-_{(aq)}$$

$$H_2SO_{4\,(l)} \xrightarrow[\text{(dissociation)}]{\text{Water}} H^+_{(aq)} + HSO_4^-{}_{(aq)}$$

$$HSO_4^-{}_{(aq)} \xrightarrow{\text{(dissociation)}} H^+_{(aq)} + SO_4^{2-}{}_{(aq)}$$
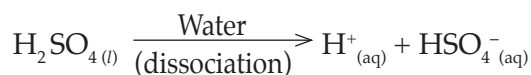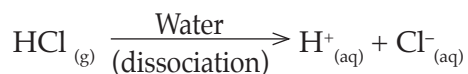
(2) **Base**

Ans. A base is a substance which on dissolving in water gives rise to the OH^- ion as the only anion. For example, $NaOH$, $Ca(OH)_2$

$$Na\ OH_{(s)} \xrightarrow[\text{(dissociation)}]{\text{Water}} Na^+_{(aq)} + OH^-_{(aq)}$$

$$Ca\ (OH)_{2\,(s)} \xrightarrow[\text{(dissociation)}]{\text{Water}} Ca^{2+}_{(aq)} + 2OH_{(aq)}$$
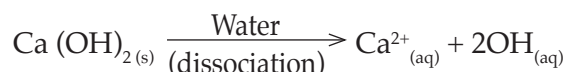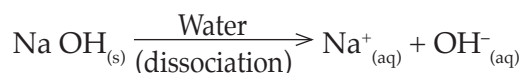
(3) **Strong Acid**

Ans. On dissolving in water, a strong acid dissociates almost completely, and the resulting aqueous solution contains mainly H^+ ion and the concerned acidic radical.

e.g. HCl, HBr, HNO_3, H_2SO_4.

(4) **Weak Acid**

Ans. On dissolving in water a weak acid does not dissociate completely, and the resulting aqueous solution contains H^+ ion and the concerned acidic radical in small proportion along with large proportion of the undissociated molecules of the acid.

e.g., H_2CO_3 (Carbonic acid), CH_3COOH (Acetic Acid)

(5) **Strong Base**

Ans. On dissolving in water, a strong base dissociates almost completely and the resulting aqueous solution contains mainly OH^- ions and the concerned basic radicals.

e.g. $NaOH$, KOH, $Ca(OH)_2$, Na_2O.

(6) **Weak Base**

Ans. On dissolving in water, a weak base does not dissociates completely and the resulting aqueous solution contains a small proportion of OH^- ions and the concerned basic radicals along with a large proportion of undissociated molecules of the base. e.g. NH_4OH.

(7) **Alkali**

Ans. The bases which are highly soluble in water are called alkali. e.g. $NaOH$, KOH, NH_3. Here, $NaOH$ and KOH are strong alkalies while NH_3 is a weak alkali.

(8) **Basicity of acids**

Ans. The number of H^+ ions obtainable by the dissociation of one molecule of an acid is called its basicity.

(9) **Acidity of bases**

Ans. The number of OH^- ions obtainable by the dissociation of one molecule of a base is called its acidity.

(10) **Concentration of solute in the solution.**

Ans. The proportion of a solute in a solution is called the concentration of the solute in the solution.

(11) **Concentrated solution.**

Ans. When the concentration of a solute in its solution is high, it is a concentrated solution.

(12) **Dilute solution**

Ans. When the concentration of a solute in its solution is low, it is dilute solution.

(13) **Neutralization**

Ans. A reaction in which an acid reacts with a base to form salt and water is called a neutalization.

$$NaOH + HCl \longrightarrow NaCl + H_2O$$
$$Base + Acid \longrightarrow Salt + Water$$

(14) **Cathode**

Ans. The electrode connected to the negative terminal of a battery by means of a conducting wire is called a cathode.

(15) **Anode**

Ans. The electrode connected to the positive terminal of a battery by means of a conducting wire is called an anode.

(16) **Cations**

Ans. Cations are positively charged ions which are attracted towards negative electrode (cathode) when electricity is passed into a solution of an ionic compound.

(17) Anions

Ans. Anions are negatively charged ions which are attracted towards positive electrode (anode) when electricity is passed into a solution of an ionic compound.

(18) Electrolytic cell

Ans. An assembly that consists of a container with an electrolyte and two electrodes dipped in it, is called an electrolytic cell.

Q.9. Give scientific reasons:

*(1) Hydronium ions are always in the form H_3O^+.

Ans. Acids in water gives H^+ ions. This H^+ ions do not exist freely in water. This is because H^+ is a single proton, a hydrogen atom has only one proton and one electron. If the electron is removed to make H^+, all that is left is an extremely tiny positively charged nucleus. This H^+ ion will immediately combine with the surrounding water (H_2O) molecules to form (H_3O^+) hydronium ion.

*(2) Buttermilk spoils if kept in a copper or brass container.

Ans. Buttermilk contains an organic acid called as lactic acid. The lactic acid reacts with copper and brass and forms toxic compounds which are not fit for consumption. They are harmful and may cause food poisoning. So it is not advisable to keep buttermilk in brass or copper.

(3) Ionic compound NaCl has very high stability.

Ans. The outermost shell of both Na^+ and Cl^- ions is a complete octet. An electronic configuration with a complete octet indicates a stable state.

A molecule of NaCl has Na^+ and Cl^- ions. An ionic bond is formed between these ions. The force of attraction between them is very strong as it is formed between the oppositely charged Na^+ and Cl^- ions.

Therefore NaCl, an ionic compound has high stability.

(4) Ionic compound dissociates while forming an aqueous solution.

Ans. On dissolving in water, an ionic compound forms an aqueous solution. In the solid state, the oppositely charged ions in the ionic compound are sitting side by side. When an ionic compound beings to dissolve in water, the water molecules push themselves in between the ions of the compound and it separates them from each other, that is to say, an ionic compound dissociates while forming an aqueous solution.

Q.10. *(1) Fill in the columns in the part of the following table:

Ans.

Name of the compound	Molecular formula	Basic radical	Acidic radical	Type of the compound
Hydrochloric acid	HCl	H^+	Cl^-	Acid
Nitric Acid	HNO_3	H^+	NO_3^-	Acid
Hydrogen Bromide	HBr	H^+	Br^-	Acid
Sulphuric acid	H_2SO_4	H^+	SO_4^{2-}	Acid
Boric acid	H_3BO_3	H^+	BO_3^{3-}	Acid
Sodium hydroxide	NaOH	Na^+	OH^-	Base
Potassium hydroxide	KOH	K^+	OH^-	Base
Calcium hydroxide	$Ca(OH)_2$	Ca^{2+}	OH^-	Base
Ammonium hydroxide	NH_4OH	NH_4^+	OH^-	Base
Sodium chloride	NaCl	Na^+	Cl^-	Salt
Calcium nitrate	$Ca(NO_3)_2$	Ca^{2+}	NO_3^-	Salt
Potassium sulphate	K_2SO_4	K^+	SO_4^{2-}	Salt
Calcium chloride	$CaCl_2$	Ca^{2+}	Cl^-	Salt
Ammonium sulphate	$(NH_4)_2SO_4$	NH_4^+	SO_4^{2-}	Salt

* (2) Complete the following :

$NH_{3\,(g)} + H_2O_{(l)} \longrightarrow NH_{4\,(aq)}^+ + OH^-_{(aq)}$

$Na_2O_{(s)} + H_2O_{(l)} \longrightarrow 2Na^+_{(aq)} + \text{.............}$

$CaO_{(s)} + H_2O_{(l)} \longrightarrow \text{.............} + \text{.............}$

Ans. $NH_{3\,(g)} + H_2O_{(l)} \longrightarrow NH_{4\,(aq)}^+ + OH^-_{(aq)}$

$Na_2O_{(s)} + H_2O_{(l)} \longrightarrow 2Na^+_{(aq)} + 2OH^-_{(aq)}$

$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca^{2+}_{(aq)} + 2OH^-_{(aq)}$
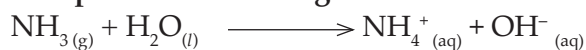
* (3) Complete the following table.

Ans.

Acid : Number of H^+ obtained from one molecule.						
HCl	HNO_3	H_2SO_4	H_2CO_3	H_3BO_3	H_3PO_4	CH_3COOH
1	1	2	2	3	3	1
Base : Number of OH^- ions obtained from one molecule						
NaOH	KOH	$Ca(OH)_2$	$Ba(OH)_2$	$Al(OH)_3$	$Fe(OH)_3$	NH_4OH
1	1	2	2	3	3	1

* (4) Complete the following table of the concentration of various aqueous solutions.

Ans.

Solute			Quantity of solute		Volume of Solution	Concentration of the solution	
A	B	C	D	$E = \dfrac{D}{C}$	F	$G = \dfrac{D}{F}$	$H = \dfrac{E}{F}$
Name	Molecular formula	Molecular mass (u)	Gram (g)	Mole (mol)	Litre (L)	Gram/ Litre (g/L)	Molarity M mole/litre (mol/L)
Sodium chloride	NaCl	58.5 u	117 g	2 mol	2L	58.5 g/L	1 M
Hydrogen chloride	HCl	36.5 u	3.65 g	0.1 mol	1L	3.65 g/L	0.1 M
Sodium hydroxide	NaOH	40	60	1.5 mol	2L	30 g/L	0.75 M

* (5) Complete the following table of neutralization reactions and also write down the names of the acids, bases and salts in it.

Ans.

Acid	+	base	$\longrightarrow$	Salt	+	Water
HNO_3	+	KOH	$\longrightarrow$	KNO_3	+	H_2O
Nitric acid	+	Potassium hydroxide	$\longrightarrow$	Potassium nitrate	+	water
H_2SO_4	+	$2NH_4OH$	$\longrightarrow$	$(NH_4)_2SO_4$	+	$2H_2O$
Sulphuric acid	+	Ammonium hydroxide	$\longrightarrow$	Ammonium sulphate	+	water
HBr	+	KOH	$\longrightarrow$	KBr	+	H_2O
Hydrogen Bromide	+	Potassium hydroxide	$\longrightarrow$	Potassium Bromide	+	water

*(6) Complete the following reactions.

Ans. Metal + Dilute acid $\longrightarrow$ Salt + Hydrogen

$$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$$

$$Zn_{(s)} + \underline{H_2SO_{4\,(aq)}} \longrightarrow ZnSO_{4\,(aq)} + H_{2(g)}$$

$$Cu_{(s)} + 2\,HNO_{3(aq)} \longrightarrow Cu(NO3)_{2(aq)} + H_{2(g)}$$

*(7) Complete the following.

Ans. Metal oxide + Dilute acid $\longrightarrow$ Salt + Water

$$CaO_{(s)} + 2\,HCl_{(aq)} \longrightarrow CaCl_{2\,(aq)} + H_2O_{(l)}$$

$$MgO_{(s)} + 2\,HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_2O_{(l)}$$

$$ZnO_{(s)} + 2\,HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_2O_{(l)}$$

$$Al_2O_{3(s)} + 6\,HF_{(l)} \longrightarrow 2AlF_{3(aq)} + 3H_2O_{(l)}$$

$$Fe_2O_{3(s)} + 6\,HCl_{(aq)} \longrightarrow 2FeCl_{3(aq)} + 3H_2O_{(l)}$$

*(8) Complete the following reactions.

Ans. Oxide of non-metal + base $\longrightarrow$ salt + water

$$CO_{2(g)} + 2\,NaOH_{(aq)} \longrightarrow Na_2CO_{3(aq)} + H_2O_{(l)}$$

$$\underline{CO_{2(g)}} + 2\,KOH_{(aq)} \longrightarrow K_2CO_{3(aq)} + H_2O_{(l)}$$

$$SO_{3(g)} + 2\,\underline{NaOH_{(aq)}} \longrightarrow Na_2SO_{4(aq)} + H_2O_{(l)}$$

(9) Complete the reactions in the following table.

Ans.

Carbonate salt of metal + dilute acid $\longrightarrow$ Another salt of metal + Carbon dioxide + water
$Na_2CO_{3\,(s)} + 2\,HCl_{(aq)} \longrightarrow 2\,NaCl_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
$Na_2CO_{3\,(s)} + \underline{H_2SO_{4\,(aq)}} \longrightarrow Na_2SO_{4\,(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
$Ca\,CO_{3\,(s)} + 2\,HNO_{3\,(aq)} \longrightarrow \underline{Ca\,(NO_3)_{2\,(aq)}} + CO_{2\,(g)} + H_2O_{(l)}$
$K_2\,CO_{3\,(s)} + H_2SO_{4\,(aq)} \longrightarrow \underline{K_2\,SO_{4\,(aq)}} + \underline{CO_{2\,(g)}} + H_2O_{(l)}$

Bicarbonate salt of metal + dilute acid $\longrightarrow$ Another salt of metal + carbon dioxide + water
1. $NaHCO_{3\,(s)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$
2. $KHCO_{3\,(s)} + HNO_{3\,(aq)} \longrightarrow KNO_{3\,(aq)} + \underline{CO_{2\,(g)}} + \underline{H_2O_{(l)}}$
3. $NaHCO_{3\,(s)} + \underline{CH_3COOH_{(aq)}} \longrightarrow CH_3COONa_{(aq)} + \underline{CO_{2\,(g)}} + H_2O_{(l)}$

Q.11. Answer in brief:

(1) What are acids, bases and salts ?

Ans. Some compounds are seen to have H^+ as the basic radical in their molecules. These are all acids. Some compounds are seen to have OH^- as the acidic radical in their molecule. All these compounds are bases. Those ionic compounds which have a basic radical other than H^+ and an acidic radical other than OH^- are called salts.

(2) What is ionic bond?

Ans. The molecule of an ionic compound has two consitituents namely cation (positive ion / basic radical). There is a force of attraction between these ions as they are oppositely charged, and that is called the ionic bond. The force of attraction between one positive charge on a cation and one negative charge on an anion makes one ionic bond.

(3) Give examples to show that proportions of H^+ and OH^- ions in aqueous solution determines the properties of those solutions.

Ans. The examples to show that proportions of H^+ and OH^- ions in aqueous solution determines the properties of those solutions are :

(a) The proportions of H^+ and OH^- ions divides soil into the acidic, neutral and basic, types of soil.

(b) It is necessary for blood, cellsap etc to have H^+ and OH^- ions in certain definite proportions for their proper functioning.

(c) Fermentation carried out with the help of micro-organisms, other biochemical processes and also many chemical processes require the proportion of H^+ and OH^- ions to be maintained within certain limits.

(4)   What is pH scale ?

Ans. In 1909, the Danish scientist Sorensen introduced a convenient scale of expressing H^+ ion concentration which is found to be useful in chemical and biochemical processes. It is the pH scale (pH : power of hydorgen). The pH scale extends from 0 to 14. According to this scale pure water has a pH of 7. pH 7 indicates a neutral solution. This pH is the midpoint of the scale. The pH of an acidic solution is less than 7 and that of a basic solution is greater than 7.

(5)   Give the pH of following solutions.

Ans.

	Solution	pH
Strong acids	1 M HCl	0.0
	Gastric juice	1.0
	Lemon juice	2.5
	Vinegar	3.0
	Tomato juice	4.1
	Black coffee	5.0
	Acid rain	5.6
weak acids	Urine	6.0
Neutral	Rain, milk	6.5
Weak bases	Pure water, sugar solution	7.0
	Blood	7.4
	Solution of baking soda	8.5
	Toothpaste	9.5
	Milk of magnesia	10.5
	Lime water	11.0
Strong bases	1 M NaOH	14.0

(6)   What is universal indicator? Which is the most accurate method of measuring the pH of a solution?

Ans. In the pH scale, the pH of solutions varies from 0 to 14 in accordance with the strength of the acid or base. To show these variations in pH, a universal indicator is used. A universal indicator shows different colours at different values of pH. A universal indicator is made by mixing several synthetic indicators in specific proportions. The pH of a solution can be determined by means of a universal indicator solution or the pH paper made from it.

However, the most accurate method of measuring the pH of a solution is to use an electrical instrument called pH meter. In this method, pH is measursed by dipping electrodes into the solution.

*(7)   Classify the following oxides into three types and name the types.

CaO, MgO, CO_2, SO_3, Na_2O, ZnO, Al_2O_3, Fe_2O_3

Ans. There are three types of oxides : Basic oxides, Acidic oxides and Amphoteric oxides.

Basic oxides	Acidic oxides	Amphoteric oxides
CaO	CO_2	ZnO
MgO	SO_3	Al_2O_3
Na_2O		
Fe_2O_3		

Generally metal oxides are basic in nature.

Exception Al_2O_3 and ZnO which are amphoteric.

Generally non-metal oxides are acidic in nature.

*(8)   Explain by drawing a figure of the electronic configuration

(a)   Formation of sodium chloride from sodium and chlorine.

Ans.

Na
Sodium atom
(2, 8, 1)

Cl
Chlorine atom
(2, 8, 7)

Na^+
Sodium ion
(2, 8)
(Cation)

Cl^-
Chlorine atom
(2, 8, 8)
(Anion)

NaCl

(b) Formation of a magnesium chloride from magnesium and chlorine.

Ans.

Cl
Chlorine atom
(2, 8, 7)

Mg
Magnesium atom
(2, 8, 2)

Cl
Chlorine atom
(2, 8, 7)

Cl^-
Chlorine ion
(2, 8, 8)
Anion

Mg^{2+}
Magnesium atom
(2, 8)
Cation

Cl^-
Chlorine ion
(2, 8, 8)
Anion

$MgCl_2$
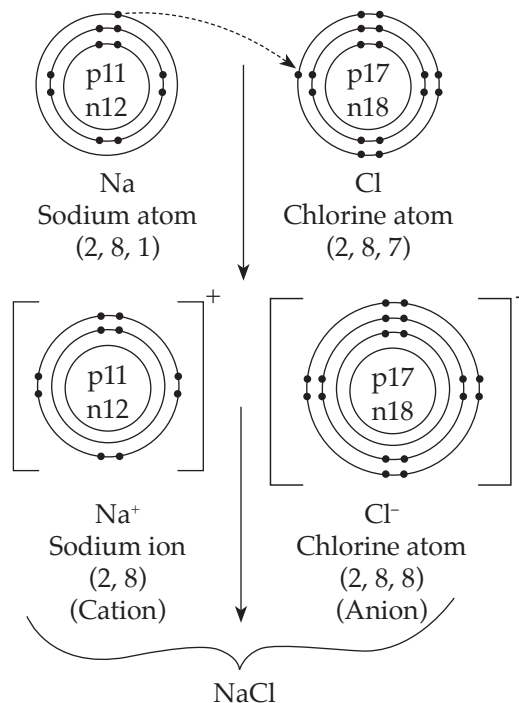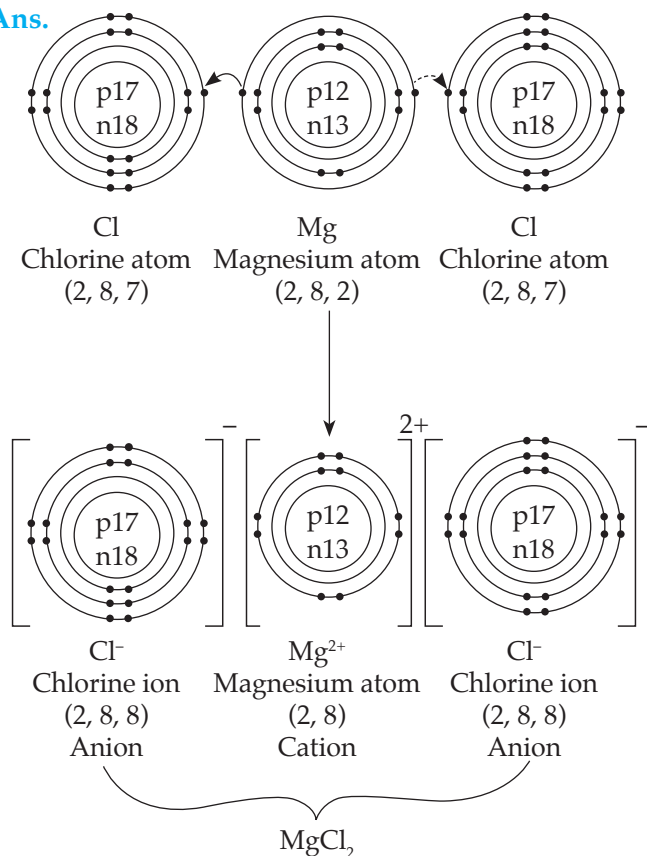
*(9) Show the dissociation of the following compounds on dissolving in water, with the help of chemical equation and write whether the proportion of dissociation is small or large.

Hydrochloric acid, Sodium chloride, Potassium hydroxide, Ammonia, Acetic acid, Magnesium chloride, Copper sulphate.

Ans.

(a) Hydrochloric acid (HCl)

$$HCl_{(g)} \xrightarrow[\text{dissociation}]{\text{Water}} H^+_{(aq)} + Cl^-_{(aq)}$$
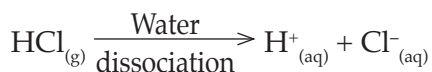
Hydrochloric acid is a strong acid, as on dissolving in water, it dissociates almost completely and the resulting aqueous solution contains mainly H^+ ions and the concerned acidic radical. The proportion of dissociation is large.

(b) Sodium chloride (NaCl)
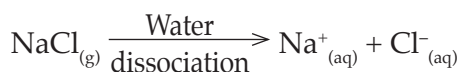
$$NaCl_{(g)} \xrightarrow[\text{dissociation}]{\text{Water}} Na^+_{(aq)} + Cl^-_{(aq)}$$

When an ionic compound begins to dissolve in water, the water molecules push themselves in between the positive and negative ions of

the compound and separate them from each other. The proportion of dissociation is large.

(c) Potassium hydroxide (KOH)

$$KOH_{(s)} \xrightarrow[\text{dissociation}]{\text{Water}} K^+_{(aq)} + OH^-_{(aq)}$$
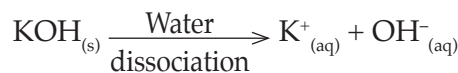
Potassium hydroxide is a strong base, as on dissolving in water, it dissociates almost compeletely and the resulting aqueous solution contains mainly OH^- ions and the concerned basic radical. The proportion of dissociation is large.

(d) Ammonia (NH_3)

$$NH_{3(g)} + H_2O_{(l)} \xrightarrow[\text{dissociation}]{\text{Water}} NH^+_{4(aq)} + OH^-_{(aq)}$$
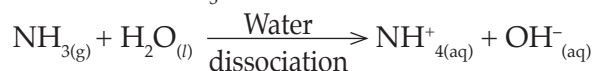
Ammonia dissolves in water to form NH_4OH (ammonium hydroxide). NH_4OH does not dissociate completely as it is a weak base. The aqueous solution contains a small proportion of OH^- ions and the concerned basic radical along with a large proportion of undissociated molecules of the base i.e. NH_4OH.

(e) Acetic acid (CH_3COOH)

$$(CH_3COOH) \xrightarrow[\text{dissociation}]{\text{Water}} CH_3COO^- + H^+$$
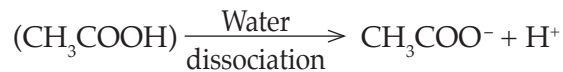
Acetic acid is a weak acid, on dissolving in water it does not dissociate completely, and the resulting aqueous solution contains H^+ ion and the concerned acidic radical in small proportion along with large proportion of the undissociated molecules of the acid. The propotion of dissociation is small.

(f) Magnesium chloride ($MgCl_2$)

$$MgCl_2 \xrightarrow[\text{dissociation}]{\text{Water}} Mg^{2+} + 2Cl^-$$
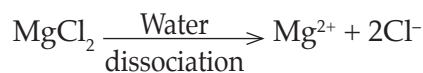
Magnesium chloride dissolves in water and forms magnesium ions and chloride ions. When an ionic compound begins to dissolve in water, the water molecules push themselves in between the ions of the compound and separate them from each other. The proportion of dissociation is large.

(g) Copper sulphate ($CuSO_4$)

$$CuSO_{4(s)} \xrightarrow[\text{dissociation}]{\text{Water}} Cu^{2+} + SO_4^{2-}$$

When copper sulphate dissolves in water, water molecules push themselves in between the ion of the compound and separate them from each other. The proportion of dissociation is large.

*(10) **Write down the concentration of each of the following solutions in g/L and mol/L.**

(a) 7.3g HCl in 100ml solution

(b) 2g NaOH in 50ml solution

(c) 3g CH_3COOH om 100ml solution

(d) 4.9g H_2SO_4 in 200ml solution

Ans. (a) 7.3g HCl in 100ml solution

To find : The concentration in g/L.

Solution :

Solute					Volume of Solution	Concentration of the solution	
A	B	C	D	$E = \dfrac{D}{C}$	F	$G = \dfrac{D}{F}$	$H = \dfrac{E}{F}$
Name	Molecular formula	Molecular mass (u)	Gram (g)	Mole (mol)	Litre (L)	Gram/ Litre (g/L)	Molarity M (mol/L)
Hydrochloric acid	HCl	36.5 u	7.3 g	0.2 mol	100 ml = 0.1L	73 g/L	2 mol/L
Sodium Hydroxide	NaOH	40 u	2.0 g	0.05 mol	50 ml = 0.05L	40 g/L	1 mol/L
Acetic Acid	CH_3COOH	60 u	3.0 g	0.05 mol	100 ml = 0.1L	30 g/L	0.5 mol/L
Sulphuric acid	H_2SO_4	98 u	4.9 g	0.05 mol	200 ml = 0.2L	24.5 g/L	0.25 mol/L

*(11) **Answer the following questions.**

(a) **Classify the acids according to their basicity and give one example of each type.**

Ans. **Basicity of acids :** The number of H^+ ions obtainable by the dissociation of one molecule of an acid is called its basicity. The acids are classified as monobasic, dibasic and tribasic acids based on the number of H^+ ions present.

Examples of monobasic acid : HCl, HNO_3, CH_3COOH

Example of dibasic acid : H_2SO_4, H_2CO_3

Example of tribasic acid : H_3BO_3, H_3PO_4

(b) **What is meant by neutralization? Give two examples from everyday life of the neutralization reaction.**

Ans. In neutralisation reaction, an acid reacts with a base to form salt and water. In a neutralisation reaction the acid dissociates to form H^+ ions and base dissociates to form OH^- ions. They combine to form H_2O molecules which mixes with the solvent.

Examples in daily life :

(i) When people suffer from acidity, they take some antacids to neutralise the acid in their stomach.

(ii) If an ant stings us the pain is due to formic acid. It is neutralised by rubbing moist baking soda which is basic in nature.

(c) **Explain what is meant by electrolysis of water. Write the electrode reactions and explain them.**

Ans. **Electrolysis of water :**

Electrolysis of water is the decomposition of water into oxygen and hydrogen gas due to an electric current being passed through acidified water.

Cathode reaction :

$2H_2O_{(l)} + 2e^- \longrightarrow H_{2(g)} + 2OH^-_{(aq)}$

Anode reaction :

$2H_2O_{(l)} \longrightarrow O_{2(g)} + 4 H^+_{(aq)} + 4e^-$
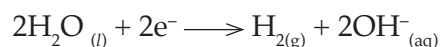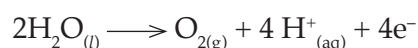
It is found that in the above activity that the volume of gas formed near the cathode is double that of the gas formed near the anode. Hydrogen gas is formed near the cathode and oxygen gas near the anode. From this, it is clear that electrolysis of water has taken place and its constituent elements have been relased.

*(12) **Classify aqueous solutions of the following substances according to their pH into three groups : 7, more than 7, less than 7.**

common salt, sodium acetate, hydrochloric acid, carbon dioxide, potassium bromide, calcium hydoxide, ammonium chloride, vinegar, sodium carbonate, ammonia, sulphur dioxide.

Ans.

	(i) pH = 7	(ii) pH > 7	(ii) pH < 7
(a)	Aqueous solution of common salt.	Aqueous solution of sodium acetate.	Aqueous solution of sulphur dioxide.
(b)	Aqueous solution of potassium bromide.	Aqueous solution of sodium carbonate	Aqueous solution of hydrochloric acid.
(c)		Aqueous solution of ammonia.	Aqueous solution of carbon-di-oxide.
(d)		Aqueous solution of calcium hydroxide.	Aqueous solution of ammonium chloride.
(e)			Aqueous solution of vinegar

* **(13)** **Write down the changes that will be seen in each instance and explain the reason behind it.**

(a) **50ml water is added to 50ml solution of copper sulphate.**

Ans. Copper sulphate solution is blue. It is a concentrated solution. When 50 ml of water is added to this concentrated solution, it becomes a diluted solution. The intensity of the blue colour is now different in this homogenous mixture.

(b) **Two drops of the indicator phenolphthalein were added to 10ml solution of sodium hydroxide.**

Ans. Sodium hydroxide is a base and phenolphthalein is a synthetic indicator. Sodium hydroxide solution will turn pink if phenolphthalein is added to it. It is a test for bases.

(c) **Two or three filings of copper were added to 10ml dilute nitric acid and stirred.**

Ans. When copper metal reacts with dilute nitric acid, the metal does not displace hydrogen from the acid like reaction with other metals. Instead the reaction produces nitric oxide, (NO).

$3 Cu_{(s)} + 8 NHO_{3(aq)}$
Copper + nitric acid (dil.)
$\longrightarrow 3 Cu(NO_3)_{2(aq)} + 2 NO_{(g)} + 4 H_2O_{(l)}$
    copper   + nitric   + water
    nitrate   oxide
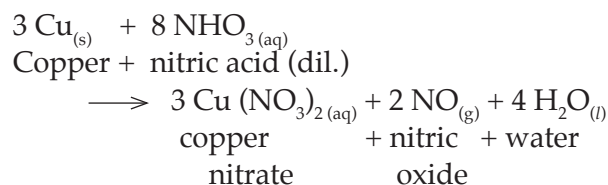
(d) **A litmus paper was dropped into 2 ml dilute HCl. Then 2 ml concentrated NaOH was added to it and stirred.**

Ans. **Blue litmus Paper :** HCl is hydrochloric acid, so the blue litmus turns red. When equal amount of NaOH is added the colour again changes to blue and remains the same.

Red litmus paper : Red litmus paper shows no colour change in hydrochloric acid. When some amount of NaOH is added the colour changes to blue initially but when the amount of NaOH is sufficient the blue colour dissappears.

Equal amounts of HCl and NaOH results in the formation of NaCl, a salt, and the solvent water. This reaction is called the neutralization reaction.

$NaOH + HCl \longrightarrow NaCl + H_2O.$
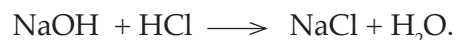
Base   + Acid   Salt + Water.

(e) **Magnesium oxide was added to dilute HCl and magnesium oxide was added to dilute NaOH.**

Ans. (i) Magnesium oxide + dil HCl.

This is a neutralization reaction. Magnesium oxide is an insoluble base, it reacts with dilute HCl to produce a soluble salt $MgCl_2$ and water H_2O.

$MgO + 2 HCl \longrightarrow MgCl_2 + H_2O$
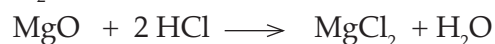
(ii) Magnesium oxide + NaOH.

No chemical reaction takes place between magnesium oxide and sodium hydroxide.

(f) **Zinc oxide was added to dilute HCl and zinc oxide was added to dilute NaOH.**

Ans. (i) Zinc oxide reacts with dilute hydrochloric acid to form zinc chloride and water. It is a neutralization reaction.
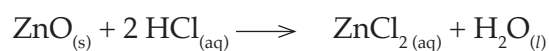
$ZnO_{(s)} + 2 HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_2O_{(l)}$

(ii) Zinc oxide reacts with sodium hydroxide to form sodium zincate and water.

$ZnO_{(s)} + 2 NaOH_{(aq)} \longrightarrow Na_2ZnO_{2(aq)} + H_2O_{(l)}$
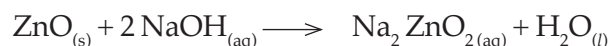
(g)   **Dilute HCl was added to limestone.**

Ans. When hydrochloric acid is added to limestone, carbon dioxide is liberated. Limestone is calcium carbonate.

$$CaCO_3 + 2\,HCl \longrightarrow CaCl_2 + CO_2 + H_2O$$
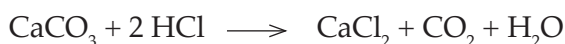
Carbon dioxide is prepared in the laboratory using these chemicals.

(h)   **Pieces of blue vitriol were beated in a test tube. On cooling, water was added to it.**

Ans. On heating, the crystalline structure of blue vitriol breaks down to form a colourless powder and water is released. This water is part of the crystal structure of blue vitriol. It is called water of cystallization.

On adding water to the white powder, a solution was formed which has the same colour as the copper sulphate salt solution.

(i)   **Dilute H_2SO_4 was taken in an electrolytic cell and electric current was passed through it.**

Ans. If pure water is used in the electrolyltic cell, current does not flow even on putting on the switch.

Pure water is a bad conductor of electricity. Dilute H_2SO_4 is acidulated water. The electrical conductivity of water increases on mixing with strong acid or base in it due to their dissociation and electrolysis of water takes place.

H_2SO_4 is fully dissociated in aqueous solution.

$$H_2SO_4 \longrightarrow 2H^+ + SO_4^{2-}$$
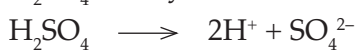
H_2O is a weak electrolyte and is only slightly dissociated

$$H_2O \longrightarrow H^+ + OH^-$$
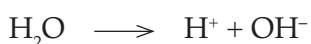
During electrolysis, the hydrogen ions migrate towards the cathode and are discharged there. [H^+ ions gains electrons and are converted to hydrogen gas]

$$2\,H^+ + 2\,e^- \longrightarrow H_2$$

Cathode reaction :

$$2\,H_2O_{(l)} + 2e^- \longrightarrow H_{2\,(g)} + 2\,OH^-_{(aq)}$$

Anode reaction :

$$2H_2O_{(l)} \longrightarrow O_{2\,(g)} + 4H^+_{(aq)} + 4e^-$$
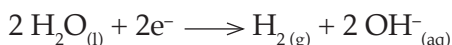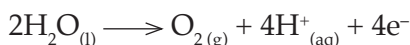
For every hydrogen ion discharged at the anode, another hydrogen ion is formed at the cathode. The net result is that the concentration of the sulphuric acid remains constant and

electrolysis of water is overall reaction.

$$2\,H_2O \longrightarrow 2\,H_2 + O_2$$
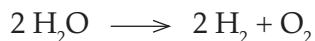
In this activity the volume of the hydrogen gas formed near the cathode is double that of the oxygen gas formed near the anode.

Q.12. Answer in detail:

(1)   **Explain Arrhenius theory of acids and bases.**

Ans. The Swedish scientist Arrhenius put forth a theory of acids and bases in the year 1887. This theory gives definitions of acids and bases as follows :

Acid : An acid is a substance which on dissolving in water gives to H^+ ion as the only cation. For example, HCl, H_2SO_4, H_2CO_3
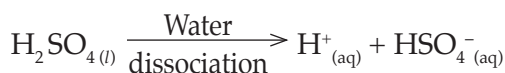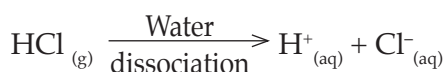
$$HCl_{(g)} \xrightarrow[\text{dissociation}]{\text{Water}} H^+_{(aq)} + Cl^-_{(aq)}$$

$$H_2SO_{4\,(l)} \xrightarrow[\text{dissociation}]{\text{Water}} H^+_{(aq)} + HSO_4^{-}{}_{(aq)}$$

$$HSO_4^{-}{}_{(aq)} \xrightarrow{\text{dissociation}} H^+_{(aq)} + SO_4^{2-}{}_{(aq)}$$

Base : A base is a substance which on dissolving in water gives rise to the OH^- ion as the only anion, For example , $NaOH$, $Ca(OH)_2$

$$NaOH_{(s)} \xrightarrow[\text{dissociation}]{\text{Water}} Na^+_{(aq)} + OH^-_{(aq)}$$

$$Ca(OH)_{2(s)} \xrightarrow[\text{dissociation}]{\text{Water}} Ca^{2+}_{(aq)} + 2OH_{(aq)}$$
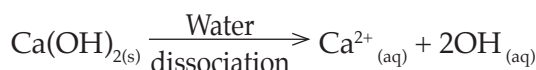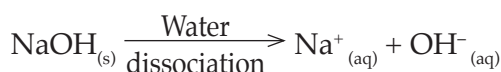
(2)   **Write a short note on Neutralization.**

Ans. Take 10 ml of dilute HCl in a beaker, go on adding dilute NaOH drop by drop and recording the pH. Stop adding the NaOH when the green colour appears on the pH paper, that is when the pH of solution becomes 7.

Both HCl and NaOH dissociate in their aqueous solutions. Addition of NaOH to HCl solution is like adding a large concentration of OH^- ions to a large concentration of H^+ ions. However water dissociates into H^+ and OH^- ions to a very small extent. Therefore on mixing the excess OH^- ions combines with excess H^+ ions and forms H_2O molecules which mix with solvent water.

This change can be represented by the ionic equation shown as follows.

$H^+ + Cl^- + Na^+ + OH^- \longrightarrow Na^+ + Cl^- + H_2O$
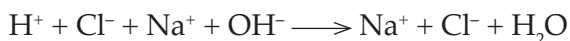
It can be observed that Na^+ and Cl^- ions are there on both the sides.

Therefore the net ionic reaction is

$H^+ + OH^- \longrightarrow H_2O$
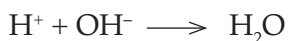
As NaOH solution is added drop by drop to the HCl solution, the concentration of H^+ goes on decreasing due to combination with added OH^- ions, and that is how the pH goes on increasing.

When enough NaOH is added to HCl, the resulting aqueous solution contains only Na^+ and Cl^- ions, that is, NaCl, a salt, and the solvent water. The only source of H^+ and OH^- ions in this solution in dissociation of water. Therefore, this reaction is called the Neutralization reaction. The Neutralization reaction is also represented by the following simple equation.

$HCl + NaOH \longrightarrow NaCl + H_2O$

Acid + base   salt + water
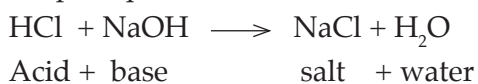
(3)   **Explain water of Crystallization.**

Ans.   Take some crystals of blue vitriol ($CuSO_4 \cdot 5H_2O$) in test tube. Heat the test tube on low flame of a burner. On heating, the crystalline structure of blue vitriol broke down to form a colourless powder and water came out. This water was part of crystal structure of blue vitroil. It is called water of crystallization. On adding water to the white powder a solution
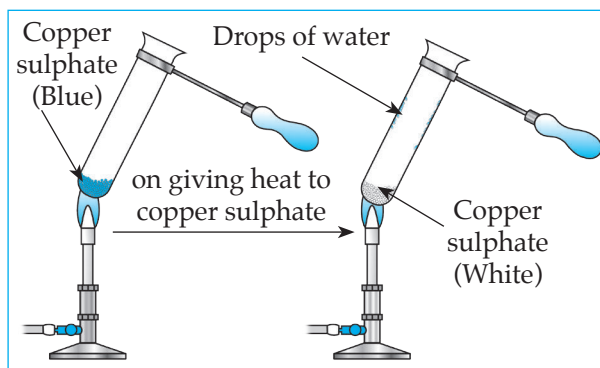
Properties of water of crystallization

was formed which had the same colour as the solution in the first test tube. From this we come to know that no chemical change has occurred in the crystals of blue vitriol due to heating. Losing water on heating blue vitriol, breaking down of the crystal structure, losing blue colour and regaining blue colour on adding water are all physical changes.
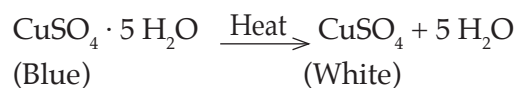
$CuSO_4 \cdot 5 H_2O \xrightarrow{\text{Heat}} CuSO_4 + 5 H_2O$
(Blue)   (White)
       (anhydrous copper sulphate)

Similarly ferrous Sulphate crystals also contain 7 molecules of water of crystallization which are lost on heating. The reaction is represented as
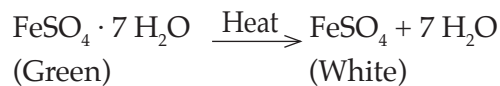
$FeSO_4 \cdot 7 H_2O \xrightarrow{\text{Heat}} FeSO_4 + 7 H_2O$
(Green)   (White)
      (anhydrous ferrous sulphate)

Ionic compounds are crystalline in nature. These crystals are formed as a result of definite arrangement of ions. In the crystals of some compounds water molecules are also included in this arrangement. That is the water of crystallization. The water of crystallization is present in a definite proportion of the chemical formula of the compound.

(4)   **Explain the conduction of electricity through solutions of ionic compounds**

Ans.   Electrons conduct electricity through electrical wires, and ions conduct electricity through a liquid or a solution. Electrons leave the battery at the negative terminal, complete the electric circuit and enter the battery at the positive terminal. When there is a liquid or a solution in the circuit, two rods, wires or plates are immersed in it. These are called electrodes. Electrodes are made of conducting solid. The electrodes conducted to negative terminal of a battery by means of a conducting wire is called a cathode and the electrode connected to the positive terminal of a battery is called anode.

We have seen that salts, strong acids and strong base dissociates almost completely in their aqueous solutions. Therefore the aqueous solutions of all these three contain large number of cations and anions.

A characteristic of liquid state is the mobility of its particles. Due to its mobility the positive charged ions of the solution are attracted to the negative electrode or cathode. On the other hand, the negative charged ions of the solution are attracted to the positive electrode or anode. The movement of ions in the solution towards the respective electrodes amounts to the conduction of electricity through the

solution. From this we can understand that those liquids or solutions which contain a large number of dissociated ions conduct electricity.

Testing the electrical conductivity of a solution

Dissociation of ions

Q.13. Explain the following chemical reactions with the help of balanced equations:

(1) Magnesium reacts with dilute hydrochloric acid.

Ans. When magnesium reacts with dilute hydrochloric acid, it forms magnesium chloride and hydrogen gas is liberated.

$$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$$
Magnesium Hydrochloric   Magnesium Hydrogen
                  acid   chloride

* (2) Zinc reacts with dilute sulphuric acid.

Ans. When zinc reacts with dilute sulphuric acid, it forms zinc sulphate and hydrogen gas is liberated.

$$Zn_{(s)} + H_2SO_{4\,(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2\,(g)}$$
Zinc Sulphuric acid   Zinc sulphate Hydrogen

(3) When copper reacts with nitric acid.

Ans. When copper reacts with nitric acid, it forms copper nitrate and hydrogen gas liberated.

$$Cu_{(s)} + 2HNO_{3\,(aq)} \longrightarrow Cu(NO_3)_{2\,(aq)} + H_{2\,(g)}$$
Copper Nitric acid   Copper Hydrogen
                                      nitrate

(4) When ferric oxide reacts with diluted hydrochloric acid.

Ans. When Ferric oxide reacts with diluted hydrochloric acid, it forms ferric chloride and water.

$$Fe_2O_{3\,(s)} + 6HCl_{(aq)} \longrightarrow 2FeCl_{3\,(aq)} + 3H_2O_{(l)}$$
Ferric   Hydrochloric   Ferric   Water
oxide   acid   chloride

(5) When calcium oxide reacts with dilute hydrochloric acid.

Ans. When calcium oxide reacts with dilute hydrochloric acid, it forms calcium chloride and water.

$$CaO_{(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2\,(aq)} + H_2O_{(l)}$$
Calcium Hydrochloric   Calcium   Water
oxide   acid   chloride

(6) When Magnesium oxide reacts with dilute hydrochloric acid.

Ans. When magnesium oxide reacts with dilute hydrochloric acid, it forms magnesium chloride and water.

$$MgO_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2\,(aq)} + H_2O_{(l)}$$
Magnesium Hydrochoric   Magnesium Water
  oxide   acid   chloride

(7) When zinc oxide reacts with dilute hydrochloric acid.

Ans. When zinc oxide reacts with dilute hydrochloric acid, it forms zinc chloride and water.

$$ZnO_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2\,(aq)} + H_2O_{(l)}$$
Zinc   Hydrochloric   Zinc   Water
oxide   acid   chloride

(8) When aluminium oxide reacts with hydrogen fluoride.

Ans. When aluminium oxide reacts with hydrogen fluoride, it forms Aluminium fluoride and water.

$$Al_2O_{3\,(s)} + 6HF_{(l)} \longrightarrow 2AlF_{3\,(aq)} + 3H_2O_{(l)}$$
Aluminium   Hydrogen Aluminium Water
  oxide   fluoride   fluoride

(9) When carbon dioxide reacts with sodium hydroxide.

Ans. When carbon dioxide reacts with Sodium hydroxide, it forms Sodium carbonate and water.

$$CO_{2\,(g)} + 2NaOH_{(aq)} \longrightarrow Na_2CO_{3\,(aq)} + H_2O_{(l)}$$

Carbon Sodium   Sodium   Water
dioxide hydroxide   carbonate

(10) When carbon dioxide reacts with potassium hydroxide.

Ans. When carbon dioxide reacts with potassium hydroxide, it forms potassium carbonate and water.

$$CO_{2\,(g)} + 2KOH_{(aq)} \longrightarrow K_2CO_{3\,(aq)} + H_2O_{(l)}$$

Carbon Potassium Potassium Water
dioxide hydroxide   carbonate

(11) When sulphur trioxide reacts with sodium hydroxide.

Ans. When sulphur trioxide reacts with sodium hydroxide, it forms sodium sulphate and water.

$$SO_{3\,(g)} + 2NaOH_{(aq)} \longrightarrow Na_2SO_{4\,(aq)} + H_2O_{(l)}$$

Sulphur Sodium   Potassium Water
trioxide hydroxide   sulphate

(12) When calcium hydroxide reacts with carbon dioxide.

Ans. When calcium hydroxide reacts with carbon dioxide, it forms calcium carbonate and water.

$$Ca(OH)_{2\,(aq)} + CO_{2\,(g)} \longrightarrow CaCO_{3\,(s)} + H_2O_{(l)}$$

Calcium   Carbon   Calcium   Water
hydroxide dioxide   carbonate
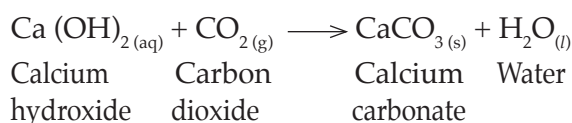
(13) When sodium carbonate reacts with hydrochloric acid.

Ans. When sodium carbonate reacts with hydrochlric acid, it forms sodium chloride , carbon dioxide and water.

$$Na_2CO_{3\,(s)} + 2HCl_{(aq)}$$

Sodium   Hydrochloric
carbonate   acid

$$\longrightarrow 2NaCl_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$$

Sodium   Carbon   Water
chloride   dioxide
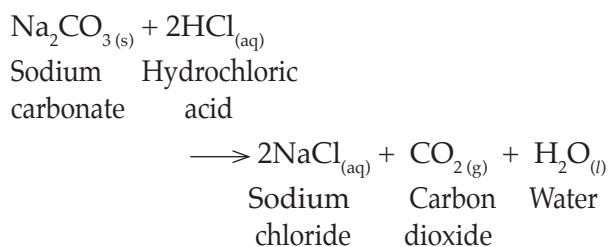
(14) When sodium carbonate react with sulphuric acid.

Ans. When sodium carbonate reacts with sulphuric acid, it forms sodium sulphate, carbon dioxide and water.

$$Na_2CO_{3\,(s)} + H_2SO_{4\,(aq)}$$

Sodium   sulphuric
carbonate   acid

$$\longrightarrow Na_2SO_{4\,(aq)} + CO_{2\,(g)} + H_2O_{(l)}$$

Sodium   Carbon   Water
sulphate   dioxide
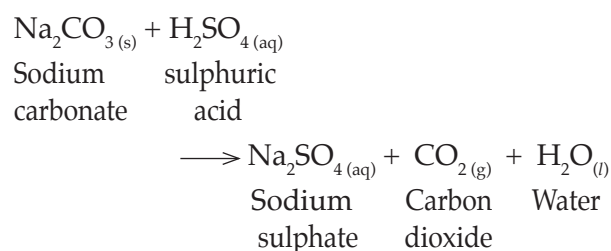
(15) When calcium carbonate react with nitric acid.

Ans. When calcium carbonate reacts with nitric acid, it forms calcium nitrate, carbon dioxide and water.

$$CaCO_{3\,(s)} + 2HNO_{3\,(aq)}$$

Calcium   Nitric
carbonate   acid

$$\longrightarrow Ca(NO_3)_2 + CO_{2\,(g)} + H_2O_{(l)}$$

Calcium   Carbon   Water
nitrate   dioxide
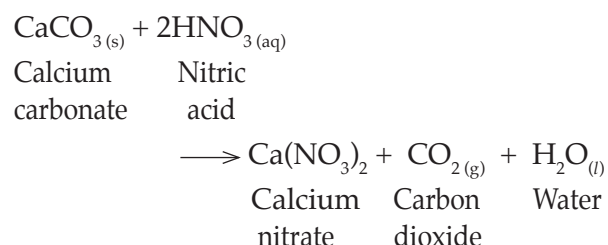
(16) When potassium carbonate react with sulphuric acid.

Ans. When potassium carbonate reacts with sulphuric acid, it forms potassium sulphate, carbon dioxide and water.

$$K_2CO_{3\,(s)} + H_2SO_{4\,(aq)}$$

Potassium Sulphuric
carbonate   acid

$$\longrightarrow K_2SO_{4\,(aq)} + CO_{2\,(g)} + H_2O_{(l)}$$

Potassium Carbon   Water
sulphate   dioxide
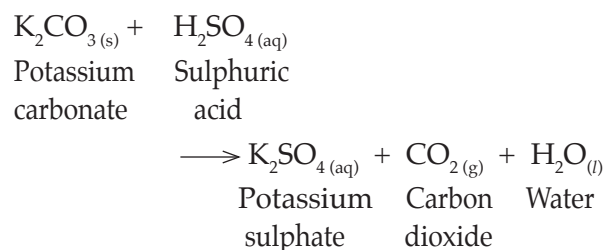
* (17) When sodium bicarbonate react with hydrochloric acid. OR

Dilute HCl was poured on baking soda

Ans. When sodium bicarbonate reacts with hyrdochloric acid, it forms sodium chloride, carbon dioxide and water.

$$NaHCO_{3\,(s)} + HCl_{(aq)}$$

Sodium   Hydrochloric
bicarbonate   acid

$$\longrightarrow NaCl_{(aq)} + CO_{2\,(g)} + H_2O_{(l)}$$

Sodium   Carbon   Water
chloride   dioxide
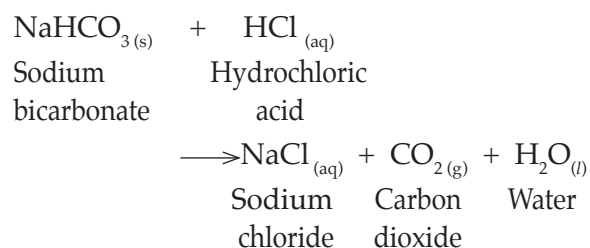
(18) When potassium bicarbonate react with nitric acid.

Ans. When potassium bicarbonate reacts with nitric acid, it forms potassium nitrate, carbon dioxide and water.

$KHCO_{3(s)}$ + $HNO_{3(aq)}$

Potassium   Nitric

bicarbonate   acid

$\longrightarrow KNO_{3(aq)}$ + $CO_{2(g)}$ + $H_2O_{(l)}$

Potassium   Carbon   Water

nitrate   dioxide
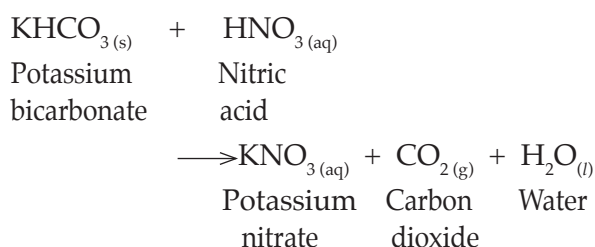
(19) When sodium bicarbonate react with acetic acid.

Ans. When sodium bicarbonate reacts with acetic acid, it forms sodium acetate, carbon dioxide and water.

$NaHCO_{3(s)}$ + $CH_3COOH_{(aq)}$

Sodium   Acetic

bicarbonate   acid

$\longrightarrow CH_3COONa_{(aq)}$ + $CO_{2(g)}$ + $H_2O_{(l)}$

Sodium   Carbon   Water

acetate   dioxide
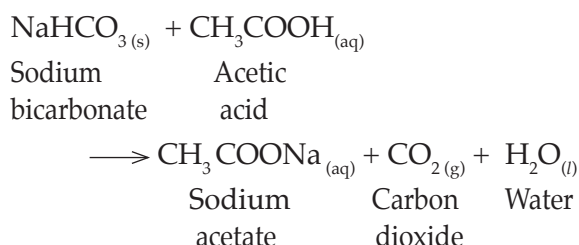
(20) When copper sulphate is heated.

Ans. When copper sulphate is heated it loses it's water of crystallation to form white anhydrous copper sulphate.

$CuSO_4 \cdot 5 H_2O \xrightarrow{\text{Heat}} CuSO_4$ + $5H_2O$

Copper   (White)   Water

sulphate (blue)   anhydrous

Copper sulphate
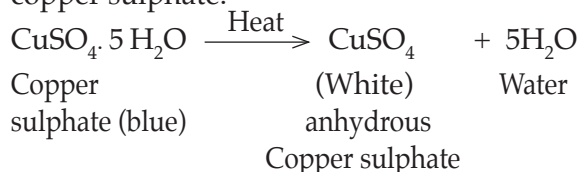
(21) When Ferrous sulphate is heated.

Ans. When ferrous sulphate is heated it loses its water of crystallation to form white anhydrous ferrous sulphate.

$FeSO_4 \cdot 7 H_2O \xrightarrow{\text{Heat}} FeSO_4$ + $7H_2O$

Ferrous   anhydrous   Water

sulphate (green)   Ferrous sulphate

(White)
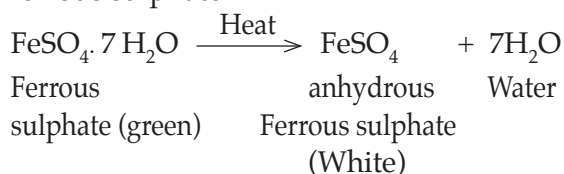
*(22) NaOH solution was added to HCl solution.

Ans. When NaOH reacts with HCl, it gives NaCl and water.

$NaOH_{(aq)}$ + $HCl_{(aq)} \longrightarrow NaCl_{(aq)}$ + $H_2O_{(l)}$

Sodium   Hydrochloric   Sodium   Water

hydroxide   acid   chloride
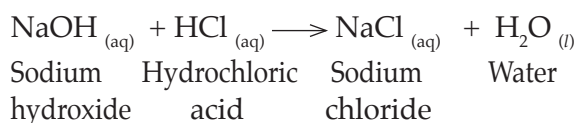
*(23) Dilute nitric acid was added to calcium oxide.

Ans. When dilute nitric acid reacts with calcium oxide, it forms calcium carbonate and water.

$2HNO_{3(l)}$ + $CaO_{(g)} \longrightarrow Ca(NO_3)_{2(s)}$ + $H_2O_{(l)}$

dil +   calcium $\longrightarrow$ calcium   + water

nitric acid   oxide   nitrate
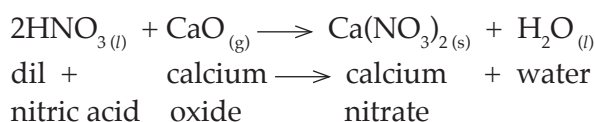
Q.14. Use your brain power!

(1) **What are the names of the following compounds? NH_3, Na_2O, CaO.**

Ans. NH_3 **:** Ammonia

Na_2O **:** Sodium oxide

CaO. : Calcium oxide

(2) **Into which type will you classify the above compounds. acid, base or salt?**

Ans. $NH_3 \longrightarrow$ base

$Na_2O \longrightarrow$ base

CaO $\longrightarrow$ base

(3) **Give examples of monobasic, dibasic and tribasic acids.**

Ans. **Monobasic acid** examples: HNO_3, HCl, CH_3COOH

Dibasic acid examples: H_2SO_4, H_2CO_3

Tribasic acid examples: H_3BO_3, H_3PO_4

(4) **Give the three types of bases with their examples.**

Ans. **Types of bases:**

Monoacidic base examples : NaOH, KOH, NH_4OH

Diacidic base examples: $Ca(OH)_2$, $Ba(OH)_2$

Triacidic base examples: $Al(OH)_3$, $Fe(OH)_3$

(5) **What would be the definition of an acid and a base with reference to the neutralization reaction?**

Ans. **Acid:** An acid is a substance which neutralises a base to form salt and water.

Base: A base is a substance which neutralises an acid to form salt and water.

(6) **Take aqueous solution of sodium chloride, copper sulphate, glucose, urea, dil H_2SO_4 and dil NaOH in a beaker and test the electrical conductivity of the solutions. Answer the given below questions.**

(a) **With which solutions did the bulb glow?**

Ans. Solutions with which bulb glows: Aqueous solution of NaCl, $CuSO_4$, H_2SO_4 and NaOH.

(b) **Which solutions are electrical conductors?**

Ans. Solutions which are electrical conductors: NaCl, $CuSO_4$, H_2SO_4 and NaOH.

(7) **During electrolysis of copper sulphate, if electric current is passed through the electrolytic cell for a long time, what change would be seen at the anode?**

Ans. When electricity is passed for a long time through copper sulphate solution, the following reaction is seen at the anode:

Anode Reaction: $Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e^-$
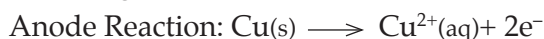
All the copper atoms will get converted into copper ions and get deposited on the cathode. This process continues till the copper anode exists.

(8) Would water be a good conductor of electricity?

Ans. Pure water is not a good conductor of electricity.

(9) (a) Write down chemical equations for
(i) Zinc oxide reacts with sodium hydroxide
(ii) Aluminium oxide reacts with sodium hydroxide.

Ans. (i) When zinc oxide reacts with sodium hydroxide,it forms sodium zincate and water

$ZnO + 2NaOH \longrightarrow Na_2ZnO_2 + H_2O$

zinc + sodium   sodium + water
oxide hydroxide   zincate
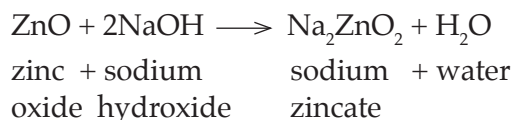
(ii) When Aluminiuum oxide reacts with sodium hydroxide, it forms sodium aluminate.

$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$

aluminium + sodium   sodium + water
oxide   hydroxide   aluminate
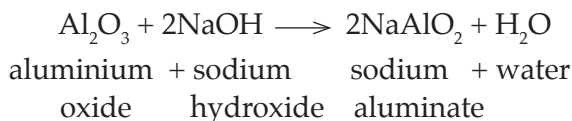
(b) Can we call Al_2O_3 and ZnO acidic oxides on the basis of above reactions.

Ans. No, because they also react with acids to form their respective salts and water. So, they show the properties of basic oxides also.

(c) Define 'amphoteric oxides' and give two examples.

Ans. Amphoteric oxides are those oxides which react with both acids as well as bases to form their respective salts and water.

Amphoteric oxides show the properties of both acidic oxides as well a basic oxides.

Q.15. Activity based questions.

(1) Cut a lemon into two equal parts. Take the juice of each part into two separate beakers. Pour 10 ml of drinking water in one beaker and 20 ml in the second. Stir the solutions in both the beakers and taste them. Is there any difference in the tastes of the solutions in the two beakers? What is that difference?

Ans. (i) In the above activity, the sour taste of the solutions is because of the solute, lemon juice in them.

(ii) The quantity of the lemon juice is the same in both the solutions. Yet their taste is different.

(iii) The solution in the first beaker is more sour than the one in the second.

(iv) Although the quantity of the solute is the same in both the solutions, the quantity of the solvent is different.

(v) Ratio of the quantity of the solute to the quantity of the resulting solution is different. This ratio is larger for the solution in the first beaker and therefore that solution tastes more sour.

(vi) On the other hand, the proportion of the lemon juice in the total solution in the second beaker is smaller and taste is less sour.

(vii) The taste of foodstuff depends upon the nature of the taste-giving ingredient and its proportions in the foodstuff.

(viii) Similarly, all the properties of a solution depend on the nature of the solute and solvent and also on the proportion of the solute in a solution

(ix) The proportions of a solute in a solution is called the concentration of the solute in the solution.

(2) Take a big test tube. Choose a rubber stopper in which a gas tube can be fitted. Take a few pieces of magnesium ribbon on the test tube and add some dilute HCl to it. Take a lighted candle near the end of the gas tube and observe. What did you observe?

Ans. (i) Magnesium metal reacts with dilute HCl and an inflammable gas, hydrogen, is formed.

(ii) During this reaction, the reactive metal displaces hydrogen from the acid to release hydrogen gas.

(iii) At the same time, the metal is converted into basic radical which combines with the acidic radical from the acid to form the salt.

$$Mg_{(s)} + 2 \, HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(aq)}$$

(3) **Take some water in a test tube and add a little red oxide (the primer used before painting iron articles) to it. Now add a small quantity of dilute HCl to it, shake the test tube and observe.**

(i) Does the red oxide dissolve in water?

(ii) What change take place in the particles of red oxide on adding dilute HCl?

Ans. The chemical formula of red oxide is Fe_2O_3. It is insoluble in water. The water insoluble red oxide reacts with HCl to produce a water soluble salt $FeCl_3$. This gives a yellowish colour to the water. The following chemical equation can be written for this chemical change.

$$Fe_2O_{3\,(s)} + 6 \, HCl_{(aq)} \longrightarrow 2 \, FeCl_{3\,(aq)} + 3 \, H_2O_{(l)}$$
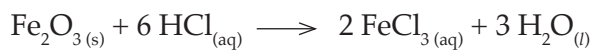
(4) **Fit a bent tube in a rubber cork. Take some lime water in a test tube and keep it handy. Take some baking soda in another test tube and add some lime juice to it. Immediately fit the bent tube over it. Insert its other end into the lime water. Note down your observations of both the test tubes. Repeat the procedure using washing soda, vinegar and dilute HCl properly. What do you see?**

Ans. In this activity, when limewater comes in contact with the gas released in the form of an effervescence, it turns milky. This is a chemical test for carbon dioxide gas. When lime water turns milky, we infer that the effervescence is of CO_2. This gas is produced on reaction of acids with carbonate and bicarbonate salts of metals. A precipitate of $CaCO_3$ is produced on its reaction with the lime water $Ca(OH)_2$. This reaction can be represented by the following chemical equation.

$$Ca(OH)_{2\,(aq)} + CO_{2\,(g)} \longrightarrow CaCO_{3\,(s)} + H_2O_{(l)}$$
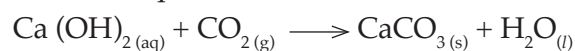
Washing soda is sodium carbonate Na_2CO_3. It will react same as baking soda ($NaHCO_3$).

Vinegar and HCl are acids, they do not react chemically with lime juice.

*(5) **Obtain a sample of rainwater. Add to it a few drops of universal indicator. Measure its pH. Describe the nature of the sample of rainwater and explain the effect it has on the living world.**

Ans. pH of rain water is 6.5 that means rain water is slightly acidic. When we add universal indicator to rain water it turns orangish red, indicating pH value is between 0 to 7, which tells us that rain water is acidic in nature. Most of the plants grow best when pH of soil is close to 7. If the soil is too acidic or too basic, it affects plant growth.

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ASSIGNMENT - 5	
Time : 1 Hr	**Marks : 30**

Q.1. (A) Fill in the blanks and write the complete statements: **(2)**

(1) The bases which are soluble in wate are called as ....

(2) CO_2 gas turns .... milky.

(B) State whether the following statements are true or false and if false write the correct satement: **(2)**

(i) Copper oxide is called red primer. (ii) H_2SO_4 is a strong acid.

(C) Match the Columns:

Column 'A'	Column 'B'
(1) Crystalline blue vitriol	(a) $FeSO_4 \cdot 7 H_2O$
(2) Crystalline green vitriol	(b) $K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24 H_2O$
(3) Crystalline washing soda	(c) $CuSO_4 \cdot 5 H_2O$
(4) Crystalline alum	(d) $Na_2CO_3 \cdot 10 H_2O$

Q.2. (A) Answer the following in one or two sentences: **(2)**

(i) Name any two bases with their acidity 2. (ii) What is molarity of a solution? How is it written?

(B) Define the following: **(2)**

(i) Weak acid (ii) Neutralisation.

Q.3. (A) Differentiate Between: **(2)**

(i) Cations and Anions

(B) Give Scientific Reasons: (Any Two) **(4)**

(i) Buttermilk spoils if kept in a copper or brass containers.

(ii) Ionic compounds dissociates while forming an aqueous solution.

(iii) Hydronium ions are always in the form H_3O^+

Q.4. (A) Answer in brief: (Any three) **(6)**

(i) What is PH scale?

(ii) Classify the following oxides in to three types and name the types. CaO, MgO, CO_2, SO_3, Na_2O, ZnO, Al_2O_3, Fe_2O_3

(iii) Explain by drawing a figure of the electronic configuration of formation of a magnesium chloride from magnesium and chlorine

(iv) Write down the concentration of each of the folloing solutions in g/L and Mol/L.
(a) 7.3 g HCl is 100 ml solution. (b) 2 g NaOH in 50 ml solution.

(B) Explain the following chemical reactions with the help of balanced equations: (Any Two) (4)

(i) Magnesium reacts with dilute hydrochloric acid.

(ii) When Sodium carbonate reacts with Sulphuric acid.

(iii) When Carbon dioxide reacts with Sodium hydroxide.

(C) Answer in Detail: (Any One) **(6)**

(i) Explain Arrhenius theory of acid and bases. (ii) Explain water of crystallination.

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6 Classification of Plants

- Robert Whittaker (1959) proposed the five kingdom classification for the study of living organisms.

- According to the five kingdom classification living organisms are classified into kingdom Monera, Kingdom Protista, Kingdom Plantae, Kingdom Fungi and Kingdom Animalia.

- The group of autotrophic living organisms having eukaryotic cell walls is the group of plants. They are autotrophic as they can perform photosynthesis with the help of chlorophyll.

  CRITERIA FOR CLASSIFICATION:

  (i) Presence or absence of organs like roots, stems, leaves and flowers.

  (ii) Presence or absence of seperate conducting tissues for conduction of water and food.

  (iii) Presence or absence of seeds.

  (iv) Whether the seeds are enclosed in a fruit or not.

- At the higher levels of plant classification, different characteristics are considered for classification e.g. depending upon the absence or presence of flower, fruits and seeds, plants are classified as crytogams or phanerogams.

- Depending upon whether seeds are enclosed within a fruit or not, phanerogams are classified as gymnosperms and angiosperms.

- Angiosperms are further classified as monocots and dicots depending upon the number of cotyledons in seeds.

- Cryptogams are further classified into Thallophyta, Bryophyta and pteridophyta.

- Thallophyta group of plants do not have specific parts like root-stem-leaves-flowers but are autotrophic due to the presence of chlorophyll and are called algae. e.g. Spirogyra, Ulothrix, Ulva, Sargassum etc.

- Various types of fungi like yeasts and moulds which do not have chlorophyll are also included in Thallophyta.

- Bryophyta group of plants are called the "amphibians' of the plant kingdom because they grow in moist soil but need water for reproduction.

- The structure of the plant body of bryophytes is flat, ribbon-like long, without true roots, stem and leaves. Instead, they have stem-like or leaf-like parts and root-like rhizoids. e.g. Moss(Funaria), Marchantia, Anthoceros, Riccia etc.

- Pteridophyta group of plants have well-developed roots, stem and leaves and separate tissues for conduction of food and water.

- Pteridophyta plants do not bear flowers and fruits. They reproduce with the help of spores formed along the back or posterior surface of their leaves.

- Pteridophyta plants reproduce asexually by spore-formation and sexually by zygote formation. e.g. Nephrolepis, Marsilea, Pteris, Adiantum, Equisetum, Selaginella, Lycopodium etc.

- Phanerogams have special structures for reproduction and produce seeds.

- Depending upon whether the seeds are enclosed in a fruit or not, phanerogams are classified into gymnosperms and angiosperms.

- In Gymnosperms, the seeds do not have natural coverings, i.e. these plants do not form fruits and are therefore called gymnosperms. e.g. Cycas, Picea (Christmas tree), Thuja (Morpankhi), Pinus (Deodar) etc.

- In Angiopserms, flowers are their reproductive organs. Flowers develop into fruits and seeds are formed within fruits, thus the seeds are covered. Hence they are called angiosperms.

- The plants whose seeds can be divided into two equal halves or dicotyledons are called dicotyledonous plants and those whose seeds cannot be divided into equal parts are called monocotyledonous plants.

MASTER KEY QUESTION SET - 6

*Q.1. (A) Complete the sentences by filling in the blanks and explain those statements:

(angiosperm, gymnosperms, spore, bryophyta, thallophyta, zygote)

(1) .... plants have soft and fibre-like body.

Ans. Thallophyta: These plants grow mainly in water i.e. fresh water as well as in saline water. therefore they usually have a soft and fibre-like (filamentous) body.

(2) ....is called the 'amphibian' of the plant kingdom.

Ans. Bryophyta: They grow in moist soil but need water for reproduction. Therefore they are called 'amphibians of plant kingdom'.

(3) In pteridophytes, asexual reproduction occurs by ....formation and sexual reproduction occurs by .... formula.

Ans. Spore, zygote: Pteridophyta plants show alteration of generation. One generation reproduces by spore-formation and the next generation reproduces sexually by zygote formation

(4) Male and female flowers of ....are borne on different sporophylls of the same plant.

Ans. Gymnosperms: As these plants do not take the assistance of pollinators i.e. vectors. The male and female flowers are present on the different sporophyll of the same plant for successful fertilisation.

(B) Fill in the blanks:

(1) The five kingdom classification was proposed by ....

(2) In 1883, ... classified plants in two subkingdoms.

(3) Various types of fungi like yeasts and moulds are included in the group ....

(4) Bryophytes have root-like structure called ....

(5) .... reproduce with the help of spores formed along the back or posterior surface of their leaves.

(6) In .... the reproductive organs cannot be seen.

(7) .... are mostly evergreen, perennial and woody.

(8) Gymnosperms bear male and female flowers on different .... of the same plant.

(9) In .... the seeds are not enclosed by fruits.

(10) In ...., the seeds are covered by fruits.

(11) The plants whose seeds cannot be divided into equal parts are called ....

Ans. *(1) Robert Whittaker (2) Eichler (3) thallophyta (4) rhizoids (5) Pteridophyta (6) Cryptogams (7) Gymnosperms (8) sporophylls (9) gymnosperms (10) angiosperms (11) monocotyledons*

(C) Rewrite the following statements by selecting correct options given below:

(1) The five kingdom classification was proposed by ....
(a) Robert Whittaker   (b) Robert Hooke
(c) Eichler   (d) Louis Pasteur

(2) In 1883, ... classified plants into two sub-kingdoms.
(a) Robert Whittaker
(b) Alexander Fleming
(c) Eichler
(d) Robert Hooke

(3) Ulothrix, ulva, sargassum belong to ....
(a) Bryophyta   (b) Thallophyta
(c) Pteridophyta   (d) Gymnosperms

(4) .... is a bryophyte.
(a) Ulva   (b) Nephrolepis
(c) Funaria   (d) Equisetum

(5) Lycopodium belongs to ....
(a) thallophyta   (b) bryophyta
(c) gymnosperms   (d) pteridophyta

(6) In .... the seeds are naked.
(a) Pteridophyta   (b) Angiosperms
(c) Gymnosperms   (d) Bryophyta

(7) In .... the flowers are reproductive organs.
(a) Angiosperms   (b) Gymnosperms
(c) Pteridophyta   (d) Bryophyta

(8) Leaves of .... show reticulate venation.
(a) Bamboo   (b) Banana
(c) Onion   (d) Banyan

(9) In .... the flowers are tetramerous or pentamerous.
(a) Monocotyledons   (b) Dicotyledons
(c) Gymnosperms   (d) Pteridophyta

(10) In monocotyledonous plants, the stem is ....
(a) hollow   (b) false
(c) disc-like   (d) all of these.

Ans. *(1) Robert Whittaker (2) Eichler (3) Thallophyta (4) Funaria (5) pteridophyta (6) Gymnosperms (7) Angiosperms (8) Banyan (9) Dicotyledons (10) all of these*

*Q.2. (A) Match the proper terms from columns A and C with the description in column B:

Column 'A'	Column 'B'	Column 'C'
(1) Thallophyta	Seeds are formed in fruits	Fern
(2) Bryophyta	No natural covering on seeds	Cycas
(3) Pteridophyta	These plants mainly grow in water	Tamarind
(4) Gymnosperms	These plants need water for reproduction	Moss
(5) Angiosperms	Tissues are present for conduction of water and food	Algae

Ans.

Column 'A'	Column 'B'	Column 'C'
(1) Thallophyta	These plants mainly grow in water	Algae
(2) Bryophyta	These plants need water for reproduction	Moss
(3) Pteridophyta	Tissues are present for conduction of water and food	Fern
(4) Gymnosperms	No natural covering on seeds	Cycas
(5) Angiosperms	Seeds are formed in fruits	Tamarind

(B) Match the columns:

(1) Column 'A'	Column 'B'
(1) *Ulva*	(a) Bryophyta
(2) *Marsilea*	(b) Gymnosperm
(3) *Marchantia*	(c) Pteridophyta
(4) *Thuja*	(d) Thallophyta

Ans. *(1-d); (2-c); (3-a); (4-b)*

(2) Column 'A'	Column 'B'
(1) Onion	(a) Dicotyledon
(2) Cyas	(b) Pteridophyta
(3) Mango	(c) Monocotyledon
(4) Lycopodium	(d) Gymnosperm

Ans. *(1-c); (2-d); (3-a); (4-b)*

Q.3. Odd man out:

(1) Ulothrix, Ulva, Nephrolepis, Sargassum

Ans. Nephrolepis: It belongs to division pteridophyta whereas the others belong to division thallophyta.

(2) Funaria, Marchantia, Anthoceros, Equisetum

Ans. Equisetum: It belongs to division pteridophyta whereas the others belong to division bryophyta.

(3) Nephrolepis, Marsilea, Cycas, Lycopodium

Ans. Cycas: It is a gymnosperm whereas others are pteridophyta.

(4) Spirogyra, Riccia, Ulva, Ulothrix

Ans. Riccia: It is a bryophyte whereas the others are thallophytes.

(5) Corn, Rice, Wheat, Groundnut

Ans. Groundnut: It is a dicotyledonous plant whereas others are monocotyledonous plants.

(6) Cycas, Pinus, Thuja, Hibiscus

Ans. Hibiscus: It is an angiosperm whereas rest are gymnosperms.

Q.4. State whether the following statements are true or false and if false, write the correct statement:

(1) Thallophyta are called as the amphibians of the plant kingdom.

Ans. False, Thallophyta plants grow mainly in water.

(2) Fungi like yeasts and moulds are included in division byophyta.

Ans. False, Fungi like yeasts and moulds are included in division thallophyta.

(3) Moss (*Funaria*) belongs to division bryophyta.

Ans. True

(4) Bryophyta have specific tissues for conduction of food and water.

Ans. False, Bryophyta do not have specialised tissues for conduction of food and water.

(5) Plants belonging to Thallophyta group are only unicellular.

Ans. False, Plants belonging to thallophyta group may be unicellular or multicellular.

(6) Pteridophytes have well developed roots, stems and leaves.

Ans. True

(7) Pteridophytes reproduce with the help of spores formed along the back or posterior surface of their leaves.

Ans. True

(8) Nephrolepis belongs to division Pteridophyta.

Ans. True

(9) Depending upon whether seeds are enclosed in a fruit or not, phanerogams are classified into monocots and dicots.

Ans. False, Depending whether seeds are enclosed in a fruit or not, angiosperms are classified into monocots and dicots.

(10) Gymnosperms are mostly evergreen, perennial and woody.

Ans. True

(11) Gymnosperms bear male and female flowers on different sporophylls of different plants.

Ans. False, Gymnosperms bear male and female flowers on different sporophylls of the same plant.

(12) In Angiosperms, the seeds are covered by fruits.

Ans. True

(13) Dicotyledonous plants show reticulate venation.

Ans. False, Dicotyledonous plants show parallel venation.

(14) Moncotyledonous plants have trimerous flowers.

Ans. True

(15) In dicotyledonous plants, the stem is strong and hard.

Ans. True

Q.5. Complete the analogy:

(1) Spirogyra : Thallophyta : : Riccia : ....

(2) Moss : Bryophyta : : Selaginella : ....

(3) Nephrolepis : Pteridophyta : : Ulothrix : ....

(4) Pteridophyta : Roots : : Bryophyta : ....

(5) Gymnosperms : naked seeds : : Angiosperms : ....

(6) Dicotyledon : Reticulate venation : : Monocotyledon : ....

(7) Bamboo stem : Hollow : : Onion Stem : ....

(8) Dicotytedon flower : tetramerous : : Monocotylendon : ....

(9) Monocotylendon : tap root : : Dicotyledon : ....

Ans. *(1) Bryophyta (2) Pteridophyta (3) Thallophyta (4) Rhizoids (5) covered seeds (6) parallel venation (7) disc like (8) trimerous (9) fibrous roots*

Q.6. Answer the following in your own words:

*(1) Write the characteristics of subkingdom phanerogams.

Ans.

(i) Plants which have special structures for reproduction and produce seeds are called phanerogams.

(ii) In these plants, after the process of reproduction, seeds are formed which contain the embryo and stored food.

(iii) During germination of the seed, the stored food is used for the initial growth of the embryo.

(iv) Depending upon whether seeds are enclosed in a fruit or not phanerogams are classified into gymnosperms and angiosperms.

*(2) Write a paragraph in your own words about the ornamental plants called ferns.

Ans.

(i) Ferns belong to the group of plants called Pteridophyta.

(ii) They have well developed roots, stem and leaves but do not bear flowers and fruits.

(iii) They have separate tissues for conduction of food and water.

(iv) They reproduce with the help of spores formed along the back or posterior surface of their leaves.

(v) They reproduce asexually by spore formation and sexually by zygote formation.

*(3) Write the characteristics of the plants belonging to division bryophyta.

Ans.

(i) Bryophyta group of plants are called the amphibians of the plant kingdom because they grow in moist soil but need water for reproduction.

(ii) These plants are thalloid, multicellular and autotrophic.

(iii) They reproduce by spore-formation.

(iv) Their plant body structure is flat, ribbon-like, long, without true roots, stem and leaves.

(v) Instead they have stem-like or leaf-like parts and root-like rhizoids.

(vi) They do not have specific tissues for conduction of food and water.

(vii) **Examples:** Moss *(Funaria)*, *Anthoceros*, *Riccia* etc.

*(4) Collect a Monocot and dicot plant available in your area. Observe the plant carefully and describe them in scientific language.

Ans. Monocot Plant: *Lily*

(i) Its seeds cannot be divided into two equal halves.

(ii) Its roots are fibrous.

(iii) Its stem is hollow.

(iv) Its leaves show parallel venation.

(v) Flowers with 3 parts or in multiples of three (trimerous).

Dicot Plant : *Hibiscus*

(i) Its seeds can be divided into two equal halves.

(ii) It has well developed roots. There is a primary root (tap root) and many secondary roots arise from the primary roots.

(iii) Its stem is strong and hard.

(iv) Its leaves show reticulate venation.

(v) Its flowers has four to five petals (Pentamerous).

*(5) Which criteria are used for the classification of plants? Explain with reason.

Ans. Criteria for classification of plants:

(i) Presence or absence of organs.

(ii) Presence or absence of separate conducting tissues for conduction of water and food.

(iii) Whether the plants bear seeds or not.

(iv) If they bear seeds, then whether the seeds are enclosed in a fruit or not.

(v) Number of cotyledons in the seeds.

*Q.7. Sketch, label the figures of the following plants and explain them in brief:

(1) Spirogyra.

Ans.

Cell wall Nucleus Pyrenoid

Spiral chloroplasts

Ulva   *Chara*   *Spirogyra*
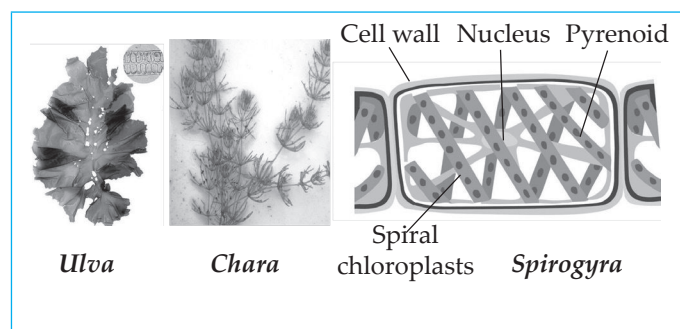
(i) Spirogyra belongs to the division thallophyta. They are called as algae.

(ii) It grows mainly in water.

(iii) It does not have specific parts like root-stem-leaves-flowers but are autotrophic due to the presence of chlorophyll.

(iv) The plant body of Spirogyra is soft and fibre-like.

(2) Funaria and Marchantia (Bryophyta)

Ans.

Funaria   *Marchantia*   *Anthoceros*
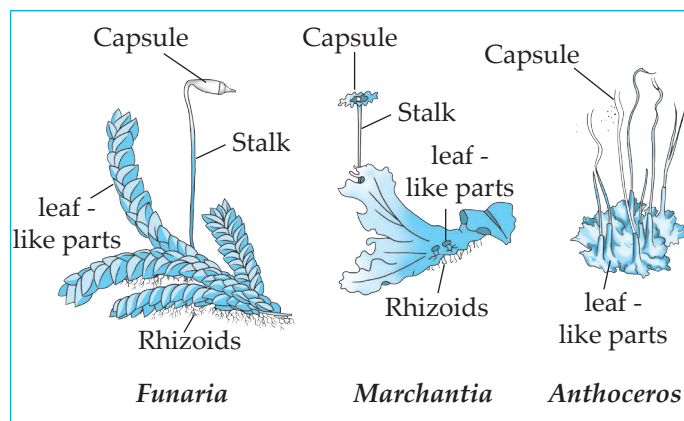
(i) These plants are called 'amphibians' of the plant kingdom because they grow mostly in soil and need water for reproduction.

(ii) They do not have specific tissues for conduction of food and water.

(3) Fern (Pteridophyta):

Ans.

Sporangia in sori on leaflet   *Ferns*
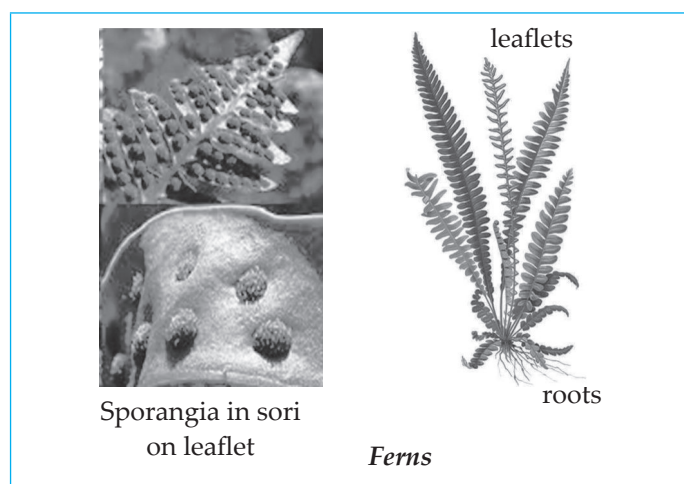
(i) They have well developed roots, stem and leaves for conduction of food and water.

(ii) They do not bear flowers and fruits.

Q.8. Answer in brief:

(1) Write the characteristics of Thallophyta.

Ans.

(i) Thallophyta plants grow mainly in water.

(ii) This group of plants, which do not have specific parts like root-stem-leaves-flowers but are autotrophic due to the presence of chlorophyll are called algae.

(iii) Algae show great diversity. They may be unicellular or multicellular and microscopic or large.

(iv) Some of these are found in fresh water while some are found in saline water.

(v) Various types of fungi like yeasts and moulds which do not have chlorophyll are also included in this group.

(vi) **Examples:** *Spirogyra*, *Ulothrix*, *Ulva* etc.

(2) Write the characteristics of Gymnosperms.

Ans.

(i) Gymnosperms are mostly evergreen, perennial and woody.

(ii) Their stems are without branches.

(iii) The leaves form a crown.

(iv) These plants bear male and female flowers on different sporophylls of the same plant.

(v) Seeds of these plants do not have natural coverings, i.e. these plants do not form fruits and are therefore called gymnosperms (gmnos: naked, sperms: seeds)

(vi) **Examples:** *Cycas*, *Picea* (christmas tree), Thuja, Pinus (deodar) etc.

Q.9. Distinguish between:

(1) Bryophyta and Pteridophyta:

Bryophyta	Pteridophyta
(1) Bryophytes grow in soil but need water for reproduction.	(1) Pteridophytes grow in soil.
(2) Plant body is without specific parts like true roots, stem and leaves.	(2) Plant body is differentiated into true roots, stem and leaves.
(3) Conducting tissues for food and water absent.	(3) Conducting tissues for food and water present.
(4) **Examples:** *Moss (Funaria)*, *Marchantia*, *Anthoceros*, etc.	(4) **Examples:** *Nephrolepis, Marsilea, Pteris, Adiantum, Lycopodium* etc.

(2)   Angiosperms and Gymnosperms.

Angiosperms	Gymnosperms
(1) In Angiosperms, the stems have branches.	(1) In Gymnosperms, the stems are without branches.
(2) Reproductive organs are flowers.	(2) Reprodcutive organs are cones.
(3) Seeds are enclosed in natural coverings, i.e., fruits.	(3) Seeds are not enclosed in natural coverings.
(4) **Examples:** *Mango, Bamboo* etc.	(4) **Examples:** *Cycas, Picea* etc.

(3)   Cryptogams and Phanrogams.

Cryptogams	Phanrogams
(1) Their reproductive organs are hidden.	(1) Their reporductive organs are exposed.
(2) They reproduce by forming spores.	(2) They reproduce by forming seeds.
(3) They are less evolved plants.	(3) They are highly evolved plants.
(4) They are divided into thallophyta, bryophyta, pteridophyta.	(4) They are divided into gymnosperms and angiosperms.

*(4)   **Dicots and Monocots.**

	Dicots	Monocots
Seed	Two cotyledons	Single cotyledon
Root	Well developed, primary root (Tap root)	Fibrous roots
Stem	Strong, hard. e.g. Banyan tree	Hollow, e.g. Bamboo False, e.g. Banana Disc-like, e.g. Onion.
Leaf	Reticulate venation	Parallel venation
Flower	Flowers with 4 or 5 parts or in their multiples (tetramerous or pentamerous)	Flowers with 3 parts or in multiples of three (trimerous).

Q.10.   Can you tell!

*(1)   **Which are the special cell organelles that differentiate plant cells from animal cells.**

Ans.   Organelles like cell wall and plastids are present in plant cell whereas they are absent in animal cells. Organelles like centrosome are absent in plant cell whereas they are present in animal cells.

Q.11.   Use your brain power:

*(1)   **What is the similarity between the plants of the groups Thallophyta, Bryophyta and Pteridophyta irrespective of differences in their body structure?**

Ans.

(i)   All the three divisions thallophyta, bryophyta and pteridophyta are autotrophic. They contain chlorophyll and can prepare this own food by photosynthesis.

(ii)   All these plants reproduce by spore formation.

(iii)   They are all called Cryptogams as their reproductive organs cannot be seen.

(Cryptos : hidden, gams: reproductive organs)

Q.12.   Activity based Question / Observe and discuss.

(1)   **You may have seen a lush green soft carpet on old walls, bricks and rocks in the rainy season. Scrape it gently with a small ruler, observe it under a magnifying lens and discuss.**

Ans.

(i)   It shows considerable tissue complexity and differntiated into two main parts: a root and a shoot.

(ii)   They have a variety of specialised tissues within these two regions of the body.

(iii)   Same kind of cells are seen throughout the whole body except reproductive cells.

(2)   **You may have seen ferns among the ornamental plants in a garden. Take a leaf of fully grown fern and observe it carefully.**

Ans.

(i)   New leaves typically expand by the unrolling in a tight spiral manner.

(ii)   The anatomy of fern leaves can either be simple or highly divided.

(iii)   They show the presence of spores formed along the back or posterior surface of their leaves.

(3)   **Observe all garden plants like *Cycas*, Christmas tree, *Hibisus*, Lily etc. and compare them. Note the similarities and differences**

among them. Which differences did you notice in gymnosperms and angiosperms?

Ans. *Cycas* and Christmas tree are gymnosperms, whereas *Hibiscus* and lily are angiosperms.

Similarities: These plants have special structures for reproduction and produce seeds. During germination of the seed, the stored food is used for the initial growth of the embryo.

Differences: In gymnosperms reproductive organs have cones whereas in angiosperms reproductive organs have flowers. In gymnosperms seeds are without natural coverings whereas in angiosperms seeds are enclosed in natural coverings called fruits.

(4) **Soak the seeds of corns, beans, groundnut, tamarind, mango, wheat, etc. in water for 8 to 10 hrs. After they are soaked, check each seed to see whether it divides into two equal halves or not and categorize them accordingly.**

Ans. **Monocots:** corn, wheat (it cannot be divided into equal halves)

Dicots: beans, groundnut, tamarind and mango (it can be divided into two equal halves)

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ASSIGNMENT - 6

Time : 1 Hr.	Marks : 30

Q. 1 (A) Complete the sentences by filling in the blanks and explain those statements: **(6)**

(gymnosperms, thallophyta, gamete, spore)

(1)   Male and female flowers of .... are borne on different sporophylls of the same plant.

(2)   .... plants have soft and fibre-like body.

(3)   In Pteridophytes, asexual reproduction occurs by .... formation and sexual reproduction occurs by .... formation.

(B) Match the columns: **(4)**

Column 'A'	Column 'B'
(1) Ulva	(a) Bryophyta
(2) Marsilea	(b) Gymnosperm
(3) Marchantia	(c) Pteridophyta
(4) Thuja	(d) Thallophyta

(C) Select the odd man out: **(2)**

(1)   Cycas, Pinus, Thuja, Hibiscus.

(2)   Corn, Rice, Wheat, Groundnut.

Q. 2 Answer the following questions. **(8)**

(1)   Write the characteristics of subkingdom Phanerogams.

(2)   Distinguish between monocots and dicots.

(3)   Sketch, label and describe the spirogyra.

(4)   Write the characteristics of the plants belonging to division Bryophyta.

Q. 3 Answer the following in brief. **(10)**

(1)   Write down the characteristics of Thallophyta with examples.

(2)   Write down the characteristics of Gymnosperms with examples.

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7 Energy Flow in an Ecosystem

💡 *Points to Remember :*

- According to mode of nutrition organisms are classified as producers, consumers, saprotrophs (saprophytes) and decomposers.

- Primary consumers are directly dependent on autotrophs (producers). Eg.: grasshopper, squirrel, elephant)

- Secondary consumers use herbivores as their food. Eg.: Frog, owl, fox, etc.

- Apex or top consumers use herbivores and carnivores as their food. No animals feed on top consumers. Eg.: Tiger, lion, etc.

- Omnivores feed on herbivores and carnivores. Eg.: Humans, bear, etc.

- Continuous interactions between producers, consumers and decomposers in a definite sequence is called as food chain.

- Many food chains interconnected at various levels is called as food web.

- Each level in the food chain is called a trophic level. A trophic level is the step at which the organism obtains its food in the chain.

- The initial quantity of energy goes on decreasing at every level of energy exchange. Similarly, the number of organisms also decreases from the lowest level to the highest level. This pattern of energy exchange in an ecosystem is called a 'Pyramid of Energy'.

- After the death of apex consumers, their energy becomes available to the decomposers.

- Energy is passed on from one trophic level to the other. Decomposers dissipate some amount of energy in the form of heat. However, no part of the energy ever returns to the sun. Hence, such passage of energy is referred to as 'one way' transport.

- The cyclical flow of nutrients within an ecosystem is called the bio-geo-chemical cycle.

- Nutrients, necessary for the growth of organisms are continuously transferred from abiotic to biotic factors within an ecosystem. This cycle operates continuously through the medium of the biosphere formed by the lithosphere, atmosphere and hydrosphere.

- There a two types of bio-geo-chemical cycles - Gaseous cycle and sedimentary cycle.

- Gaseous cycle includes nitrogen, oxygen, carbon dioxide, water vapour, etc.

- Sedimentary cycle includes soil components like iron, calcium, phosphorus etc.

- The circulation and recycling of carbon from the atmosphere to living organisms and after their death back to the atmosphere is called the carbon cycle.

- Abiotic carbon atones are circulated and recycled into biotic form mainly through photosynthesis and respiration.

- The circulation and recycling of oxygen within the biosphere is called the oxygen cycle.

- Oxygen is released in the process of photosynthesis and used up in the process like respiration, combustion, decomposition, corrosion, rusting, etc.

- The circulation and recycling of nitrogen gas into the form of different compounds through various biotic and abiotic process in nature is called the nitrogen cycle.

- Important processes of nitrogen cycle are:

   (i) Nitrogen fixation: Conversion of nitrogen into nitrates and nitrites through atmospheric, industrial and biological processes.

   (ii) Ammonification: Release of ammonia through decomposition of dead bodies and excretory wasters of organisms.

   (iii) Nitrification: Conversion of ammonia into a nitrite and then nitrate.

   (iv) Denitrification: Conversion of nitrogen compounds into gaseous nitrogen.

MASTER KEY QUESTION SET - 7

Q.1. (A) Fill in the blanks and rewrite the complete statements:

(1) .... in, 1942 studied the food chain and energy flow through it.

(2) After the death of apex consumers, energy becomes available to ....

(3) Green plants of the ecosystem store .... in the form of food.

(4) Plants convert carbon dioxide into .... by the process of photosynthesis.

(5) Carnivores feed upon ....

(6) .... is used up in the processes like respiration, combustion, decomposition, corrosion, rusting etc.

(7) Nitrogen forms .... % of the atmosphere.

(8) Most organisms cannot use the free form of ....

(9) .... first proposed the concept of Ecological Pyramid in 1927.

(10) Ecological Pyramid is called ....

(11) .... is produced from oxygen through various atmospheric processes.

(12) Interactions between producers, consumers and saprophytes in a definite sequence is called ....

(13) Many food chains interconnected at various levels is called ....

(14) Decomposers dissipate pate some amount of energy in the form of ....

(15) The flow of nutrients in an ecosystem is ....

(16) The cyclical flow of nutrients within an ecosystem is called ....

(17) .... is an accumulation of the main abiotic gaseous nutrient materials found in the earth's atmosphere.

(18) Oxygen is released into the atmosphere by the process of ....

(19) Charles Eiton Studied the .... of the Beer islands in England.

Ans. *(1) Lindeman (2) decomposers (3) solar energy (4) carbohydrates (5) herbivores (6) oxygen (7) 78 (8) nitrogen (9) Charles Elton (10) Eltonian pyramid (11) Ozone (12) food chain (13) food web (14) heat (15) Cyclical (16) bio-geo-chemical (17) Gaseous cycle (18) photosynthesis (19) Tundra Ecosystem*

(B) Write down the correct answers for the sentences from the given options:

(1) .... is a primary consumer.

(a) Elephant (b) Frog   (c) Owl   (d) Tiger

(2) .... is a secondary consumer.

(a) Grasshopper   (b) Elephant

(c) Frog   (d) Human

(3) Tiger is a ....

(a) producer   (b) primary consumer

(c) apex consumer   (d) secondary consumer

(4) An intricate network of food chains is called ....

(a) biosphere   (b) food web

(c) energy pyramid   (d) ecosystem

(5) Fungi and other microbes are called ....
(a) producers (b) consumers
(c) decomposers (d) omnivores

(6) Oxygen forms .... of the atmosphere.
(a) 78% (b) 21% (c) 10% (d) 90%

(7) Microbes which do not need oxygen are called ....
(a) producers (b) aerobes
(c) anaerobes (d) decomposers

(8) The pattern of energy exchange in an ecosystem is called ....
(a) food chain (b) food web
(c) pyramid of energy (d) trophic levels

(9) Carbon atoms are circulated and recycled through ....
(a) nitrification and denitrification
(b) photosynthesis and respiration
(c) respiration and nitrification
(d) photosynthesis and ammonification

(10) Carbon dioxide is released into the atmosphere through ....
(a) burning of fossil fuels (b) volcanic activity
(c) respiration (d) all of these

(11) Conversion of ammonia into a nitrite and then nitrate is called ....
(a) nitrogen fixation (b) denitrification
(c) nitrification (d) nitrogen fixation

(12) Conversion of nitrogen compounds into gaseous nitrogen is called ....
(a) nitrogen fixation (b) denitrification
(c) ammonification (d) nitrification

(13) .... is an important component of proteins and nucleic acids.
(a) Carbon (b) Nitrogen
(c) Phosphorus (d) Oxygen

(14) Amount of matter and energy .... from the lowest level to the highest level.
(a) decreases (b) increases
(c) remains the same (d) multiplies

(15) .... is the most important source of energy in any ecosystem.
(a) sun (b) moon
(c) producers (d) decomposers

(16) Flow of energy in an ecosystem is ....
(a) cyclical (b) two way transport
(c) one way transport (d) to and fro transport

(17) The Indian Institute of Ecology and Environment, Delhi, has published ....
(a) Invasive species in a changing Environment
(b) Encyclopaedia of Ecology and Environment
(c) Environment and Ecology Magazine
(d) Biodiversity and Disaster Management

(18) Oxygen is released in the process of ....
(a) respiration (b) decomposition
(c) combustion (d) photosynthesis

(19) .... cycle is a gaseous cycle.
(a) Carbon (b) Phosphorus
(c) Calcium (d) Iron

(20) .... is a sedimentary cycli.
(a) Carbon (b) Nitrogen (c) Oxygen (d) Calcium

Ans. *(1) Elephant (2) Frog (3) apex consumer (4) food web (5) decomposers (6) 21% (7) anaerobes (8) pyramid of energy (9) photosynthesis and respiration (10) all of these (11) nitrification (12) denitrification (13) nitrogen (14) decreases (15) sun (16) one way transport (17) Encyclopaedia of Ecology and Environment (18) photosynthesis (19) carbon (20) Calcium*

*(C) Complete the following table:

Bio-geo-chemical cycles	Biotic Processes	Abiotic Processes
(1) Carbon cycle	Photosynthesis, Respiration, Decomposition.	Burning of fossil fuels, forest fires, volcanic activity.
(2) Oxygen cycle	Photosynthesis, Respiration, Decomposition.	Combustion, Corrosion, rusting, formation of ozone (O_3).
(3) Nitrogen cycle	Biological nitrogen fixation, ammonification, nitrification, denitrification.	Atmospheric nitrogen fixation, industrial nitrogen fixation.

*(D) Correct and rewrite the following statements and justify your corrections:

(a) Carnivores occupy the second trophic level in the food chain.

Ans. **False.** Producers form the first trophic level in the food chain. Herbivores depend directly on producers. So they form the second trophic level whereas carnivores depend on herbivores so they form the third trophic level in the food chain.

(b) The flow of nutrients in an ecosystem is considered to be a 'one way' transport.

Ans. **False.** The flow of nutrients in an ecosystem is cyclic. The nutrients are circulated and recycled from the biosphere to living organisms and after their death back to the biosphere.

(c) Plants in an ecosystem are called primary consumers.

Ans. **False.** Plants are autotrophs. They produce their own food by the process of photosynthesis. All animals in the ecosystem directly or indirectly depend on plants for food.

Q.2. State whether the following statements are true or false and if false, write the correct statement:

(1) Herbivores occupy the third trophic level in a food chain.

Ans. **False,** herbivores occupy the second trophic level in a food chain as they are directly dependent on producers.

(2) Apex consumers use herbivores and carnivores as their food.

Ans. **True.**

(3) Humans are apex consumers.

Ans. **True.**

(4) Omnivores feed only on carnivores.

Ans. **False,** Omnivores feed on both herbivores and carnivores.

(5) A food chain has two links.

Ans. **False,** A food chain consists of four, five or more links.

(6) The number of consumers in a food web is fixed.

Ans. **False,** A food web can have many consumers.

(7) The amount of matter and energy goes on increasing at every level in a food chain.

Ans. **False,** The amount of matter and energy goes on decreasing at every level in a food chain.

(8) Robert Brown first proposed the concept of Ecological Pyramid.

Ans. **False,** Charles Elton first proposed the concept of ecological pyramid.

(9) After the death of apex consumers, the energy becomes available to decomposers.

Ans. **True.**

(10) The gaseous cycle is a speedier cycle than the sedimentary cycle.

Ans. **True.**

(11) Climatic changes and human activities seriously affect the speed, intensity and equilibrium of bio-geo-chemical cyles.

Ans. **True.**

(12) Carbon dioxide is released in the atmosphere through photosynthesis

Ans. **False,** Carbon dioxide is released in the atmosphere through respiration, burning of fossil fuels and wood, forest fires and volcanic activity.

(13) The equilibrium of oxygen and carbon dioxide gases is maintained by decomposers.

Ans. **False,** The equilibrium of oxygen and carbon dioxide gases is maintained by plants.

(14) The conversion of ammonia into a nitrite and then nitrate is called nitrogen fixation.

Ans. **False,** The conversion of ammonia into a nitrite and then nitrate is called nitrification.

(15) Conversion of nitrogen compounds into gaseous nitrogen is called nitrogen fixation

Ans. **False,** Conversion of nitrogen compounds into gaseous nitrogen is called denitrification.

(16) Release of ammonia through decomposition of dead plants and excretory wastes of organisms is called ammonification.

Ans. **True.**

(17) The cyclic flow of nutrients within an ecosystem is called Energy Pyramid.

Ans. **False,** The cyclic flow of nutrients within an ecosystem is called bio-geo-chemical cycle.

Q.3. Find the odd man out:

(1) Frog, Owl, Squirrel, Fox.

Ans. Squirrel. It is a primary consumer whereas the rest are secondary consumers.

(2) Grasshopper, squirrel, elephant, lion.

Ans. Lion. It is an apex consumer, the others are primary consumers (herbivores).

(3) Nitrogen cycle, oxygen cycle, carbon cycle, phosphorus cycle.

Ans. Phosphorus cycle. It is a sedimentary cycle whereas the others are gaseous cycle.

(4) Photosynthesis, Nitrification, Ammonification, Denitrification.

Ans. Photosynthesis. It is a process in carbon and oxygen cycle whereas the others are processes in nitrogen cycle.

(5) Burning of fossil fuels, forest fire, respiration, volcanic activity.

Ans. Respiration. It is a biotic process of releasing carbon dioxide whereas the others are abiotic processes of releasing carbon dioxide.

(6) Photosynthesis, combustion, decomposition, corrosion.

Ans. Photosynthesis. It is a process that releases oxygen whereas the others use up oxygen.

Q.4. Complete the analogy:

(1) Grasshopper : primary consumer : : Tiger : ....

(2) Owl : secondary consumer : : squirrel : ....

(3) Elephant : Primary consumer : : Lion : ....

(4) Flow of energy : one way : : Flow of nutrients : ....

(5) Plants : Producers : : Bacteria and Fungi : ....

(6) Nitrogen : Gaseous cycle : : Phosphorus : ....

(7) Oxygen : 21% : : Nitrogen : ....

(8) Photosynthesis : Carbon cycle : : Ammonification : ....

(9) Respiration : Oxygen cycle : : Nitrification : ....

(10) Respiration : Biotic process : : Combustion : ....

(11) Microbes using oxygen : Aerobes : : Microbes not using oxygen : ....

Ans. *(1) Apex consumer (2) Primary consumer (3) Apex consumer (4) Cyclic (5) Decomposers (6) Sedimentary cycle (7) 78% (8) Nitrogen cycle (9) Nitrogen cycle (10) Abiotic process (11) Anaerobes*

Q.5. Name the following:

(1) The animals that feed on herbivores.

Ans. Carnivores.

(2) Organisms that feed on herbivores and carnivores.

Ans. Omnivores.

(3) Two examples of primary consumers.

Ans. Grasshopper, squirrel.

(4) Two examples of secondary consumers.

Ans. Frog, owl.

(5) Two examples of Apex consumers.

Ans. Lion, Tiger.

(6) Levels in the food chain.

Ans. Trophic level.

(7) Organisms that decompose the dead bodies of plants and animals.

Ans. Decomposers.

(8) Process which release oxygen.

Ans. Photosynthesis.

(9) Release of ammonia through decomposition of dead bodies and excretory wastes of organisms.

Ans. Ammonification.

(10) Conversion of nitrogen into nitrates and nitrites through atmospheric, industrial and biological processes.

Ans. Nitrogen fixation.

Q.6. Match the columns:

(A) Column 'A'	Column 'B'
(1) Flow of nutrients.	(a) Sedimentary cycle.
(2) Flow of energy.	(b) One way.
(3) Carbon.	(c) Gaseous cycle
(4) Phosphorus	(d) Cyclical

Ans. *(1 - d) (2 - b) (3 - c) (4 - a)*

(B)	Column 'A'	Column 'B'
(1)	Producers	(a) 2nd trophic level
(2)	Herbivores	(b) 3rd trophic level
(3)	Carnivores	(c) 1st trophic level

Ans. *(1 - c) (2 - a) (3 - b)*

Q.7. Define the following:

(1) Food chain

Ans. Interactions between producers, consumers and decomposers in a definite sequence is called as a food chain.

(2) Food web

Ans. The interconnection among different food chains in an ecosystem at various levels is called as a food web.

(3) Trophic level:

Ans. A trophic level is the step at which the organism obtains its food in the chain.

(4) Pyramid of energy

Ans. The pattern of energy exchange in an ecosystem is called a 'Pyramid of energy'.

(5) Bio-geo-chemical cycle

Ans. The cyclical flow of nutrients within an ecosystem is called bio-geo-chemical cycle.

(6) Carbon cycle

Ans. The circulation and recycling of carbon from the atmosphere to living organisms and after their death back to the atmosphere is called the carbon cycle.'

(7) Oxygen cycle

Ans. The circulation and recycling of oxygen within the biosphere is called as oxygen cycle.

(8) Nitrogen cycle

Ans. The circulation and recycling of nitrogen gas into the form of different compounds through various biotic and abiotic processes in nature is called the nitrogen cycle.

Q.8. Give scientific reasons:

*(1) Energy flow through an ecosystem is 'one way'.

Ans.

(i) The sun is the most important source of energy in any ecosystem.

(ii) Green plants of the ecosystem store some amount of solar energy in the form of food.

(iii) Before reaching the decomposers, this energy is passed on from one trophic level to the next.

(iv) Decomposers dissipate some amount of energy in the form of heat.

(v) However, no part of the energy ever returns to the sun. Hence, energy flow through an ecosystem is 'one way'.

*(2) Equilibrium is necessary in the various bio-geo-chemical cycles.

Ans.

(i) The cyclic flow of nutrients within an ecosystem is called bio-geo-chemical cycles.

(ii) Nutrients, necessary for the growth of organisms are continuously transferred from abiotic to biotic factors and biotic to abiotic factors with an ecosystem.

(iii) Any imbalance in the cycles will break the link between the biotic and abiotic factors.

(iv) Therefore, equilibrium is necessary between bio-geo-chemical cycles.

*(3) Flow of nutrients through an ecosystem is cyclic.

Ans.

(i) All organisms need nutrients for their growth.

(ii) The nutrients carbon, oxygen, nitrogen, iron, calcium etc. are circulated and recycled from the biosphere to living organisms and after their death back to the biosphere.

(iii) Nutrients are taken up by plants and then passed on to the consumers.

(iv) Eventually, after their death, all types of consumers, are decomposed by decomposers like bacteria and fungi and the nutrients are again released into the biosphere and is, used again by living organisms.

Therefore, flow of nutrients through an ecosystem is cyclic.

Q.9. Distinguish between:

(1) Gaseous Cycle and Sedimentary Cycle.

Gaseous Cycle	Sedimentary Cycle
(1) It is an accumulation of the main abiotic gaseous nutrient materials found in the earth's atmosphere.	(1) It is an accumulation of the main abiotic nutrient materials found in the soil, sediment and sedimentary rocks, etc. of the earth.
(2) It includes nitrogen, oxygen, carbon dioxide, water vapour etc.	(2) It includes soil components like iron, calcium, phosphorus etc.

(2) Carbon Cycle and Nitrogen Cycle.

Carbon Cycle	Nitrogen Cycle
(1) The circulation and recycling of carbon from the atmosphere to living organisms and after their death back to the atmosphere is called carbon cycle.	(1) The circulation and recycling of nitrogen into the form of different compounds through various biotic and abiotic processes in nature is called the nitrogen cycle.
(2) Main processes involved in carbon cycle are photosynthesis and respiration.	(2) Main processes involved in nitrogen cycle are nitrogen fixation, ammonification, nitrification and denitrification.
(3) Carbon in the form of carbon dioxide is directly absorbed by plants for photosynthesis.	(3) Nitrogen gas cannot be directly absorbed by plants. So nitrogen is fixed by the process of nitrogen fixation and then absorbed from the soil.

*(3) Flow of matter and Flow of energy.

Flow of matter	Flow of energy
(1) It involves circulation and recycling of nutrients in a cyclic manner within the biosphere.	(1) It involves the flow of energy from one trophic level to another in unidirectional or non-cyclic manner.
(2) There is no dissipation of matter at any level.	(2) There is dissipation of energy at every level.
(3) Biosphere is the source of nutrients.	(3) Sun is the most important source of energy.

Q.10. Write short notes on:

(1) Trophic level.

Ans.

(i) Each level in the food chain is called a trophic level.

(ii) A trophic level is the step at which the organism obtains its food in the chain.

(iii) The amount of matter and energy gradually decreases from producers at lowest level to top consumers at the highest level.

(2) Food web.

Ans.

(i) An ecosystem consists of many food chains that are interconnected at various levels. This is called food web.

(ii) A organism may be the prey for many other organisms.

(iii) For example, an insect feeds upon leaves of various plants but the same insect is the prey for different animals like wall lizards, birds etc.

(iv) This forms an intricate web instead of a linear food chain. Such an intricate network is called as food web.

(v) Generally food webs are formed everywhere in nature.

(3) Pyramid of Energy.
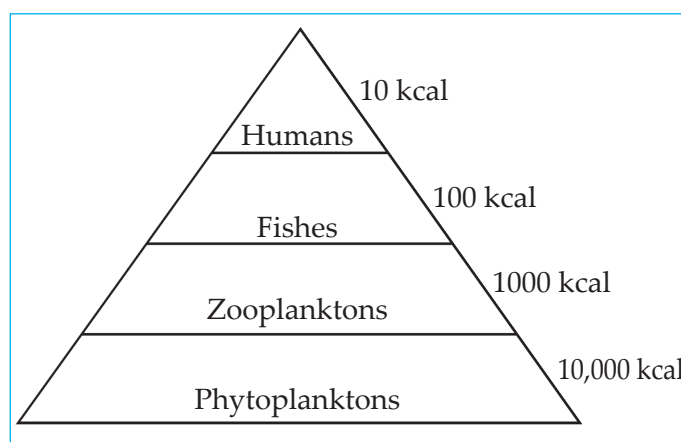
Energy Pyramid

Ans.

(i) Each level in the food chain is called a trophic level.

(ii) The amount of matter and energy gradually decreases from producers at lowest level to top consumers at the highest level.

(iii) The initial quantity of energy goes on decreasing at every level of energy exchange.

(iv) Similarly, the number of organisms also decreases from the lowest level to the highest level.

(v) This pattern of energy exchange in an ecosystem is called a Pyramid of energy.

Q.12. **Answer the following:**

(1) **What is the importance of oxygen?**

Ans.

(i) Oxygen forms 21% of the atmosphere.

(ii) It is also present in hydrosphere and lithosphere.

(iii) Oxygen is required for the process of respiration, combustion, decomposition, corrosion, rusting etc.

(iv) Oxygen is important for the synthesis of proteins, carbohydrates and fats.

(v) It is also used in various chemical reaction.

(vi) Ozone (O_3) is produced from oxygen through various atmospheric processes. This ozone layer protects us from the harmful ultraviolet rays of the sun.

(2) **What is nitrogen fixation? How does it take place?**

Ans. The process of conversion of free nitrogen gas of the atmosphere into nitrogen compounds is called as nitrogen fixation.

It takes place in following ways:

(a) **Atmospheric nitrogen fixation:**

(i) Lightning results in a reaction between nitrogen and oxygen present in the air to produce oxides of nitrogen.

(ii) These oxides dissolve in rainwater forming dilute nitric acid.

(iii) This nitric acid reacts with the alkalis of the soil (like limestone) to turn into nitrates.

(b) **Biological nitrogen fixation:**

(i) It is the conversion of atmospheric nitrogen into nitrogen compounds by living organisms.

(ii) Nitrogen fixing bacteria, called rhizobium are found in the root nodules of the leguminous plants.

(iii) They can fix atmospheric nitrogen into nitrates.

(3) **What is ammonification?**

Ans.

(i) When plants and animalls die, their remains are converted into ammonia and ammonium compounds by decay bacteria and fungi (decomposers) present in the soil.

(ii) This process of release of ammonia through decomposition of dead bodies and excretory wastes of organisms is called as ammonification.

(4) **What is nitrification?**

Ans.

(i) Ammonia is converted first into a nitrite and then nitrate.

(ii) This conversion of ammonia into a nitrite and then a nitrate is called as nitrification.

(5) **What is denitrification?**

Ans.

(i) Nitrogen compounds in the soil are converted into free gaseous nitrogen by the denitrifying bacteria present in the soil.

(ii) This process of conversion of nitrogen compounds into gaseous nitrogen is called as denitrification.

(6) **Write the balanced chemical equations for photosynthesis and respiration.**

Ans.

(i) Photosynthesis:

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$$

(ii) Respiration:

$$C_6H_{12} + 6O_2 \xrightarrow{\text{Mitochondria}} 6CO_2\uparrow + 6H_2O + \text{Energy}$$
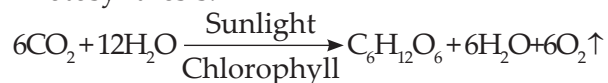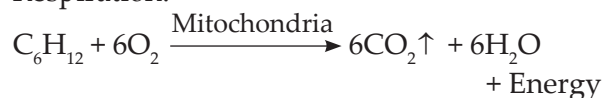
(7) **The cycle of gases and the sedimentary cycle cannot be completely separated from each other. Give two examples to support this statement.**

Ans.

(i) Nitrogen is present in the form of a gas in the atmosphere and in the form of compounds like nitrogen oxide in the soil and sediments.

(ii) Similarly, carbon, occurs in abiotic form mainly in coal, granite, diamond, limestone, etc. in the earth's crust and in form of carbon dioxide gas in the atmosphere.

(iii) Therefore, the cycle of gases and the sedimentary cycle cannot be completely separated from one another.

(8) **How does interaction take place between biotic and abiotic factors of an ecosystem?**

Ans.

(i) All living organisms depend upon abiotic factors.

(ii) Plants use the abiotic factors like carbon

dioxide, water and energy from the sun to produce food by photosynthesis.

(iii) Also, the type of soil and the climatic conditions determine the type of flora and fauna in that region.

(iv) Thus, the biotic and abiotic factors interact with each other through biogeochemical cycles.

(9) (i) Make a list of the various consumers of the ecosystem around you and classify them according to mode of nutrition.

Ans.

Primary Consumers	Secondary Consumers	Apex Consumers	Mixed Consumers
Rabbit, Deer, Monkey, Zebra, Birds	Frog, owl, fox, lizards	Tiger, lion, crocodiles, Leopards	Humans, bears, crows

(ii) Pictures of various organisms are given below. Construct a food web from these pictures.

Ans. **Food web (diagram)**
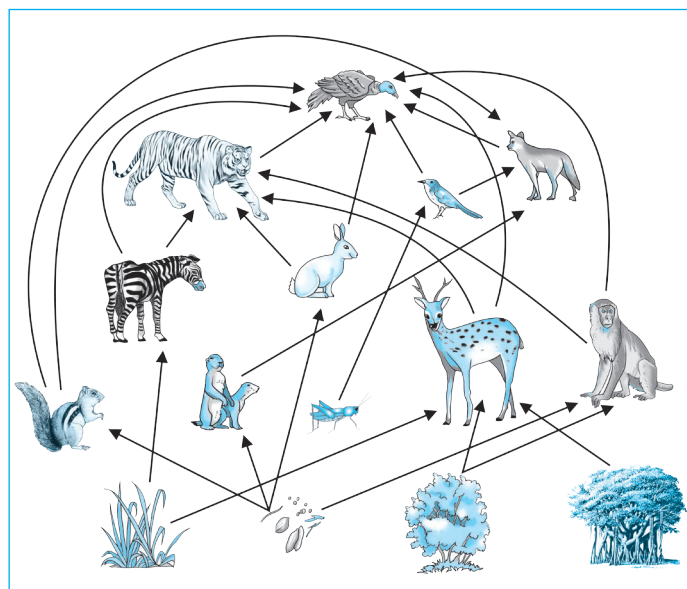
Q.13. Answer in brief:

*(1) What would you do to help maintain the equilibrium in the various bio-geo-chemical cycles? Explain in brief.

Ans.

(i) Biogeochemical cycles always involve the achievement of equilibrium, i.e., a balance in the cycling of the nutrients between the spheres.

(ii) Human activities that are known to be environmentally unfriendly can disrupt this balance.

(iii) We should avoid deforestation as trees play an important role in maintaining the balance.

(iv) We should avoid overuse of fertilizers. The fertilizers get washed away in the nearby water bodies disrupting the balance.

(v) Avoid burning of fossil fuels as these fuels release a large amount of carbon in the form of carbondioxide thus disrupting the balance.

(vi) Vehicular emissions is another contributor to the disruption in balance of the various cycles. These emissions release oxides of nitrogen and carbon and other hazardous air pollutants. So we must use better quality fuel like CNG or ethanol to reduce vehicular emissions.

*(2) Explain in detail the inter-relationship between the food chain and food web.

Ans.

(i) Interaction go on continuously between producers, consumers and decomposers.

(ii) There is a definite sequence in these interactions which is called the food chain.

(iii) Each chain consists of four, five or more links.

(iv) An ecosystem consists of many food chains that are interconnected at various levels. Thus a food web is formed.

(v) An organism may be the prey for many other organisms.

(vi) For example, an insect feeds upon leaves of various plants but the same insect is the prey for different animals like frog, wall lizard, birds, etc.

(vii) Thus many food chains interconnected together form an intricate web called as food web.

*(3) State the different types of bio-geo-chemical cycles and explain the importance of these cycles.

Ans.

(i) The different types of bio-geo-chemical cycles are nitrogen, oxygen, carbon, water vapour, iron, calcium, phosphorus, etc.

(ii) Nutrients, necessary for the growth of the organisms are continuously transferred from abiotic to biotic factors and biotic to abiotic factors within an ecosystem.

(iii) These cycles operate continuously through the medium of the biosphere formed by the

lithosphere, atmosphere and hydrosphere.

(iv) The recycling of biological, geological and chemical sources of nutrients takes place through these cycles.

(v) Nutrients from the biosphere enter the bodies of plants and animals. Eventually, after death, all types of consumers are decomposed by decomposers like bacteria and fungi and they are again released into the biosphere and are used again by living organisms.

(vi) Therefore these cycles helps in maintaining the flow of nutrients and energy through ecosystem and maintaining the equilibrium in the ecosystem.

*(4) **Explain the following with suitable example. What type of changes occur in the amount of energy during its transfer from plants to apex consumers?**

Ans.

(i) Plants of the ecosystem store some of the solar energy in the form of food.

(ii) Before reaching the decomposers, this energy is passed on from one trophic level to the next.

(iii) At every trophic level, some amount of energy is used by the organism for its own life processes and some amount of energy is lost to the surroundings.

(iv) Decomposers dissipate some amount of energy in the form of heat.

(v) However, no part of the energy ever returns to the sun. Hence, such passage of energy is referred to as 'one way' transport.

(vi) Therefore energy is maximum at the base of the pyramid and is least at the apex, e.g. phytoplanktons which form the base of pyramid have 10,000 kcal of energy while humans at apex have 10 kcal of energy.

(5) **Write the important processes of nitrogen cycle.**

Ans.

(i) **Nitrogen fixation:** Conversion of nitrogen into nitrates and nitrites through atmospheric, industrial and biological processes.

(ii) **Ammonification:** Release of ammonia through decomposition of dead bodies and excretory wastes of organisms.

(iii) **Nitrification:** Conversion of ammonia into a nitrite and then nitrate.

(iv) **Denitrification:** Conversion of nitrogen

components into gaseous nitrogen.

(6) **Explain the following questions with suitable diagrammatic representation:**

*(a) **Carbon cycle.**

Ans.
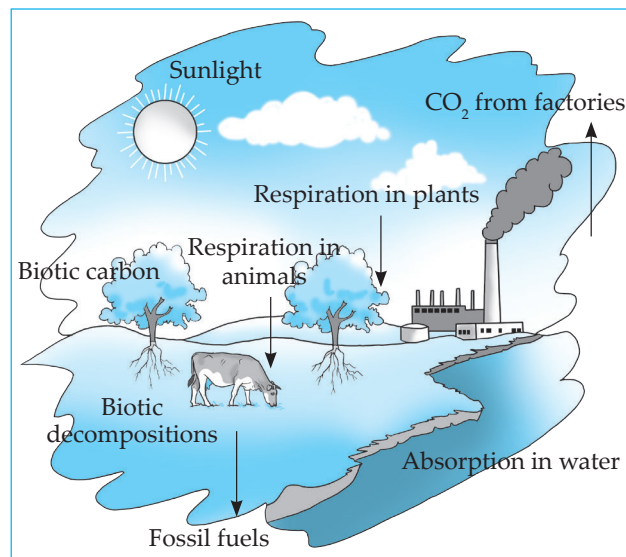
The carbon cycle

(i) The circulation and recycling of carbon from the atmosphere to living organisms and after their death back to the atmosphere is called the carbon cycle.

(ii) Abiotic carbon atoms are circulated and recycled into biotic form mainly through photosynthesis and respiration. Hence, the carbon cycle is one of the important bio-geo-chemical cycles.

(iii) Plants convert carbon dioxide into carbohydrates by the process of photosynthesis.

(iv) Similarly, they produce carbon compounds like proteins and fats, too.

(v) Carnivores feed upon herbivores. In this way, biotic carbon is transported from plants to herbivores, from herbivores to carnivores and from carnivores to apex consumers.

Main processes in the carbon cycle

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2\uparrow$$

$$C_6H_{12}O_6 + 6O_2 \xrightarrow{\text{Mitochondria}} 6CO_2\uparrow + 6H_2O + \text{Energy}$$
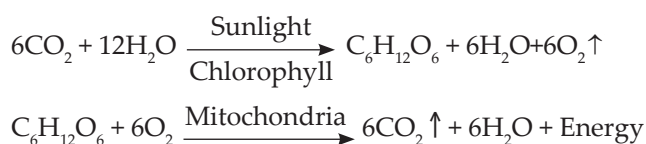
(vi) Eventually, after death, all types of consumer, are decomposed by decomposers like bacteria and fungi and carbon dioxide is released

again into the atmosphere and is used again by living organisms. In this way, carbon is continuously passed on from one living organism to another. After the death of living organisms, carbon goes to the atmosphere and is again taken up by living organisms.

*(b)   Nitrogen cycle.

Ans.
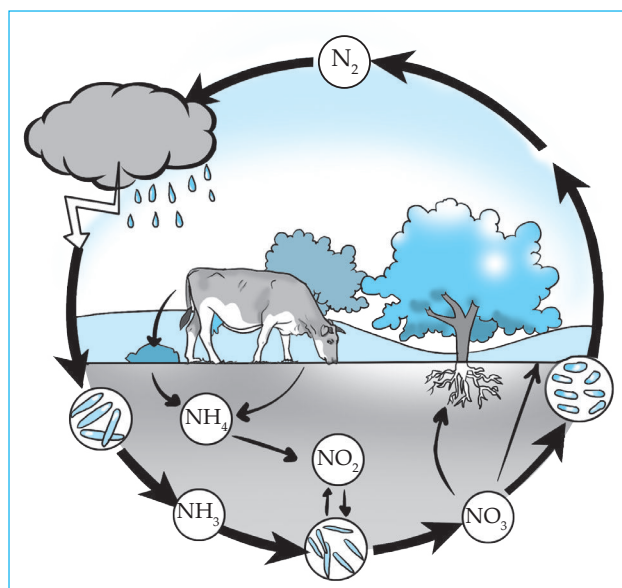
The nitrogen cycle

(i)   Nitrogen forms 78% i.e. the maximum portion of the atmosphere. It is necessary for the maintenance of the cycle of nature.

(ii)   The circulation and recycling of nitrogen gas into the form of different compounds through various biotic and abiotic processes in nature is called the nitrogen cycle.

(iii) All organisms participate in the nitrogen cycle. It is an important component of proteins and nucleic acids.

(iv)   As compared to other elements, it is inactive and does not easily combine with other elements. Most organisms cannot use the free form of nitrogen.

(v)   Important processes of nitrogen cycle.

(1)   Nitrogen fixation: Conversion of nitrogen into nitrates and nitrites through atmosphere, industrial and biological processes.

(2)   Ammonification: Release of ammonia through decomposition of dead bodies and excretory wastes of organisms.

(3)   Nitrification: Conversion of ammonia into a nitrite and then nitrate.

(4)   Denitrification: Conversion of nitrogen compounds into gaseous nitrogen.

*(c)   Oxygen cycle.

Ans.
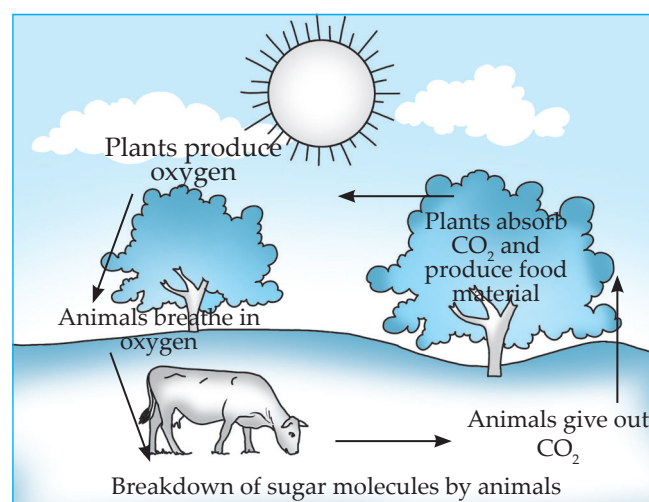
The oxygen cycle

(i)   Oxygen forms 21% of the atmosphere. It is also present in the hydrosphere and lithosphere. Circulation and recycling of oxygen within the biosphere is called the oxygen.

(ii)   This cycle, includes both the biotic and abiotic components. Oxygen is continuously produced as well as used up in the atmosphere.

(iii) Oxygen is highly reactive and it readily reacts with other elements and compounds.

(iv)   As oxygen is found in various forms like molecular oxygen (O_2), water (H_2O), carbon dioxide (CO_2), inorganic compounds etc, the oxygen cycle of the biosphere is extremely complex.

(v)   Oxygen is released in the process of photosynthesis whereas it is used up in processes like respiration, combustion, decomposition, corrosion, rusting, etc.

*Q.14. Use your brain power:

(1)   Why are the number of tertiary consumers (apex carnivores) always less than those of other consumers?

Ans.

(i)   In a food chain, at each trophic level some amount of energy is used by the organism for its own life processes and some amount of energy is lost to the surroundings in the form of heat energy.

(ii)   Therefore, after a few trophic levels, the

amount of energy in the food chain cannot support a higher trophic level.

(iii) Therefore, the number of tertiary consumers is less than that of other consumers.

(2) Is the number of consumers in a food web fixed?

Ans. No. The number of consumers in a food web is not fixed.

(3) What will be the effect on an ecosystem if only one type of organism in it forms the food for several different consumers in that ecosystem?

Ans. If only one type of organism forms the food for several consumers in an ecosystem, there will be competition for that food among organisms. Slowly the organism that is the prey will go on declining and other organisms will die of starvation. This will lead to an imbalance in the ecosystem.

(4) Why is balance or equilibrium necessary in a food web?

Ans. It is necessary to maintain the balance or equilibrium in a food web as the survival of consumer is dependent on another. For example, the carnivorous animals will starve and their number will dwindle due to starvation if the primary consumers are removed from the food web. On the other side, if secondary consumers are removed from the food web the population of primary consumers would remain unchecked and that will directly affect the producers. Therefore removing any one of the consumers from the food web would affect the whole food web in general.

(5) Explain the food chain of various ecosystems which you have studied last year.

Ans.

(i) **Food chain in a forest ecosystem:**
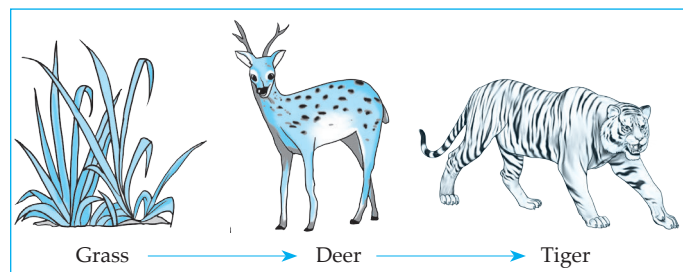
Grass ⟶ Deer ⟶ Tiger

In a forest ecosystem grass is eaten by a deer, which in turn is eaten by a tiger. The grass, deer and tiger form a food chain. In this food chain, energy flows from the grass (producer) to the deer (primary consumer) to the tiger (secondary consumer).

(ii) **Food chain in an aquatic ecosystem (Pond):**

Algae   Insects   small fish   big fish   Fish eating bird
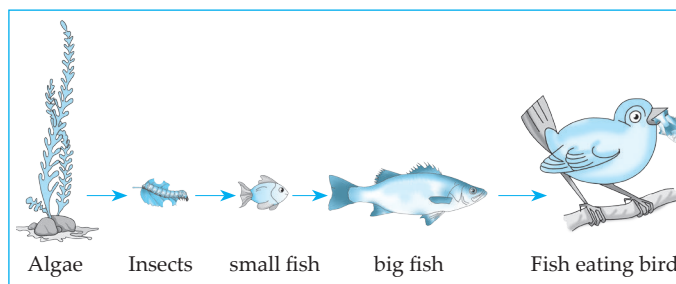
In a aquatic ecosystem algae are eaten by insects. Insects are eaten by small fish, small fish are in turn eaten by big fish. And the big fish are eaten by fish eating birds. In this food chain energy flows from the algae (producer) to the insects (primary consumers) to the small fish (secondary consumers) to the big fish (tertiary consumer) and to the fish eating birds (apex consumer).

(6) What would happen if the energy remains trapped in the body of apex consumers even after their death? What will happen if there were no decomposers like microbes and fungi in nature?

Ans.

(i) After the death of apex consumers, their energy becomes available to the decomposers. If energy remains trapped in the body of apex consumers then energy will not be available for decomposers and they will not survive thus disturbing the balance of the ecosystem.

(ii) Decomposers like microbes and fungi break down the bodies of dead plants and animals and convert them into simple carbon compounds. These substances easily mix with air, water and soil from where they are again absorbed by the plants and incorporated into the food chain. If there were no decomposers, decomposition will not happen and the nutrients will be trapped in the bodies of plants and animals and this will disturb the food chain, food web and the equilibrium in the ecosystem.

*Q.15. Think about it:

(1) **What happens to the energy during its transfer from producers to apex consumers? Does it remain trapped in apex consumers? Does it remain in the body of apex consumer till its death?**

Ans.

(i) When energy is transferred from producers to apex consumers, some amount of energy is used by the organisms for their own life processes at every trophic level and some amount of energy is lost to the surroundings as heat energy.

(ii) No, the energy does not remain trapped in apex consumer, it is passed on to the decomposers.

(iii) Yes, it does remain in the body of apex consumers till its death. Only after its death the energy is passed on to the next consumer.

(2) **The carbon cycle is very effective in the temperate region. Why is it so?**

Ans. Temperate regions are rich in forests. Forest play a major role in carbon cycle. Trees absorb carbondioxide and convert it into food (Chemical energy) by a process of photosynthesis. Thus, carbon cycle is very effective in temperate regions.

(3) **Even though the carbon content on the earth is constant, why is there a rise in temperature due to carbon dioxide?**

Ans. Carbon content on earth is constant but the burning of wood, and fossil fuels releases CO_2 into the atmosphere which is a greenhouse gas and causes more heat to be trapped on the earth's surface leading to increase in temperature.

(4) **Identify the relationship between carbon in the air and the rise in atmospheric temperature.**

Ans. There is a direct relationship between carbon in air and rise in atmospheric temperature. More the level of carbon dioxide, more the heat trapped and hence higher rise in temperature.

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ASSIGNMENT - 7

Time : 1 Hr.   **Marks : 30**

Q.1. (A) Fill in the blanks: **(2)**

(1)   Plants convert carbon dioxide into .... by the process of photosynthesis.

(2)   After the death of apex consumers, energy becomes available to ....

(B) Match the columns: **(2)**

Column 'A'	Column 'B'
(1) Flow of nutrients	(a) Sedimentary cycle
(2) Flow of energy	(b) One way
(3) Carbon	(c) Gaseous cycle
(4) Phosphorus	(d) Cyclical

(C) Select the odd man out: **(2)**

(1)   Grasshopper, squirrel, elephant, lion.

(2)   Photosynthesis, nitrification, ammonification, denitrification

Q.2. Answer the following questions in short: **(8)**

(1)   Give reason : Energy flow through an ecosystem is one way.

(2)   Distinguish between gaseous cycle and sedimentary cycle.

(3)   Write a short note on Food web.

(4)   Write a note on pyramid of energy.

Q.3. Answer the following questions in brief.   **(6)**

(1)   Explain in detail the inter-relationship between food chain and food web.

(2)   What would you do to help maintain the equilibrium in the various biogeochemical cycles?

Q.4. Answer in detail: **(10)**

(1)   Describe the carbon cycle with a suitable diagrammatic representation.

(2)   Describe the oxygen cycle with a suitable diagrammatic representation.

❖ ❖ ❖

8 Useful and Harmful Microbes

Points to Remember:

- Microbes are tiny organisms which cannot be seen with the unaided eye. They can only be seen with the help of microscope.

- Some microbes are useful while some are harmful.

- **Useful microbes:**
    - Lactobacilli are useful microbes that convert milk into yoghurt. They convert lactose, the sugar in milk, into lactic acid. This process is called fermentation.
    - Lactobacilli are also used to produce milk products, cider, cocoa, pickles, leavened fodder, wine, probiotics etc.
    - Rhizobium bacteria present in the root nodules of leguminous plants produce nitrogenous compounds from atmospheric nitrogen. They supply nitrates, nitrites and amino acids to that plant and in exchange get energy in the form of carbohydrates from it . Such a mutually beneficial relationship is called symbiosis.
    - Yeast cells convert carbohydrates into alcohol and carbon dioxide . This is called fermentation.
    - Yeast is used to produce bread as it makes the bread soft, spongy and fluffy.
    - Antibiotics are carbon compounds obtained from some bacteria and fungi for destroying or preventing the growth of harmful micro-organisms. Some antibiotics are broad –spectrum while some are narrow-spectrum.
    - The antibiotic Pencillin was discovered by Alexander Fleming from the fungus Penicillium.

- **Harmful Microbes:**
    - Fungi grow on articles like gunny bags, leather items, wooden items in the presence of moisture and spoil them.
    - Various species of fungi grow on food items like pickles, murabba, jam, sauce, chutney etc. They release poisonous chemicals called mycotoxins and spoil them.
    - Clostridium bacteria spoil cooked food and cause food poisoning.
    - Different kinds of harmful bacteria, fungi and viruses cause various diseases in plants, animals and humans.
    - These diseases can be prevented by following proper preventive measures.

MASTER KEY QUESTION SET - 8

Q.1.   (A) Fill in the blanks:

(1)   The rod-shaped bacteria found in milk or buttermilk are called ....

(2)   Lactobacilli are .... bacteria.

(3)   In fermentation, the pH of milk decreases causing .... of milk proteins.

(4)   Yoghurt has a specific sour taste due to ....

(5)   Lactobacilli kill the harmful bacteria like .... in the alimentary canal and help to improve our immunity.

(6)   Bacteria found in the root nodules of leguminous plants are ....

(7)   A mutually beneficial relationship is called ....

(8)   .... bacteria convert lactose into lactic acid.

(9)   .... is a unicellular fungus with 1500 different species in existence.

(10)   The yeast cell is a .... type of cell.

(11)   Molasses is produced from ....

(12)   The sugars .... and................... in grape juice are fermented for making wines.

(13)   Oil spills in oceans are cleaned with the help of .... bacteria.

(14)   Carbon compounds obtained from bacteria and fungi for destroying or preventing the growth of harmful micro-organisms are called ....

(15)   Antibiotics useful against wide variety of bacteria are called .... antibiotics.

(16)   When a pathogenic micro-organism is difinitely known, then .... antibiotics are used.

(17)   The .... in Pune undertakes research related to diseases like measles, jaundice, fever and diseases of the lungs with support from the World Health Organization.

(18)   Penicillin is a group of antibiotics obtained from the fungus ....

(19)   Ants grow .... in their anthill and obtain food from it.

(20)   Fungi release .... into the food, making the food poisonous.

(21)   .... produce bottle-shaped endospores in adverse conditions.

(22)   Clostridium bacteria grow in .... conditions.

(23)   .... conducted important research on the toxin responsible for gas gangrene and the antitoxin responsible for treating it.

(24)   .... is a smokeless and high quality fuel.

(25)   Nowdays, seeds are coated with .... before sowing.

Ans.   *(1) lactobacilli (2) anaerobic (3) coagulation (4) lactic acid (5) costridium (6) rhizobium (7) symbiosis (8) Lactobacilli (9) Yeast (10) eukaryotic (11) sugarcane juice (12) glucose, fructose (13) Alcanivorax (14) antibiotics (15) broad-spectrum (16) narrow-spectrum (17) National Institute of Virology (18) penicillium (19) fungi (20) mycotoxins (21) Clostridium (22) anaerobic (23) Ida Bengston (24) Ethanol (25) rhizobial solution or powder*

(B) Write the sentence with the correct answer from the options given below:

(1)   The lactobacilli convert lactose, the sugar in the milk, into ....

(a) lactic acid   (b) acetic acid
(c) alcohol   (d) citric acid

(2)   The .... destroys harmful microbes present in the milk.

(a) high pH   (b) neutral pH
(c) low pH   (d) none of these

(3)   Lactobacilli kill the harmful bacteria like .... present in the alimentary canal.

(a) rhizobium   (b) saccharomyces
(c) clostridium   (d) alcanivorax

(4)   During fermentation, yeast cells convert carbohydrates into ....

(a) glucose and fructose
(b) alcohol and carbon dioxide
(c) proteins and fats
(d) fatty acids and amino acids

(5) Molasses is fermented with the help of yeast called ....

(a) Yarrowia lipolytica (b) Alcanivorax
(c) Rhizobia   (d) Saccharomyces

(6) A yeast .... is used to absorb the toxins released during the production of palm oil.

(a) Yarrowia lipolytica (b) Alcanivorax
(c) Saccharomyces cereviceae
(d) Penicillium

(7) Antibiotics mainly act against ....

(a) Bacteria   (b) Viruses
(c) Algae   (d) Fungi

(8) .... is a broad-spectrum antibiotic.

(a) Gentamycin   (b) Penicillin
(c) Amoxicillin   (d) Erythromycin

(9) .... is a narrow-spectrum antibiotic.

(a) Ampicillin   (b) Amoxicillin
(c) Tetracyclin   (d) Penicillin

(10) Antibiotic penicillin was discovered by ....

(a) Louis Pasteur   (b) Alexander Fleming
(c) Ida Bengston   (d) Van Ermengem

(11) The bacteria which spoil cooked food are ....

(a) Saccharomyces   (b) Lactobacilli
(c) Clostridium   (d) Rhizobium

(12) .... can grow and reproduce only in living cells.

(a) Bacteria   (b) Viruses
(c) Fungi   (d) Protozoa

(13) .... proved that the anaerobic bacterium clostridium botulinum, is responsible for food poisoning.

(a) Louis Pasteur   (b) Ida Bengston
(c) Alexander Fleming (d) Van Ermengem

(14) AIDS is caused by ....

(a) Virus   (b) Bacteria (c) Protozoa   (d) Fungi

(15) Dengue is caused by ....

(a) droplets spread in air
(b) contact with infected person
(c) mosquito bite
(d) contaminated water and food

(16) Pneumonia is caused by ....

(a) virus   (b) bacteria (c) fungi   (d) protozoa

(17) .... can be prevented by vaccination.

(a) Malaria   (b) AIDS
(c) Leprosy   (d) Chicken pox

(18) Malaria is caused by ....

(a) protozoa   (b) bacteria
(c) fungi   (d) virus

(19) Bacteria causes ....

(a) malaria   (b) scabies
(c) cholera   (d) bird flu

(20) Bird flue (H_7N_9) and swine flu (H_1N_1) are caused by ....

(a) bacteria   (b) protozoa
(c) fungi   (d) virus

Ans. *(1) lactic acid (2) low pH (3) clostridium (4) alcohol and carbondioxide (5) Saccharomyces (6) Yarrowia lipolytica (7) Bacteria (8) Amoxicillin (9) Penicillin (10) Alexander Fleming (11) Clostridium (12) Viruses (13) Van Ermengem (14) Virus (15) mosquito bite (16) bacteria (17) Chicken pox (18) protozoa (19) cholera (20) virus*

(C) Complete the statements using the proper option from those given below. Explain the statements:

(mycotoxins, budding, rhizobium, molasses, endospores, broad-spectrum, lactobacilli)

*(1) Yeast reproduces asexually by the .... method.

Ans. **Budding.**

The yeast cells develop small round bodies on the parent cell. These are called buds. New daughter cells develop from these buds.

*(2) Toxins of fungal origin are called ....

Ans. **Mycotoxins.**

Mycotoxins are poisonous chemicals released into the food by fungi. This makes the food poisonous.

(3) .... bacteria are used for making yoghurt.

Ans. **Lactobacilli.**

The lactobacilli convert lactose, the sugar in the milk, into lactic acid. As a result, the pH

of milk decreases causing coagulation of milk proteins. Milk changes into yoghurt.

(4) The use of .... has helped to reduce the use of chemical fertilizers.

Ans. **Rhizobium.**

Rhizobium bacteria are found in the root nodules of leguminous plants. They help to convert atmospheric nitrogen into nitrogen compounds and provide it to the plants. This helps to reduce the use of chemical fertilizers and their adverse effects.

(5) Amoxicillin is a .... antibiotic.

Ans. **Broad-spectrum.**

This antibiotic is useful against a wide variety of bacteria. It is used against pathogens which connot be identified during symptoms of a disease.

(6) Ethanol is produced by the fermentation of ....

Ans. **Molasses.**

Molasses is produced from sugarcane juice. It is rich in carbohydrates. When it is fermented with the help of the yeast called saccharomyces, ethanol (C_2H_5OH) is produced.

(7) Clostridium bacteria produce bottle-shaped ....

Ans. **Endospores.**

These endospores help them to survive in adverse conditions.

Q.2. **State whether the following statements are true or false and if false, write the correct statement:**

(1) Lactobacilli are aerobic bacteria.

Ans. **False:** Lactobacilli are anaerobic bacteria.

(2) The lactobacilli convert lactose sugar into alcohol.

Ans. **False:** The lactobacilli convert alctose sugar into lactic acid.

(3) Yoghurt has a specific sour taste due to acetic acid.

Ans. **False:** Yoghurt has a specific sour taste due to lactic acid.

(4) The bacteria clostridium are present in the root nodules of leguminous plants.

Ans. **False:** The bacteria rhizobium are present in the root nodules of leguminous plants.

(5) Yeast cell is a prokaryotic cell.

Ans. **False:** Yeast cell is an eukaryotic cell.

(6) The use of rhizobium has helped to reduce the use of chemical fertilizers.

Ans. **True.**

(7) Ethanol is a smokeless and high quality fuel.

Ans. **True.**

(8) A yeast, *Saccharomyces cereviceae* is used for absorbing toxins released during palm oil production.

Ans. **False:** A yeast, Yarrowia lipolytica is used to absorb the toxins released during the production of palm oil.

(9) Gentamycin is a narrow-spectrum antibiotic.

Ans. **True.**

(10) Antibiotics mainly act against bacteria.

Ans. **True.**

(11) Oil spills in oceans are cleared with the help of clostridium bacteria.

Ans. **False:** Oil spills in oceans are cleared with the help of Alcanivorax bacteria.

(12) Tetracycline is a narrow-spectrum antibiotic.

Ans. **False:** Tetracycline is a broad-spectrum antibiotic.

(13) Amoxicillin is a broad-spectrum antibiotic.

Ans. **True.**

(14) Penicillin is a group of antibiotics obtained from a fungus Saccharomyces.

Ans. **False:** Penicillin is a group of antibiotics obtained from a fungus Penicillium.

(15) Antiobiotic penicillin was discovered by Alexander Fleming.

Ans. **True.**

(16) The bacteria lactobacilli cause food-poisoning.

Ans. **False:** The bacteria clostridium cause food-poisoning.

(17) Clostridium bacteria grow in aerobic conditions.

Ans. **False:** Clostridium bacteria grow in anaerobic conditions.

(18) AIDs is caused by a virus.

Ans. **True**.

(19) Influenza is caused by a bacteria.

Ans. **False:** Influenza is caused by a virus.

(20) Antibiotics useful to one person can be suggested to others also.

Ans. **False:** Antibiotics useful to one person cannot be suggested to others as different diseases require different antibiotics.

(21) Dengue is caused by a bacteria.

Ans. **False:** Dengue is caused by a virus.

(22) Dandruff and ringworm are caused by fungi.

Ans. **True.**

(23) Pneumonia is spread through droplets spread in air by infected person.

Ans. **True.**

(24) Chicken pox is spread due to contaminated food and water.

Ans. **False:** Chicken pox is spread due to contact with infected person.

(25) Ida Bengston was honoured with the 'Typhoid Medal' in 1947.

Ans. **False:** Ida Bengston was honoured with the 'Typhus Medal' in 1947.

Q.3. **(A) Find the odd man out:**

*(1) Pneumonia, Diphtheria, Chickenpox, Cholera.

Ans. **Chickenpox.** It is caused by a virus whereas others are caused by bacteria.

*(2) Lactobacilli, Rhizobia, Yeast, Clostridia.

Ans. **Yeast.** It is a fungus whereas the rest are bacteria.

*(3) Root rot, rust (tambere), rubella, mozaic.

Ans. **Rubella.** It is a disease of humans whereas the rest are diseases of plants.

(4) AIDS, Hepatitis, Leprosy, Dengue.

Ans. **Leprosy.** It is caused by bacteria whereas the rest are caused by viruses.

(5) Cholera, Leprosy, Pneumonia, Influenza.

Ans. **Influenza.** It is caused by a virus whereas the rest are caused by bacteria.

(6) Ampicillin, Amoxycillin, Penicillin, Tetracycline.

Ans. **Penicillin.** It is a narrow-spectrum antibiotic whereas others are broad-spectrum antibiotics.

(7) Tetracycline, Penicillin, Gentamycin, Erythromycin.

Ans. **Tetracycline.** It is a broad-spectrum antibiotic

whereas others are narrow-spectrum antibiotics.

*(B) Write the names of the microbes found in following food materials:

yoghurt, bread, root nodules of leguminous plants, idli, dosa, spoiled potato curry.

Ans. Yoghurt - Lactobacilli

Bread - Yeast

Root nodules of leguminous plants - Rhizobium

Idli - Yeast, bacteria

Dosa - Yeast, bacteria

Spoiled potato curry - Clostridium

Q.4. **Complete the analogy:**

(1) Dengue : Virus : : Malaria : ....

Ans. Protozoa.

(2) Hepatitis : Virus : : Pneumonia : ....

Ans. Bacteria.

(3) Cholera : Bacteria : : Swine flu : ....

Ans. Virus.

(4) Swine flu : H_1N_1 : : Bird Flu : ....

Ans. H_7N_9.

(5) Measles : Virus : : Ringworm : ....

Ans. Fungi.

(6) Yoghurt : Lactobacilli : : Bread : ....

Ans. Yeast.

(7) Oil spills : Alcanivorax : : Absorption of arsenic : ....

Ans. Saccharomyces cereviceae.

(8) Rhizobium : Nitrogen fixation : : Clostridium : ....

Ans. Food poisoning.

Q.5. **Match the columns:**

*(1) Column 'A'	Column 'B'
(1) Rhizobium	(a) Food poisoning
(2) Clostridium	(b) Nitrogen fixation
(3) Penicillium	(c) Bakery products
(4) Yeast	(d) Production of antibiotics

Ans. *(1 - b), (2 - a), (3 - d), (4 - c)*

(2)	Column 'A'	Column 'B'
	(1) Leprosy	(a) Virus
	(2) Ringworm	(b) Fungi
	(3) Influenza	(c) Protozoa
	(4) Malaria	(d) Bacteria

Ans. *(1 - d), (2 - b), (3 - a), (4 - c)*

Q.6.   Give reasons:

*(1)   Foam accumulates on the surface of 'dal' kept for a long time in summer.

Ans.

(i)   Dal is rich in proteins.

(ii)   During summer, bacteria attack the dal and cause fermentation resulting in the production of carbon dioxide gas.

(iii) Therefore foam accumulates on the surface of the 'dal' kept for long time in summer.

*(2)   Why are naphthalene balls kept with clothes to be put away?

Ans.

(i)   Naphthalene balls are balls of chemical pesticide and deodorant.

(ii)   They help to kill or repel insects such as moths, cockroaches, mice etc.

(iii) Therefore, naphthalene balls are kept with clothes to be put away to prevent clothes from getting damaged.

(3)   Lactobacilli are used for making yoghurt from milk.

Ans.

(i)   Lactobacilli convert lactose, the sugar in the milk, into lactic acid. This process is called fermentation.

(ii)   As a result, the pH of milk decreases causing coagulation of milk proteins.

(iii) Thus, milk proteins are separated from other constituents of milk and milk changes into yoghurt.

(iv)   Yoghurt has a specific sour taste due to lactic acid. The low pH destroys harmful microbes present in the milk. Therefore, lactobacilli are used for making yoghurt from milk.

(4)   Antibiotics should be taken only when prescribed by a doctor.

Ans.

(i)   Antibiotics are a group of medicines used to kill disease - causing bacteria and certain protozoa.

(ii)   The doctor selects and prescribes the antibiotic best suited for our disease.

(iii) If taken in extra dose, they can kill the useful bacteria present in our body.

(iv)   If the course of antibiotics is not completed, the bacteria develop resistance to that antibiotic making it ineffective.

(v)   Therefore, antibiotics should be taken only when prescribed by a doctor.

(5)   Nowadays, seeds are coated with rhizobial solution or powder before sowing.

Ans.

(i)   When seeds coated with rhizobial solution or powder are sown, rhizobia enter the plantlets.

(ii)   This is called rhizobial inoculation.

(iii) Rhizobia can produce nitrogenous compounds from atmospheric nitrogen.

(iv)   This experiment has helped in the supply of nitrogen to cereal and other crops, besides leguminous crops.

(v)   Therefore, nowadays seeds are coated with rhizobial solution or powder before sowing.

(6)   Antibiotics are not effective against common cold or influenza.

Ans.

(i)   Antibiotics are a group of medicines used to control inflections caused by bacteria.

(ii)   Common cold or influenza is caused by a virus.

(iii) Antibiotics are not effective against viruses.

(iv)   Therefore antibiotics are not effective against common cold or influenza.

(7)   Cotton fabrics, gunny bags, leather items and wooden items do not last long.

Ans.

(i)   Microscopic spores of fungi are present in the air.

(ii)   If there is sufficient moisture, spores germinate on cotton fabric, gunny bags, leather, wooden items etc.

(iii) The fungal hyphae (fires of the fungus) penetrate deep into the material to obtain nutrition and to reproduce.

(iv) This causes the materials to wear and become weak.

(v) As a result, cotton fabric, gunny bags, leather and wooden items do not last long.

(8) Food on which fungi has grown cannot be eaten.

Ans.

(i) Various species of fungi grow on food items like pickles, murabba, jam, sauce, chutney etc.

(ii) They use the nutrients in these food items for growth and reproduction.

(iii) During this activity, fungi release mycotoxins, certain poisonous chemicals, into the food and thus food becomes poisonous.

(iv) Hence, the food on which fungi have grown cannot be eaten.

Q.7. Write short notes:

(1) Rhizobial inoculation.

Ans.

(i) Nowadays seeds are coated with rhizobial solution or powder before sowing.

(ii) After sowing, rhizobia enter the plantlets.

(iii) This is called rhizobial inoculation.

(iv) In this experiment has helped in the supply of nitrogen to cereal and other crops, besides leguminous crops.

(2) Bio-remediation.

Ans.

(i) Bio-remediation is a technique that involves the use of organisms to break down environmental pollutants.

(ii) Generally, fungi like yeast and bacteria are used for bio-remediation.

(iii) A yeast, *Yarrowia lipolytica* is used to absorb the toxins released during the production of palm oil and the heavy metals and minerals released in some other industrial processes.

(iv) *Saccharomyces cereviceae* is used for absorption of a pollutant, arsenic.

(v) Oil spills in oceans are cleaned with the help of Alcanivorax bacteria.

(3) Antibiotics.

Ans.

(i) Carbon compounds obtained from some bacteria and fungi for destroying or preventing the growth of harmful micro-organisms are called antibiotics.

(ii) Antibiotics, a discovery of the 20th century, have brought a revolution in the field of medicine.

(iii) Antibiotics mainly act against bacteria. Some antibiotics can destroy protozoa.

(iv) Some antibiotics are useful against a wide variety of bacteria they are called broad-spectrum antibiotics . Examples - ampicillin, amoxicillin, tetracycline, etc.

(v) When the pathogen cannot be identified even though the symptoms of disease are visible, broad spectrum antibiotics are used.

(vi) Whenever a pathogenic micro-organism is definitely known, then narrow-spectrum antibiotics are used. Examples : Penicillin, gentamycin, erythromycin, etc.

(4) Clostridium.

Ans.

(i) Clostridium are the bacteria that spoil food.

(ii) Out of about 100 different species of this bacterium, some are free living in the soil wheras some live in the alimentary canals of the humans and other animals.

(iii) These bacteria are rod-shaped and produce bottle-shaped endospores in adverse conditions.

(iv) One special characteristic of these bacteria is that they cannot withstand the normal oxygen level of the air because they grow in anaerobic conditions.

Q.8. Answer the following questions:

***(1) Which vaccincs are given to infants? Why?**

Ans.

(i) Hepatitis A and B, DTP (Diphtheris, Tetanus, Pertussis.) Polio, MMR (Measles, Mumps, Rubella), Chicken pox, Influenza, Tetanus, BCG, Rotavirus etc.

(ii) Vaccines consist of dead or weakend microbes. When these are swallowed or injected, the body produces antibodies to fight them. These antibodies remain in the body and protect it from any future attack of the disease causing microbes. Therefore, vaccines are given to infants for preventing diseases.

*(2) **How is a vaccine produced?**

Ans.

(i) Vaccines are made using the disease causing bacteria or virus but in a form that will not harm the human beings.

(ii) Vaccine is made from dead or weakened microbes or their toxins.

(iii) Vaccine stimulates the immune system to produce antibodies which give lift-long protection against the disease.

(iv) There are specific vaccines for specific diseases.

*(3) **How do antibiotics cure disease?**

Ans.

(i) Antibiotics cure diseases by destroying or preventing the growth of harmful micro-organisms.

*(4) **Are the antibiotics given to humans and animals the same? Why?**

Ans.

(i) Generally antibiotics work against any harmful bacteria, whether it is attacking humans or animals.

(ii) But some of them are better suited to humans while some are better for animals. This is due to the adverse effects they show in different species.

(iii) Also, the dosages of antibiotics for humans and animals differ.

*(5) **Why is it necessary to safely store the pathogens of a discase against which vaccines are to be produced?**

Ans.

(i) Pathogens are microbes which can cause diseases in us.

(ii) For the preparation of a vaccine, a particular pathogen is cultured and grown in a laboratory.

(iii) If these pathogens are not safely stored, they many get modified due to environmental factors, resulting in decrease in the efficiency of the vaccine.

(iv) Also, the live pathogens may escape and cause diseases in us.

(6) **How is bread made?**

Ans.

(i) Bread is made using flour, yeast, salt and water. The yeast uses sugar as food.

(ii) In the process of obtaining nutrition, yeast cells convert the carbohydrates into alcohol and carbon dioxide. This process is called fermentation.

(iii) The bubbles of carbon dioxide given off cause the dough to rise.

(iv) This dough can be used to make bread.

(v) When this dough is baked, more bubbles of carbon dioxide are formed due to heat. As the gas escapes, the bread rises and becomes soft and fluffy.

(7) **What is the advantage of Rhizobium to farmers?**

Ans.

(i) The use of rhizobium has helped to reduce the use of chemical fertilizers and thereby their adverse effects.

(ii) It has also helped to reduce expenses on fertilizers and thus beneffited the farmers.

(8) **How can we observe lactobacilli in buttermilk?**

Ans.

(i) Smear a drop of fresh buttermilk on a glass slide.

(ii) Stain it with methylene blue and put a coverslip over it.

(iii) Observe the smear under the 10X objective of a compound microscope and then with the more powerful 60X objective.

(iv) The blue rod-shaped organisms moving about are lactobacilli.

*(9) **What is fermentation?**

Ans.

(i) Yeast uses sugar for food.

(ii) Yeast grows and multiplies rapidly due to the carbon compounds in the sugar solution.

(iii) In the process of obtaining nutrition, yeast cells convert the carbohydrates in the food into alcohol and carbondioxide.

(iv) Also, the bacteria lactobacilli convert lactose, the sugar in milk into lactic acid.

(v) This process is called fermentation.

(10) **What is symbiosis? Give example.**

Ans.

(i) Symbiosis is a mutually beneficial relationship.

(ii) Example: Rhizobia living in root rodules of leguminous plants supply nitrates, nitrites and amino acids to that plant and in exchange get energy in the form of carbohydrates.

(11) Name different species of clostridium bacteria and the diseases caused by them.

Ans.

(i) Clostridium tetani - Tetanus

(ii) Clostridium Perfringens - Food poisoning

(iii) Clostridium botulinum - Botulism (Paralysis of muscles)

(iv) Clostridium difficile - colitis (Infection of intestive)

Q.9. Answer in brief:

(1) How is alcohol produced?

Ans.

(i) Alcohol is often produced along with sugar in sugar factories.

(ii) Molasses is produced from sugarcane juice. It is rich in carbohydrates.

(iii) Molasses is fermented with the help of the yeast saccharomyces.

(iv) In this process, ethanol (C_2H_5OH) alcohol is produced as a primary product and ester and other alcohols are produced as secondary products.

(v) Besides molasses, maize, barley and other grains are also used for industrial production of alcohol.

(vi) Glucose and fructose, the sugars present in grape juice are also fermented with the help of yeast to produce alcohol which is used to make wines.

(2) Give the uses of Lactobacilli.

Ans. Uses of Lactobacilli.

(i) Various milk products like yoghurt, buttermilk, ghee, cheese, shrikhand, etc. can be obtained by fermentation of milk.

(ii) Lactobacilli fermentation is useful for large scale production of cider, cocoa, pickles of vegetables etc.

(iii) Lactobacilli and some other useful microbes taken together are used to treat abdominal discomfort.

(iv) Leavened fodder offered to domestic cattle like cows and buffaloes is fodder fermented with the help of lactobacilli.

(v) The lactobacilli fermentation process is used to make wine and some types of bread.

(3) What is Penicillin? What is it used for?

Ans.

(i) Penicillin is a group of antibiotics obtained from a fungus, penicillium.

(ii) It is used for controlling the infections caused by bacteria like staphylococci, clostridia, streptococci etc.

(iii) Medicines containing penicillin are useful to treat certain bacterial infections of the ear, nose, throat and skin as well as diseases like pneumonia and scarlet fever.

(4) How was the antibiotic penicillin discovered?

Ans.

(i) Alexander Fleming, a professor of microbiology at St. Mary's Hospital had cultured varieties of bacteria and fungi in Petri dishes in his laboratory.

(ii) On 3rd September 1928, while observing staphylococci cultures, he made an interesting observation in one petri dish.

(iii) In that petri dish, fungal colonies had grown but the area around those colonies was clean and clear. i.e. the bacteria had actually been destroyed.

(iv) After further studies, he confirmed that the fungus growing there was Penicillium and its secretion had destroyed the bacerial colonies.

(v) Thus, the first antibiotic - penicillin had been discovered accidentlly and this formed the basis to find cures for incurable discases.

(5) What are the precautions to be followed while taking antibiotics?

Ans.

(i) Antibiotics should be taken only when prescribed by a doctor.

(ii) Don't purchase any antibiotic from medical stores without a prescription from a doctor.

(iii) Don't consume antibiotics on your own to treat common diseases like a throat infection, common cold or influenza.

(iv) Even if you feel well before completing of the prescribed course of the antibiotic you must continue and complete it.

(v) Don't suggest to others the antibiotics which were useful to you.

(6) How can we observe Rhizobium bacteria in the roots of leguminous plant?

Ans.

(i) Take a plantlet of fenugreek, groundnut or any other bean and sterilize it with a 3 to 5% solution of hydrogen peroxide.

(ii) Afterwards, keep it in a 70% solution of ethyl alcohol for 4 to 5 minutes.

(iii) Clean the roots with sterile water and take thin sections of the root nodules.

(iv) Select good section and place it an a solution of safranin for 2 to 3 minutes.

(v) Place the stained section on a glass slide, cover it with a coverslip and observe it under the compound microscope. The pinkish rod-shaped organisms are the rhizobium bacteria.

Q.10. Write down the mode of infection and preventive measures for the following:

* **(1) Write down the modes of infection and the preventive measures against fungal disease.**

Ans. Mode of infection : Contact with infected person or his/her belongings like clothes.

Preventive measure : Personal hygiene avoid contact with infected person.

(2) Write down the causative pathogen, mode of infection and preventive measures of AIDs.

Ans. Causative Pathogen : Virus.

Mode of infection : Through blood and semen of infected person and milk of mother suffering from AIDS.

Preventive measure : Safe sexual contact, avoid resuse of needles and injections.

(3) Write down the modes of infection and preventive measures against Bird Flu (H_7N_9) and swine Flue (H_1N_1).

Ans. Mode of infection : Contact with infected birds and animals.

Preventive measure : Personal hygiene, properly cooked neat.

(4) Write down the modes of infection and preventive measures against Malaria and dengue.

Ans. Mode of infection : Mosquito bite, unclean surroundings.

Preventive measure : Cleanliness of surroundings, preventing stagnation of water, controlling mosquitoes.

(5) Write down the modes of infection and preventive measures against Peumonia.

Ans. Mode of infection : Droplets spread in air by infected person.

Preventive measure : Vaccination, avoiding contact with infected person.

(6) Write down the modes of infection and preventive measures for leprosy.

Ans. Mode of infection : Long erm contact with infected person.

Preventive measure : Avoiding contact with infected persons and their belongings.

(7) What are the mode of infection and preventive measures for Hepatitis?

Ans. Mode of infection : Contaminated water and food.

Preventive measure : Use clean and filtered water, proper storage of food.

(8) What are the mode of infection and preventive measures for Influenza.

Ans. Mode of infection : Contact with infected person.

Preventive measure : Personal hygiene and avoiding contact with infected person.

Q.11. Can you recall?

(1) What is meant by microbes? What are their characteristics?

Ans. Microbes are tiny microscopic organisms which cannot be seen with the unaided eye.

Characteristics of Microbes.

(i) They are smallest organisms on earth.

(ii) They are composed of prokaryotic or eukaryotic cells.

(iii) They can be seen only with the help of microscope.

(iv) They are found in any kind of environment ranging from coolest polar regions to hottest of deserts. Also found in soil, water and air.

(v) Some of them are useful whereas some of them are harmful micro-organisms.

Q.12. Can you tell?

(1) How many different industries depend upon the lactobacilli bacteria?

Ans. Industries like milk products, cider, cocoa, pickles, pharmaceuticals depend on lactobacilli bacteria.

(2) Which types of cottage industries and factories can be started in areas with abundant milk production?

Ans. Cottage industries like manufacture of milk products like ghee, cheese, paneer, curd, shrikhand, etc. chocolate making can be started in areas with abundant milk production.

(3) Which changes do you notice in leather articles and gunny (jute) bags during the rainy season?

Ans. In rainy season we can notice whitish green cotton - like growth or black powder or white discs on leather articles and gunny (jute) bags during the rainy season as these articles are infected by fungus.

(4) For how long afterwards can you use those articles?

Ans. Those articles cannot be used for long as they wear out and do not last long.

(5) Why do these articles not get spoilt during the summer or winter?

Ans.

(i) Spores of fungi can germinate when there is sufficient moisture.

(ii) During summer or winter the weather is hot and dry and so fungus cannot grow in such weather.

(iii) Also microbes cannot survive extreme hot or cold temperatures of summer or winter. Therefore, these articles do not get spoilt during summer or winter.

Q.13. Use your brain power!

(1) Why do doctors advise you to take yoghurt or buttermilk if you have indigestion or abdominal discomfort?

Ans.

(i) The lactobacilli present in yoghurt or buttermilk helps to restore the natural microbial flora in the intestine thus helping in digestion and absorption of nutrients.

(ii) Also buttermilk helps to cool down the stomach and works as a laxative to ease the congestion during abdominal discomfort.

(2) Sometimes, yoghurt becomes bitter and froths up. Why does this happen?

Ans. Sometimes yoghurt becomes bitter due to excess fermentation by bacteria. Excess amount of lactic acid is produced making the curd bitter.

(3) Which different milk products are obtained at home by fermentation of the cream from the milk?

Ans. Yoghurt, buttermilk, ghee, cheese, shrikhand, sour cream, etc.

(4) Recently, it has been made compulsory in India and some other countries to mix 10% ethanol with fuels like petrol and diesel. What is the reason for this?

Ans.

(i) Ethanol is a smokeless and high quality fuel. So it helps to reduce pollution when mixed with petrol or diesel.

(ii) As petrol or diesel is a fossil fuel less consumption of it will lead to resourceful use of it and making the country self-efficient by moving towards sustainable fuel like ethanol.

(5) Why are wineries located near Nashik in Maharashtra?

Ans.

(i) Nashik in Maharashtra is the leading grape producer in the country as it has the soil suitable for the production of grapes.

(ii) Glucose and fructose, the sugars present in grape juice are fermented with the help of

yeast to produce wines. Therefore, wineries are located near Nashik in Maharashtra.

(6) Chapattis made from wheat only swell up but bread becomes spongy, soft and easy to digest. Why is it so?

Ans.

(i) The chapatti dough has water, which on heating converts into steam and tries to escape. While doing so, it lifts up the upper layer of the chapatti. Therefore, the chapatti swells up.

(ii) Bread is made by adding yeast to the flour. In the process of obtaining nutrition, the yeast cells convert the carbohydrates into alcohol and carbondioxide. When this dough is baked, the carbon dioxide escapes out making the bread spongy, soft and easy to digest.

(7) Salt is applied on the inner surface of pickle jars and the pickle is covered with oil. Why is this done?

Ans.

(i) Salt acts as a preservative. It prevents the growth of bacteria by forcing the microbes to lose water by osmosis. Hence, salt is applied on the inner surface of pickle jars.

(ii) Pickle is covered with oil as oil acts as preservative. It seals off the air from the item that is being pickled and provides an environment in which microbes cannot grow.

(8) Which preservatives are mixed with ready-to-eat foods to prevent them from spoiling?

Ans. Common salt, sugar, sodium benzoate, citric acid, sodium metabi-sulphite etc. are some of the preservatives mixed with ready-to-eat foods to prevent them from spoiling.

(9) Find out the uses of fungi to plants and animals?

Ans.

(i) Fungi decompose the bodies of dead animals and convert them into simple carbon compounds. These substances easily mix with air, water and soil from where they are again absorbed by plants and enter the food chain.

(ii) Some fungi living in symbiotic association with plants help to absorb water and inorganic compounds like nitrate and phosphate.

(iii) Fungi are also used to derive antibiotics like penicillin which are useful to animals.

(iv) Ants grow fungi in their anthill and obtain food from it.

(v) Some species of wasps and insects lay their eggs in the fungal bodies growing on trees thus ensuring a food supply for their larvae.

(10) What is the structure of lichen, a condiment? Where else is it used?

Ans.

(i) Lichen is a symbiotic association between a fungus and an algae (cyanobacterium).

(ii) Lichens are sensitive to environmental disturbances and are used in assessing air pollution in an area.

(iii) Lichens are also used in making dyes, perfumes and in traditional medicines.

(iv) A few lichen species are eaten by insects or animals such as reindeer.

Q.13. Collect information.

(1) Which plant and animal diseases are caused by micro-organisms and what are the measures to be taken against them?

Ans. Plant diseases:

(i) Citrus canker is a bacterial disease that affects trees of citrus fruits.

(ii) Rust of wheat is a fungal disease that affects wheat crops.

(iii) Yellow vein mosaic is a viral disease which affect vegetables like bhindi (okra).

Preventive Measures:

(i) Seeds which are healthy and disease free should be selected for sowing.

(ii) Infected plants should be removed.

(iii) Plants should be sprayed with fungicides and germicides to prevent diseases.

Animal diseases:

(i) Anthrax is a disease that affects cattle. It is caused by a bacterium.

(ii) Foot and mouth is a dangerous disease in cattle caused by a virus.

(iii) Rabies is a viral disease that affects animals.

Preventive Measures:

(i) The place where animals are kept should be washed with germicides.

(ii) Animals should be dewormed regularly.

(iii) The animals should be treated with necessary antibiotics for infectious diseases.

(iv) They should be regularly vaccinated.

(v) Take the animals to veterinary hospital for proper treatment and vaccination.

Q.14. Activity based question.
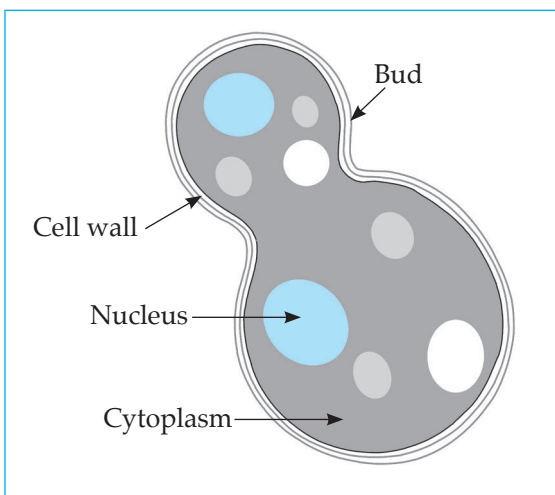
Bring 'active dry yeast' from the market. Mix a spoonful of yeast, two spoonfuls sugar with a sufficient quantity of lukewarm water in a bottle. Fix a colourless, transparent balloon on the mouth of that bottle.

What changes do you observe after 10 minutes? Mix limewater with the gas accumulated in the balloon. Collect that limewater in a beaker and observe it. What do you notice?

Ans.

(i) After 10 minutes, the balloon is filled with a gas and gets inflated.

(ii) Lime water turns milky thus proving that the gas accumulated is carbon dioxide.

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ASSIGNMENT - 8

Time : 1 Hr.	Marks : 30

Q.1. (A) Fill in the blanks: (2)

(1)   The rod-shaped bacteria found in milk or buttermilk are called ....

(2)   Fungi release .... in the food, making the food poisonous .

(B) Match the columns: (4)

Column 'A'	Column 'B'
(1) Rhizobium	(a) Food poisoning
(2) Clostridium	(b) Nitrogen fixation
(3) Penicillium	(c) Bakery products
(4) Yeast	(d) Production of antibiotics

(C) Find the odd man out: (2)

(1)   Pneumonia, Diphtheria, Chickenpox, Cholera.

(2)   Root rot, Rust (tambere), Rubella, Dengue.

Q.2. Answer the following questions in short. (Any four): (12)

(1)   What is fermentation?

(2)   Write down the modes of infection and the preventive measures against fungal disease.

(3)   Write down the modes of infection and preventive measures against AIDS.

(4)   Give Reason : Napthaline balls are kept with clothes to be put away.

(5)   What is penicillin? What is it used for?

(6)   Which vaccines are given to infants? Why?

Q.3. Answer the following questions in brief. (Any two): (10)

(1)   Write a note on Antibiotics.

(2)   How is alcohol produced?

(3)   How was the antibiotic penicillin discovered?

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9 Environmental Management

Points to Remember :

- Atmospheric conditions at a specific time at a particular place are referred to as weather.
- The climate of a particular region is the average of daily readings of various weather-related parameters recorded for several years.
- Weather is related to a specific location and specific time whereas climate is related to a longer duration and larger area.
- Climate plays a very important role in our day to day life. It influences our basic needs like food, clothing and shelter as well as our occupations.
- The science that studies the inter-relationships between the various components of air, natural cycles, geological movements of the earth and climate is called meteorology.
- Meteorology includes the study of storms, clouds, rainfall, thunder, lightning, etc. Depending upon the study of such factors, weather forecasts are made. They are useful to common people, farmers, fisheries, aviation services, water transport and various other organizations.
- The World Meteorological Organization was established by the United Nations Organization on 23rd March 1950. This organization plays an important role in food security, water management, transportation and communication.
- The Indian Meteorological Department was founded by the British in 1875 at Shimla. Its head office is at Pune and its Regional Offices are at Mumbai, Kolkata, Chennai, Nagpur and Delhi. In this institute, research goes on continuously on various aspects like instruments for climatic readings, predictions about climate made using radar, predictions about climate related to seismology, predictions regarding rainfall by satellites, air pollution, etc.
- After the famine of 1877, H. F. Blanford, the founder of IMD had made a prediction for monsoon for the first time taking the snowfall in the Himalayas as the parameter for this prediction. In the decade of the 1930's Sir Gilbert Walker had underlined the relationship between various worldwide climatic factors and the Indian monsoon, and based on available observations and previous recordings related to this relationship he put forth a hypothesis regarding the nature of the monsoon. With the initiative of Dr. Vasantrao Govarikar in the decade of the 1990's a monsoon model based upon 16 worldwide climatic parameters was developed. This model was in use from 1990 to 2002.
- Various models are used for monsoon and climate predictions are used like the Mathematical model (Dynamic model), Statistical model and Holistic model.
- Waste materials generated through various daily human activities are called solid waste.
- Solid waste is of different types like domestic waste, industrial waste, hazardous waste, farm or garden waste, electronic waste, biomedical waste, urban waste, radioactive waste and mining waste depending upon its source.

- Solid waste is classified as Biodegradable waste and Non-biodegradable waste. Biodegradable waste is easily degraded by microbes. It mainly includes kitchen waste (spoiled food, fruits, vegetables), ash, soil, dung, parts of the plants etc. Non-biodegradable waste is not easily degraded because it requires a very long period of time and the use of various techniques. It includes plastic, metal and other similar materials.

- It is the need of the hour to implement solid waste management practices to avoid the possible problems due to solid waste generated from urban and industrial areas and to maintain a clean environment.

- There are 7 principles of solid waste management - Reuse, Refuse, Recycle, Rethink, Reduce, Research and Regulation and public awareness.

- Disaster management is action implemented through proper planning, organized activity and co-ordination.

- The main objective of first aid is prevention of death, preventing deterioration of health and starting the process of rehabilitation.

- Basic principles of first aid: Life and Resuscitation – ABC – Airway, Breathing and Circulation.

- Different ways of transporting victims or patients of disaster should be used depending upon the situation like Cradle method, Carrying piggy back, Human crutch method, Pulling or lifting method, Carrying on four-hand chair, Carrying on two-hand chair, Stretcher.

MASTER KEY QUESTION SET - 9

Q.1. **(A) Fill in the blanks:**

(1) .... is that which remains constant in a region for a long duration.

(2) .... influences our basic needs like food, clothing and shelter as well as our occupations.

(3) ....is observed as 'World Meteorological Day'.

(4) Various climatic factors bring about the .... of rocks in the earth's crust.

(5) .... in the soil play an important role in formation of organic materials.

(6) The science that studies the inter-relationships between the various components of air, natural cycles, geological movements of the earth and climate is called ....

(7) .... plays an important role in food security, water management, transportation and communication.

(8) Meteorological departments have .... which are equipped with modern instruments and technology.

(9) India has launched several .... to provide predictions regarding calamities like dust storms, sand storms, heavy rainfall, tsunami etc.

(10) In the decade of 1930s, ... had underlined the relationship between various worldwide climatic factors and the Indian Monsoon.

(11) Data about current climatic parameters is mathematically analysed with the help of ....

(12) Waste materials generated through the various daily human activities are called ....

(13) Bandages, dressings, gloves, medicines, needles etc. are classified as .... waste.

(14) Remains of heavy metals like lead, cadmium, etc. from mines are .... waste.

(15) The waste that can be easily degraded by microbes is called ....

(16) If organic waste is carefully decomposed, we can get .... and .... out of it.

(17) It is the need of the hour to implement .... practices.

(18) Paper and glass can be ....

(19) If the victim has difficulty in breathing, the head should be held in a .... position.

(20) If breathing has stopped, the victim should be given artificial ventilation by ....

(21) Mouth to mouth respiration and pressing the heart down performed alternately is called ....

(22) .... is action implemented through proper planning, organized activity and co-ordination.

(23) For injuries like sprains, twisting and contusion , ... should be applied to the injured part.

(24) A .... is a portable appliance that is used to put out a fire.

Ans. (*1) Climate (2) Climate (3) 23rd March (4) weathering (5) Microbes (6) Meteorology (7) The World Meteorological Organization (8) observatories (9) satellites (10) Sir Gilbert Walker (11) Param supercomputer (12) solid waste (13) biomedical waste (14) mining waste (15) biodegradable waste (16) compost, fuel (17) solid waste management (18) recycled (19) backward sloping (20) mouth to mouth resuscitation (21) cardio-pulmonary resuscitation (CPR) (22) Disaster management (23) ice (24) fire-extinguisher*.

(B) Write the sentence with the correct answer from the options given below:

(1) Atmospheric conditions at a specific time at a particular place are referred to as ....
 (a) environment   (b) weather
 (c) climate   (d) biosphere

(2) .... is a long term predominant condition of the atmosphere.
 (a) Climate   (b) Weather
 (c) Pressure   (d) Biosphere

(3) Various climatic factors like .... are considered during construction of runways, seaports, huge bridges and skyscrapers, etc.
 (a) direction and speed of wind
 (b) temperature
 (c) atmospheric pressure
 (d) all of these

(4) The .... was established by the United Nations Organization on 23rd March 1950.
 (a) World Health Organization
 (b) National Oceanographic and Atmospheric Administration
 (c) World Meteorological Organization
 (d) Indian Institute of Tropical Meteorology

(5) .... is/are related to various weather and climatic factors.
 (a) Salinity of marine water
 (b) Formation of ocean currents
 (c) Water cycle
 (d) All of these

(6) .... is the founder of IMD.
 (a) Dr. Vasantrao Govarikar
 (b) H.F. Blanford
 (c) Sir Gilbert Walker
 (d) Dr. Radhakrishnan Nair

(7) The monsoon model based upon 16 worldwide parameters was developed by the initiative of ....
 (a) Dr. Vasantrao Govarikar
 (b) H.F. Blanford
 (c) Sir Gilbert Walker
 (d) Virghese Kurien

(8) In .... , forecasts are made taking into account the estimates of current weather related events and ongoing physical activity.
 (a) Statistical model
 (b) Holistic model
 (c) Mathematical model
 (d) All of these

(9) In ...., predictions are based upon those parameters used in other models which have the greatest effect on the monsoon.
 (a) Holistic model
 (b) Mathematical model
 (c) Statistical model
 (d) Scientific model

(10) In, ... the current climatic observations in a region are compared with earlier parameters such as oceanic temperature,

atmospheric pressure and the nature of the monsoon rainfall for several years.

(a) Mathematical model

(b) Holistic model

(c) Statistical model

(d) Dynamic model

(11) Mumbai generates .... of solid waste per day.

(a) 1700 tons   (b) 900 tons

(c) 5000 kgs   (d) 5000 tons

(12) Pune generates .... of solid waste per day.

(a) 500 tons   (b) 1700 tons

(c) 900 tons   (d) 600 tons

(13) Nagpur generates .... of waste per day.

(a) 900 tons   (b) 1700 tons

(c) 500 tons   (d) 5000 tons

(14) Radioactive materials, explosives and infectious materials are classified as .... waste.

(a) Industrial waste   (b) Biomedical waste

(c) Urban waste   (d) Hazardous waste

(15) .... are radioactive waste.

(a) Remains of heavy metals like arsenic, cadmium etc.

(b) Strontium-10, Ceium-141, Barium_140

(c) Waste from blood banks and laboratories

(d) All of these

(16) Chemicals, pigments, sludge, ash, metals, etc. are classified as .... waste.

(a) Domestic waste   (b) Industrial waste

(c) Urban waste   (d) Hazardous waste

(17) Waste food, paper, plastic, vegetable and fruit waste etc. are classified as .... waste.

(a) Industrial waste   (b) Farm waste

(c) Domestic waste   (d) Urban waste

(18) .... is the 3 R mantra.

(a) Refuse, Research, Recycle

(b) Reduce, Reuse, Recycle

(c) Reduce, Reuse, Refuse

(d) Rethink, Recycle, Reuse

(19) Period of natural degradation for banana peels is ....

(a) 1 month   (b) 1-2 weeks

(c) 3-4 weeks   (d) 2 months

(20) Period of natural degradation for cloth bags is ....

(a) 2-3 weeks   (b) 1 month

(c) 5 months   (d) 1 year

(21) Period of natural degradation for wood is ....

(a) 1 month   (b) 5 months

(c) 10-15 years   (c) 40-50 years

(22) Period of natural degradation for certain plastic bags is ....

(a) 50-100 years   (b) infinite duration

(c) 10 lakh years   (d) 1000 years

(23) Period of natural degradation for thermocol or Styrofoam cup is ....

(a) 10 lakh years   (b) infinite duration

(c) 200-250 years   (d) 1 year

(24) If any bone is fractured, it is essential that the fractured part be ....

(a) mobilized   (b) immobilized

(c) pulled   (d) massaged

(25) For transporting children and under-weight victims, ... method is used.

(a) carrying piggy back

(b) human crutch method

(c) cradle method

(d) stretcher

(26) .... method is useful to carry patients who are unconscious.

(a) Cradle

(b) Carrying piggy back

(c) Human crutch

(d) Carrying on four-hand chair

(27) .... method is used for carrying an unconscious patient through a short distance.

(a) Carrying piggy back

(b) Cradle method

(c) Carrying on two-hand chair

(d) Pulling or lifting method

(28) .... method is useful to carry patients who cannot use their hands but can hold their body upright.

(a) Carrying on four-hand chair

(b) Carrying on two-hand chair

(c) Carrying piggy back

(d) Cradle method

(29) .... method is used to carry patients when support is needed for the part below the waist.

(a) carrying on four-hand chair

(b) carrying on two-hand chair

(c) Stretcher

(d) Pulling or lifting method

(30) .... is the largest producer of electricity from solid waste.

(a) India   (b) America

(c) Japan   (d) China

(31) For injuries like sprains, twisting and contusion, ... should be applied on the injured part.

(a) turmeric powder   (b) antiseptic pad

(c) ice-pack   (d) pressure

Ans. *(1) weather (2) Climate (3) all of these (4) World Meteorological Organization (5) All of these (6) H. F. Blanford (7) Dr. Vasantrao Govarikar (8) Mathematical model (9) Holistic model (10) Statistical model (11) 5000 tons (12) 1700 tons (13) 900 tons (14) Hazardous waste (15)* Strontium-10, Ceium-141, Barium_140 *(16) Industrial waste (17) Domestic waste (18) Reduce, Reuse, Recycle (19) 3-4 weeks (20) 1 month (21) 10-15 years (22) 10 lakh years (23) infinite duration (24) immobilized (25) cradle method (26) Carrying piggy back (27) Pulling or lifting method (28) Carrying on two-hand chair (29) Carrying on four-hand chair (30) America (31) ice-pack*

*(C) Complete the statements using the proper option from those given below. Explain the statements:

(Geographic favourability, climate, weather, observatory)

(1) Of the abiotic factors that affect biodiversity by far the most important is ....

Ans. Climate.

Climate influences our basic needs like food, clothing and shelter as well as our occupations. Various factors of climate like temperature, atmospheric pressure, sunlight, rainfall, humidity etc. will decide which kind of plants and animals can survive there.

(2) A description of the climatic conditions of short duration in a particular area is ....

Ans. Weather.

Atmospheric conditions at a specific time at a particular place are referred to as weather. Weather is related to a specific location and specific time whereas climate is related to a longer duration and larger area.

(3) Irrespective of the progress of human beings, we have to think about ....

Ans. Geographical favourability.

Geographical favourability includes location, availability of water, availability of natural resources and climate of a region. This has a great impact on the progress of human beings. Countries that have more favourable factors will progress more.

(4) Establishments where various climatic factors are recorded are called ....

Ans. Observatory.

Most countries in the world have established meteorology departments for recording climatic factors. These departments have observatories which are equipped with modern instruments and technology.

Q.2. Match the columns:

(1) Column 'A'	Column 'B'
(1) Harmful waste	(a) Glass, rubber, carry bags etc.
(2) Domestic waste	(b) Chemicals, pigments, ash, etc.
(3) Biomedical waste	(c) Radioactive material
(4) Industrial waste	(d) Left over food, vegetables, peeling of fruits
(5) Urban waste	(e) Bandages, cotton, needles etc.

Ans. *(1 - c), (2 - d), (3 - e), (4 - b), (5 - a)*

(2)	Column 'A'	Column 'B'
(1)	Mining waste	(a) Leaves, flowers, crop residue.
(2)	Electronic waste	(b) Remains of heavy metals like lead, arsenic, cadmium.
(3)	Farm waste	(c) Strontium-10, Cerium-141, Barium-140
(4)	Radioactive waste	(d) Cell phones, TV sets, Computers

Ans. *(1 - b), (2 - d), (3 - a), (4 - c)*

(3)	Column 'A'	Column 'B'
(1)	Banana peelings	(a) 10 lakh years.
(2)	Plastic bags	(b) 200-250 years.
(3)	Leather shoes	(c) 3-4 weeks
(4)	Aluminium cans	(d) 40-50 years

Ans. *(1 - c), (2 - a), (3 - d), (4 - b)*

(4)	Column 'A'	Column 'B'
(1)	Thermocol	(a) 1 year.
(2)	Tin cans	(b) Infinite duration.
(3)	Woollen socks	(c) 10-15 years
(4)	Wood	(d) 50-100 years

Ans. *(1 - b), (2 - d), (3 - a), (4 - c)*

Q.3. **State whether the following statements are true or false and if false, write the correct statement:**

(1) Climate is a long term predominant condition of the atmosphere.

Ans. **True.**

(2) Climate changes continuously.

Ans. **False.** Climate does not change continuously. It remains constant in a region for a long duration.

(3) If present climatic conditions are analysed with reference to the past climatic conditions, we can predict climatic changes of the future.

Ans. **True.**

(4) Forecasting is difficult for places where climatic changes are slow and of a limited nature.

Ans. **False.** Forecasting is easy for places where climatic changes are slow and of a limited nature.

(5) Climate plays a very important role in the formation and enrichment of soil.

Ans. **True.**

(6) Prediction maps are prepared once in 24 hours.

Ans. **False.** Prediction maps are prepared twice in every 24 hours.

(7) The first prediction of monsoon in India was made by Dr. Vasantrao Govariakar.

Ans. **False.** The first prediction of monsoon in India was made my H.F. Blanford.

(8) H.F. Blanford used the rainfall in Kerala as the parameter for prediction of monsoon in India.

Ans. **False.** H.F. Blanford used the snowfall in Himalyas as a parameter for prediction of monsoon in India.

(9) In Holistic model, predictions are made taking into account estimates of current weather related events and ongoing physical interactions between them.

Ans. **False.** In Holistic model, predictions are based upon those parameters used in other models which have the greatest effect on monsoon.

(10) Any meteorological model depends upon the inter-relationships between parameters used in that model and the results expected from it.

Ans. **True.**

(11) Remains of heavy metals like lead, arsenic, cadmium etc. from mines are industrial waste.

Ans. **False.** Remains of heavy metals like lead, arsenic, cadmium etc. from mines are mining waste.

(12) Use of 'use and throw' type of articles like pens, canned cold drinks, tetra packs should be encouraged in waste management.

Ans. **False.** Use of 'use and throw' type of articles like pens, canned cold drinks, tetra packs should be strictly avoided in waste management.

(13) We should use tissue paper instead of one's own handkerchief for effective waste management.

Ans. **False.** We should use one's own handkerchief instead of tissue paper for effective waste management.

(14) Certain plastic bags take 1 month to degrade.

Ans. **False.** Certain plastic bags take 10 lakh years to degrade.

(15) Banana peelings can degrade in 3-4 weeks.

Ans. **True.**

(16) If the victim has burn injuries, it is beneficial to cover the burnt part with blanket.

Ans. **False.** If the victim has burn injuries, it is beneficial to hold the injured part under clean and cold flowing water for at least 10 minutes.

(17) CPR helps to bring the circulation to normal.

Ans. **True.**

(18) If breathing has stopped, the head should be held in backward sloping position.

Ans. **False.** If breathing has stopped, the victim should be given artificial ventilation by mouth to mouth resuscitation.

(19) Japan is the largest producer of electricity from solid waste.

Ans. **False.** America is the largest producer of electricity from solid waste.

(20) China has developed the projects of production of threads, paper and other useful materials from banana peelings.

Ans. **False.** Japan has developed the projects of production of threads, paper and other useful materials from banana peelings.

Q.4. **Find the odd man out:**

(1) Waste food, paper, plastic, bandages.

Ans. **Bandages.** It is a biomedical waste whereas the others are domestic waste.

(2) Pesticides, fertilizers, crop residue, Sludge.

Ans. **Sludge.** It is an industrial waste whereas the others are farm waste.

(3) Strontium -10, Cerium – 141, Barium – 140, Cadmium.

Ans. **Cadmium.** It is a mining waste whereas the others are radioactive waste.

(4) Banana peels, Cloth bag, Food waste, Plastic bag.

Ans. **Plastic bag.** It is a non-biodegradable waste whereas the others are degradable wastes.

(5) Fruits, Ash, Metals, Vegetables.

Ans. **Metal.** It is a non-biodegradable waste whereas the others are degradable wastes.

Q.5. **Complete the analogy:**

(1) Specific duration and specific time: Weather : : Longer duration and longer time : ....

(2) Mumbai : 5000 tons solid waste : : Pune : ....

(3) Kitchen waste, parts of plants : Wet solid waste : : Plastic, metals : ....

(4) Largest producer of electricity from solid waste : America : : Production of useful materials from banana peelings : ....

(5) Cloth bags : 1 month : : Rags : ....

(6) Tin cans : 50-100 years : : Aluminium cans : ....

(7) Wood : 10-15 years : : Styrofoam : ....

Ans. *(1) Climate (2) 1700 tons solid waste (3) Dry solid waste (4) Japan (5) 5 months (6) 200-250 years (7) Infinite duration*

Q.6. **Define:**

(1) **Weather**

Ans. Atmospheric conditions at a specific time at a particular place are referred to as weather.

(2) **Climate**

Ans. The climate of a particular region is the average of daily readings of various weather-related parameters recorded for several years.

(3) **Meteorology**

Ans. The science that studies the inter-relationships between the various components of air, natural cycles, geological movements of earth and climate is called meteorology.

(4) **Solid waste**

Ans. Waste materials generated through daily human activities are called solid waste.

Q.7. **Answer the following:**

*****(1)** **Why is e-waste harmful? Express your opinion about this.**

Ans.

(i) E-waste is electronic waste which includes non-functional TV Sets, cell phones, music systems, computers and their parts, etc.

(ii) E-waste contains heavy metals like lead, beryllium, mercury and cadmium.

(iii) These metals accumulate in the soil for long periods and thus affect the biodiversity of the soil.

(iv) Many a times e-waste like battery etc. contain acids which make the soil acidic.

(v) E-waste can cause ground water pollution, which also affects living organisms when they drink this polluted water.

(vi) Thus E-waste affects human health and soil microorganisms directly or indirectly.

(2) What is the necessity of solid waste management?

Ans. Necessity of solid waste management:

(i) For preventing environmental pollution and to keep the surroundings clean.

(ii) For energy as well as fertilizer production and through that to generate work and employment opportunities.

(iii) To reduce the strain on natural resources through treatment of solid waste.

(iv) To improve the health and quality of life and to maintain environmental balance.

(3) What are the harmful effects of solid waste?

Ans. Harmful effects of solid waste:

(i) Effect on biodiversity.

(ii) Releases bad odour.

(iii) Produces toxic gases.

(iv) Leads to degradation of natural beauty.

(v) Leads to pollution of air, water and soil.

(vi) Spreads diseases.

(4) What first-aid should be given for injuries like sprains, twisting and contusion?

Ans. For injuries like sprains, twisting and contusion, the 'RICE' remedy should be applied:

(i) **Rest:** Allow the victim to sit in a relaxed position.

(ii) **Ice:** Apply an ice-pack to the injured part.

(iii) **Compression:** After the ice-pack treatment, the injured part should be massaged gently.

(iv) **Elevate:** The injured part should be kept in a raised/elevated position.

(5) Why do meteorogical models need to be changed continually?

Ans.

(i) Any meteorological model depends upon the inter-relationship between parameters used in that model and the results expected from it.

(ii) However, as these inter-relationships with reference to the ocean and atmosphere are never constant, meteorological models need to be changed continually.

*(6) Explain with suitable examples, the relationship between weather forecasting and disaster management.

Ans.

(i) Depending upon the factors such as storms, clouds, rainfall etc. weather forecasts are made. It is useful in aviation, shipping, fishing, industries as well as during natural calamities like dust storms, sand storms, heavy rainfall, tsunami etc where proper predictions are made with well equipped satellites and highclass technology.

(ii) Observatories at several locations are doing excellent work in the analysis of the information received from these satellites.

(iii) This data can be used in prevention of losses and danger, improving tolerance, providing relief from disaster, minimising the intensity and extent of harm as well as preparation to face the disaster.

(7) Forecasts about which weather related factors are given during the news bulletins on Doordarshan and Akashwani?

Ans. Forecasts about weather related factors like atmospheric pressure, sunlight, clouds, velocity, humidity, rainfall, visibility and temperature are given during the news bulletins on Doordarshan and Akashwani.

(8) What is urban waste? What does it include?

Ans.

(i) Waste generated through household industries and large commercial and industrial establishments is called urban waste.

(ii) It includes carry bags, glass, metal pieces and rods, threads, rubber, paper, cans from shops, waste from vegetable and meat markets, construction waste etc.

(9) What does biomedical waste include?

Ans. Biomedical waste includes bandages, dressings, gloves, needles, saline bottle, medicines, medicine bottles, test tubes, body parts, blood etc. from clinics, hospitals, blood banks and laboratories.

Q.8. Answer in brief:

*(1) **State the scientific and eco-friendly methods of waste management.**

Ans. Following are the scientific and eco-friendly methods of waste management:

(i) **Waste separation:** In this method, dry and wet wastes are separated, stored and later collected for proper use.

(ii) **Composting:** Decomposition of degradable kitchen waste in small pits in the backyard, garden or terrace is called composting. Good quality manure can be produced by composting leftover food, peels of fruits, vegetables etc.

(iii) **Vermicomposting:** Converting solid waste into manure or compost with the help of earthworms is called vermicomposting.

Vermicompost manure is highly nutritious and can be used for agricultural purposes and garden plants.

(iv) **Secured landfill:** Solid waste is disposed off in secured landfills. The site for secured landfill is selected 2 km away from water bodies and human habitation. Care is taken to see that the site does not fall in sensitive zone. The landfills are layered with clay and plastic and then the garbage is spread and left to decompose naturally.

(v) **Pyrolysis:** In this method, the waste is heated to a high temperature to obtain gas and electricity. Semi-combustible waste is burnt in pyrolysis. It is suitable for municipal solid waste management.

(vi) **Incineration:** Biomedical waste is burnt in incinerators to kill the pathogens. Disinfection and sterilization is also done while treating the biomedical waste.

*(2) **How will you register your individual participation in solid waste management?**

Ans. We can register our individual participation in solid waste management in the following ways:

(i) **Following the 3R mantra:** Reduce (reducing the waste), reuse (reuse of waste) and recycle (recycling of waste).

(ii) Throwing plastic wrappers of chocolates, ice-creams, biscuits, etc. into dust bins. Avoid littering.

(iii) Avoiding the use of plastic bags and instead using cloth bags or bags prepared from old sarees, bed-sheets, curtains etc.

(iv) Using both sides of a paper for writing. Reusing greeting cards and gift papers.

(v) Avoiding use of tissue paper and preferring to use one's own handkerchief.

(vi) Using rechargable batteries instead of lead batteries.

(vii) Implementing various programmes of solid waste management and educating, encouraging the family and society in this regard.

(viii) Avoiding 'use and throw' type of articles like pens, canned cold drinks and tetra-packs etc.

(3) **What are the principles of solid waste management?**

Ans. Principles of solid waste management:

(i) **Reuse:** After use, materials should be reused for some other proper purposes.

(ii) **Refuse:** Refusal to use articles made from non-degradable articles like plastic and thermocol.

(iii) **Recycle:** Production of useful articles by recycling solid wastes. For example, paper and glass can be recycled.

(iv) **Rethink:** Rethinking our habits, activities and their consequences in connection with the use of various articles of daily use.

(v) **Reduce:** Restriction the use of resources to avoid their wastage. Old materials should be reused. One thing should be shared by many use and throw type of objects should be avoided.

(vi) **Research:** Conducting research related to reuse of materials that are temporarily out of use.

(vii) **Regulation and Public awareness:** Following the laws and rules related to waste management and motivating others to do the same.

(4) **What is disaster management? What actions does it include?**

Ans. Disaster management is action implemented through proper planning, organized activity and co-ordination.

It includes the following:

(i) Prevention of loss and danger.

(ii) Improving tolerance.

(iii)　Providing relief from disaster, minimising the intensity and extent of harm.

(iv)　Preparation to face the disaster.

(v)　Immediate action in the disaster situation.

(vi)　Assessment of damages and intensity of the disaster.

(vii)　Arranging for rescue work and help.

(viii)　Rehabilitation and rebuilding.

* **(5)** **Give examples of the importance of climate in the living world with explanations, in your own words.**

Ans.

(i)　Daily weather as also long term climatic conditions influence human lifestyle directly or indirectly. Land, water bodies, plants and animals collectively form the natural environment on earth. This environment is responsible for the development of organisms.

(ii)　The climate of a particular region helps to determine the diet, clothing, housing, occupations and lifestyle of the people of that region. For example, the characteristic lifestyle of Kashmiri and Rajasthani people.

(iii)　Salinity of marine water, formation of oceanic currents, water cycle, etc. are all related to various weather and climatic factors.

(iv)　Various climatic factors bring about the weathering of rocks in the earth's crust.

(v)　Climate plays a very important role in the formation and enrichment of soil.

(vi)　Microbes in the soil play an important role in formation of organic materials. This process depends upon various climatic factors.

* **(6)** **Explain with suitable examples, the care to be taken when using methods of transporting patients.**

Ans.

(i)　**Cradle Method:** This method is used for children and under-weight victims.

(ii)　**Carrying piggy back:** This method is used for carrying patients who are unconscious.

(iii)　**Human crutch method:** If one of the legs is injured, the victim should be supported with minimum load on the other leg.

(iv)　**Pulling or lifting method:** This method is used for carrying an unconscious patient, through a short distance.

(v)　**Carrying on four-hand chair:** This method

is used when support is needed for the part below the waist.

(vi)　**Carrying on two-hand chair:** This method is useful for those patients who cannot use their hands but can hold their body upright.

(vii)　**Stretcher:** In an emergency, if a conventional stretcher is not available, then a temporary stretcher can be made using bamboo, blanket, etc.

* **(7)** **How is first aid provided to victims of disasters who are injured?**

Ans.

(i)　**Bleeding:** If the victim is injured and bleeding through the wound, should be covered with an antiseptic pad and pressure applied on it for 5 minutes with either thumb or palm.

(ii)　**Fracture and impact on vertebrae:** If any bone is fractured, it is essential that the fractured part be immobilized. It can be done with the help of any available wooden rods / batons / rulers. If there is an impact on the back or vertebral column; the patient should be kept immobile on a firm stretcher.

(iii)　**Burns:** If victims have burn injuries, it is beneficial to hold the injured part under clean and cold flowing water for at least 10 minutes.

(8) **How is Solid Waste classified? OR**
What are the sources of Solid Waste?

Ans.

(i)　**Domestic waste:** Waste food, paper, plastic paper, plastic bags, vegetable waste, fruit skins, glass and sheet metal articles, etc.

(ii)　**Industrial waste:** Chemicals, pigments, sludge, ash, metals, etc.

(iii)　**Hazardous waste:** Chemicals generated in various industries, radioactive materials, explosives, infectious materials, etc.

(iv)　**Farm/Garden waste:** Leaves, flowers, branches of trees, crop residues like straw, animal urine and dung, pesticides, remains of various chemicals and fertilizers, etc.

(v)　**Electronic waste:** Non-functional TV sets, cell phones, music systems, computers and their parts, etc.

(vi)　**Biomedical waste:** Bandages, dressings, gloves, needles, saline bottles, medicines, medicine bottles, test tubes, body parts, blood, etc. from clinics, hospitals, blood banks and laboratories.

(vii) **Urban waste:** Waste generated through household industries and large commercial and industrial establishments, carry bags, glass, metal pieces and rods, threads, rubber, paper, cans from shops, vegetable and meat markets, construction waste, etc.

(viii) **Radioactive waste:** Radioactive materials like Strontium-10, Cerium-141, Barium-140 and heavy water, etc. generated from atomic energy plants, uranium mines, atomic research centres, nuclear weapons testing sites, etc.

(ix) **Mining waste:** Remains of heavy metals like lead, arsenic, cadmium, etc. from mines.

Q.9. **Write short notes on:**

* **(1)** **Meteorology:**

Ans.

(i) The science that studies the inter-relationship between the various components of air, natural cycles, geological movements of the earth and climate is called meteorology.

(ii) Meteorology includes the study of storms, clouds, rainfall, thunder, lightning etc.

(iii) Depending upon the study of such factors, weather forecasts are made.

(iv) They are useful to common people, farmers, fisheries, aviation services, water transport and various other organizations.

* **(2)** **Climatic factors:**

Ans.

(i) The climate of a particular region is the average of daily readings of various weather-related parameters recorded for several years.

(ii) Climatic factors include direction and speed of wind, temperature, atmospheric pressure, clouds, rainfall, humidity, visibility etc.

(iii) These factors influence our basic needs like food, clothing shelter as well as our occupations.

(iv) Various climatic factors bring about the weathering of rocks in the earth's crust.

(v) Microbes in the soil play an important role in formation of organic materials. This process also depends upon various climatic factors.

* **(3)** **Monsoon model:**

Ans.

(i) The tradition of forecasting the monsoon season in India is older than 100 years.

(ii) After the famine of 1877, H.F. Blanford, the founder of IMD had made such a prediction for the first time taking the snowfall in Himalayas as a parameter for this prediction.

(iii) In the decade of the 1930's, the then director of IMD, Sir Gilbert Walker had underlined the relationship between various worldwide climatic factors and the Indian monsoon and based on available observations and previous recordings related to this relationship, he put forth a hypothesis regarding the nature of the monsoon.

(iv) With the initiative of Dr. Vasantrao Govarikar in the decade of the 1990's a monsoon model based upon 16 worldwide climatic parameters was developed. This model was in use from 1990 to 2002.

(v) Presently, new models are being developed at IITM.

Work is in progress at two levels, namely designing new models and developing new technology.

(vi) The main focus is on development of the radar system and satellite technology.

* **(4)** **Plastic waste:**

Ans.

(i) Plastic waste is the accumulation of plastic products in the environment that adversely affects environment, humans and animals.

(ii) Plastic waste is excessively generated as plastic is inexpensive and durable.

(iii) Plastic is slow to degrade. It takes around 10 lakh years for certain plastic bags to degrade.

(iv) Plastic waste affects land and water.

(v) It also affects the health of animals, cattle unknowingly ingest these plastic bags leading to stomach cancer in them.

(vi) Plastic also releases toxic chemicals which are carcinogenic to humans.

(vii) To avoid plastic waste, cloth bags should be used instead of plastic bags. Plastic articles should be recycled.

* **(5)** **Industrial waste:**

Ans.

(i) Industrial waste is the waste produced by industrial processes or activities.

(ii) There is a huge variety of industries producing different types of materials and articles. All of

these use raw materials and give out a lot of waste.

(iii) There are hundreds of mines which extract copper, silver, gold, iron, coal etc. Huge quantities of waste are produced while processing them.

(iv) Cement industries give out solid, liquid and gaseous wastes.

(v) While refining crude oil, a lot of poisonous gaseous and liquid wastes are produced.

(vi) Construction units produce huge quantities of waste stones, pebbles, broken bricks, wood waste etc. Mostly they are dumped in landfills.

(vii) It also includes chemicals, pigments, sludge, ash, metal, etc. given out from mining, textile, construction, chemical industries.

* (6)   Principles of first aid:

Ans.   First aid is provided to disasters victims in life and resuscitation manner - ABC.

(i)   **Airway:** If the victim has difficulty in breathing, the head should be held in a backward sloping position or the chin should be raised so that the respiratory passage remains open.

(ii)   **Breathing:** If breathing has stopped, the victim should be given artificial ventilation by mouth to mouth resuscitation.

(iii)   **Circulation:** If the victim is unconscious, then after giving mouth to mouth respiration twice, the heart should be pressed down hard by pressing the chest with both the palms. These two actions should be repeated alternately about 15 times. This is called cardio-pulmonary resuscitation (CPR). If helps to bring the circulation back to normal.

(7)   Indian Meteorological Department:

Ans.

(i)   The Indian Meteorological Department was founded by the British in 1875 at Shimla.

(ii)   Its head office is at Pune and its Regional offices are at Mumbai, Kolkata, Chennai, Nagpur and Delhi.

(iii)   Maps are prepared every day which indicate the daily predictions about the weather. Such maps are prepared and published twice in every 24 hours.

(iv)   In this institute, research goes on continuously on various aspects like instruments for climatic readings, predictions made about climate using radar, predictions about climate

related to seismology, predictions regarding rainfall by satellites, air pollution etc.

(v)   The Indian Meteorological Department provides information regarding weather and climatic conditions to other departments like aviation, shipping, agriculture, irrigation, marine oil exploration and production etc.

(vi)   Predictions regarding calamities like dust storms, sand storms, heavy rainfall, hot and cold waves, tsunami, etc. are communicated to various departments, all types of mass communication media and all citizens.

(vii)   India has launched several satellites equipped with highclass technology.

(viii)   Observatories at several locations are doing excellent work in the analysis of the information received from these satellites.

(8)   Mathematic model (Dyanic model):

Ans.

(i)   Forecasts are made with the help of mathematical models which take into account estimates of current weather related events and ongoing physical interactions between them.

(ii)   Data about current climatic parameters is mathematically analysed with the help of the Param Supercomputer.

(iii)   Various mathematical models based upon daily geographic events are developed by supercomputer technology.

(9)   Statistical Model:

Ans.

(i)   In this model, current climatic observations in a region are compared with earlier parameters such as oceanic temperature, atmospheric pressure and the nature of the monsoon rainfall for several years.

(ii)   This data is comparatively analysed by statistical methods and predictions are made about the monsoon in the present conditions.

(10)   Holistic Model:

Ans.

(i)   In this model, predictions are based upon those parameters used in other models which have the greatest effect on the monsoon.

(ii)   Nowadays, predictions declared by IMD are the collective outcome of various model. This is called a holistic model.

Q.10. Distinguish between:

*(1) Weather and Climate:

Weather	Climate
(i) Atmospheric conditions at a specific time at a particular place are referred to as weather.	(i) The climate of a particular region is the average of daily readings of various weather-related parameters recorded for several years.
(ii) Weather can change continuously.	(ii) Climate remains constant in a region for a long duration.
(iii) Weather is related to a specific location and specific time.	(iii) Climate is related to a longer duration and larger area.
(iv) Changes in the weather may occur for short periods of time.	(iv) Changes in the climate take place slowly over a much long duration.

*(2) Degradable and non-degradable wastes:

Degradable Waste	Non-degradable Waste
(i) This type of waste is easily degraded by microbes.	(i) This type of waste is not easily degraded by microbes because it takes a very long period of time and the use of various techniques.
(ii) It includes kitchen waste (spoiled food, fruits, vegetables), ash, soil, dung, parts of the plants etc.	(ii) It includes plastic, metal and other similar materials.
(iii) It is also called wet solid waste or wet garbage.	(iii) It is also called dry solid waste or dry garbage.
(iv) If it is carefully decomposed, we can get compost and fuel of good quality from it.	(iv) It can be recycled.

Q.11. Can you tell?

(1) What is meant by pollution?

Ans. Contamination of natural environment that can harmfully affect the ecosystem is called as pollution.

(2) In which different ways do our surroundings get polluted?

Ans.

(i) Air pollution is caused due to emissions from industries, vehicles, burning of fossil fuels, construction, mining and agriculture.

(ii) Water pollution is caused by domestic sewage and industrial waste water released into the water bodies.

(iii) Soil pollution is caused due to industrial wastes, domestic waste, chemical fertilizers, biomedical waste and pesticides.

(iv) Noise pollution is caused by machines, vehicular traffic, loudspeakers and household appliances.

(3) What is meant by solid waste?

Ans. The waste materials generated through the various daily human activities are called solid waste.

(4) What are the different things included in solid waste?

Ans. Domestic waste, industrial waste, hazardous waste, electronic waste, biomedical waste, urban waste, radioactive waste and mining waste are the different things included in solid waste.

(5) What are the different types of casualties that are seen to occur in different types of disasters?

Ans. (i) Death

(ii) Injuries

(iii) Loss of limbs or body parts

(iv) Burns

(v) Diseases

(vi) Fractures

(vii) Bleeding

(viii) People becoming unconscious

Q.12. Use your brain power.

(1) Which factors are affected favourably or unfavourably by climate? What must we do to minimize the effect?

Ans.

(i) Climate plays a very important role in our day to day life.

(ii) It influences our basic needs like food, clothing and shelter as well as our occupations.

(iii) Climate is especially important for an agrarian country like India. Also climatic factors like direction and speed of the wind, temperature, atmospheric pressure etc. are also considered during construction work.

(iv) The science of meteorology helps in predicting climatic conditions by satellites in different ways such as prediction of rainfall, air pollution, dust storms, hot and cold waves tsunamic etc so that all the citizens are well-equipped beforehand and can take preventive measures.

(2) **Why is it necessary to recycle non-degradable waste?**

Ans.

(i) Non-degradable waste cannot be easily degraded because it takes a very long period of time and the use of various techniques.

(ii) Therefore non-degradable waste should be recycled so, that it does not accumulate and cause hazards to the environment.

(3) **Which materials are included in solid dry waste?**

Ans. Solid dry waste includes paper, plastic, metals, glass, cardboard, thermocol etc.

(4) **Make a list of various waste materials and articles in your area and prepare a chart as follows:**

Ans.

	Material	Degradable (Organic)	Non-degradable (Inorganic)	Recycling	Reuse	Toxic
(1)	Plastic bottle	No	Yes	Yes	Yes	Yes
(2)	Paper	Yes	No	Yes	Yes	No
(3)	Vegetable and fruit peels	Yes	No	No	No	No
(4)	Empty tins	No	Yes	Yes	Yes	Yes
(5)	Glass pieces	No	Yes	Yes	Yes	No
(6)	Dried flowers	Yes	No	No	No	No
(7)	Rags	Yes	No	Yes	Yes	No
(8)	Fused bulbs and tube lights	No	Yes	Yes	Yes	Yes
(9)	Leftover food	Yes	No	No	No	No
(10)	Plastic bags	No	Yes	Yes	Yes	Yes

Q.13. Think about it:

(1) **Into which two categories can the waste materials in the lists above be classified?**

Ans. The waste materials can be classified as biodegradable waste and non-biodegradable waste.

Q.14. Find out:

(1) **Nowadays, an electronic device - the cell phone - is very popular. From a mobile shop near your house, find out how they dispose off old and broken down cell phones.**

Ans. Old and broken down cell phones are sold to scrap dealers, who sell to a bigger dealer where reusable parts are taken out and useless parts are sent for recycling.

(2) **Which waste management processes are used in your village / town / city?**

Ans.

(i) The Municipal Corporation or Municipality collects the various kinds of wastes like dry waste, solid waste, biomedical waste in different coloured containers and transports them to areas where they are treated and disposed off.

(ii) Industrial waste is mostly recycled and biomedical waste is treated by the scientific methods mentioned below.

(a) **Solid waste** is disposed off in secured land fills. The site for secured landfill is selected 2 km away from water bodies and away from human habitation. Care is taken to see that

the site does not fall in sensitive zone. The landfills layered with clay and plastic and then the garbage is spread and left.

(b) **Pyrolysis** is done for semi combustible material. Semi combustible materials are heated to high temperature by gas and electricity.

(c) The municipality can also set up biogas plants where the solid waste is converted to biogas by anaerobic fermentation. The biogas can be used to generate power and also a good manure which can be used for agriculture.

(d) **Bimedical waste** is burnt in incinerators to kill the pathogens. Disinfection and sterilization is also done while treating biomedical waste by the Municipal Corporation.

These are some of the waste management processes used in village / town / city.

Q.15. Activity based Questions:

(1) **Observe the garbage collected in the dustbin of your classroom and make a list of the various materials in it.**

Discuss with your teacher, how these materials can be properly disposed off. Can we do the same with the garbage generated in our house? Think about it.

Solid Waste

Ans.

(i) Garbage collected in classroom dustbin:
   (a) Waste paper and paper bits.
   (b) Pencil shavings
   (c) Wrappers of chocolates, biscuits etc.
   (d) Left over food from tiffins and fruit peels.
   (e) Empty ball pen refills.

(ii) Out of these left over food from tiffins and fruit peels and pencil shaving can be used to make compost manure in school garden.

The remaining waste can be sold to scrap dealers and sent for recycling.

(iii) Yes, we can do the same with the garbage generated in the house.

(2) **What is the main difference between what we see in the two pictures alongside (A and B).**

(A)

(B)

Ans.

(i) We see that in picture A there is lot of garbage spread around making the place very dirty, whereas in picture B, there is no garbage and the place is absolutely neat and clean.

(3) **What should we do to permanently maintain the condition seen in picture B?**

Ans. To permanently maintain the condition seen in picture B, we should follow the 3R mantra (Reduce, Reuse, Recycle). Also, we must avoid littering, throwing plastic bags, wrappers of chocolates, ice-creams, biscuits etc.

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ASSIGNMENT - 9

Time : 1 Hr.	Marks : 30

Q.1. (A) Fill in the blanks: **(2)**

(1) .... influences our basic needs like food, clothing and shelter as well as our occupations.

(2) .... is action implemented through proper planning, organized activity and co-ordination.

(B) Match the columns: **(2)**

Column 'A'	Column 'B'
(1) Harmful waste	(a) Glass, rubber, carry bags, etc.
(2) Domestic waste	(b) Chemicals, pigments, ash, etc.
(3) Biomedical waste	(c) Radioactive material
(4) Industrial waste	(d) Left over food, vegetables, peelings of fruits.
	(e) Bandages, cotton, needles, etc.

(C) State whether the following statements are true or false. If false, rewrite the correct statement: **(2)**

(1) If the victim has burn injuries, it is beneficial to cover the burnt part with blanket.

(2) Certain plastic bags take 1 month to degrade.

Q.2. Answer the following questions in short: **(8)**

(1) Why is e-waste harmful? Express your opinion about this.

(2) Write a note on meteorology.

(3) Write a note on Plastic waste.

(4) Distinguish between weather and climate.

Q.3. Answer the following questions in brief. (Any two): **(6)**

(1) What are the principles of first aid?

(2) How is first-aid provided to victims of disasters who are injured?

(3) Explain with suitable examples, the relationship between weather forecasting and disaster management.

Q.4. Answer the following in detail: **(10)**

(1) State the scientific and eco-friendly methods of waste management.

(2) Explain with suitable examples, the care to be taken when using methods of transporting patients.

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10 Information Communication Technology: The new direction of progress

Information Communication Technology: The new direction of progress

Devices

| Computer | Radio | Television Set | Mobile |

Computer
- Components
- Memory → Internal → RAM / External → ROM
- Operating System
- Program
- Data
- Hardware
- Software ← Microsoft Word / Microsoft Powerpoint / Microsoft Excel / Adobe Reader

Television Set — Generations
- 1st Generation
- 2nd Generation
- 3rd Generation
- 4th Generation
- 5th Generation

Mobile — Opportunities
- Software field
- Hardware field
- Training
- Marketing

MASTER KEY QUESTION SET - 10

*Q.1. (A) Fill in the blanks and rewrite the complete statements:

(1) While working with a computer we can read the information stored in its memory and perform other actions in .... memory.

(2) While presenting pictures and videos about the works of scientists, we can use ....

(3) To draw graphs based on the quantitative information obtained in an experiment, one uses ....

(4) The first generation computers used to shut down because of ....

(5) A computer will not work unless .... is supplied to it.

Ans. *(1) RAM (Random Access Memory) (2) Microsoft Powerpoint (3) Microsoft Excel (4) excessive heat generation (5) operating system*

(B) Rewrite the following statements by selecting the correct options given below:

(1) .... includes communication devices and the use of those devices as well as the services provided with their help.
(a) Operating System
(b) Office
(c) Computers
(d) Information Communication Technology

(2) .... are used for sharing information.
(a) Telephones   (b) Hard disks
(c) RAM   (d) ROM

(3) Hard disks are used for .... information.
(a) Storing   (b) Communicating
(c) Sharing   (d) All of the above

(4) Computers are used for .... information.
(a) Storing   (b) Managing
(c) Sharing   (d) All of the above

(5) Computers have gone through .... generations.
(a) 5   (b) 7   (c) 10   (d) 8

(6) First generation of Computers were considered to be present in the period of ....
(a) 2000 – 2001   (b) 1901 – 2001
(c) 1946 - 1959   (d) 1996 - 2001

(7) Full form of RAM is ....
(a) Roaming Application Memory
(b) Random Accessible Media
(c) Random Access Memory
(d) None of the above

(8) Full form of ROM is ....
(a) Roaming Only Memory
(b) Random Output Media
(c) Read Only Memory
(d) None of the above

(9) RAM and ROM are 2 types of .... memory.
(a) external   (b) internal
(c) physical   (d) garbage

(10) The information stored in ROM is only ...., changes cannot be made.
(a) external memory (b) readable
(c) accessible   (d) physical

(11) .... is a group of commands to be given to the computer.
(a) Program   (b) Memory
(c) Data   (d) Operating System

(12) .... communicates between the computer and the person working on it.
(a) Program   (b) Memory
(c) Data   (d) Operating System

(13) .... is a raw information.
(a) Program   (b) Memory
(c) Data   (d) Operating System

Ans. *(1) Information Communication Technology (2) Telephones (3) Storing (4) All of the above (5) 5 (6) 1946-1959 (7) Random Access Memory (8) Read Only Memory (9) Internal (10) readable (11) Program (12) Operating System (13) Data*

(C) Complete the table:

Name of the device	What is it used for?	Where is it used?	Benefits from its use
Computer / laptop			
Mobile			
Radio			
Television set			

Ans.

Name of the device	What is it used for?	Where is it used?	Benefits from its use
Computer / laptop	To process the data	Office, Schools	1. Faster Processing 2. Larger storage of data
Mobile	Communication	Office, Schools	1. Portable
Radio	Mass Communication	House, Office	1. Music 2. News
Television set	Mass Communication	House, Office	1. Entertainment 2. News

Q.2. **State whether the following statements are true or false and if false, write the correct statement:**

(1) **RAM and ROM are the types of external memory.**

Ans. **False,** RAM and ROM are the types of internal memory.

(2) **ICT includes communication devices and the use of those devices as well as services provided with their help.**

Ans. **True.**

(3) **A computer cannot be used without operating system.**

Ans. **True.**

(4) **Microsoft Excel is used to make PowerPoint.**

Ans. **False,** Microsoft Excel is used to make spreadsheets.

(5) **Software refers to the set of commands given to the computer.**

Ans. **True**

Q.3. **Write the Full forms of the following:**

(1) **ICT**

Ans. Information Communication Technology

(2) **OS**

Ans. Operating System

(3) **RAM**

Ans. Random Access Memory

(4) **ROM**

Ans. Read Only Memory

(5) **CPU**

Ans. Central Processing Unit

(6) **DOS**

Ans. Disk Operating System

(7) **PDF**

Ans. Portable Document Format

(8) **ALU**

Ans. Arithmetic Logical Unit

(9) **GUI**

Ans. Graphical User Interface

(10) **C-DAC**

Ans. Centre for Development of Advanced Computing

(11) **ISCII**

Ans. Indian Script Code for Information Interchange

Q.4. **Match the columns:**

Column 'A'	Column 'B'
(1) Antivirus	(a) Output Device
(2) OS	(b) Software
(3) CPU	(c) Input Device
(4) Printer	(d) Operating System
(5) Mouse	(e) Brain of the computer

Ans. *(1 - b), (2 - d), (3 - e), (4 - a), (5 - c)*

Q.5. **Answer the following in one or two sentences:**

(1) **Name the computer which was made between 1946 - 1959.**

Ans. The ENIAC computer was made in the period of 1946 – 1959.

(2) **Give one example of Input Unit.**

Ans. Keyboard.

(3) **Name the 3 major parts of the processing units.**

Ans.

(i) Memory unit

(ii) Control unit

(iii) ALU unit

(4) **What precautions need to the taken care while entering formula into the excel?**

Ans. While using a formula, the '=' sign should be typed first. Similarly, no space should be inserted while typing any formula.

(5) **What is internet?**

Ans. This is a kind of Search Engine. It helps to find the information we want from all the information available on the internet.

(6) **What is a PDF?**

Ans. A PDF or Portable Document Format file can be used to view the file to print it or to handle files.

(7) **What is C-DAC?**

Ans. C-DAC, is a well-known Centre for Development of Advanced Computing, situated in Pune.

*(8) **What devices will you use to share with others the knowledge that you have?**

Ans. Devices like radios, televisions, pendrives, computers, laptops, mobiles, landlines, hard drives, CDs, memory cards help us in sharing our knowledge with others.

*(9) **Make a list of various hardware and software items of a computer.**

Ans. **Hardware:** Mouse, Keyboard, Pendrive, Monitor and other parts of computer.

Software: Operating Systems, Application Programs, Antivirus, etc.

Q.6. **Define the following:**

(1) **Memory:**

Ans. Memory is the place for storing data obtained from the input and also the generated solution or answer by the computer.

(2) **RAM:**

Ans. RAM is created from electronic components and can function only as long as it is supplied with electricity.

(3) **ROM:**

Ans. Information stored in ROM can only be read and changes cannot be made to the information originally stored here.

(4) **Operating System:**

Ans. It is a program which provides a means of communication between the computer and the person working on it. It is called the DOS (Disk Operating System).

(5) **Program:**

Ans. A program is a group of commands to be given to a computer.

(6) **Data and Information:**

Ans. Data is information in its raw (unprocessed) form.

(7) **Hardware:**

Ans. Hardware consists of all the electronic and mechanical parts used in computers.

(8) **Software:**

Ans. Software refers to the commands given to the computer, information supplied to it (input) and the results obtained from the computer after analysis (output).

Q.7. **Give scientific reasons:**

(1) **Computer cannot function without its operating system.**

Ans.

(i) Operating system is like a link between the computer and the person working on it.

(ii) Operating system manages all the activities performed by the computer.

(iii) Without the operating system, the user won't be able to input any data or run any program.

Thus, a computer cannot run without an operating system.

(2) **ROM is a Read Only Memory.**

Ans.

(i) ROM also known as Read Only Memory is a part of internal memory of a computer where the information stored can only be read.

(ii) ROM helps store data permanently for a long period of time and the information stored cannot be deleted.

(iii) Thus, data in a ROM can only be read and cannot be altered or modified and hence it is called as Read Only Memory.

*Q.8. **Answer the following in short:**

*(1) **Explain the role and importance of information communication in science and technology.**

Ans. ICT plays a key role in creating, displaying, collecting, processing and communicating information in the field of science and technology.

Following is the importance of ICT in science and technology:

(i) Access to wide range of information

(ii) Storing of Data

(iii) Processing of Data

(iv) Securing work files

(v) Proper representation of data

*(2) **Which application software in the computer system did you find useful while studying science, and how?**

Ans.

(i) **Microsoft word:** To write down the information collected and making a document for further evaluation.

(ii) **Microsoft excel :** To draw graph based on the obtained numerical information from the experiment.

(iii) **Internet explorer:** To search for information in finding out the solution or solving the queries by reading the available information.

*(3) **What precautions should be taken while using various types of software on the computer?**

Ans.

(i) Antivirus must be installed.

(ii) Software should be legal and from a trusted place.

(iii) Application should be scanned before using.

(iv) Pirated Software should not be used

(v) Provide all necessary data to obtain the best possible results.

*(4) **Which are the various devices used in information communication? How are they used in the context of science?**

Ans. Various devices used in information communication are: Computers, Laptops, Mobiles, Radios, Television, etc.

Computers, Laptops and Mobiles: Help in accessing, collecting, processing, communicating, sharing and storing of information. It helps in determining the appropriate conclusions in all fields, including the field of science.

Television: Help in getting information about the new and innovative technology.
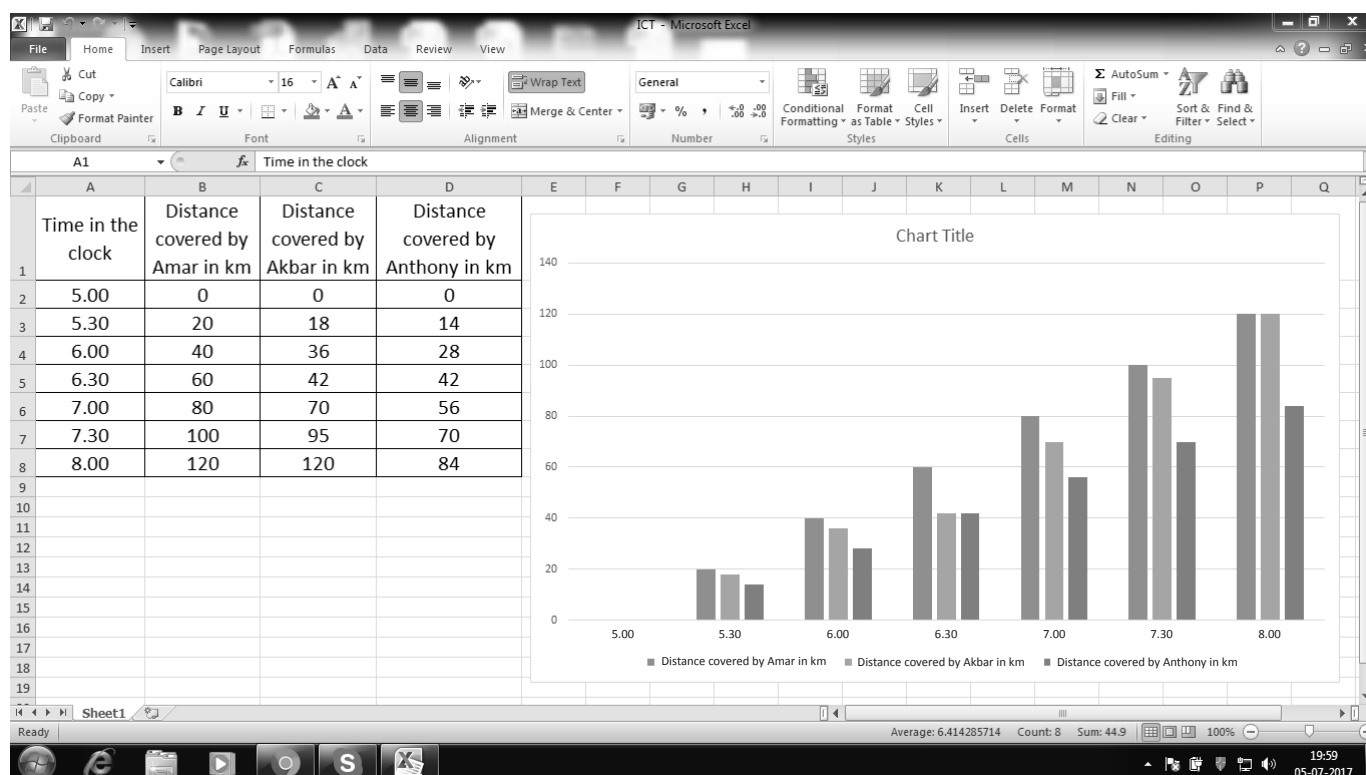
Q.9. **Answer in brief:**

*(1) **Which technical difficulties did you face while using the computer? What did you do to overcome them?**

Ans.

(i) **Lagging:** Due to lot of applications running at the same time, the computer starts lagging and becomes slow. Closing a few applications helped solve the problem of lagging.

(ii) **Viruses and Bugs:** Cybercrimes are rising daily, even from single mail the computer can be attacked by viruses. Installing a valid antivirus help solve the problem of viruses and bugs.

(iii) **Breach of Privacy:** Confidential information being accessed by anyone is the breach of privacy. Putting privacy setting in place helps solve the problem.

(iv) **Physical Damage:** Hardwares over a period of time might get physically damaged. Taking precautions while using helps solve the problem.

*(2) **Using a spreadsheet, draw graphs between distance and time, using the information about the movements of Amar, Akbar and Anthony given in the table 4, in the lesson on Laws of Motion. What precautions will you take while drawing the graph?**

Ans.

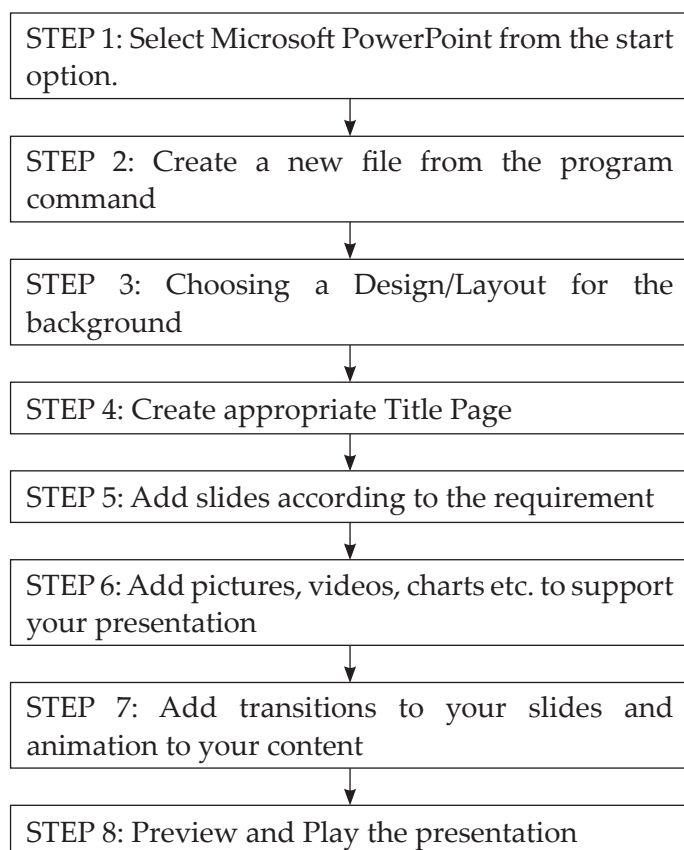| Time in the clock	Distance covered by Amar in km	Distance covered by Akbar in km	Distance covered by Anthony in km
5.00	0	0	0
5.30	20	18	14
6.00	40	36	28
6.30	60	42	42
7.00	80	70	56
7.30	100	95	70
8.00	120	120	84

Precautions to be taken while drawing a graph:

(i) The data should be kept in tabular form.

(ii) Whenever there is 'drag and fill' option used, 'smart tag' option should be used after 'drag data' to fill data as required.

(iii) Entered data should be formatted in the manner required.

(iv) Various types of graphs can be created by using the same data, so appropriate graph should be selected.

(v) Chart titles and axes titles should be updated as per the data.

*(3) **Using information communication technology, prepare PowerPoint presentations on at least three topics in your textbook. Make a flowchart of the steps you used while making these presentations.**

Ans. Steps for preparation of PowerPoint presentations:

STEP 1: Select Microsoft PowerPoint from the start option.

↓

STEP 2: Create a new file from the program command

↓

STEP 3: Choosing a Design/Layout for the background

↓

STEP 4: Create appropriate Title Page

↓

STEP 5: Add slides according to the requirement

↓

STEP 6: Add pictures, videos, charts etc. to support your presentation

↓

STEP 7: Add transitions to your slides and animation to your content

↓

STEP 8: Preview and Play the presentation

*(4) **Explain the differences between the different generations of computers. How did science contribute to these developments?**

Ans. **Generation: 1st**
Time Period: 1940 – 1956
Development: Vacuum Tubes

Characteristics:

(i) Huge in size

(ii) Expensive

(iii) Lot of Electricity Consumption

(iv) Heat Generation

Generation: 2nd
Time Period: 1956 – 1963
Development: Transistors
Characteristics:

(i) Frequent Shutdowns

(ii) Superior to 1st Generation

(iii) Small in size and Fast

(iv) Cheaper as compared to 1st Generation

(v) Less consumption of Electricity

Generation: 3rd
Time Period: 1963 – 1971
Development: IC
Characteristics:

(i) Keyboards and Monitors

(ii) OS

(iii) Smaller and further Cheaper

Generation: 4th
Time Period: 1971 – 2010
Development: Microprocessor
Characteristics:

(i) Use of Internet

(ii) GUI

(iii) Introduction of Portable devices like mobiles, laptops, etc.

Generation: 5th
Time Period: 2010 – Till Date
Development: Artificial Intelligence (AI)
Characteristics:

(i) Voice Recognition

(ii) Sensors

(iii) Nano Technology

1st Generation computers occupied the entire room, but due to advancement in science and technology, today's computer fits into our pockets.

Initially computers needed a specific language to interact but today we use voice recognition for the same.

In these ways, science has contributed in making the computers faster, smaller, cheaper and much more useful.

(5) **Write in short the opportunities in the field of ICT.**

Ans.

(i) **Software Field:** This is an important field. Having accepted the challenge of creating software, many companies have entered this field. The opportunities in the software field can be classified as follows - application program development, software package development, operating systems and utility development, special purpose scientific applications.

(ii) **Hardware Field:** Today, there are several companies in our country too, which make computers. They sell computers that they have themselves made. Others sell computers brought from outside as well as repair them and take maintenance contracts to keep computers in big companies working efficiently without a break. Plenty of jobs are available here. There are job opportunities in hardware designing, hardware production, hardware assembly and testing, hardware maintenance, servicing and repairs, etc.

(iii) **Marketing:** There are many establishments which make and sell computers and related accessories. They need good sales personnel who are experienced in the working of computers as well as skilled in marketing.

(iv) **Training:** The training of new entrants for various jobs is a vast field. It is very important to have dedicated teachers who are competent in the field of computers.

**(6)** **Write in short about the industries conducting research in the field of computers.**

Ans.

(i) C-DAC, the well-known Centre for Development of Advanced Computing, situated in Pune, is the leading institute in India which conducts research in the field of computers.

(ii) The first Indian supercomputer was made with help from this institute. Valuable guidance for making this computer (the Param computer) was received from the senior scientist Vijay Bhatkar. Param means the supreme.

(iii) This computer can perform one billion calculations per second. It is used in many fields like space research, movements in the interior of the earth, research in oil deposits, medicine, meteorology, engineering, military etc. C-DAC has also participated in developing the ISCII code for writing different language scripts. (Indian Script Code for Information Interchange).

(7) **Using Microsoft Word to create a document and write equations.**

Ans.

(i) Click on the Microsoft word 2010 icon on the desktop

(ii) Select the 'New option in the 'File' tab, and then select the 'Blank document' option.

(iii) Type your material on the blank page on the screen using the keyboard. Use the language, font size, bold, etc. options in the Home tab to make the typed material attractive.

(iv) To type equations in the text, select the 'Equation' option in the 'Insert' tab.
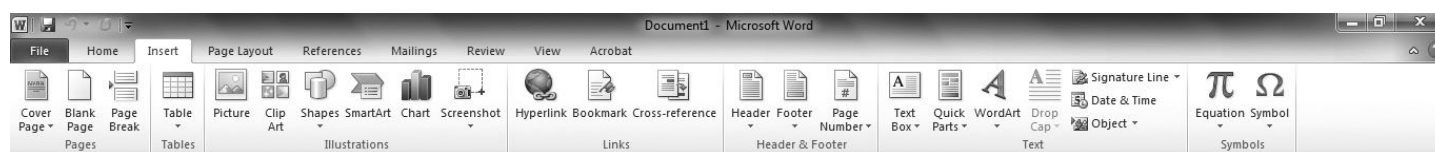
(v) Select the proper equation and type it using mathematical symbols.
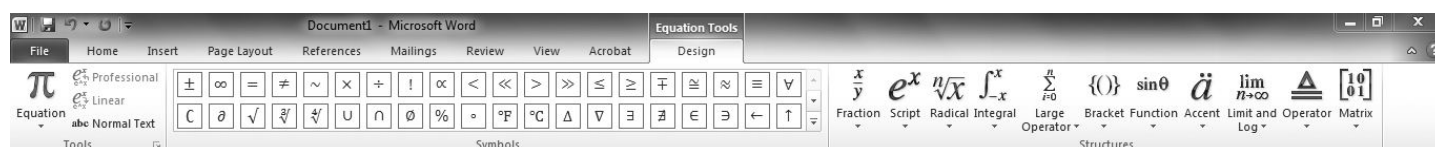
(8) **What precautions will you take when entering data?**

Ans.

(i) As far as possible, the data should be kept in tabular form. Different types of data should be entered in different cells. Data should be entered neatly and in one 'flow'. Unnecessary space and special characters should not be used.

(ii) Many times we 'drag and fill' data. At such times, the 'smart tag' can be used after 'drag data' to fill any data in any manner as required.

(iii) Once the data has been entered it can be formatted in different ways. Similarly, we can perform different types of calculations, using different formulae.

(iv) While using a formula, the '=' sign should be typed first. Similarly, no space should be inserted while typing any formula.

*Q.10. Can you tell!

(1) **Which devices do we directly or indirectly use for collecting, sharing processing and communicating information?**

Ans. (1) Computers (2) Laptops (3) Mobiles (4) Memory Cards (5) Pendrives 6) Landlines (7) Hard disks etc.

(2) **How does a computer work?**

Ans.

Input unit	Processor	Output Unit
All types of information/data is entered into the computer through this unit. Generally, a keyboard is used to enter data or information	Processing Unit 1. Memory unit 2. Control unit 3. ALU unit	The result / solution/ answer is eventually sent to the output unit. Generally a screen / monitor or printer is used as an output unit.

Q.11. **Think about it:**

(1) **How is information communication technology important for dealing with explosion of information?**

Ans. Information explosion means a situation where information is available in abundance, in other words, too much information.

Devices like computers, laptops help us in easier accessment of information that we need from all the data.

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ASSIGNMENT - 10

Time : 1 Hr.   **Marks : 30**

Q.1. (A) Fill in the blanks: **(2)**

(1) While working with a laptop or a computer, we can read the information stored in its memory and perform other actions in ....

(2) Graph based on quantitative information obtained is displayed in ....

(B) Fill in the blanks by selecting the appropriate option: **(2)**

(1) RAM and ROM are two types of .... memory.

(a) external (b) internal (c) physical (d) garbage

(2) .... is a group of commands to be given to the computer.

(a) Program (b) Memory (c) Data (d) Operating System

Q.2. State whether the following statements are true or false and if false, write the correct   **(2)**
statement:

(1) RAM and ROM are the types of external memory.

(2) A computer cannot be used without operating system.

Q.3. Write the full forms of the following: **(3)**

(1) ICT   (2) OS   (3) CPU

Q.4. Answer in one line: **(2)**

(1) What precautions need to the taken care while entering formula into the Excel?

(2) What is internet?

Q.5. Give scientific reasons: **(2)**

(1) Computer cannot function without its operating system.

Q.6. Write in short the opportunities in the field of ICT: **(8)**

(1) Software Field   (2) Hardware Field

(3) Marketing   (4) Training

Q.7. Answer in brief: **(9)**

(1) What precautions should be taken while using various types of software on the computer?

(2) Which are the various devices used in information communication? How are they used in the context of science?

(3) Write in short about the industries conducting research in the field of computers.

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