Wondershare PDFelement

Five MARKS

1. LAWS OF MOTION

1. What are the types of inertia? Give an example for each type. [AUG – 2022, PTA – 3]

a) Inertia of rest: It is the resistance of a body to change its state of rest.

Ex: When we shake a tree, leaves and fruits fall down.

- *b) Inertia of motion*: It is the resistance of a body to change its state of motion.
 Ex: An athlete runs some distance before jumping for a longer and higher jump.
- *c) Inertia of direction :* It is the resistance of a body to change its direction of motion.
 Ex : When car turns, we lean sideways.

2. State Newton's laws of motion.

[AUG - 2022, SEP - 2021]

a) Newton's First law :

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

b) Newton's second law :

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

c) Newton's third law :

For every action, there is an equal and opposite reaction. $F_{B=}$ - F_A

3. Deduce the equation of a force using Newton's second law of motion. (or) A body of mass m is initially moving with a velocity u. When a force 'F' acts on the body it picks up velocity 'v' in 't second' so that the acceleration 'a' is produced. Using this data derive the relation between the force, mass and acceleration. [PTA – 5]

Newton's second law of motion :

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

Derivation for the equation of force:

Let, $m \rightarrow mass of a moving body$

 $u \rightarrow \text{ initial velocity}$

 $F \rightarrow$ unbalanced external force $v \rightarrow$ final velocity after a time interval 't'

Initial momentum $P_i = mu$,

Final momentum $P_f = mv$

Change in momentum, $\Delta P = P_f - P_i = mv - mu$ $F \propto \frac{Change in momentum}{time}$ $F = \frac{mv - mu}{t} = m \left[\frac{v - u}{t}\right];$ F = ma (\because $a = \frac{v - u}{t}$)

Force = mass \times acceleration



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Hence the law is proved.

5. Describe rocket propulsion.

[AUG - 2022, SEP - 2020, PTA - 4]

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

- ♦ When rocket is fired, fuel is burnt and hot gas is ejected with high speed & huge momentum.
- ✤ To balance this momentum, an equal & opposite force is produced, projecting rocket forward.
- \bullet In motion, mass of rocket decreases, until the fuel is completely burnt.
- ✤ There is no net external force acting on it, and so linear momentum is conserved.
- Mass of rocket decreases with altitude. This increases the velocity and reaches escape velocity, which is sufficient to just escape from the gravitational pull of Earth.

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

Newton's Universal Law of gravitation :

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

F

Mathematical Expression of Universal Law of gravitation :

Let, m_1 and m_2 be the masses of two bodies A and B Let r be the distance between them.

$$\begin{array}{ll} \text{n.} \\ \propto \frac{\text{m}_1\text{m}_2}{\text{r}^2} & \Rightarrow & \text{F} = \mathbf{G}\frac{\text{m}_1\text{m}_2}{\text{r}^2} \end{array}$$



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



7. Give the applications of universal law of gravitation.

- i) Helps to calculate mass and radius of earth, acceleration due to gravity, etc.
- ii) Helps in discovering new stars and planets.
- iii) Helps to predict the path of astronomical bodies.
- iv) Helps to maintain the motion of planets around the sun and moon around the earth.
- v) Helps to maintain water flow in rivers and seas.

Additional Question

8. Describe the applications of torque.

[SEP – 2020]

Gears : It helps to change the speed of rotation of wheel by changing torque.

Seasaw: The heavier person lifts the lighter person on a seasaw.

Steering wheel: It transfers the torque to the wheels of a car with less effort.

IX. Hot Questions

1. "Wearing helmet and fastening the seat belt is highly recommended for safe journey" Justify your answer using Newton's laws of motion.

Wearing helmet is highly recommended for safe journey:

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

Fastening the seat belt is highly recommended for safe journey:

- When vehicle stops suddenly, by law of inertia, we will be in motion until a force act on us.
- ***** If we don't wear a seat belt, we would get hurt during this motion.
- ***** If we wear a seat belt, the seat belt gives us an unbalanced force that stops us.



2.OPTICS

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

[MAY - 2022]

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

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



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

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



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

Construction :

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

Working :

- Object AB is placed beyond the focal length of objective lens ($u > F_0$)
- ♦ A real, inverted and magnified image A' B' is formed at the other side of objective lens.
- ✤ A'B' acts as the object for eye lens.
- Eye lens is adjusted, so that A'B' falls within its principal focus.
- ♦ Virtual, enlarged and erect image A"B" is formed on the same side of object.



Additional Questions

5. An object AB is placed at the centre of curvature C of the convex lens as shown in the picture. Complete the ray diagram. [PTA – 1]



6. Write advantages and disadvantages of telescope.

Advantages of Telescopes :

[PTA – 3]

- Elaborate view of the Galaxies, Planets, stars and other heavenly bodies is possible.
- ✤ Camera can be attached for taking photograph.
- ✤ Telescope can be viewed even with the low intensity of light.

Disadvantages of Telescopes :

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



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



- ii) Position, nature and size of the image :
 - Object (AB) is placed within principal focus and observer's eye is just behind the lens.
 - An erect, virtual and enlarged image (A'B') is formed in the same side of the object
 - ✤ Distance is equal to the least distance of distinct vision (D).

iii) Uses of Simple microscope :

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

3. THERMAL PHYSICS

1. Derive the ideal gas equation.
According to Boyle's law $PV = Constant \dots (1)$ According to Charles's law $\frac{V}{T} = Constant \dots (2)$ According to Avogadro's law $\frac{V}{n} = Constant \dots (3)$ Combine (1), (2) & (3) $\frac{PV}{nT} = Constant \dots (4)$ This is called a combined law of gases.

Gas contains μ moles. \therefore **n** = μ **N**_A(5)

(5) in (4),
$$\frac{PV}{\mu N_A T}$$
 = Constant
 $\frac{PV}{\mu N_A T}$ = k_B (k_B = Boltzmann constant = 1.38 × 10⁻²³ JK⁻¹)
PV = $\mu N_A k_B T$

Considering $\mu N_A k_B = R = 8.31 \text{ J mol}^{-1} \text{K}^{-1}$ R is Universal gas constant.

Thus ideal gas equation (or) equation of state is PV = RT.

[SEP – 2020]



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



Real expansion = $L_3 - L_2$ Apparent expansion = $L_3 - L_1$

- Liquid is poured in a container upto a level L_1 . Heat it using a burner.
- Initially container expands. Hence, volume of liquid is reduced. Mark this level as L_2 .
- On further heating, the liquid expands and the level of liquid rises to L_3 .
- Difference between L_1 and L_3 is called apparent expansion.
- Difference between L_2 and L_3 is called real expansion.
- ✤ Real expansion is always more than apparent expansion.

4. ELECTRICITY

1. With the help of a circuit diagram, derive the formula for the resultant resistance of three resistances connected: a) in series and b) in parallel

a) Resistance in Series :

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

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

According to ohm's law,

$$V_1 = IR_1 \longrightarrow (1)$$
$$V_2 = IR_2 \longrightarrow (2)$$
$$V_3 = IR_3 \longrightarrow (3)$$
$$V = IR_s \longrightarrow (4)$$

The sum of the potential differences of each resistor is

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

$$IR_s = IR_1 + IR_2 + IR_3$$

$$R_s = R_1 + R_2 + R_3$$



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

b) Resistance in parallel :

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

Potential difference is same for all resistors.

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

According to ohm's law,



Total current is

$$I = I_1 + I_2 + I_3 \dots$$
$$\Rightarrow \frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$
$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

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

(5)

2. a) What is meant by electric current?

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

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

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

SI unit of electric current is ampere (A).

Current flowing through a conductor is said to be one ampere, when a charge of one coulomb flows across any cross-section of a conductor, in one second.



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

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

LPTA – 4





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

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

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

$H = I^2 R t$

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

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

c) How does a fuse wire protect electrical appliances?

- When a large current passes, the fuse wire melts due to joule's heating effect. Hence, the circuit gets disconnected. Thus, electric appliances are saved from any damage.
- 4. Explain about domestic electric circuits.(circuit diagram not required) [SEP 2020] Source :

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

Main-box :

Meter : Used to record the consumption of electrical energy.

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

Types of wires :

***** *Live wire* has red insulation. ***** *Neutral wire* has black insulation.

Domestic electric circuit :

over the normal TV?

✤ It is thinner in size.

✤ It consumes less energy.

✤ Its life span is more.

 \clubsuit It is more reliable.

✤ It uses less power

- ✤ Alternating current with electric potential of 220 V is supplied.
- ◆ Live wire connected via main fuse and neutral wire enter into electricity meter.
- ✤ These wires then enter into main switch.
- There are two separate circuits :

✤ It has brighter picture quality.

5 A rating – for low power rating appliances. *Ex* : Tube lights, Bulbs, Fans

***15** A rating – for high power rating appliances. *Ex* : AC, Fridge, Heaters

[PTA - 6]

Circuits are in parallel. Disconnection of one will not affect the other. Each get equal voltage.

5. a) What are the advantages of LED TV 5. b) List the merits of LED bulb. [PTA – 1]

- There is no loss of energy in the form of heat. It is cooler.
- ✤ It requires low power.
- ✤ It is not harmful to environment.
- ✤ It is cost efficient and energy efficient.
- ✤ Many colours are available.





Additional Question

6. Write the symbols and uses of the components commonly used in a circuit.

Component	Use of the component	Symbol used
Resistor	Used to fix the magnitude of current.	-\\\\- [SEP - 21]
Variable resistor or Rheostat	Used to select the magnitude of current.	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Ammeter	Used to measure current.	—A
Voltmeter	Used to measure potential difference.	-Ø-
Galvanometer	Used to detect current and its direction.	_©_
A diode	It is used in electronic devices.	Anode Cathode () () () [SEP-21]
Light Emitting Diode (LED)	It is used in seven segment display.	Anode Cathods (+) Cathods [SEP-21]
Ground connection	It provides protection. It act as a reference point to measure electric potential.	[SEP-21]

5. ACOUSTICS

1. What are the factors that affect the speed of sound in gases?

i) Effect of density :

Velocity of sound in a gas is inversely proportional to the square root of its density.

$$V \alpha \sqrt{\frac{1}{d}}$$

ii) Effect of temperature :

Velocity of sound in a gas is directly proportional to the square root of its temperature.

 $\mathbf{V} \propto \sqrt{\mathbf{T}}$

• Velocity of sound at a temperature T is, $V_T = (V_0 + 0.61T) \text{ ms}^{-1}$

Where, $V_0 \rightarrow$ velocity of sound in the gas at 0° C.

iii) Effect of relative humidity :

When humidity increases, the speed of sound increases. That is why we can hear sound from long distances clearly during rainy seasons.



2. What is mean by reflection of sound? Explain: a) Reflection at the boundary of a rarer mediumb) Reflection at the boundary of a denser mediumc) Reflection at curved surfaces

Reflection of Sound: It is the bouncing of sound waves from the interface between two media.

a) Reflection at boundary - rarer medium :

- ✤ A wave travelling in a solid medium strikes the interface between solid and air.
- Compression exerts a force F on the surface of air which is pushed backwards as air has smaller resistance.
- ✤ As particles are free to move, rarefaction is produced at the interface which travels from right to left.

b) Reflection at boundary - denser medium :

- Suppose a compression travelling in air from left to right, on reaching a rigid wall exerts a force F.
- ✤ In turn, the wall exerts an equal and opposite reaction R= F. Thus, a compression travelling towards the rigid wall is reflected back as a compression.

c) Reflection at curved surfaces:

- ✤ Intensity of reflected waves is changed.
- ✤ If it is a convex surface, reflected waves are diverged and intensity is decreased.
- ✤ If it is a concave surface; reflected waves are converged and intensity is focused at a point.

3. a) What do you understand by the term 'ultrasonic vibration'?

These are vibrations with a frequency greater than 20 kHz. Human ear cannot detect this. **Ex:** Waves produced by bats.

b) State three uses of ultrasonic vibrations.

- ✤ Used in Ultrasonic soldering and welding.
- ✤ Used to scan the growth of foetus.
- ♦ Used in Sonar.
- ✤ Used to forecast tsunami and earthquakes.

c) Name three animals, which can hear ultrasonic vibrations.

1. Mosquito, 2. Dogs, 3. Bats

4. What is an echo?

a) State two conditions necessary for hearing an echo.

b) What are the medical applications of echo?

c) How can you calculate the speed of sound using echo?

<u>Echo:</u> It is the sound reproduced due to reflection from rigid surfaces like walls, ceilings, etc.

a) Two conditions necessary for hearing an echo:

1. Minimum time gap between original sound and an echo must be 0.1 s.

2. Minimum distance required to hear an echo is 1/20 times the magnitude of velocity of sound.

b) The medical applications of echo:

Echo is used in obstetric ultrasonography. It capture images of fetus in mother's uterus.

c) Calculation of speed of sound :

Speed of Sound -	Distance travelled		2d
speed of Sound –	Time taken	-	t

Where $2d \rightarrow$ distance travelled by sound from source to wall and then back to receiver.

 $t \rightarrow \text{ time taken for an echo to be observed}$



Incident Wave -

[PTA – 1] [PTA – 1, SEP - 2020]

[SEP - 2020]



6. NUCLEAR PHYSICS

1. Explain the process of controlled and uncontrolled chain reactions.

- **Chain reaction:** It is a self-propagating process in which the number of neutrons goes on multiplying rapidly almost in a geometrical progression.
 - Ex: When uranium (U-235) is bombarded with a neutron it produces 3 neutrons by fission, these 3 neutrons cause fission reaction with another uranium.
 - * Thus neutrons are produced and fission reaction continues resulting in a chain reaction.

Controlled chain reaction:

- ◆ In this type, neutrons released is maintained to be one by absorbing the extra neutrons.
- Thus, the reaction is sustained in a controlled manner.
- Energy released can be utilized for constructive purposes.
- *Ex:* Nuclear reactor
- Uncontrolled chain reaction:
 - * Neutrons multiplies indefinitely and causes fission of fissile material in a large amount.
 - \clubsuit Thus, huge energy is released within a fraction of a second.
 - ✤ Ex: Atom bomb

2. Compare the properties of alpha, beta and gamma radiations.

[SEP - 2020]

Properties	α rays	β rays	γ rays (PTA – 3)	
Definition	Helium nucleus (₂ He ⁴).	Electrons $(-1e^{0})$.	Electromagnetic waves.	
Charge	Positively charged	Negatively charged	neutral particles	
Charge	Charge is +2e.	Charge is –e.	Charge is 0.	
lonising power	Very high.	Lower than α rays.	Very less.	
Penetrating	Low	Greater than a rays	Very high	
power	LOW	Oreater than 6 rays.	very mgn	
electric and	Deflected by both fields	Deflected by both fields;	Not deflected by both	
magnetic field	Deficeted by both fields.	but in opposite direction	fields.	
Sneed	1/10 to $1/20$ times the speed	can go up to 9/10 times	Same as speed of light	
Opeed	of light.	the speed of light.	Same as speed of light.	

3. What is a nuclear reactor? Explain its essential parts with their functions.

Nuclear reactor			
◆ It is a device in which nuclear fission reaction takes place in a self-sustained and			
controlled ma	anner to produce electricity. The essential components are,		
Fuel	Fuel A fissile material is used. <i>Ex</i> : Uranium (or) Radium		
Moderator * Used to slow down high energy neutrons. <i>Ex:</i> Graphite, heavy water			
Control rod	\diamond Used to control the number of neutrons, to have sustained chain		
Control Tou	reaction. Ex: Boron (or) Cadmium rods		
◆ Used to remove the heat produced in core reactor. <i>Ex</i> : Water, air, helium			
Steam is used to run turbine to produce electricity.			
Protection wall	✤ A thick concrete lead wall around the nuclear reactor prevents harmful		
	radiations from escaping into environment.		



Additional Questions

4. Compare nuclear fission and nuclear fusion. (or) Write the features of nuclear fission and nuclear fusion.
 [MDL - 19, PTA - 6]

	Nuclear Fission	Nuclear Fusion
1	It is the process of breaking up (splitting) of a heavy nucleus into two smaller nuclei.	It is the combination of two lighter nuclei to form a heavier nucleus.
2	Performed at room temperature.	High temperature & pressure is needed.
3	Alpha, beta & gamma rays are emitted.	Alpha rays, positrons, & neutrinos are emitted.
4	Emission of gamma rays causes diseases.	Only light and heat energy is emitted.

5. Explain uses of radioactivity in various fields.

In Agriculture: Radio isotope of phosphorous (P - 32):

* Used to increase the productivity of crops.

[MAY - 2022]

- * Used to kill insects and parasites.
- * Prevents the wastage of agricultural products.
- * Very small doses prevent sprouting and spoilage of onions, potatoes and gram.

In Medicine: Radio isotopes can be used for Diagnosis & Therapy of various diseases.

- * Radio sodium (Na²⁴): Used for the effective functioning of heart. [PTA 2]
- * **Radio iodine** (**I**¹³¹): Used to cure goiter.
- * **Radio iron (Fe⁵⁹):** Used to diagnose & treat anaemia.
- **Radio phosphorous (P³²)**: Used in treatment of skin diseases.
- * Radio cobalt (Co⁶⁰) and radio gold (Au¹⁹⁸): Used in treatment of skin cancer.

In Industries:

[PTA-4]

- * Used to detect defects and faults.
- * Used to check levels of gases, liquids and solids.
- * Used in airlines to detect explosives in luggage.
- * Used as smoke detector.

In <u>Archeological research</u>: Radio carbon dating - Determine the age.



7. ATOMS AND MOLECULES

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

Molecular mass of $H_2O=(1 \times 2) + 16 = 18$ g

Number of molecules = $\frac{\text{Mass of water}}{\text{Molecular mass}} \times \text{Avogadro number}$

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

 \therefore The No. of water molecules = 6.023×10^{21}

2. $N_2 + 3 H_2 \rightarrow 2 NH_3$ (The atomic mass of nitrogen is 14, and that of hydrogen is 1)

1 mole of nitrogen $(\underline{g}) + 3$ moles of hydrogen $(\underline{g}) \rightarrow 2$ moles of ammonia (\underline{g})

 $Mass = No. of moles \times Molecular mass$

Mass of N₂ = $1 \times (14 \times 2) = 28$ Mass of $H_2 = 3 \times (1 \times 2) = 6$ Mass of $NH_3 = 2 \times (14 + (3 \times 1)) = 34$

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

3. Calculate the number of moles in i) 27g of Al ii) 1.51×10^{23} molecules of NH₄Cl. [PTA – 5]

i) 27g of Al :

ii) 1.51×10^{23} molecules of NH₄Cl :

Number of moles $= \frac{Mass of Molecule}{Atomic mass of Molecule}$ Number of moles $= \frac{Number of Molecules}{Avogadro number}$ $=\frac{27}{27}=1$ mole $=\frac{1.51\times10^{23}}{6.023\times10^{23}}=0.25$ moles

4. Give the salient features of "Modern atomic theory". [AUG - 2022, SEP - 2020, PTA - 5]

✤ Atom is no longer indivisible. It is divided into electron, proton and neutron.

* Isotope : Atoms of the same element having different atomic mass. $Ex : {}_{17}Cl^{35}, {}_{17}Cl^{37}$

✤ Isobars : Atoms of different elements having same atomic masses. Ex :₁₈Ar⁴⁰, ₂₀Ca⁴⁰

* Artificial transmutation : Atom is no longer indestructible.

✤ Atoms may not always combine in a simple whole number ratio.

Ex: Glucose C₆H₁₂O₆ C:H:O = 6:12:6 or 1:2:1

- ✤ Atom is the smallest particle that takes part in a chemical reaction.
- The mass of an atom can be converted into energy. $\mathbf{E} = \mathbf{mc}^2$



5. Derive the relationship between Relative molecular mass and Vapour density. [PTA-6, MDL-19]

Polating Molecular Mass (DMM) -	Mass of 1 molecule of gas (or) vapour at STP	(1)
Kelulive Molecular Mass(KIMI) -	mass of 1 atom of hydrogen	(1)
Vanour Dansity (VD)	Mass of a given volume of gas (or) Vapour at	STP (2)
vapour Densuy (V.D)	Mass of the same volume of Hydrogen	<u> </u>

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

Let, number of molecules in the considered volume = n

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

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

mass of 1 molecule of hydrogen

Hydrogen is diatomic molecule so,

Vanour Donsity	_ Mass of 1 molecule of gas (or)Vapour at STP
vapour Density –	2×Mass of 1 atom of hydrogen
2 × Vanour density	_ Mass of 1 molecule of gas (or) Vapour at STP
$2 \times vapour density =$	 Mass of 1 atom of hydrogen
$2 \times Vapour density$	= Relative Molecular Mass [: By Eqn (1)]
Relative Molecular	Mass = $2 \times$ Vapour Density

Additional Questions

6. Distinguish between atoms and molecules.

[MAY - 2022]

[SEP - 2020]

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

7. What is Avogadro's Hypothesis? and state its application.

Avogadro's law / Hypothesis: "Equal volumes of all gases under similar conditions of

temperature and pressure contain equal number of molecules".

Applications of Avogadro's law:

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



8. In chemical industries, the following chemical reaction is used to produce ammonia in large scale. $N_2 + 3H_2 \rightleftharpoons 2NH_3$ [PTA - 3] Based on mole concept, calculate the mass of nitrogen gas and hydrogen gas required in kilogram to produce 1000kg of ammonia by using the above chemical equation.

Mass of
$$NH_3 = 1000 \text{ kg} = 10^6 \text{ g}$$

Molecular mass of $NH_3 = 14 + (3 \times 1) = 17 \text{ g}$

No. of moles of NH₃ = $\frac{mass \ of \ NH_3 \ produced}{molecular \ mass \ of \ NH_3} = \frac{10^6}{17}$

Required Mass of H₂ = No. of moles of H₂ × Molecular mass

$$= \frac{10^6}{17} \times \frac{3}{2} \times (2 \times 1) = 176.47 \text{ kg of H}_2$$

Required Mass of N_2 = No. of moles of N_2 × Molecular mass

$$=\frac{10^6}{15} \times \frac{1}{2} \times (14 \times 2) = 823.53 \text{ kg of } N_2$$

 \therefore Required mass of Nitrogen gas = 823.53 kg

Required mass of Hydrogen gas = 176.47 kg

8. PERIODIC CLASSIFICATION OF ELEMENTS

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

Caustic alkali dissolves Al_2O_3 forming soluble sodium meta aluminate while the impurities remain insoluble. The filtered solution processed to get back its pure form. Thus, caustic alkali is added to bauxite ore during its purification.

Al ₂ O ₃ + 2 NaOH	$\xrightarrow{150^{\circ}\text{C}} 2 \text{ N}$	NaAlO ₂	+ H ₂ O
Bauxite ore		m meta alui	ninate
NaAlO ₂ + 2 H ₂ O	> A	Al(OH)3	+ NaOH
sodium meta aluminate		inium hydro	oxide
2Al(OH)3 Aluminium hydroxid	$\xrightarrow{1000^{\circ}C} \qquad A^{1}$	l ₂ O ₃ + mina	3 H ₂ O

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

* *Fluorspar* is the another substance.

<u>Reason :</u> It lowers the fusion temperature of electrolyte.



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

 $2 \text{ Cu} + \text{O}_2 + \text{CO}_2 + \text{H}_2\text{O} \longrightarrow \text{CuCO}_3. \text{Cu(OH)}_2$ Copper carbonate (B) green layer $Cu + 2 \text{H}_2\text{SO}_4 \longrightarrow \text{CuSO}_4 + \text{SO}_2 \uparrow + 2\text{H}_2\text{O}$ $Copper sulphate(C) \quad (D)$ $A \rightarrow \text{Copper (Cu)}$ $B \rightarrow \text{Copper carbonate (CuCO}_3. \text{Cu(OH)}_2)$ $C \rightarrow \text{Copper sulphate (CuSO}_4)$ $D \rightarrow \text{Sulphur dioxide(SO}_2) \text{ gas}$

3. Explain Smelting Process.

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

Smelting of iron: Charge consisting of roasted ore, coke and limestone in the ratio 8:4:1 is

smelted in a blast furnace.

(a) Lower Region (Combustion Zone) :

✤ Temperature is at 1500°C.



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

$$\begin{array}{ccc} Fe_2O_3 \ + \ 3CO & \xrightarrow{400^{\circ}C} & 2Fe + 3CO_2 \uparrow \\ ferric \ oxide & Iron \end{array}$$

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

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

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Additional Questions

- 4. Give reason for the following statements on periodic trends in modern periodic table of elements. **[PTA - 6]**
 - a) Along the period, from left to right, the atomic radius values of the elements decrease whereas along the groups, from the top to bottom, the atomic radius values increase.
 - b) The electron affinity values increase along the period from left to right and decrease down the group.
 - c) The ionization energy values increase along the period from left to right and decrease down the group.

As we go down the group	As we go from left to right
a) Atomic radius increases.	a) Atomic radius decreases.
* <u>Reason:</u> Due to increase in valence shell number.	Reason: Atom shrinks as the attraction of protons over electrons increases.
 b) Electron affinity decreases. * <u>Reason:</u> As Atomic radius increases, valence electrons are loosely bound. 	 b) Electron affinity increases. * <u>Reason:</u> As Atomic radius decreases.
c) Ionisation energy decreases.	c) Ionisation energy increases.
Reason: As Atomic radius increases, Less energy is required to remove the electrons.	* <u>Reason:</u> As atomic radius decreases, more energy is required to remove the electrons.

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

Alloy is a homogeneous mixture of two or more metals or one or more metals with certain non-metallic elements. Types: Ferrous and Non-ferrous alloys

Reasons for alloving:

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

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

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

Methods to Prevent Metal Corrosion.

- (i) Alloying : Metals can be alloyed to prevent corrosion. *Ex:* Stainless steel.
- (ii) Surface Coating: Protective coating over the metal.
 - Galvanization Coating zinc on iron sheets by using electric current.
 - *Electroplating* Coating one metal over another metal by passing electric current.
 - Anodizing is an electrochemical process that converts metal surface into a decorative, durable and corrosion resistant. Ex: Aluminium. [SEP – 2020]
 - *Cathodic Protection* metal to be protected is coated with a corrodible sacrificial metal.

[MAY - 2022]

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7. Identify the nature of the bond present in the following molecules.

Question	Electronegativity Difference	Type of bond
(i) NaC <i>l</i>	3.0 - 1.0 = 2.0	$> 1.7 \Rightarrow$ Ionic bond
(ii) NaBr	2.8 - 1.0 = 1.8	$> 1.7 \Rightarrow$ Ionic bond
(iii) NaI	2.5 - 1.0 = 1.5	$< 1.7 \Rightarrow$ Covalent bond
(iv) NaF	4.0 - 1.0 = 3.0	$> 1.7 \Rightarrow$ Ionic bond
(v) NaH	2.1 - 1.0 = 1.1 [PTA-2]	$< 1.7 \Rightarrow$ Covalent bond
(vi) HF	$4.0 - 2.1 = 1.9 [\mathbf{PTA} - 2]$	$> 1.7 \Rightarrow$ Ionic bond

VIII. Hot Questions

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

$2Al + 3H_2O \longrightarrow Al_2O_3 +$	$3H_2\uparrow$
at red hot condition (A) steam Aluminium oxide (B)	
$2 \text{ Al} + 2 \text{ NaOH} + 2 \text{ H}_2\text{O} \longrightarrow 2 \text{ NaAlO}_2 +$	- 3 H ₂ ↑
strong caustic alkali sodium meta aluminate(C)	
$A \rightarrow Aluminium (Al)$	
$B \rightarrow Aluminium oxide (Al_2O_3)$	
$C \rightarrow$ Sodium meta aluminate (NaAlO ₂)	

9. SOLUTIONS

1. Write notes on i) saturated solution ii) unsaturated solution
 i) Saturated solution : It is the solution in which no more solute can be dissolved in a definite

amount of solvent at a given temperature.

Ex: 36 g of sodium chloride in 100g of water at $25^{\circ}C$

ii) Unsaturated solution : It is the solution that contains less solute than that of saturated solution

at a given temperature. Ex: 10 g of sodium chloride in 100g of water at 25°C

2. Write notes on various factors affecting solubility. [MDL - 19] i) Nature of the solute and solvent:

- ✤ "Like dissolves Like".
- Polar compounds are soluble in polar solvents only. *Ex: Common salt dissolves in water*.
- Non-polar compounds are soluble in non-polar solvents only. *Ex*: *Fat dissolved in ether*.

ii) Temperature:

- a) Solubility of solid in liquid:
 - ✤ It increases with increase in temperature.
 - *Ex:* More sugar will dissolve in warm water than in cold water.
 - ✤ In endothermic process, solubility increases with increase in temperature.
 - ✤ In exothermic process, solubility decreases with increase in temperature.



b) Solubility of gases in liquid:

It decreases with increase in temperature. Ex: Aquatic animal live more in cold regions.

iii) Pressure:

When pressure is increased, solubility is also increased. *Ex: soft drinks*

3. a) What happens when MgSO₄.7H₂O is heated? Write the appropriate equation.

[AUG-22, SEP-21, PTA-4]

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When MgSO₄.7H₂O is heated, it loses its water and become anhydrous magnesium sulphate.

MgSO₄ . 7H₂O Magnesium sulphate heptahydrate

b) Define Solubility.

- It is the number of grams of solute that can be dissolved in 100 g of solvent to form its saturated solution at a given temperature and pressure.
- *Ex:* 36 g of sodium chloride has to be dissolve in 100g of water to form its saturated solution.

4. In what way hygroscopic substances differ from deliquescent substances.[SEP-2021, PTA-2]

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

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

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

6. 3.5 litres of ethanol is present in 15 litres of aqueous solution of ethanol. Calculate volume percent of ethanol solution. [PTA – 2]

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

10. TYPES OF CHEMICAL REACTIONS

- Reaction in which, reactant is decomposed by heat is called thermolysis reactions.
- They are Endothermic reactions as heat is supplied or absorbed to break bonds. Types are,
 - i. Compound to Element / Element decomposition $2HgO_{(S)} \xrightarrow{heat} 2Hg_{(g)} + O_{2(g)}$

ii. Compound to Compound / Compound decomposition $CaCO_{3(S)} \xrightarrow{heat} CaO_{(S)} + CO_{2(g)}$

2. Explain the types of double displacement reactions with examples. [SEP – 2020]

Double displacement (or) metathesis reaction are reactions in which, ions of one compound is replaced by ions of another compound. Ions of identical charges alone are interchanged.

General schematic representation: $AB + CD \longrightarrow AD + CB$

Ex:

i) Precipitation

reaction: When aqueous solutions of two compounds are mixed, they react to form an insoluble compound and a soluble compound.

 $Pb(NO_3)_{2s(aq)} + 2KI_{(aq)} \rightarrow PbI_{2(S)} + 2KNO_{3(aq)}$

Ex:	$Pb(NO_3)_{2(20)} + 2KI_{(20)} \rightarrow PbI_{2(S)} + 2KNO_{3(20)}$
	10(1003)2(aq) + 2111(aq) + 1012(5) + 2111(03(aq))

ii) Neutralization reaction: It is the reaction in which acid reacts with base to form salt and water. Here, both acid and base neutralize each other.

Ex: $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$

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[PTA – 5]

3. Explain the factors influencing the rate of a reaction.

i) Nature of reactant:

Ex: Sodium reacts faster with hydrochloric acid than acetic acid.

Because, Hydrochloric acid is stronger than acetic acid and thus more reactive.

ii) Concentration of the reactants:

More the concentration, more particles per volume exist in it, reaction is faster.

Ex: Granulated zinc reacts faster with 2M hydrochloric acid than 1M Hydrochloric acid.

iii) Temperature:

Most reactions are faster at higher temperature. Because adding heat provides energy to break more bonds. *Ex:* Food at refrigerator spoil slower compared to food at outside.

iv) Pressure:

If reactants are gases, increasing pressure increases the reaction rate. Because reacting particles come closer and collide frequently.

v) Catalyst:

Catalyst increases the reaction rate without being consumed in the reaction.

Ex: On heating potassium chlorate, it decomposes into potassium chloride and oxygen at a slower rate. If manganese dioxide is added as catalyst, it increases the reaction rate.

vi) Surface area of the reactants:

Powdered form of solid reactants reacts more readily. They have more surface area. The collision of reactant particle is increased. Thus, rate of reaction is also increased.

Ex: Powdered calcium carbonate reacts more readily with hydrochloric acid than marble chips.



[SEP - 2021]

i) Role of pH in human body :

Body pH range is 7.0 to 7.8. Increases/decreases leads to disease. pH of blood is 7.4.

ii) Role of pH in our digestive system :

Stomach produces hydrochloric acid, which helps in digestion. During indigestion, it produces too much acid causing pain and irritation. pH of stomach fluid is 2.0.

iii) pH changes as the cause of tooth decay :

pH of saliva is between 6.5 to 7.5. When it falls below 5.5, enamel is weathered. Toothpastes are generally basic, it neutralizes excess acid and prevent tooth decay.

iv) pH of soil :

pH of soil is very important in agriculture. Citrus fruits require alkaline soil, rice requires acidic soil and sugarcane requires neutral soil.

v) pH of rainwater :

pH of rainwater is 7. If atmospheric air is polluted with oxides of sulphur & nitrogen, they dissolve in rainwater making its pH less than 7 causing acid rain.

5. What is a chemical equilibrium? What are its characteristics?

Chemical equilibrium: It is a state of reversible chemical reaction where there is no change in amount of reactants and products.

At equilibrium, **Rate of forward reaction = Rate of backward reaction**

Ex: CaCO_{3(s)}
$$\rightleftharpoons$$
 CaO_(s) + CO_{2(g)}

Characteristics of equilibrium;

- ✤ Rates of forward and backward reactions are equal.
- Properties like pressure, concentration, colour, density, viscosity, etc., of remain unchanged.
- It is a dynamic equilibrium, because both forward and backward reactions occur even though it appears static externally.
- ◆ In physical equilibrium, volume of all phases remain constant.

Additional Question

6. Classify the following chemical reactions based on rearrangement of atoms and justify your answer.

j	Question	Classification	Reason
	a) $2KClO_3 \rightarrow 2KCl + 3O_2$	Decomposition	Potassium chlorate is decomposed
		reaction	as Potassium chloride & Oxygen.
	b) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$	Single	Zinc element displaces copper in
	[PTA – 1]	displacement	copper sulphate and forms zinc
		reaction	sulphate and elemental copper.
	c) $2Mg + O_2 \rightarrow 2MgO$	Combination	Magnesium combines with Oxygen
		reaction	to form Magnesium oxide.
	d) $Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 +$	Double	Sodium and barium interchange
	2Na <i>Cl</i>	displacement	their position to form barium
ļ		reaction	sulphate & sodium chloride.





VII. HOT Questions

1. A solid compound 'A' decomposes on heating into 'B' and a gas 'C'. On passing the gas 'C' through water, it becomes acidic. Identify A, B and C.

Calcium carbonate(*A*) decompose to give *calcium oxide*(*B*) and *carbon dioxide*(*C*) on heating.



11. CARBON AND ITS COMPOUNDS

1. What is called homologous series? Give any three of its characteristics. (*write any 3*) Organic compounds having same general formula and similar chemical properties in which the successive members differ by a -CH₂ group is called homologous series.

Ex: Methane CH_4 Ethane CH_3 - CH_3 Propane CH_3 - CH_2 - CH_3

Characteristics of homologous series:

i) Each member differs from its preceding or succeeding by methylene (-CH₂) group.

ii) All members contain same elements and functional group.

iii) They are represented by a general molecular formula. *Ex:* Alkanes C_nH_{2n+2} .

iv) Members in each series show regular gradation in their physical properties.

v) Chemical properties are similar.

vi) All the members can be prepared by a common method.

2. Arrive at, systematically, the IUPAC name of the compound: CH₃-CH₂-CH₂-OH. [TB:162]

Step1: Longest chain has 3 carbon atoms. .: Root word is 'prop'.

Step2: It has single bond. .. Primary suffix is "ane".

Step3: Functional group is alcohol (–OH).



Step 4: Locant number of –OH is 1 : Secondary suffix is '1-ol'

 \therefore The name of the compound is **Propan** $-/1 - \mathbf{ol}$



3. How is ethanol manufactured from sugarcane?

Ethanol is manufactured by fermentation of molasses.

Steps in conversion of molasses to ethanol:

- (i) Molasses is diluted with water to bring the concentration of sugar to 8 to 10%.
- (ii) Addition of Nitrogen Source: It is fortified by adding ammonium sulphate/phosphate.

(iii) Addition of yeast:

- Solution is collected in large 'fermentation tanks'
- ♦ Yeast is added and kept at 303 K for few days.
- ✤ During this period, invertase and zymase in yeast, converts sucrose into ethanol.
- ✤ Fermented liquid is called as 'wash'.



(iv) Distillation of Wash:

'Wash' contains 15 to 18% alcohol. It is subjected to fractional distillation.

<u>Rectified spirit</u>: It contains 95.5% ethanol & 4.5% of water. It is the main fraction of 'wash'. <u>Absolute alcohol</u>: Rectified spirit is refluxed over quicklime for 5 to 6 hours and then allowed to stand for 12 hours. *Pure/absolute alcohol* (100%) is obtained.

4. Give the balanced chemical equation of the following reactions:

(i) Neutralization of NaOH with ethanoic acid.

[PTA – 6]

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CH ₃ COOH	+ NaOH —	\longrightarrow CH ₃ COONa + H ₂ O	
ethanoic acid	sodium hydroxide	sodium ethanoate water	j

(ii) Evolution of carbon dioxide by the action of ethanoic acid with NaHCO₃.

CH ₃ COOH	+ NaHCO ₃	CH ₃ COONa	+ $CO_2\uparrow$	+ H ₂ O
ethanoic acid	sodium bicarbonate	sodium acetate	brisk effervescen	ce water

(iii) Oxidation of ethanol by acidified potassium dichromate. [PTA – 6] (or)

Write a reaction which is used for the identification of alcohol., [SEP - 2020]

• Ethanol is oxidized to ethanoic acid in presence of acidified potassium dichromate.

• Orange color of $K_2Cr_2O_7$ is changed to green colour. Thus, it is used to identify alcohol.

CH ₃ CH ₂ OH	$\xrightarrow{\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+}_{2[0]}$	СН ₃ СООН	+ H ₂ O
ethanol	-1-1	ethanoic acid	

(iv) Combustion of ethanol.

CH ₃ CH ₂ OH	$I + 3O_2$	$\longrightarrow 2CO_2$	+ 3H ₂ O
ethanol	oxygen	carbon dioxide	water



5. Explain the mechanism of cleansing action of soap. [PTA – 6] (or) Explain how micelles formation take place with a diagram when soap is added to water? [PTA – 5]

<u>Structure of Soap :</u>

- * *Polar end:* It is hydrophilic (water loving). Short head with carboxylate group (-COONa)
- * Non-polar end : It is hydrophobic (water hating). Long tail of hydrocarbon chain.



- ↔ When a soap is dissolved in water, molecules join together as clusters called micelles.
- Dirt is surrounded by non-polar end.
- Polar end makes micelles soluble in water.
- Thus, dirt is washed away with the soap.

Additional Question

6. Fill in the blanks in the table using IUPAC nomenclature of organic compounds. [PTA – 2]

	Name of the compound	Structural formula	Functional group present
		$CH_3 - CH - CH_3$	
	2-Propanol	I	—ОН
		ОН	
		$CH_3 - C - H$	0
	Ethanal	ll	II
		0	-C - H
		0	
	Butanone	II	> C = 0
		$\mathrm{CH}_3-\mathrm{CH}_2-\mathrm{C}-\mathrm{CH}_3$	
	Butanoic acid	$\mathrm{CH}_3-\mathrm{CH}_2-\mathrm{CH}_2-\mathrm{COOH}$	-соон

[PTA - 1]

[PTA – 1]

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VII. HOT questions 🕔

- 1. The molecular formula of an alcohol is $C_4H_{10}O$. The locant number of its –OH group is 2.
 - (i) Draw its structural formula. [PTA 1]

$$CH_3 - CH - CH_2 - CH_3$$

|
OH

Step 1: Chain has 4 carbon atoms. : Root word is 'But'

- Step 2: It has single bond. \therefore Primary suffix is 'ane'.
- Step 3: Functional group is alcohol (-OH).

1 2 3 4 CH₃-CH-CH₂- CH₃ | OH

Step 4: Locant number of –OH group is 2. . Secondary suffix is '2-ol'

∴ The name of compound is **Butan-2-ol**

(iii) Is it saturated or unsaturated?

Butan-2-ol is **saturated** as it has only single bonds

- 2. An organic compound 'A' is widely used as a preservative and has the molecular formula $C_2H_4O_2$. This compound reacts with ethanol to form a sweet smelling compound 'B'. [PTA 5]
 - (i) Identify the compound 'A' and 'B'.

Compound (A) is Ethanoic acid or Acetic acid. Its structural formula is CH₃COOH.

(ii) Write the chemical equation for its reaction with ethanol to form compound 'B'.

СН3СООН	+ CH ₃ CH ₂ OH –	$\xrightarrow{\text{Con.H}_2\text{So}_4} \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$
ethanoic acid(A)	ethanol	ethyl ethanoate (B)

(iii) Name the process (or) chemical reaction.

This process is esterification.

 $\begin{array}{rcl} \mathsf{A} & \rightarrow & \mathsf{Ethanoic\ acid} \\ & \mathsf{B} & \rightarrow & \mathsf{Ethyl\ ethanoate} \\ & \mathsf{Process\ } & \rightarrow & \mathsf{Esterification} \end{array}$



12. PLANT ANATOMY AND PLANT PHYSIOLOGY

1. Differentiate the following.

a) Monocot root and Dicot root:

[MDI	⊿ – 19]
SEP -	2020]

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

b) Aerobic and Anaerobic respiration:

[AUG – 2022, SEP – 2021]

Aerobic respiration	Anaerobic respiration
1) Takes place in presence of oxygen.	1) Takes place in absence of oxygen.
2) Occurs in most plants and animals	2) Occurs in some bacteria.
3) Carbohydrate is completely oxidized	3) Glucose is converted into ethanol (in plants)
into carbon dioxide, water and energy.	or lactate (in bacteria).
4) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + ATP$	4) $C_6H_{12}O_6 \rightarrow 2 CO_2 + 2 C_2H_5OH + Energy (ATP)$

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

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

Stages of Aerobic Cellular Respiration :

Glycolysis:

• One glucose molecule breakdown into two molecules of pyruvic acid in cytoplasm. Krebs cycle (or) Tricarboxylic Acid cycle (TCA):

♦ After glycolysis, pyruvic acid is oxidized to CO₂ and water in mitochondrial matrix. **Electron Transport chain (ETC)**:

◆ It occurs through electron carrier complex in the inner membrane of mitochondria.

- NADH₂ & FADH₂ are oxidized to NAD⁺ & FAD⁺ to release energy via electrons.
- ◆ The electrons release energy, which is trapped by ADP to synthesize ATP.
- This is called oxidative phosphorylation. Here O_2 is reduced to water.

3. How does the light dependent reaction differ from the light independent reaction? What are the end products and reactants in each? Where does each reaction occur within the chloroplast?

Light dependent (Light) Reaction	Light independent (Dark) Reaction	
Takes place in the presence of light energy	Takes place in the absence of light.	
Photosynthetic pigments absorb light energy and convert it into ATP & NADPH ₂	CO_2 is reduced into carbohydrates with the help of ATP & NADPH ₂	
Occures in <i>thylakoid membrane</i> of chloroplast.	Occures in Stroma of chloroplast.	



VIII. Higher Order Thinking Skills (HOTS)

- 1. The reactions of photosynthesis make up a biochemical pathway.
 - A) What are the reactants and end products of light & dark reaction of photosynthesis? [PTA-5]

	Light Reaction	Dark Reaction
Reactants	sunlight, H ₂ O, NADP ⁺ , ADP	ATP and NADPH ₂
Products	ATP, NADPH ₂ and O ₂	Carbohydrate

- B) Explain how the biochemical pathway of photosynthesis recycles many of its own reactions and identify the recycled reactants.
 - Steps of photosynthesis Light reactions and Dark reactions (or) Calvin cycle.
 - ATP and NADPH₂ are formed by light reactions using sunlight. They are used by Calvin cycle to produce glucose.
 - Calvin cycle oxidizes NADPH₂ and ADP to NADP⁺ and ATP. These are used again by light reaction and reduced to NADPH₂ and ATP with the help of a water molecule.
 - ✤ In this way, photosynthesis recycles its own reaction in a series.

13. STRUCTURAL ORGANISATION OF ANIMALS

1. How is the circulatory system designed in leech to compensate the heart structure?

- Circulation happens by haemocoelic system.
- ✤ Blood vessels are replaced by haemocoelic canals filled with blood like fluid.
- ✤ Coelomic fluid contains haemoglobin.
- There are four longitudinal channels
 - One above (dorsal) and one below (ventral) the alimentary canal.
 - Other two on either (lateral) side of alimentary canal. This serves as heart.

Channels are connected posteriorly in 26th segment.

2. How does locomotion take place in leech?

Locomotion in leech takes place by,

Looping or crawling movement:

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

Swimming movement:

✤ Leeches swim very actively and perform undulating movements in water.



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

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



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14. TRANSPORTATION IN PLANTS AND CIRCULATION IN ANIMALS

1. How do plants absorb water? Explain.

Water absorbing unit - Root Hair:

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

Pathway of Water absorbed by Roots:

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

Types of movement of water into root cells:

- 1. Apoplast pathway
 - ✤ Movement of water is through the intercellular spaces and the cell walls.
 - ✤ It is dependent on the gradient.
- 2. Symplast pathway
 - ✤ Movement of water is through plasma membrane, cytoplasm and plasmodesmata.
 - ✤ It is dependent on concentration gradient. It is slower.

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

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

Importance of transpiration:

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

[AUG - 2022]



- 3. Why are leucocytes classified as granulocytes and agranulocytes? Name each cell and mention its functions.
 - Leucocytes are classified as granulocytes and agranulocytes because of its presence and absence of granules in it respectively.
 - 1) Granulocyctes: They contain granules in cytoplasm. Its nucleus is irregular (or) lobed.

<i>i) Neutrophils</i> They increase during infection and inflammation.		
ii) Eosinophils	They increase during allergy & parasitic infections.It brings detoxification of toxins.	
<i>iii) Basophils</i> They release chemicals during inflammation.		
canulocytes: Granules are not found in cytoplasm. Its nucleus is not lobed		

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

t) Lymphoeytes The	r
ii) Monocytes The	are phagocytic and can engulf bacteria.

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

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

Conduction of heart beat:

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

5. Enumerate the functions of blood.[SEP-21] Functions of blood: [AUG – 2022]

- ✤ It transports respiratory gases (O₂ & CO₂).
- ✤ It transports digested food to body parts.
- It transports hormones and excretory products like ammonia, urea, uric acid.
- ✤ It protects body & defense against diseases.
- It acts as buffer and helps in regulation of pH and body temperature.
- ✤ It maintains water balance.

Additional Question

6. Draw the external structure of human heart and label the parts. [SEP – 2020]



15. NERVOUS SYSTEM

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

(i) Cyton / Cell body / Perikaryon :

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

(ii) Dendrites:

- They are branched cytoplasmic processes
- They project from surface of the cell body.
- ✤ They conduct nerve impulses towards cyton.
- ✤ They increase the surface area for receiving signals.
- (iii) Axon: It is a single, elongated, slender projection.
 - Axon end has *Synaptic knobs*.
 - Its plasma membrane is called *axolemma*
 - Its cytoplasm is called *axoplasm*.
 - Myelin sheath acts as insulator and ensures rapid transmission of nerve impulses. It is covered by *neurilemma*.
 - * Nodes of Ranvier Depressions in Myelin sheath
- * Synapse / synaptic junction Between synaptic knob of one neuron and dendron of next neuron.
- Information from one neuron is passed to another through synapse with the release of chemicals called *Neurotransmitters*.

2. Illustrate the structure and functions of brain.

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

i) Forebrain:

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

- Corpus Callosum: Connects 2 Cerebral hemisphere.
- Cerebral Cortex: Grey outer portion Gyri and Sulci
- Cerebral Medulla: White inner portion
- Cerebral Lobes: Frontal lobe, Parietal lobe, temporal lobe, occipital lobe.
- *Functions:* Responsible for intelligence, memory, imagination, willpower, etc.,

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

* Hypothalamus: At the base of thalamus. <u>Functions</u>: Controls involuntary functions,

- Link between nervous & endocrine system.
- ii) Midbrain: Between thalamus and hindbrain. <u>Functions:</u> Controls visual & auditory reflexes.
- iii) Hindbrain:
 - ***** Cerebellum: Second largest portion. Has two large sized hemispheres & middle vermis. <u>Functions:</u> Coordinates voluntary movements, maintains body balance.
 - ***** *Pons:* It connects lobes of cerebellum. It relay signals between cerebellum, spinal cord,

midbrain and cerebrum. *Functions:* Controls respiration and sleep cycle.

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

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







32

3. What will you do if someone pricks your hand with a needle? Elucidate the pathway of

response with a neat-labelled diagram.

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

4. Describe the structure of spinal cord. Structure of spinal cord:

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

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

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



Motor neurons

Anterior Horn

Central cana



Spinal nerve

6. Classify neurons based on its structure.

i) Unipolar Neurons :

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

ii) Bipolar Neurons :

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

iii) Multipolar Neurons :

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



16. PLANT AND ANIMAL HORMONES

- 1. (a) Name the gaseous plant hormone. Describe its three different actions (physiological effects) in plants. [SEP 2021, PTA 3]
 - Gaseous plant hormone Ethylene
 - ✤ It promotes the ripening of fruits.
 - ✤ It inhibits the elongation of stem and root in dicots.
 - ✤ It hastens senescence.
 - ✤ It stimulates formation of abscission zone leading to premature shedding.
 - (b) Which hormone is known as stress hormone in plants? Why? Stress hormone - Abscisic acid. Because it increases tolerance of plants to various stress.
- 2. Describe an experiment which demonstrates that growth stimulating hormone is produced at the tip of coleoptile.
 - Frits Warmolt Went demonstrated that auxin is produced at the tip of coleoptile.

In his first experiment,

- ✤ He removed the tips. The cut tips did not grow.
- Indicate that the tips produced something essential for growth.

In his second experiment,

✤ He placed agar blocks on the removed tips. There is no response.

In his next experiment,

- He placed cut tips on agar blocks. After an hour, he removed the tips and placed this agar block on the cut plant. It grew straight up.
- Indicates that some chemical had diffused from the cut tips into agar block.

Conclusion: This Chemical was responsible for growth, and Went named it as "Auxin".

3. Write the physiological effects of gibberellins.

- Gibberellin stimulates extraordinary *elongation of internode*.
- *Bolting* is achieved by gibberellin.
- It promote the *production of male flowers*.
- It *break dormancy* of potato tubers.
- ✤ It induces parthenocarpic fruits.



4. Where are estrogens produced? What is the role of estrogens in the human body?

Estrogen is produced in graafian follicles of ovary.

Functions of estrogens:

- ✤ It brings changes during puberty.
- ✤ It initiates oogenesis.
- ✤ It stimulates the maturation of ovarian follicles.
- It helps in development of secondary sexual characters.
- 5. What are the conditions, which occur due to lack of ADH and insulin? How are the conditions different from one another?

conun		
S.No	Deficiency of ADH causes Diabetes	Deficiency of insulin causes
	Insipidus	Diabetes Mellitus
1.	Increases water loss through urine.	Glycosuria - Excretion of excess glucose in urine.
2.	Causes Polyuria	Causes Polyuria, Polydipsia, Polyphagia
3.	Reduces reabsorption of water.	Hyperglycemia - Increased blood sugar level.

17. REPRODUCTION IN PLANTS AND ANIMALS

1. With a neat labelled diagram describe the parts of a typical angiospermic ovule. [PTA – 5] Structure of the Ovule:

- 1. The main part is nucellus.
- 2. It is enclosed by two integuments
- 3. It has an opening called micropyle.
- 4. It is attached to ovary wall by funiculus.
- 5. Chalaza is the basal part.



- Egg apparatus: 1 egg cell and 2 synergids (cells) at micropylar end.
- Antipodal cells: 3 cells at chalaza end.
- Polar nuclei in the centre.

What are the phases of menstrual cycle? Indicate the changes in the ovary and uterus.
 ♦ Menstrual or Destructive Phase (4 – 5 days) : [PTA – 3]

- Development of primary follicles.
- Breakdown of endometrial lining leads to bleeding.
- Decrease in progesterone and oestrogen.
- ✤ Follicular or Proliferative Phase (6th 13th day) :
 - Primary follicles grow to Graafian follicle.
 - Endometrium regenerates through proliferation.
 - FSH and oestrogen increase.

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✤ Ovulatory Phase (14th day) :

- Graafian follicle ruptures & releases ovum (egg).
- Increase in endometrial thickness.
- LH peak.

✤ Luteal or Secretory Phase (15th – 28th day) :

- Emptied Graafian follicle develops into corpus luteum.
- If fertilization occurs, endometrium is prepared for implantation.
- If fertilization does not occur, uterine wall ruptures, bleeding starts and egg is expelled.
- LH & FSH decrease. Progesterone increases and then declines, if bleeding occurs.

Additional Question

3. Write short notes on UTIs.

[SEP – 2020]

- ♦ Urinary Tract Infection (UTI) affect both women & men.
- Woman are more susceptible from the bacteria on skin, rectum or vagina. This will enter urethra, before moving upwards.
- ✤ Types of UTI are:

i) Cystitis/Bladder infection:	Bacteria lodged in urinary bladder multiply leading to
	inflammation. It is common in age group 20 to 50.
ii) Kidney Infection:	Bacteria travel from bladder to ureter and affect kidneys. It also
	infects blood stream leading to life-threatening complications.

iii) Asymptomatic Bacteriuria: Bacteria in urinary bladder may not show any symptoms.

VIII. Higher Order Thinking Skills (HOTS)

1. Read the following passage and answer the questions that follow.

Rahini and her parents were watching a television programme. An advertisement flashed on the screen, which was promoting use of sanitary napkins. Rahini's parents suddenly changed the channel, but she objected to her parents and explained the need and importance of such advertisement.

a) What is first menstruation called? When does it occur?

First menstruation is called Menarche. It occurs between 11 to 13 years of age.

b) List out the napkin hygiene measures taken during menstruation.

- Sanitary pad should be wrapped and discarded properly.
- Sanitary pad should not be flushed in toilet.
- ✤ Napkin incinerators should be used properly.

c) Do you think that Rahini's objection towards her parents was correct? If so, Why?

Yes, she was correct. Because, maintaining menstrual hygiene is important for woman's health. It is not a shame to discuss about such topics at home.

Way to Success \circ - 10th Science

18. GENETICS

1. Explain with an example the inheritance of dihybrid cross. How is it different from monohybrid cross?

Experiment: Mendel Crossed round yellow seeded pea plants and wrinkled green seeded pea plants.

Observations:

- *** First generation** (**F**₁): When pure seeds are crossed, only round yellow seeds were produced.
- ***** Second generation (F₂): When F₁ hybrids were crossed by self-pollination,
- **Conclusion:** Factors for each trait is independent and maintain their identity in gametes and pass to the offsprings.

Results : Four types of plants.

- *Round yellow* 9 plants 2 Dominant traits
- *Round green* 3 plants] 1 Dominant &
- Wrinkled yellow -3 plants $\int 1$ Recessive
- Wrinkle green 1 Plant 2 Recessive Traits

Phenotypic ratio – 9 : 3 : 3 : 1

•		
Parent generation	Pure Round yellow seeds RRYY	Pure Wrinkled green seeds rryy
First generation (F1)		Ty Yy(Round yellow seeds)
	RrYy x	RrYy (Self-Pollination)
Second	ţ	
generation (F2)		

		RY	rY	Ry	ry
Ś	RY	RRYY	RrYY	RRYy	RrYy
	rY	RrYY	rrYY	RrYy	rrYy
	Ry	RRYy	RrYy	RRyy	Rryy
	ry	RrYy	rrYy	Rryy	rryy

Monohybrid cross	Dihybrid cross
1. Inheritance of one pair of contrasting characters.	Inheritance of two pairs of contrasting characters.
2. <i>Ex</i> : Tall Plant × Dwarf plant	<i>Ex</i> : Round yellow × Wrinkled green
3. F_2 phenotypic ratio is 3:1	F ₂ phenotypic ratio is 9:3:3:1

2. How is the structure of DNA organised? What is the biological significance of DNA? Structure of DNA – Watson and Crick Model:

- *i*) DNA molecule consists of two polynucleotide chains. They form double helix.
- ii) Nitrogenous bases in centre are linked to sugar-phosphate units.
- iii) It possess complementary base pairing between nitrogenous bases,
 - Adenine links Thymine with two hydrogen bonds (A = T)
 - Cytosine links Guanine with three hydrogen bonds ($C \equiv G$)
- *iv)* These hydrogen bonds make DNA molecule stable.
- v) Each turn of double helix is 34 A° . There are ten base pairs in a turn.
- vi) Nucleotides in a helix are joined by phosphodiester bonds.

Significance of DNA:

[SEP – 2020]

- \clubsuit It transmits hereditary information from one generation to the next.
- \clubsuit It contains information for the formation of proteins.
- $\boldsymbol{\diamondsuit}$ It controls developmental process and life activities.



- **3.** The sex of the new born child is a matter of chance and neither of the parents may be considered responsible for it. What would be the possible fusion of gametes to determine the sex of the child?
 - Human have 22 pairs of autosomes & one pair of allosomes.
 - ✤ Female gametes are homogametic (22+XX).
 - Male gametes are heterogametic (22+XY).
 - Sperm bearing (22 + X) chromosomes.
 - Sperm bearing (22 + Y) chromosomes.
 - If egg is fused with X bearing sperm (22+X) it produces a female child (44+XX).
 - ✤ If egg is fused with Y bearing sperm (22+Y) it produces a male child (44+XY).



19. ORIGIN AND EVOLUTION OF LIFE

1. Natural selection is a driving force for evolution - How? [PTA – 6, MDL – 19]

i) Overproduction: Living beings reproduce more individuals and multiply geometrically. This leads to overproduction.

- *ii) Struggle for existence:* Overproduction leads to population increase but with same space and food. This creates competition and organisms struggle for existence.
 - Intraspecific struggle : Competition among individuals of same species.
 - * Interspecific struggle : Competition between organisms of different species living together.
 - * Environmental struggle : Natural conditions like extreme heat or cold, drought & floods.
- *iii) Variations:* Favourable variations are useful. Unfavourable variations are useless.
- iv) Survival of the fittest or Natural selection: During the struggle,
 - Organisms which overcome the challenge will survive and adapt to environment.
 - ✤ Organisms which are unable to face the challenges are unfit to survive and disappear.
 - ✤ This is called natural selection. It is the key for evolution.

v) *Origin of species:* New species originates by gradual accumulation of favourable variations. Thus, above principles determines the evolutionary process and drives the evolution.

2. How do you differentiate homologous organs from analogous organs?

Homologous organs	Analogous organs
1. Look dissimilar. Different functions	1. Look similar. Similar functions
2. They are from common ancestors.	2. They have different origin.
3. Similar developmental pattern.	3. Different developmental pattern.
4. Similar basic structures.	4. Dissimilar basic structures.
5. <i>Ex</i> : Human hand, front leg of cat,	5. <i>Ex:</i> Wings of bird and insect.



3. How does fossilization occur in plants?

[PTA – 1]

Fossilization occurs when plant and animal remains are preserved in sedimentary rock.

Methods of Fossilization		
i) Petrifaction	• Silica penetrate and replaces organic tissue and forms a fossil.	
	• Can preserve hard and soft parts. Ex: Bones and wood fossils.	
ii) Mold & Cast	Organism buried in sediment leaves a mold.	
	• It is the original shape but does not reveal the internal structure.	
	• Minerals or sediment fill the mold and forms a cast.	
iii)Preservation	• Entire plant or animal can be preserved in ice or amber (tree sap).	
	• They protect them from decay.	
iv) Compression	• Hard parts of organism settle at bottom of seabed & covered by sediment.	
	• With continuous sedimentation, fossils are formed.	
v) Infiltration	• Precipitation of minerals takes place, which then infiltrate the cell wall.	
(<i>or</i>)	• This is achieved by elements like silica, calcium and magnesium carbonate.	
Replacement	• Hard parts are dissolved and replaced by these minerals.	

Additional Question

4. List the theories postulated to explain the origin of life?

[MAY-2022]

Special creation	Life on Earth is divine. It attributes to supernatural event in past.
	Life has not changed ever since its origin.
Spontaneous generation	Life originated spontaneously from lifeless matter.
(Abiogenesis)	<i>Ex</i> : Fishes from mud;
Biogenesis	Life originates from pre-existing life. Proposed by Louis Pasteur.
Extraterresterial	Life came from outer space.
or Cosmic origin	Units of life - spores (Panspermia) were transferred to different planets.
Chemical evolution	Proposed by Oparin & Haldane. Life arose by chemical reactions.
of Life	Non-living inorganic molecule \rightarrow Diverse organic molecules \rightarrow Colloidal system \rightarrow Life

20. BREEDING AND BIOTECHNOLOGY

Hybrid vigour or heterosis: Superiority of hybrid obtained by cross breeding. *Effects of hybrid vigour in animals:*

- Increased production of milk by cattle.
- Increased production of egg by poultry.
- ✤ High quality of meat is produced.
- Increased growth rate in domesticated animal.
- 2. Describe mutation breeding with an example.
 - Mutation is a sudden heritable change in nucleotide sequence of DNA.
 - Utilization of mutation in crop improvement is called **mutation breeding**.
 - Organism which undergo mutation is called **mutant**.
 - ✤ Factors that induces mutation are called **mutagens**. It is of two types,
 - *i) Physical mutagens :* Radiations like X-rays, α , β and γ , UV rays, etc.
 - ii) Chemical mutagens : Chemical substances like nitrous acid.

Example: Sharbati Sonora wheat is produced from Sonora-64 by using gamma rays.

3. Biofortification may help in removing hidden hunger. How?

<u>Biofortification</u>: Process of developing plants enriched with high levels of desirable nutrients. <u>Hidden Hunger</u>: It denotes the lack of micronutrients such as vitamin A, zinc and iron in diet. **Removal of Hidden hunger**:

- ✤ Bio-fortified foods contribute body to store micronutrients throughout the life cycle.
- * Thus, Bio-fortification is effective in removing hidden hunger.
- *Ex:* > Protina, Shakti and Rathna Rich maize hybrids.
 - > Atlas 66 Protein rich wheat.
 - Iron rich fortified rice variety.
 - > Vitamin A enriched carrots, pumpkin and spinach.

4. With a neat labelled diagram explain the techniques involved in gene cloning.

Gene cloning : Gene or a piece of DNA fragment is inserted into a bacterial cell where DNA will be copied as the cell divides. Clone is a genetically exact copy of an organism.

Steps involved in gene cloning :

- Isolation of desired DNA fragment by restriction enzymes.
- Insertion of the DNA fragment into vector (Plasmid) to make rDNA.
- ✤ Transfer of rDNA into bacterial host cell.
- Selection and multiplication of recombinant host cell to get a clone.
- ✤ Expression of cloned gene in host cell.







5. Discuss the importance of biotechnology in the field of medicine.[MAY - 2022,SEP – 2021] Biotechnology helps to develop various medicinally valuable proteins or polypeptides that form the potential pharmaceutical products for treating various diseases.

Medicines developed by rDNA technique :

- a) Insulin Treat diabetes.
- b) Human growth hormone Treat children with growth defects.
- c) Blood clotting factors Treat haemophilia.
- d) Tissue plasminogen activator Dissolve blood clots and prevent heart attack.
- e) Vaccines For diseases like Hepatitis B and rabies.

IX. Higher Order Thinking Skills (HOTS) (

1. Organic farming is better than Green Revolution. Give reasons.

Reasons for Organic farming is better than Green Revolution :

- Green revolution uses fertilizers and pesticides which are toxic and cause pollution. Whereas organic farming adds nutrients like nitrogen, phosphorus, potassium to soil.
- In Organic farming,
 - ✓ Proper soil management is done.
 - ✓ It doesn't cause global warming.
 - \checkmark There is no genetically altered gene (seeds). So it is very cheap.
 - ✓ Food chain is protected.

Thus, organic farming is safer, healthier than green revolution.

- 2. 'P' is a gene required for the synthesis of vitamin A. It is integrated with genome of 'Q' to produce genetically modified plant 'R'.
 - i) What is P, Q and R?

 $\label{eq:posterior} P \rightarrow Beta \ carotene \qquad Q \rightarrow Ordinary \ rice \ plant \qquad R \rightarrow Golden \ rice$

ii) State the importance of 'R' in India.

Important of Golden rice in India :

- ✤ It is used for fighting against cell damage
- \clubsuit It is a healthy variety.
- ✤ It prevents vitamin A deficiency.

In India vitamin A deficiency in children & adults can be prevented by using golden Rice.

21. HEALTH AND DISEASES

1. Suggest measures to overcome the problems of an alcoholic. [MAY - 2022, SEP – 2021]

Education & counselling	It will help alcoholics to overcome their problems and stress.
Physical activity	They should perform healthy activities like music, sports, yoga, etc.,
Seeking help from others	 When they need any help, they should reach their parents & friends. This would help them to share their feeling and get rid of the habit.
Medical assistance	 They should see psychologists and psychiatrists. Alcohol de-addiction and rehabilitation programmes are helpful.

2. Changes in lifestyle is a risk factor for occurrence of cardiovascular diseases. Can it be modified? If yes, suggest measures for prevention.

Yes, lifestyle can be modified to prevent cardiovascular diseases.

Measures for preventing Heart Disease :

i) Diet Management : Follow heart-healthy diet.

* Reduce the intake of calories, fat and cholesterol rich food, low carbohydrates and salt.

◆ Increase the intake of fibre diet, fruits, vegetables, proteins, minerals and vitamins.

- *ii) Physical activity* : Regular exercise, walking and yoga.
- iii) Avoid Addictive substance : Stop smoking, tobacco and alcohol.
- iv) Get quality sleep and manage stress.

22. ENVIRONMENTAL MANAGEMENT

- 1. How does rainwater harvesting structures recharge ground water? [SEP 2021]
 - (i) Roof top rainwater harvesting :

Rain water on roofs is collected and stored in surface tank. It is used for domestic purpose.

(ii) Recharge pit:

Rainwater is directed to percolation pits for filtration and then to recharge pits/ ground wells.
 (iii) Digging of tanks or lakes (Eris):

 \bigstar It is one of the traditional water harvesting system in Tamilnadu.

◆ Eris are inter connected so that if water in one Eri overflows, it gets diverted to next eri.

(iv) Ooranis : These are small ponds to collect rainwater. It is used for various domestic purposes.

2. How will you prevent soil erosion?

- Retain vegetation cover.
- Cattle grazing should be controlled.
- Crop rotation and soil management.
- Runoff water should be stored in catchment.
- Reforestation, terracing and contour ploughing.
- Wind speed is controlled by planting trees as shelterbelt.



3. What are the sources of solid wastes? How are solid wastes managed?

Sources of Solid wastes: Municipal wastes, hospital wastes, industrial wastes, e - wastes. Solid Waste Management: Collection, treatment and proper disposing of solid wastes. Methods of solid wastes disposal:

- a) Segregation: Separation of waste materials as biodegradable and non-biodegradable wastes.
- b) Sanitary landfill: Solid wastes are dumped into low-lying areas & organic matter decomposes.
- c) Incineration: non-biodegradable solid wastes are burnt in furnace at high temperature.
- d) Composting: Biodegradable matter is digested by microbes/earthworms & converted to humus.

Some Solid wastes can be Recycled:

- ✤ Papers are recycled in paper mills.
- Paddy husk can be used as livestock fodder.
- Cowdung can be used to provide biogas and manure.

4R Approach: Reduce \rightarrow Reuse \rightarrow Recover \rightarrow Recycle.

4. Enumerate the importance of forest.

- ✤ Forests are an important component of environment.
- Protect wildlife and provide habitat for wild animals.
- ✤ They are the source for many renewable natural resource.
- They provide wood, food, fodder, fiber and medicine.
- They act as carbon sink
- ✤ Regulate climatic conditions, increase rainfall, reduce global warming
- Prevent natural hazards like flood and landslides
- ✤ It helps water conservation.
- ✤ It helps in economic development.
- They maintain ecological balance.

5. What are the consequences of soil erosion?

- * *Loss of topsoil* : Soil erosion removes topsoil which reduces the fertility.
- Soil compaction : Due to this, ability of the soil to absorb water is reduced.
- Water pollution : It increases sedimentation in streams & rivers causing reduction of fishes.
- ✤ Soil erosion causes loss of humus, nutrients and decreases soil fertility
- ✤ It disturbs the soil structure, fertility, acidity, etc., thus disrupting the ecosystem.

6. Why is the management of forest and wild life resource considered as a challenging task?

Management of forest and wildlife resource is a challenging task because,

- ✤ Lack of public awareness.
- ✤ Local people kill animals and cut down trees, for their living.
- ✤ Uncertainty of rainfall, affects forest irrigation.
- ✤ Changes in rainfall pattern due to global warming, climatic changes, etc,.
- Illegal cutting of trees and killing of animals.
- ✤ Increase in human population.



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Additional Question

7. Define Tidal energy. List out the advantages of tidal energy.

Tidal energy is the energy obtained from the movement of water due to ocean tides.

Advantages of tidal energy :

- (i) No fuel and no waste.
- (ii) It does not produce pollution.
- (iii) Tides are predictable, so tidal energy can be produced at any time.
- (iv) It can generate electricity at lower speeds than wind turbines.

IX. Higher Order Thinking Skills (HOTS)

1. Why is the Government imposing ban on the use of polythene bags and plastics? Suggest alternatives. How is this ban likely to improve the environment?

Reasons for banning polythene bags and plastics:

- ◆ Plastics can not degrade naturally causing pollutions in land, soil and water.
- Burning of plastics leads to air pollution.
- ◆ Plastics prevent absorption of water into Earth, which reduces groundwater level.
- ◆ Polythene bags are accidentally eaten by animals. It harms them and may lead to death.

Alternatives : Use containers, cloth bags, paper wraps, compostable bags, jute bags.

Improvement : Reduces various pollutions and improves health of individuals.

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