# Two MARKS

## 1. LAWS OF MOTION

**1. Define inertia. Give its classification.** **[AUG - 2022]**

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

***Classification of Inertia :***

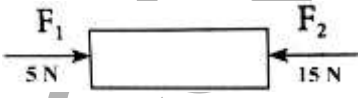
❖ Inertia of rest ❖ Inertia of motion ❖ Inertia of direction

**2. Classify the types of force based on their application.** **[AUG - 2022]**

***Types of Forces:***

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

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




Given , $F_1 = 5N$ $F_2 = 15\ N$

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

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

**4. Differentiate mass and weight.** **[MAY - 2022]**

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

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

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

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

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

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

**Moment of clockwise direction = Moment of anticlockwise direction**

**7. State Newton's second law.** **[MDL – 19, MAY - 2022]**

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

$$\mathbf{F} = \boldsymbol{ma}$$

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

❖ The turning effect is more when the distance between line of action and axis of rotation is more.

❖ Hence, the spanner has a long handle is preferred to tighten screws in heavy vehicles.

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

❖ To increase the time of contact.

❖ To reduce the impulse and the pain.

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

❖ Astronauts are not floating but falling freely around the Earth due to their huge orbital velocity.

❖ Since space station and astronauts have equal acceleration, they are under free fall condition.

## Additional Questions

**11. Shock absorbers are used in luxury buses. Why?** **[PTA – 2]**

Shock absorbers are used in luxury buses for the comfort purpose. Because, they absorb or damp the shocks or unwanted oscillations of the bus due to damaged roads.

**12. Illustrate some examples of Newton's third law of motion.** **[PTA – 2]**

*i)* ***Action :*** When birds fly, they push the air downwards with their wings.
***Reaction :*** The air pushes the birds upwards.

*ii)* ***Action :*** When a person swims, he pushes the water using the hands backwards.
***Reaction :*** The water pushes the swimmer in the forward direction.

*iii)* ***Action :*** When we fire a bullet, the gun recoils backward and the bullet is moving forward.
***Reaction :*** The gun equalizes this forward action by moving backward.

**13. Why the apples weigh more at poles than at equator?** **[PTA – 3]**

❖ Weight depends on the acceleration due to gravity of the Earth(g). The acceleration due to gravity is more at poles than at equator.

❖ So, the apples weigh more at poles than at equator.

# 2. OPTICS

**1. What is refractive index?**

The ratio of speed of light in vacuum to the speed of light in a medium is refractive index.

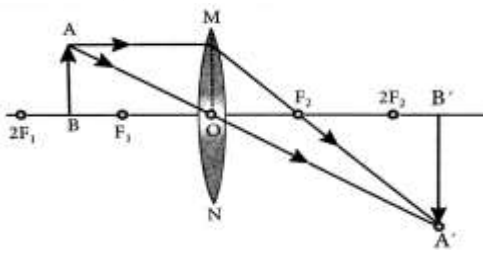
$$\mu = \frac{c}{v}$$

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

The ratio of the sine of the angle of incidence and sine of the angle of refraction is equal to the ratio of refractive indices of the two media. **[AUG - 2022]**

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

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




**4. Define dispersion of light.**

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

**5. State Rayleigh's law of scattering.** **[PTA-3]**

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

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

**6. Differentiate convex lens and concave lens.** **[PTA-3]**

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

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

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

**8. What are the causes of 'Myopia'?** **[MDL – 19]**

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

**9. Why does the sky appear in blue colour?** **[PTA – 1]**

By Reyleigh's law of scattering blue colour of sunlight scatters the most by the atmosphere. Thus, the sky appears blue in colour.

**10. Why are traffic signals red in colour?** **[PTA – 4]**

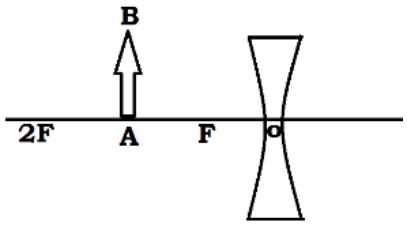
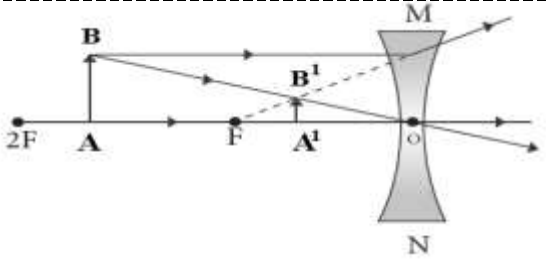
Red light has longest wavelength and scatters less. Thus it travels longer and hence it is used in traffic signals to stop the vehicle.

## Additional Questions

**11. Write any two applications or uses of concave lens.** **[SEP – 2021]**

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

**12. Complete the ray diagram of a concave lens.** **[PTA – 6]**

| Question | Answer |
|---|---|
|   |   |

## IX. Higher order thinking (HOT) questions

1. **While doing an experiment for the determination of focal length of a convex lens, Raja suddenly dropped the lens. It got broken into two halves along the axis. If he continues his experiment with the same lens, (a) can he get the image? (b) Is there any change in the focal length?**
   a) **Yes**. He got the image. But, with less intensity.
   b) **No**. There is no change in the focal length, because it is cut along the axis.

2. **The eyes of the nocturnal birds like owl are having a large cornea and a large pupil. How does it help them? (or) How owls could see at night?**
   - ❖ Nocturnal birds are the birds that are active at night. ***Ex :*** *Owl*
   - ❖ Large cornea and large pupil, increases the amount of light entering into its eyes.
   - ❖ Thus, it helps them to see clearly in dim light.

### Additional Question

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

# 3. THERMAL PHYSICS

1. **Define one calorie.** **[AUG – 2022, MDL – 19]**
   One calories is the amount of heat energy required to rise the temperature of 1 gram of water through 1℃.

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

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

3. **What is co-efficient of cubical expansion?** **[PTA – 6]**
   It is the ratio of increase in volume of the body per degree rise in temperature to its unit volume.

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

Its SI unit is $K^{-1}$.

**4. State Boyle's law.** **[MDL – 19, MAY - 2022]**

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

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

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

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

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

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

| Ideal gas | Real gas |
|---|---|
| 1. Atoms/molecules do not interact with each other. | 1. Atoms/molecules interact with each other. |
| 2. It has low intermolecular/interatomic force of attraction. | 2. It has definite intermolecular/ interatomic force of attraction. |

**7. What is co-efficient of real expansion?** **[SEP – 2020]**

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

**8. What is co-efficient of apparent expansion?**

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

## Additional Questions

**9. State Avogadro's Law.** **[SEP – 2021]**

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

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

**10. Define Co-efficient of linear expansion.** **[PTA – 1]**

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

## IX. HOT Question

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

We feel more chillness in the hand in which ***ice*** is placed at 0°C

***Reason:*** *When water and ice are kept in our hand at* 0°C, *ice requires additional latent heat energy to melt down. ∴ Ice absorbs more heat energy when compared to water.*

# 4. ELECTRICITY

**1. Define electric potential and potential difference.**

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

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

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

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

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

**3. State Ohm's law.**

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

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

Where R → Resistance of the material.

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

| Resistivity ($\rho$) | Conductivity ($\sigma$) |
|---|---|
| i) It is the resistance of a conductor of unit length and unit area of cross section. | i) It is the reciprocal of electrical resistivity. |
| ii) Its unit is **ohm metre** (Ωm). | ii) Its unit is **mho metre$^{-1}$**. |
| iii) It is the measure of resisting power. | iii)It is the measure of ability to pass the current. |

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

Domestic appliances are connected in parallel.

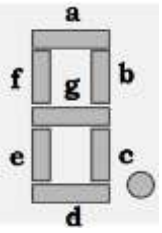
**Reason:**
- ❋ Disconnection of one circuit does not affect other circuit
- ❋ Each appliance gets an equal voltage.

## Additional Questions

**6. Define the unit of electrical energy consumption. [PTA – 5]**

- ❖ Unit of electrical energy consumption is watt second or kilowatt hour.
- ❖ It is the product of electric power and time of usage.
- ❖ One kilowatt hour is known as one unit of electrical energy.

**7. Draw the picture of seven segment display for any one alpha numeric number.[PTA–3]**



# 5. ACOUSTICS

**1. Why does sound travel faster on a rainy day than on a dry day? (or) Why does sound propagate faster on a rainy season than on summer season? [PTA – 6]**

- ❖ Presence of moisture in air decreases the density and increases velocity.
- ❖ Hence, with high moisture, sound travel faster on a rainy day than on a dry day.

**2. Why does an empty vessel produce more sound than a filled one? [PTA – 2]**

- ❖ Amplitude of vibration of air is greater than liquid.
- ❖ Also amplitude is more due to the free space in empty vessel.
- ❖ Intensity is also increased by multiple reflections in empty vessel.

**3. Air temperature in the Rajasthan desert can reach 46°$C$. What is the velocity of sound in air at that temperature? ($V_0$ = 331 m $s^{-1}$)**

$V_0 = 331\ m\ s^{-1}$ $\quad T = 46°C$

$V_T = V_0 + 0.61\ T = 331 + 0.61 \times 46 = 359.06\ ms^{-1}$

**4. Explain why, the ceilings of concert halls are curved. [MAY-2022, PTA-6]**

- ❖ Ceilings of concert halls are curved because sound intensity is maximized after multiple reflections and reaches every corner. Audience can listen the sound clearly.

**5. Mention two cases in which there is no Doppler effect in sound. [MDL – 19, SEP - 2020]**

- ❖ When source (S) and listener (L) both are at rest.
- ❖ When source (S) and listener (L) move with constant distance between them.

## Additional Questions

**6. Write any two application of echo? [MAY-2022]**

- ❖ Used by some animals to locate objects.
- ❖ Echo is used to determine the velocity of sound waves in any medium.
- ❖ It is used in obstetric ultrasonography, to capture images of fetus in mother's uterus.

**7. Difference between the Sound and Light waves. [PTA – 3]**

| S.No | SOUND | LIGHT |
|---|---|---|
| 1. | Medium is required for propagation. | Medium is not required for propagation. |
| 2. | Longitudinal waves. | Transverse waves. |
| 3. | Wavelength from 1.65 cm to 1.65 m | Wavelength from $4 \times 10^{-7}$ m to $7 \times 10^{-7}$ m |
| 4. | Speed = 340$ms^{-1}$ at NTP. | Speed = $3 \times 10^{8}$ $ms^{-1}$. |

## X. HOT Questions

**1. Suppose that a sound wave and a light wave have the same frequency, then which one has a longer wavelength?**

a) Sound **b) Light** c) both a and b d) data not sufficient

$\lambda \propto V$ ∴ ***Light has longer wavelength.***

**2. When sound is reflected from a distant object, an echo is produced. Let the distance between the reflecting surface and the source of sound remain the same. Do you hear an echo sound on a hotter day? Justify your answer.**

- As temperature increases, speed of sound increases. ∴ Speed of sound is more on hotter day.
- The distance is same. Hence, time taken by the sound would be less on hotter day.
- Echo occurs when time difference is atleast 0.1 s.
- Thus, if the new time is less than 0.1 s, echo won't be heard. If it is greater than 0.1 s, echo can be heard even on a hotter day.

# 6. NUCLEAR PHYSICS

**1. Write any three features of natural and artificial radioactivity. [AUG-22, MAY-22, PTA-1]**

| Natural radioactivity | Artificial radioactivity |
|---|---|
| 1. Spontaneous process. | Induced process. |
| 2. Cannot be controlled. | Can be controlled. |
| 3. Alpha, beta and gamma are emitted. | Elementary particles like neutron, positron, etc., are emitted. |

**2. Define Critical mass.**

- Minimum mass of fissile material necessary to sustain the chain reaction is called critical mass($m_c$).

❋ ***Sub critical:*** Mass is less than critical mass. ❋ ***Super critical:*** Mass is more than critical mass.

**3. Define one Roentgen.**

One roentgen is the quantity of radioactive substance that produces a charge of $2.58 \times 10^{-4}$ coulomb in 1 kg of air under standard conditions of pressure, temperature and humidity.

**4. State Soddy and Fajan's displacement law.**

i) When a radioactive element emits an alpha particle, a daughter nucleus is formed whose mass number is less by 4 units and atomic number is less by 2 units, than the parent nucleus.

ii) When a radioactive element emits a beta particle, a daughter nucleus is formed whose mass number is the same and atomic number is more by 1 unit, than the parent nucleus.

**5. Give the function of control rods in a nuclear reactor. (or) What are control rods? [PTA – 3]**

- Control rods are used to control the number of neutrons by absorbing them to maintain the chain reaction. ***Ex:*** Boron, Cadmium rods.

**6. In Japan, some of the new born children are having congenital diseases. Why?**

- The atom bombs exploded in Japan emitted hazardous radiations causing genetic diseases.
- Thus, exposed mothers give birth to children with congenital diseases.

7. **Mr. Ramu is working as an X - ray technician in a hospital. But, he does not wear the lead aprons. What suggestion will you give to Mr. Ramu?**
   - ❖ Though it do not have any impact initially, in future he may suffer from many diseases.
   - ❖ Thus, I will suggest Ramu to wear Lead coated aprons and gloves to safeguard himself.
8. **What is stellar energy?**
   Fusion reaction in the cores of Sun and other stars results in enormous energy called stellar energy.
9. **Give any two uses of radio isotopes in the field of agriculture.**
   **Phosphorous isotopes (P-32):**
   - ❋ Increases the productivity of crops.
   - ❋ Used to kill insects and parasites.

## Additional Questions

10. **Nuclear fission of a uranium nucleus ($U^{235}$) as follows** $_{92}U^{235} + {}_0n^1 \rightarrow X + Y + 3\,{}_0n^1 + Q$ (energy)
    ***Find the daughter nuclei X and Y emitted from the above reaction.*** **[PTA – 4]**

    *Nuclear Fission reaction is* $_{92}U^{235} + {}_0n^1 \longrightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3\,{}_0n^1 + Q$ (energy)

    ∴ **X** – $_{56}Ba^{141}$, **Y** – $_{36}Kr^{92}$

## XII. Higher Order Thinking Questions

1. **'X – rays should not be taken often'. Give the reason.** **[PTA – 5]**
   - ❖ Exposure to X-rays can cause cell mutations and cancer.
   - ❖ Exposure to X-rays can cause vomiting, bleeding, fainting, hair loss and skin damage.
2. **Cell phone towers should be placed far away from the residential area – Why?**
   - ❖ Cell phone towers emit high frequency radio waves, which are dangerous and cause health risks like cancer, birth defects, memory loss, etc.,
   - ❖ Thus, it is better to place cell phone towers far away from residential areas.

# 7. ATOMS AND MOLECULES

1. **Define: Relative Atomic Mass (or) Define Standard atomic weight.** **[AUG - 22, PTA – 3]**
   Relative Atomic mass of an element is the ratio between average mass of its isotope to $\frac{1}{12}^{th}$ part of the mass of a carbon-12 atom.

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

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

| Isotope | Atomic Mass (amu) | % abundance |
|---|---|---|
| $_8O^{16}$ | 15.9949 | 99.757 |
| $_8O^{17}$ | 16.9991 | 0.038 |
| $_8O^{18}$ | 17.9992 | 0.205 |

3. **Define: Atomicity. Give an example.** **[AUG – 2022, MAY-2022, SEP – 2021]**
   - ❖ Number of atoms present in molecule is called its atomicity.
   - ❖ ***Ex :*** Atomicity of Phosphorous($P_4$) is 4.

4. **Give any two examples for hetero diatomic molecules.** **[AUG - 2022]**

   Hydrogen Chloride *(HCl)*, Hydrogen Fluoride *(HF)*

5. **What is Molar volume of a gas?**

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

6. **Find the percentage of nitrogen in ammonia.** **[PTA – 1]**

$$\% \text{ of Nitrogen in } NH_3 = \frac{\text{Mass of element}}{\text{Molecular mass}} \times 100 = \frac{14}{17} \times 100 = 82.35\ \%$$

## VIII. HOT Question

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

$$CaCO_3 \rightarrow CaO + CO_2$$

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

One mole of $CaCO_3$.

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

Gram Molecular Mass of $CaCO_3 = (40 \times 1) + (12 \times 1) + (16 \times 3)$

$= 40 + 12 + 48 = 100$ g

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

One mole of $CO_2$.

# 8. PERIODIC CLASSIFICATION OF ELEMENTS

1. **A is a reddish brown metal, which combines with $O_2$ at < 1370 K gives B, a black coloured compound. At a temperature > 1370 K, A gives C which is red in colour. Find A, B and C with the reaction.** **[PTA – 4]**

$$2\ Cu + O_2 \xrightarrow{< 1370\ K} 2\ CuO$$

**(B) *Copper II oxide (black)***

$$4\ Cu + O_2 \xrightarrow{> 1370\ K} 2\ Cu_2O$$

**(C) *Copper I oxide (red )***

**A → Copper (Cu);**
**B → Copper II oxide (CuO)**
**C → Copper I oxide ($Cu_2O$)**

**2. A is a silvery white metal. A combines with $O_2$ to form B at 800°C, the alloy of A is used in making the aircraft. Find A and B.** **[PTA – 1]**

$$4\,Al + 3O_2 \xrightarrow{800°C} 2\,Al_2O_3$$

**(A)** ***Aluminium oxide*** **(B)**

**A → Aluminium (Al)**

**B → Aluminium oxide ($Al_2O_3$)**

**3. What is rust? Give the (chemical) equation for formation of rust.** **[SEP – 2021, PTA – 4]**

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

$$4Fe + 3O_2 + x\,H_2O \longrightarrow 2\,Fe_2O_3 . x\,H_2O \text{ (Rust)}$$

***Iron*** ***Hydrated ferric oxide***

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

Presence of air and water vapour (in air) are the two necessary conditions for rusting of iron.

## Additional Questions

**5. From the following clues identify the group number in the periodic table and write the names of any two elements of that group.** **[PTA – 1]**

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

**b) These elements are mostly unreactive.**

***Group :*** $18^{th}$ (or) Noble gas ***Ex :*** Helium(He), Neon(Ne), Argon(Ar).

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

***Reason:*** Froth floatation depends on preferential wettability of ore with oil. Only if impurity is heavier than ore, can be concentrated by froth floatation. Thus, lighter ore like Copper pyrites ($CuFeS_2$) are concentrated by froth floatation method. **[PTA – 4]**

**7. 'X' is an element that belongs to $1^{st}$ group of the modern periodic table. 'X' is a gas and its covalent radius value is 0.37 A°. Identify and write the chemical symbol of 'X'.** **[PTA – 6]**

❖ Element X is ***Hydrogen,*** Chemical symbol is **H / $H_2$**.

## VIII. Hot Questions

**1. Name the acid that renders aluminium passive. Why?** **[PTA – 3]**

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

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

Electronegativity of H = 2.1 and F = 4.0

Difference in electronegativity = 4.0 – 2.1 = 1.9 which is >1.7

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

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

Electronegativity

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

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

## Additional Questions

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

$$3\,Fe + 4\,H_2O\,(steam) \longrightarrow Fe_3O_4 + 4H_2\uparrow$$

*Iron* — *Magnetic oxide*

**A → Iron (Fe)**
**B → Magnetic oxide ($Fe_3O_4$)**
**C → Nickel steel (Fe, C, Ni)**

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

- **A ⟶ Aluminium.** This process is *aluminothermic process*.

$$Fe_2O_3 + 2Al \longrightarrow 2\,Fe + Al_2O_3 + Heat$$

*Iron oxide* — *Iron*

# 9. SOLUTIONS

**1. Define the term - Solution.**

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

**2. What is mean by binary solution?**

Binary solution consists of two components one solute and one solvent. ***Ex:*** NaCl in water

**3. Give an example each i) gas in liquid ii) solid in liquid iii) solid in solid iv) gas in gas**

i) Gas in liquid - Soda water ii) Solid in liquid - NaCl in water **[PTA – 1]**
iii) Solid in solid - Copper in gold iv) Gas in gas - Mixture of Helium and oxygen

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

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

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

**5. Define Volume percentage.**

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

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

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

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

**7. Define Hydrated salt.**

It is the ionic substances, which contain water of crystallization. ***Ex :*** Blue vitriol ($CuSO_4 . 5H_2O$)

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

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

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

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

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

## Additional Questions

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

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

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

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

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

## VII. HOT Questions

1. **Vinu dissolves 50 g of sugar in 250 ml of hot water, Sarath dissolves 50 g of same sugar in 250 ml of cold water. Who will get faster dissolution of sugar? and Why? [PTA – 6]**

   Vinu readily dissolves sugar than Sarath because solubility increases with increase in temperature.

2. **'A' is a blue coloured crystalline salt. On heating it loses blue colour and to give 'B'. When water is added, 'B' gives back to 'A'. Identify A and B, write the equation. [MAY - 2022]**

   ❖ When **blue vitriol (A)** is heated, it loses its five water molecules and becomes colourless **$CuSO_4$ (Anhydrous copper sulphate) 'B'**. If water is added, it returns back to blue vitriol (A).

$$\underset{\substack{\text{Copper sulphate pentahydrate}\\ \textit{Blue colour}}}{CuSO_4.5H_2O} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \underset{\substack{\text{Anhydrous copper sulphate}\\ \textit{colourless}}}{CuSO_4} + 5H_2O$$

| | |
|---|---|
| **A →** | **blue vitriol, Copper sulphate pentahydrate ($CuSO_4.5H_2O$)** |
| **B →** | **Anhydrous copper sulphate ($CuSO_4$)** |

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

## Additional Question

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

   ***i) Identify compound A.***

| | |
|---|---|
| **A →** | **Magnesium sulphate heptahydrate ($MgSO_4.7H_2O$)** |
| | Colourless, crystalline, hydrated salt of magnesium |

   **ii) Give the Chemical equation for this heating reaction.**

   When Magnesium sulphate heptahydrate(A) is heated, anhydrous magnesium sulphate ($MgSO_4$) is formed losing seven water molecules(as in Green vitriol - $FeSO_4.7H_2O$)

$$\underset{\text{Magnesium sulphate heptahydrate}}{MgSO_4.7H_2O} \underset{\text{Cooling}}{\overset{\text{Heating}}{\rightleftharpoons}} \underset{\text{Anhydrous Magnesium sulphate}}{MgSO_4} + 7H_2O$$

# 10. TYPES OF CHEMICAL REACTIONS

1. **When an aqueous solution of potassium chloride is added to an aqueous solution of silver nitrate, a white precipitate is formed. Give the chemical equation of this reaction. [PTA – 6]**

*Double Displacement Reaction*

$$KCl_{(aq)} + AgNO_{3(aq)} \longrightarrow \underset{\textit{Potassium nitrate}}{KNO_{3(aq)}} + \underset{\substack{\textit{silver nitrate}\\ \textit{White precipitate}}}{AgCl_{(s)} \downarrow}$$

2. **Why does the reaction rate of a reaction increase on raising the temperature? (or) Why food kept at room temperature spoil faster than at refrigerator? [PTA –6, MDL – 19]**
   - ❖ Raising temperature provides more energy to break more bonds (i.e) Reaction rate is increased.
   - ❖ Thus, Food kept at room temperature spoil faster than at refrigerator, as the temperature in fridge is lower which makes the reaction rate slower.

3. **Define combination reaction. Give one example for an exothermic combination reaction.**
   A reaction in which two or more reactants combine to form a compound is known as Combination (or) Synthesis (or) Composition reaction.

   ***General schematic representation:*** $A + B \rightarrow AB$ **[MAY - 2022]**

   ***Example for Exothermic combination reaction:*** $SiO_{2(s)} + CaO_{(s)} \rightarrow CaSiO_{3(s)}$

4. **Differentiate reversible and irreversible reactions. [AUG-22, MAY-22, SEP-2021, PTA-1]**

| Reversible reaction | Irreversible reaction |
|---|---|
| 1. It can be reversed under suitable condition. | 1. It cannot be reversed. |
| 2. Both forward and backward reactions take place simultaneously. | 2. It proceeds only in forward direction. |
| 3. It attains equilibrium. | 3. Equilibrium is not attained. |
| 4. It is relatively slow. | 4. It is fast. |

## Additional Questions

5. **Define Single displacement reaction with example. [SEP – 2020]**

   ***Single displacement reaction:*** It is the reaction between an element and a compound, where one element of the compound-reactant is replaced by the element-reactant to form a new compound and an element.

   ***Ex:*** $Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_{2(g)}$

6. **If the pH value of solution is zero then what will be the nature of the solution? Give reason.**
   - ❖ pH of a solution is zero means, $-\log [H^+] = 0$; $[H^+] = 1$ **[PTA – 3]**
   - ❖ Concentration of hydrogen ion is 1. So it is highly **acidic** in nature.

**7. Which one of the following reactions is feasible? Give support to your answer. [PTA – 3]**

**i)** $2NaCl + F_2 \rightarrow 2NaF + Cl_2$ **ii)** $NaF + Cl_2 \rightarrow NaCl + F_2$

- 1st reaction: is feasible whereas 2nd reaction is not feasible
- Because, fluorine is more reactive than chlorine. So Fluorine displaces Chlorine.

**8.** $CaCO_{3(s)} + Heat \rightarrow CaO_{(s)} + CO_{2(g)}$ $CaCO_{3(s)} + Heat \rightleftarrows CaO_{(s)} + CO_{2(g)}$

**Analyse the above chemical reactions. At what condition(s) these reactions are feasible? [PTA – 4]**

- The first reaction is thermal decomposition reaction. Heat is required to break the bonds.
- If the first reaction is carried out in a closed vessel, it reaches a chemical equilibrium. Thus, second reaction is feasible.

**9. Write one example each for chemical reactions to be faster and chemical reactions to be slower in your daily life activities. [PTA – 3]**

- ***Faster Reaction*** - Digestion of food
- ***Slower Reaction*** - Rusting of iron

**10. Which of the following chemical reactions is a neutralization reaction? Reason out.**

$NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$ **[PTA – 4]**

$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(g)} + Heat$

- The first reaction is ***neutralization reaction***.
- ***Reason:*** Sodium replaces hydrogen from hydrochloric acid forming sodium chloride, a salt.

**11. Does pure water conduct electricity? Justify you answer. [PTA – 5]**

Pure water does not conduct electricity, because of the absence of ions in pure water.

**12. What is the role of manganese dioxide in the heating reaction of potassium chlorate for the production of oxygen gas? [PTA – 6]**

Manganese dioxide acts as a ***catalyst*** and increases the reaction rate.

## VII. HOT Questions

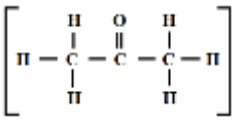
**1. Can a nickel spatula be used to stir copper sulphate solution? Justify your answer. [PTA – 6]**

- Nickel spatula cannot be used to stir copper sulphate solution.
- Nickel is more reactive than copper. Hence, nickel displaces copper from its solution.

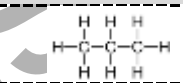
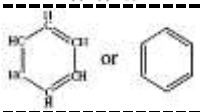
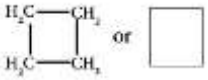
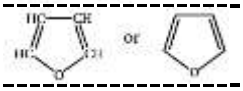
# 11. CARBON AND ITS COMPOUNDS

**1. Name the simplest ketone and give its structural (or) molecular formula.** **[PTA –2]**

*Simplest ketone* : Acetone
*Structural formula* : $CH_3–CO–CH_3$
*IUPAC Name* : Propanone



**2. Classify the following compounds based on the pattern of carbon chain and give their structural formula: (i) Propane (ii) Benzene (iii) Cyclobutane (iv) Furan** **[PTA – 1, MAY-2022]**

| Name | Classification | Molecular formula | Structural formula |
|---|---|---|---|
| i) Propane | Acyclic (or) open chain compounds | $C_3H_8$ |  |
| ii) Benzene | Aromatic compound | $C_6H_6$ |  |
| iii) Cyclobutane | Alicyclic compound | $C_4H_8$ |  |
| iv) Furan | Heterocyclic compound | $C_4H_4O$ |  |

**3. How is ethanoic acid prepared from ethanol? Give the chemical equation.**

Ethanoic acid is prepared from oxidation of ethanol in the presence of alkaline potassium permanganate or acidified potassium dichromate.

$$\underset{\textit{Ethanol}}{CH_3CH_2OH} \xrightarrow[2[O]]{KMnO_4/OH^-} \underset{\textit{Ethanoic acid}}{CH_3COOH} + H_2O$$

**4. How do detergents cause water pollution? Suggest remedial measures to prevent this pollution.**

Detergents having branched hydrocarbon chain are not fully biodegradable by micro-organisms in water. So, they cause water pollution. **[PTA – 3]**

***Remedy:*** We can use straight hydrocarbon chains, which can be easily degraded by bacteria.

**5. Differentiate soaps and detergents.** **[SEP – 2020, PTA – 3, MDL – 19]**

| Soaps | Detergents |
|---|---|
| 1. Sodium salt of long chain fatty acid | 1. Sodium salts of sulphonic acids. |
| 2. Ionic part is $–COO^-Na^+$ | 2. Ionic part is $–SO_3^-Na^+$ |
| 3. It is less effective in hard water. | 3. 4. It is effective even in hard water. |
| 4. It forms a scum in hard water. | 5. It does not form a scum in hard water. |
| 5. Poor foaming capacity. | 6. Rich foaming capacity. |
| 6. Biodegradable. | 7. Mostly non-biodegradable. |

## Additional Questions

**6. Write any 2 uses of Ethanol.** **[SEP – 2021]**

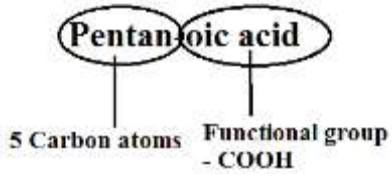
- Ethanol is used in medical wipes, as an antiseptic.
- It is used as solvent for drugs, oils, fats, perfumes. Dyes, etc,.

**7. Why ethene is more reactive than ethane?** **[PTA – 1]**

- Ethane is a saturated hydrocarbon with a strong Single bond.
- Ethene is an unsaturated hydrocarbon with a weak double bond
- Thus, ethene is unstable and more reactive than ethane which is stable.

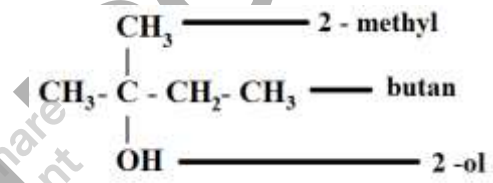
**8. Applying IUPAC rules, derive the structural formula of the following compounds.** **[PTA – 2]**

***a)*** **Pentanoic acid**




$CH_3-CH_2-CH_2-CH_2-COOH$

***b)*** **2-methyl-butan-2-ol**




**9. Read & categorize the following statements that are suitable for ethanol & ethanoic acid** **[PTA–4]**

**a) 95.5% of this compound's water solution is called rectified sprit** - Ethanol

**b) Pure form of this compound change into ice like crystals on freezing** - Ethanoic acid

**c) This compound undergoes decarboxylation on heating with soda lime.** - Sodium salt of ethanoic acid

**10. Compound A is a colourless liquid having burning taste. When the vapour of compound A is passed over heated copper at 573 K, it is dehydrogenated to acetaldehyde. What is compound 'A'? What is the role of copper in this chemical reaction? Write the balanced chemical equation of this reaction.** **[PTA – 6]**

- Compound A is **Ethanol** , $CH_3CH_2$-OH
- Copper is used as ***catalyst.***

$$\underset{\textit{ethanol}}{CH_3CH_2OH} \xrightarrow[573\ K]{Cu} \underset{\textit{acetaldehyde}}{CH_3CHO} + H_2\uparrow$$

# 12. PLANT ANATOMY AND PLANT PHYSIOLOGY

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

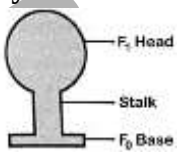
- ❖ Vascular bundles of dicot stem are conjoint collateral, endarch and open.
- ❖ They are arranged as ring around the pith.

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

Tissue between upper and lower epidermis of leaf is called mesophyll.

- ❖ Palisade parenchyma: Elongated cells with more chloroplasts. Helps in photosynthesis.
- ❖ Spongy parenchyma: Spherical cells with intercellular spaces. Helps in gaseous exchange.

**3. Draw and label the structure of oxysomes.**




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

❋ Dermal/Epidermal tissue system ❋ Ground tissue system ❋ Vascular tissue system

**5. What is photosynthesis and where in a cell does it occur? [SEP – 2021, PTA – 3]**

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

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} C_6H_{12}O_6 + 6H_2O + 6O_2 \uparrow$$

- ❖ It occurs in the chloroplast.

**6. What is Respiratory quotient? [AUG – 2022, MAY - 2022,SEP – 2021, PTA – 1]**

Respiratory Quotient (R.Q.) is the ratio of volume of carbon dioxide liberated and volume of oxygen consumed during respiration. $\mathbf{R.Q} = \frac{\text{volume of } CO_2 \text{ liberated}}{\text{volume of } O_2 \text{ consumed}}$

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

- ❖ During light independent reactions, $CO_2$ is reduced into carbohydrates with the help of ATP and $NADPH_2$ which is generated during light dependent reaction.
- ❖ So, light dependent reaction should occur before the light independent reaction.

**8. Write the reaction for photosynthesis. [MAY - 2022]**

$$\underset{\textit{Carbon di oxide}}{6CO_2} + \underset{\textit{Water}}{12H_2O} \xrightarrow[\text{Chlorophyll}]{\text{Light}} \underset{\textit{Glucose}}{C_6H_{12}O_6} + \underset{\textit{Water}}{6H_2O} + \underset{\textit{Oxygen}}{6O_2} \uparrow$$

## Additional Questions

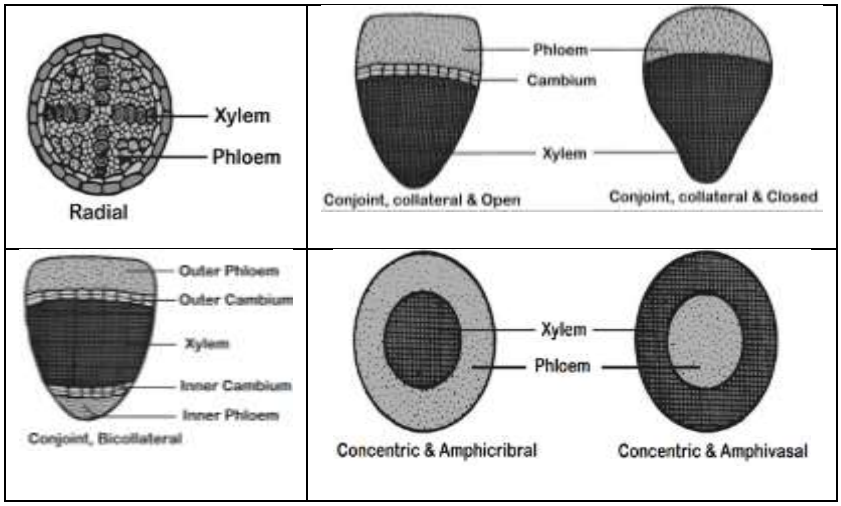
**9. What are the factors affecting photosynthesis? [AUG – 2022]**

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

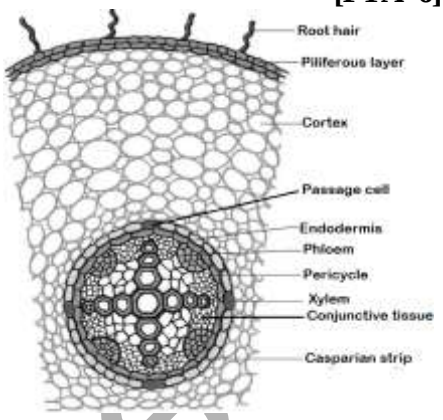
**10. What is vascular bundle? [PTA – 1]**

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

**11. Draw and label the different types of vascular bundles. (Conjoint vascular bundles) [PTA – 4]**




**12. Draw and label the internal structure of a Dicot/Bean root [PTA–6]**




## VIII. Higher Order Thinking Skills (HOTS)

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

❖ Light dependent reaction takes place in *thylakoid membrane* of chloroplast.

Calvin cycle takes place in stroma of chloroplast

# 13. STRUCTURAL ORGANISATION OF ANIMALS

**1. Why are the rings of cartilages found in trachea of rabbit? [PTA – 4, SEP – 2020]**

The rings of cartilages are found in trachea of rabbit to help in free passage of air.

**2. List out the parasitic adaptations in leech. [MDL – 19]**

❖ Blood is sucked by pharynx.

❖ Anterior and posterior suckers helps to attach to the host.

❖ Three jaws, causes painless Y-shaped wound in the host.

❖ For continuous blood supply, Hirudin is produced to prevent blood to coagulate.

❖ Parapodia and setae are absent.

❖ Blood is stored in crop and gives nourishment for several months.

## Additional Question

**3. What are the glands embedded in the Rabbit skin to regulate the body temperature?**

Sweat glands and sebaceous glands. **[PTA – 3]**

## VIII. Higher Order Thinking Skills (HOTS)

1. **Arjun is studying in tenth standard. He was down with fever and went to meet the doctor. As he went to the clinic, he saw a patient undergoing treatment for severe leech bite. Being curious, Arjun asked the doctor why leech bite was not felt as soon as it attaches to the skin? What would have been the reply given by the doctor? (or) Why do the host doesn't feel bite of a leech.**

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

2. **Shylesh has some pet animals at his home. He has few rabbits too, one day while feeding them he observed something different with the teeth. He asked his grandfather, why is it so? What would have been the explanation of his grandfather?**

   Rabbit has diphyodont and heterodont dentition. Rabbit has diphyodont and heterodont dentition.

## IX. Value based questions

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

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

2. **How is the digestive system of rabbit suited for herbivorous mode of feeding? [PTA –3]**
   - ❖ Teeth helps to cut, tear and grind food.
   - ❖ Diastema helps in mastication and chewing of food.
   - ❖ Secretions of digestive glands helps in digestion of food.
   - ❖ Bacteria in small and large intestine helps in digestion of cellulose.

# 14. TRANSPORTATION IN PLANTS AND CIRCULATION IN ANIMALS

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

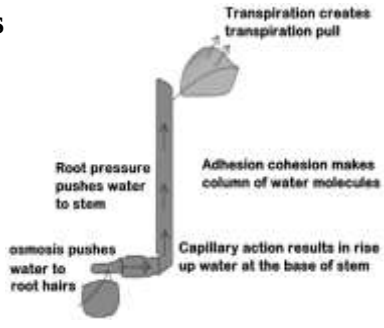
   Change in turgidity of guard cells causes opening and closing of stomata.

2. **What is cohesion? [PTA – 1]**

   The force of attraction between water molecules is called cohesion.

3. **Trace the pathway followed by water molecules from the time it enters a plant root to the time it escapes into the atmosphere from a leaf.**
   - ❖ Root hair absorbs water by osmosis.
   - ❖ Root pressure conducts water to stem through xylem.
   - ❖ Stem conducts water to leaf.
   - ❖ Excess water is evaporated through stomata by transpiration.

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




4. **What would happen to leaves of a plant that transpires more water than its absorption in roots?**
   - ❖ Plant dehydrates and losses moisture resulting in wilting or drying of leaves.
   - ❖ It affects plant growth, photosynthesis and may lead to death.

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

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

***Structure:***

- Heart is enclosed by pericardium.
- It is four chambered and is situated between lungs.
  - Auricle - Two upper thin walled chambers
  - Ventricle - Two lower thick walled chambers
- These chambers are separated by septum.

***Working of human heart :***

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

**6. Why is the circulation in man referred to as double circulation? [PTA – 1]**

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

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

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

**8. What is the importance of valves in the heart? [MAY - 2022, PTA – 2]**

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

**9. Who discovered Rh factor? Why was it named so? [PTA – 6]**

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

**10. How are arteries and veins structurally different from one another? [PTA – 5]**

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

**11. Why the sinoatrial node is called as the pacemaker of heart? [MDL – 19, PTA – 5]**

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

**12. Differentiate between systemic circulation and pulmonary circulation. [PTA – 2]**

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

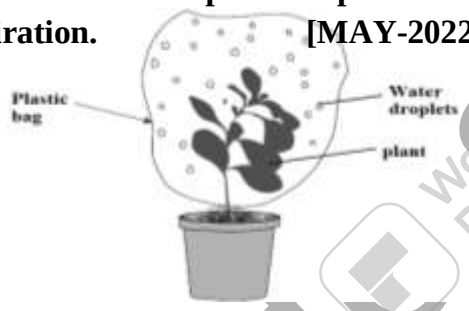
**13. The complete events of cardiac cycle last for 0.8 sec. What is the timing for each event?**

***Each Event of cardiac cycle involves:***

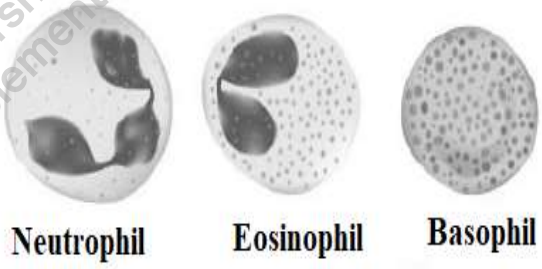
- ***Atrial systole***: 0.1 sec
- ***Ventricular systole***: 0.3 seconds
- ***Ventricular diastole:*** 0.4 seconds

## Additional Questions

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




**15. Draw pictures of Granulocytes. [AUG – 2022, MAY-2022]**




## VII. Give reasons for the following statements

**1. Minerals cannot be passively absorbed by the roots.**

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

**2. Guard cells are responsible for opening and closing of stomata. [SEP – 2021]**

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

**3. The movement of substances in the phloem can be in any (or) all direction. [PTA – 4]**

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

4. **Minerals in the plants are not lost when the leaf falls.** **[PTA – 2]**

***Reason:*** Minerals are remobilised from older dying leaves to younger leaves.

So, minerals in plants are not lost, when leaf falls.

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

***Reason:*** Right ventricle have to pump out blood with force away from heart.

Thus, the walls of ventricles are thicker than auricles.

6. **Mature RBC in mammals do not have cell organelles.** **[PTA – 4]**

***Reasons:***

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

## X. Higher Order Thinking Skills (HOTS)

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

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

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

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

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

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

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

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

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

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

# 15. NERVOUS SYSTEM

1. **Define stimulus.**
   Stimulus is the changes in environmental condition, detected by receptors present in the body.
2. **Name the parts of the hind brain.** **[PTA – 2]**
   - ❖ Cerebellum
   - ❖ Pons
   - ❖ Medulla oblongata
3. **What are the structures involved in the protection of brain?** **[PTA – 4]**
   - ❖ Brain is covered by duramater, arachnoid membrane and piamater that protect from injury.
   - ❖ Cerebrospinal fluid acts as shock absorbing fluid and protect brain from sudden shock.
4. **Give an example for conditioned reflexes.**
   Playing harmonium by striking a particular key on seeing a music note
5. **Which acts as a link between the nervous system and endocrine system?**
   Hypothalamus acts as a link between the nervous system and endocrine system.
6. **Define reflex arc.** **[PTA – 4]**
   Reflex arc is the pathway taken by nerve impulse to accomplish reflex action.

## Additional Questions

7. **Classify neurons based on its function.** **[PTA – 3]**
   ***Sensory / Afferent neurons:*** They carry impulses from sense organ to central nervous system.
   ***Motor / Efferent neurons:*** They carry impulses from central nervous system to effector organ.
   ***Association neurons:*** They conduct impulses between sensory and motor neurons.
8. **Write the functions of cerebellum.** **[PTA – 6]**
   Cerebellum coordinates voluntary movements and maintains body balance.

## VII. Differentiate between

1. **Voluntary and involuntary actions.** **[PTA – 5]**

| S.No | Voluntary action | Involuntary action |
|---|---|---|
| 1. | Controlled by brain. ***Ex :*** eating | Controlled by spinal cord. ***Ex :*** sneezing |
| 2. | With our conscience. | Without our conscience. |
| 3. | Under the control of will. | Not under the control of will. |
| 4. | It results in muscular action. | It results in muscular action or secretions. |

2. **Medullated and non-medullated nerve fibre (or) Myelinated & non-myelinated nerve fibre.** **[PTA – 3]**

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

## IX. Higher Order Thinking Skills (HOTS)

1. **'A' is a cylindrical structure that begins from the lower end of medulla and extend downwards. It is enclosed in bony cage 'B' and covered by membranes 'C'. As many as 'D' pairs of nerves arise from the structure 'A'.** **(i) What is A?**
**(ii) Name (a) bony cage 'B' and (b) membranes 'C'** **(iii) How much is D?**

A → Spinal cord
**B** → Vertebrae (or) Vertebral column **[PTA – 6]**
**C** → Meninges
**D** → 31 Pairs

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

L → Neuron
**M** → Axon
**N** → Dendron
**O** → Synaptic junction (or) Synapse
**P** → Neurotransmitter

# 16. PLANT AND ANIMAL HORMONES

1. **What are synthetic auxins? Give examples.** **[MAY - 2022, PTA – 4]**
These are artificially synthesized auxins that have properties like auxins.
***Example:*** 2,4 D (2,4 Dichlorophenoxy acetic acid), Indole 3 Butyric Acid (IBA).

2. **What is bolting? How can it be induced artificially?** **[MDL – 19]**
❖ Bolting is the sudden shoot elongation followed by flowering.
❖ It can be induced artificially by treatment of gibberellin.

3. **Bring out any two physiological activities of abscisic acid.**
❖ It promotes abscission process. ❖ It promotes senescence in leaves.

4. **What will you do to prevent leaf fall and fruit drop in plants? Support your answer with reason.**
❖ Spraying auxins can prevent leaf fall and fruit drop.
❖ Because auxin prevents the formation of abscission layer.

5. **What are chemical messengers?**
❖ Hormones produced by Endocrine Glands are called Chemical Messengers.
❖ ***Ex:*** Growth hormone.

**6. Write the differences between endocrine and exocrine gland.**

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

**7. What is the role of parathormone?**

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

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

| Hormone | Tissues on which they exert their effect |
|---|---|
| ***Vasopressin or Antidiuretic hormone(ADH)*** | Kidney tubules |
| ***Oxytocin*** | Smooth muscles of uterus and mammary gland. |

**9. Why are thyroid hormones referred as personality hormones? [AUG – 2022, MDL – 19]**

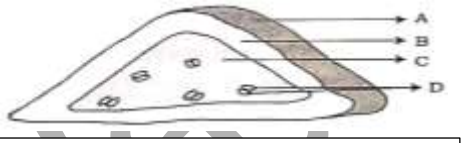
Thyroid hormones are essential for normal physical, mental and personality development. Hence, it is also known as personality hormone.

**10. Which hormone requires iodine for its formation? What will happen if intake of iodine in our diet is low?**

- ❖ Thyroid hormone requires iodine for its formation.
- ❖ If intake of iodine is low, it causes goiter.

## Additional Questions

**11. Identify the parts A, B, C, D in the given figure. [MAY-2022]**




| | |
|---|---|
| **A**- Capsule | **B**- Cortex |
| **C**- Medulla | **D**- Blood vessels |

**12. Identify the parts of A, B, C and D in the given figure. [SEP – 2020]**


| | |
|---|---|
| **A – Thyroid Cartilage** | **C – Trachea** |
| **B – Thyroid gland** | **D – Nodule** |

**13. Explain the disorder with which the person shown in the figure is suffering. [PTA – 1]**

- ❖ The person is suffering from **goitre.**
- ❖ It is caused due to inadequate supply of iodine in our diet.

**14. How is Corpus luteum formed? Name the hormones secreted by corpus luteum. [PTA –2]**

Progesterone from Corpus Luteum is formed in ovary from ruptured follicle during ovulation.

**15. What is parthenocarpic fruit? Give an example. [PTA – 6]**

These are Seedless fruits developed without fertilization. Induced by external application of auxins.

***Ex :*** *Watermelon, Tomato.*

## IX. Higher Order Thinking Skills (HOTS)

1. **What would be expected to happen if,**

| | |
|---|---|
| **a) Gibberellin is applied to rice seedlings.** | Internodal elongation and increase in height. |
| **b) A rotten fruit gets mixed with unripe fruits.** | Ethylene from ripe fruits will hasten the ripening. |
| **c) When cytokinin is not added to culture medium?** | Culture tissue will not show any growth. |

2. **A plant hormone was first discovered in Japan when rice plants were suffering from Bakanae disease caused by *Gibberella fujikoroi*. Based on this information answer the following questions:**

| | |
|---|---|
| **a) Identify the hormone involved in this process.** | Gibberellin. |
| **b) Which property of this hormone causes the disease?** | Internodal elongation. |

**c) Give two functions of this hormone.**

- ❖ Gibberellin stimulates extraordinary *elongation of internode*.
- ❖ *Bolting* is achieved by gibberellin.

3. **Senthil has high blood pressure, protruded eyeball and an increased body temperature. Name the endocrine gland involved and hormone secretion responsible for this condition.**
   - ❖ Thyroid gland and thyroid hormones are responsible for this condition.
4. **Sanjay is sitting in the exam hall. Before the start of the exam, he sweats a lot, with increased rate of heartbeat. Why does this condition occur?**
   - ❖ It is due to the secretion of emergency hormones during stress and emotion.
5. **Susan's father feels very tired and frequently urinates. After clinical diagnosis, he was advised to take an injection daily to maintain his blood glucose level. What would be the possible cause for this? Suggest preventive measures.**

   It is due to deficiency of insulin, which leads to Diabetes mellitus.

   ***Preventive measures:***

   ❖ Eat healthy foods ❖ Exercise regularly ❖ Avoid smoking

# 17. REPRODUCTION IN PLANTS AND ANIMALS

1. **What will happen if you cut planaria into small fragments?**

   Each fragments of the cut planaria will give rise to new individual.

2. **Why is vegetative propagation practiced for growing some type of plants? [PTA – 1]**

   *Vegetative propagation is practiced, because*

   - ❖ Some plants have lost their capacity to produce seeds.
   - ❖ Some higher plants retain their characters.

3. **How does binary fission differ from multiple fission?**

| S.No. | Binary Fission | Multiple Fission |
|---|---|---|
| 1. | Two new organisms are formed. | Many new organisms are formed. |
| 2. | Occurs during favourable environmental conditions. | Occurs during unfavourable environmental conditions. |
| 3. | ***Ex :*** Amoeba | ***Ex :*** Algae |

**4. Define triple fusion.** **[MAY - 2022, MDL – 19]**

- ❖ One sperm fuses with egg and forms a diploid Zygote.
- ❖ Other sperm fuses with secondary nucleus and forms triploid primary endosperm nucleus.

**5. Write the characteristics of insect pollinated flowers.** **[PTA – 6]**

- ❖ Insect pollinated flowers are brightly coloured, have smell and nectar.
- ❖ Its pollen grains are larger, exine is pitted, spiny, etc., and firmly adhere to stigma.

**6. Name the secondary sex organs in male.** **[MAY - 2022]**

Vas deferens, epididymis, seminal vesicle, prostate gland and penis.

**7. What is colostrum? How is milk production hormonally regulated?** **[PTA – 2]**

Colostrum is the milk produced during the first 2 to 3 days after child birth.

- ❖ Milk production is stimulated by prolactin.
- ❖ Ejection of milk is stimulated by oxytocin.

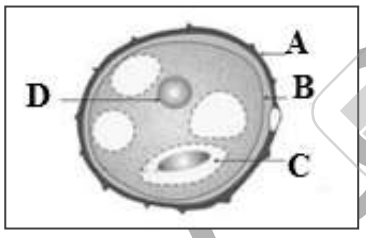
**8. How can menstrual hygiene be maintained during menstrual days?** **[PTA – 4]**

- ❖ Sanitary pads should be changed regularly.
- ❖ Use warm water to clean genitals.
- ❖ Wearing loose clothing.

**9. How does developing embryo gets its nourishment inside the mother's body?** **[PTA – 6]**

**Placenta** allows the exchange of food materials, diffusion of oxygen, excretion of nitrogenous wastes and elimination of carbon dioxide.

**10. Identify the parts A, B, C and D.** **[AUG – 2022, MDL – 19]**




**Pollen grain**

**A** – Exine
**B** – Intine
**C** – Generative cell
**D** – Vegetative nucleus

**11. Write the events involved in the sexual reproduction of a flowering plant.**

1) Pollination 2) Fertilization

**a) Discuss the first event and write the types. (or) What is pollination? [SEP - 2021]**

First event is pollination. It is the transfer of pollen grains from anther to stigma.

Types: ❖ Self-pollination ❖ Cross pollination

**b) Mention the advantages and the disadvantages of that event.**

| Self-pollination | Cross-pollination |
|---|---|
| ***Advantages :*** | ***Advantages :*** |
| ❖ Do not depend on agents | ❖ It leads to production of new varieties. |
| ❖ No wastage of pollen grains. | ❖ More viable seeds are produced. |
| ***Disadvantages :*** | ***Disadvantages :*** |
| ❖ Seeds are less in numbers. | ❖ Pollination may fail due to distance barrier. |
| ❖ Seeds produce weak plants. | ❖ More wastage of pollen grains. |
| ❖ New varieties cannot be produced | ❖ It may introduce some unwanted characters |
| | ❖ Depend on the external agencies. |

**12. Why are the human testes located outside the abdominal cavity? Name the pouch in which they are present.**

Human testes is outside the abdominal cavity, because sperm formation requires a lower temperature than our body temperature. Pouch in which they are present is scrotum.

**13. Luteal phase of the menstrual cycle is also called the secretory phase. Give reason.**

Progesterone and estrogen are secreted during luteal phase. It maintains pregnancy and prevents contraction of uterus. Thus, this phase is called secretory phase.

**14. Why are family planning methods not adopted by all the people of our country?**

- **Poverty**
- **Illiteracy**
- **Religious Opposition**
- **Lack of Cheap and Effective Methods**

## Additional Questions

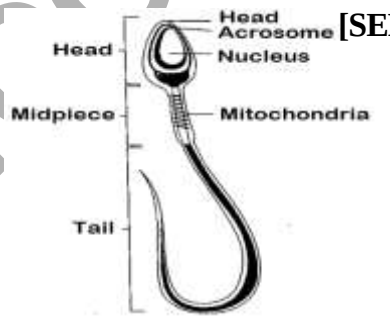
**15. State the importance of pollination. [SEP – 2021]**

- Pollination results in fertilization, which leads to fruits and seeds.
- New varieties of plants are formed in case of cross-pollination.

**16. Write the importance of fertilization in plants. [PTA – 2]**

- It stimulates ovary to develop into fruit.
- It helps in development of new characters.

**17. Draw and label the parts of a sperm. [SEP – 2021]**




## VIII. Higher Order Thinking Skills (HOTS)

**1. In angiosperms the pollen germinates to produce pollen tube that carries two gametes. What is the purpose of carrying two gametes when single gamete can fertilize the egg?**

In angiosperms, double fertilization takes place.

***The purpose of two gametes:***

i) Endosperm thus formed provides food to developing embryo.
ii) It increases the viability of seeds.
iii) Plant has better chances of survival.

**2. Why menstrual cycle does not take place before puberty and during pregnancy?**

- Before puberty, progesterone & estrogen secretion is absent. So, there is no menstrual cycle.
- After fertilization, corpus luteum persists. So progesterone continues to secrete to protect the embedded embryo. So, there is no menstrual cycle during pregnancy.

# 18. GENETICS

1. **Why did Mendel select pea plant for his experiments?** **[MAY - 2022]**
   - ❖ It is naturally self pollinating and easy to cross-pollinate
   - ❖ It has short life span. We can follow several generations.
   - ❖ It has deeply defined contrasting characters.
   - ❖ Flowers are bisexual.
2. **What do you understand by the term phenotype and genotype?** **[AUG – 2022]**
   - ❖ Phenotype – It is the external expression of a particular trait.
   - ❖ Genotype – It is the genetic expression of an organisms.
3. **What are allosomes? (or) Define Sex-chromosomes.** **[PTA – 2]**
   - ❖ Chromosomes which are responsible for determining the sex of an individual are called Allosomes (or) sex chromosomes (or) hetero-chromosomes.
   - ❖ Human male have XY chromosomes. Human female have XX chromosomes.
4. **What are Okazaki fragments?** **[PTA – 4]**

   Short segments of DNA which are synthesised by lagging strand are called Okazaki fragments.
5. **Why is euploidy considered to be advantageous to both plants and animals?** **[PTA – 1]**

   Euploidy is advantageous to plants, as they give increased fruit and flower size.

   Euploidy is not advantageous in animals. If it occurs, it creates diseases and abnormalities.
6. **A pure tall plant (TT) is crossed with pure dwarf plant (tt), what would be the $F_1$ and $F_2$ generations? Explain.** **[PTA – 5]**

***$F_1$ generation***

| | T | T |
|---|---|---|
| t | Tt | Tt |
| t | Tt | Tt |

***Phenotypes :*** *All are tall plants*

***Genotypic ratio*** *= All are Tt*

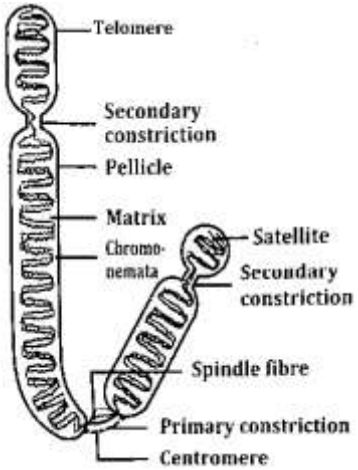
***$F_2$ generation***

| | T | t |
|---|---|---|
| T | TT | Tt |
| t | Tt | tt |

***Phenotypes :*** *3 tall and 1 dwarf plant = 3 : 1*

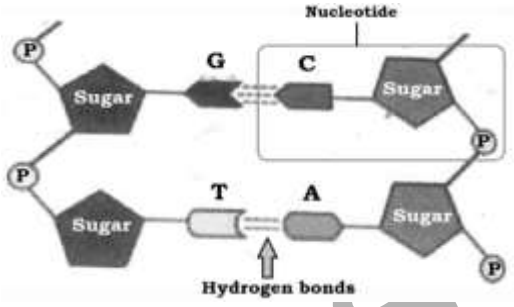
***Genotypic ratio*** *= TT : Tt : tt = 1 : 2 : 1*

7. **Explain the structure of a chromosome. [SEP–2021, PTA–6]**
   - ❖ Chromosomes are thin, long, thread like structures.
   - ❖ It consists of two identical strands called sister chromatids.
   - ❖ They are held together by centromere.
   - ❖ They are made up of DNA, RNA, chromosomal proteins, etc,.
   - ❖ Proteins provide structural support to the chromosome.
   - ❖ A chromosome consists of the following regions.
     - *i)* ***Primary constriction / centromere:*** Two arms meet at this point.
     - *ii)* ***Secondary constriction:*** It occur at any point.
     - *iii)* ***Telomere:*** End of the chromosome. Provides stability.
     - *iv)* ***Satellite:*** Some have an elongated knob-like appendage.



**8. Label the parts of the DNA in the diagram given below. Explain the structure briefly.**

The given figure is **Nucleotides in DNA**




- ❖ Each nucleotides consist of
  - a) A sugar molecule - Deoxyribose sugar
  - b) A nitrogenous base
    - Purines (Adenine and Guanine)
    - Pyrimidines (Cytosine and Thymine)
  - c) A Phosphate group
- ❖ Adenine links thymine with two hydrogen bonds (A = T).
- ❖ Cytosine links guanine with three hydrogen bonds (C ≡ G).
- ❖ Nucleotides are joined by phosphodiester bonds.
- ❖ DNA consists of two polynucleotide chains.

A = Adenine
T = Thymine
C = Cytosine
G = Guanine

## Additional Questions

**9. If we cross two different parents with the genotype of Tt x tt, what would be the genotype ratio in its $F_1$ generation? [PTA – 3]**

***$F_1$ generation***

| | *T* | *t* |
|---|---|---|
| *t* | *Tt* | *tt* |
| *t* | *Tt* | *tt* |

***Genotypic ratio*** = *Tt : tt = 2 : 2 =* ***1: 1***

**10. Differentiate phenotype and genotype. [PTA – 4]**

| Genotype | Phenotype |
|---|---|
| 1. Present inside body as genetic material. | 1. Expression of genes as external appearance. |
| 2. Determined by scientific methods. | 2. Determined by observing the organism. |
| 3. Affected by genes. | 3. Affected by genotype & environmental conditions. |

## VIII. Higher Order Thinking Skills (HOTS)

**1. Flowers of the garden pea are bisexual and self-pollinated. Therefore, it is difficult to perform hybridization experiment by crossing a particular pistil with the specific pollen grains. How Mendel made it possible in his monohybrid and dihybrid crosses?**

Mendel made this possible by following techniques

- ***Emasculation:*** Anthers are removed
- ***Bagging :*** Female flower is covered by polythene bag.

Pollen grains are collected from desired plant and dusted on the stigma in consideration.

2. **Pure-bred tall pea plants are first crossed with pure-bred dwarf pea plants. The pea plants obtained in $F_1$ generation are then selfed to produce $F_2$ generation of pea plants. [MDL – 19]**

| | |
|---|---|
| **a) What do the plants of $F_1$ generation look like?** | All are tall plants. |
| **b) What is the ratio of tall plants to dwarf plants in $F_2$ generation?** | 3:1 |
| **c) Which type of plants were missing in $F_1$ generation but reappeared in $F_2$ generation?** | Dwarf plants |

3. **Kavitha gave birth to a female baby. Her family members say that she can give birth to only female babies because of her family history. Is the statement given by her family members true. Justify your answer.**
   - ❖ No, Kavitha is not responsible for the gender of her child. Father determines the sex.
   - ❖ If egg is fused with X - bearing sperm (22+X) it produces a female child (44+XX).
   - ❖ If egg is fused with Y - bearing sperm (22+Y) it produces a male child (44+XY).
   - ❖ Thus, sperm of father, determines the sex. So, Kavitha and her family is not responsible.

## IX. Value based question

1. **Under which conditions does the law of independent assortment hold good and why?**
   Law of independent assortment holds goods only if different gene pairs lie in different chromosome pairs, because chromosomes segregates during meiosis and not individual genes.

# 19. ORIGIN AND EVOLUTION OF LIFE

1. **The degenerated wing of a kiwi is an acquired character. Why is it an acquired character? [PTA – 3]**
   - ❖ Kiwi have learnt to walk. According to use and disuse theory, wings of Kiwi degenerate.
   - ❖ This occurs in response to their change in habitat. Thus, it is an acquired character.
2. **Why is Archaeopteryx considered to be a connecting link?**
   - ❖ Archaeopteryx had wings with feathers, like a bird.
   - ❖ It had a long tail, clawed digits and conical teeth, like a reptile.
3. **Define Ethnobotany and write its importance. [AUG – 2022, PTA – 2, SEP – 2020]**
   ***Ethnobotany*** is the study of a region's plants and uses through traditional knowledge of local people.
   **Importance of Ethnobotany:**
   - ❖ It provides traditional uses of plants.
   - ❖ It gives information about known and unknown useful plants.
   - ❖ It provides information for preparing herbal medicine to treat various diseases.

**4. How can you determine the age of the fossils?** **[MDL – 19, SEP – 2020]**

- ❖ Age of fossils is determined by radioactive elements like carbon, lead or potassium in it.
- ❖ Radioactive carbon ($C^{14}$) dating method discovered by W.F. Libby (1956) is used often.
- ❖ Carbon consumption stops after death. After that $C^{14}$ starts decaying continuously.
- ❖ Time after death can be calculated by measuring the amount of $C^{14}$ present in their body.

## Additional Question

**5. What is Evolution? Who proposed the theories of evolution?** **[MAY-2022, SEP – 2021]**

- ❖ Evolution is the gradual change occurring in living organisms over a period of time.
- ❖ Lamarck and Darwin proposed the theories of evolution.

## VIII. Higher Order Thinking Skills (HOTS)

**1. Arun was playing in the garden. Suddenly he saw a dragon fly sitting on a plant. He observed the wings of it. He thought it looked similar to a wing of a crow. Is he correct? Give reason for your answer.** **[PTA – 2]**

i) **No,** the wings are different. Wings of dragon fly are thin and transparent, whereas wings of crow are strong, muscular and covered with feathers.

ii) Wings of dragon fly and crow have same function, but their origin and pattern are different. These are called analogous organs.

**2. Imprints of fossils tell us about evolution - How?**

- Fossils are the preserved traces of animals, plants, and other organisms.
- Fossils provide solid evidence that organisms from the past are not the same as today
- Fossils show a progression of evolution.
- Fossil record tells the story of past and shows the evolution over millions of years.

**3. Octopus, cockroach and frog all have eyes. Can we group these animals together to establish a common evolutionary origin. Justify your answer.** **[PTA – 4]**

i) **No,** we cannot group these animals together to establish a common evolutionary origin.

ii) Because, we need more similarities, to group them together.

iii) They have major dissimilarities like octopus is aquatic, frog is amphibian whereas cockroach is non-aquatic.

# 20. BREEDING AND BIOTECHNOLOGY

**1. Discuss the method of plant breeding for disease resistance.** **[PTA – 6]**

Developing disease resistant crops, would increase yield and reduce fungicides & bactericides.

| Examples of disease resistant crop varieties | | |
|---|---|---|
| **Crop** | **Variety** | **Resistance to diseases** |
| Wheat | Himgiri | Leaf and stipe rust, hill bund |
| Cauliflower | Pusa Shubhra, Pusa snowball K-1 | Black rot |
| Cowpea | Pusa Komal | Bacterial blight |

Selection and Hybridization are few methods of plant breeding to get disease resistant plants.

**2. Name three improved characteristics of wheat that helped India to achieve high productivity.**

**i)** Sonalika, Kalyan Sona – **High-yielding, semi-dwarf** **[PTA – 4]**

**ii)** Himgiri – **Diseases resistance**

**iii)** Atlas – 66 – **Improved nutritional quality**

**3. Name two maize hybrids rich in amino acid lysine.** **[MAY - 2022, MDL – 19]**

Protina, Shakti, Rathna are maize hybrids rich in amino acid lysine.

**4. Distinguish between :**

**a) Somatic gene therapy and Germ line gene therapy.** **[SEP – 2021, PTA – 1]**

| Somatic gene therapy | Germ line gene therapy |
|---|---|
| 1. It replaces defective gene in somatic cells. | It replaces defective gene in germ cell. |
| 2. It cannot be carried to next generation. | It can be carried to next generation. |

**b) Undifferentiated cells and Differentiated cells.**

| Undifferentiated cells | Differentiated cells |
|---|---|
| 1. Unspecialised cells. | 1. Specialised cells. |
| 2. Have variable potency. | 2. Perform specific function. |
| 3. ***Ex :*** Stem cells. | 3. ***Ex :*** Nerve cell, etc. |

**5. State the applications of DNA fingerprinting technique.** **[SEP – 2020, PTA – 3]**

- ❖ It is used in forensic.
- ❖ It is used for paternity testing.
- ❖ It helps in the study of genetic diversity, evolution and speciation.

**6. How are stem cells useful in regenerative process?**

When tissues and organs are permanently damaged or lost due to genetic condition or disease or injury, stem cells are used to treat it.

**7. Differentiate between outbreeding and inbreeding.**

| Outbreeding | Inbreeding |
|---|---|
| 1. Breeding of unrelated animals. | Breeding of closely related animals within same breed. |
| 2. Hybrids are stronger and vigorous. | Accumulates superior genes. Eliminates undesired genes. |
| 4. ***Ex :*** Mule | ***Ex :*** Sheep Hissardale |

## Additional Question

**8. Explain about Gene Therapy.** **[SEP – 2020]**

***Gene therapy :*** Replacement of defective gene by direct transfer of functional genes to treat genetic disease or disorder. Gene is altered using recombinant DNA technology.

**Two Types :** *i) Somatic gene therapy* *ii) Germ line gene therapy*

## IX. Higher Order Thinking Skills (HOTS)

**1. A breeder wishes to incorporate desirable characters into the crop plants. Prepare a list of characters he will incorporate.**

- Higher productivity and better quality
- Disease resistance
- Insects/pests resistance
- Shorter duration
- Nutritional Quality
- Semi dwarf varieties

**2. Polyploids are characterised by gigantism. Justify your answer.**

- In polyploidy, genome becomes larger. So, nucleus and cells are also larger. Hence, they produce larger leaves, stems, flowers and fruits.
- Thus, polyploids are characterised by gigantism.

# 21. HEALTH AND DISEASES

**1. What are the various routes by which transmission of human immuno deficiency virus takes place?** **[PTA – 1]**

- Sexual contact with infected person.
- Use of contaminated needles (or) syringes.
- By transfusion of infected blood or blood products.
- From infected mother to child through placenta.

**2. How is a cancer cell different from a normal cell?** **[SEP – 2021, PTA – 4]**

| Cancer cell | Normal cell |
|---|---|
| 1) Abnormal cell division & growth | 1) Cell division & growth are normal & controlled. |
| 2) Undergo metathesis. | 2) Do not undergo metathesis. |
| 3) They invade & destroy surrounding tissues. | 3) They do not invade & destroy surrounding tissues. |

**3. Differentiate between Type-1 and Type-2 diabetes mellitus.** **[PTA – 4]**

| Factors | Type -1 Diabetes Mellitus(IDDM) | Type-2 Diabetes Mellitus (NIDDM) |
|---|---|---|
| Prevalence | 10-20% | 80 - 90% |
| Age of onset | Juvenile onset (< 20 years) | Maturity onset (>30 years) |
| Body weight | Normal (or) Underweight | Obese |
| Defect | Insulin deficiency | Target cells do not respond to insulin |
| Treatment | Insulin administration | Diet, exercise and medicine |

**4. Why is a dietary restriction recommended for an obese individual?**

- Obesity is a risk factor for hypertension, diabetes, gall bladder disease, heart disease, etc,.
- Hence, dietary restrictions would be effective for an obese individual.

**5. What precautions can be taken for preventing heart diseases?** **[SEP – 2020, MDL – 19]**

***i) Diet Management* :**

- 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* :** Alcohol and smoking should be avoided.

## Additional Question

**6. Write the measures adopted for protection of an abused child.** **[SEP – 2020]**

- Child helpline
- Counselling
- Legal counsel
- Family support
- Rehabilitation
- Medical care

## X. Higher order thinking skills (HOTS)

**1. What is the role of fat in the cause of atherosclerosis?** **[PTA – 3]**

- In ***Atherosclerosis***, arteries become narrowed and hardened due to plaque around its wall.
- Plaque is the deposition of fat cholesterols. Thus, fat plays a major role in atherosclerosis.

**2. Eating junk food and consuming soft drinks results in health problems like obesity, still children prefer. What are the suggestions you would give to avoid children eating junk food/ consumption of soft drinks?**

- Instead of soft drinks, drink fresh fruit juices, energy drinks.
- Replacing Junk foods by sprouts, pulses, cereals.
- Media awareness is very essential.

**3. Regular physical exercise is advisable for normal functioning of human body. What are the advantages of practicing exercise in daily life?** **[PTA – 6]**

- It makes us feel happier, energetic and active.
- It helps us in weight loss and prevent us from Obesity.
- It can reduce the risk of many diseases.
- Increases muscle strength and endurance.

4. **A leading weekly magazine has recently published a survey analysis, which says that number of AIDS patient in the country is increasing day by day. The report says that the awareness among the people about AIDS is still very poor. You are discussing the magazine report in your class and a team of your class decides to help people to fight against the dreadful disease.**

**a) What problem you face when trying to educate the people in your village near by your school?**

- ❖ We hesitate to talk and people embarrassed to listen about AIDS.
- ❖ It creates a negative impact of isolating the AIDS patients.

**b) How do you overcome the problem?**

- ❖ We shall go with teachers, NGOs and activists.
- ❖ We can show them slideshows.

## XI. Value based questions

1. **Once a person starts taking drugs or alcohol it is difficult to get rid of the habit. Why?**
   - ❖ Because drug addicts often feel a strong urge to take alcohol.
   - ❖ They have a strong belief that drug alone can help them in stress.
   - ❖ On regular usage, they become fully dependent and cannot live without drugs.
2. **Men addicted to tobacco lead to oxygen deficiency in their body. What could be the possible reason?**

   Carbon monoxide of tobacco smoke binds to haemoglobin of RBC and decrease its oxygen carrying capacity. This leads to oxygen deficiency in their body.
3. **Name any three foods that are to be avoided and included in the diet of a diabetic patient. Why should it be followed?**

   ***Foods to be included :*** Flax seeds, guavas, tomatoes, green leafy vegetables and spinach.

   ***Foods to be avoided :*** Sweets, refined sugar, high fat content food, fruits juices

   ***Reason :*** Because, the above diet helps to reduce and control blood sugar levels.
4. **How can informational efforts change people's HIV knowledge and behaviour?[PTA –5]**

   *Informational efforts could change people's knowledge and behaviour in the following ways,*
   - ❖ Campaigns can provide clear knowledge on causes and consequences of AIDS.
   - ❖ People's attitude towards the infected people would change.
   - ❖ People Insist disposable needles syringes and screening of blood before transfusion.
   - ❖ People encourages measures for safe sex.

# 22. ENVIRONMENTAL MANAGEMENT

1. **What is the importance of rain water harvesting?** **[MAY - 2022,PTA – 4]**
   - ❖ It overcomes the rapid depletion of groundwater levels.
   - ❖ It satisfies the increased demand of water.
   - ❖ It reduces flood and soil erosion.
   - ❖ Ground water is not contaminated. So, it can be used for drinking.
2. **What are the advantages of using biogas?** **[PTA – 1]**
   - ❖ It causes less pollution.
   - ❖ Excellent way to get rid of organic wastes.
   - ❖ Left over slurry is a good manure.
   - ❖ It is safe and convenient to use.
   - ❖ It reduces the amount of greenhouse gases emitted.
3. **What are the environmental effects caused by sewage?**
   - ❖ Sewage is the major water pollutant in India.
   - ❖ It causes agricultural contamination and environmental degradation.
   - ❖ Contaminated water can cause diseases.
4. **What are the consequences of deforestation?**

   Deforestation gives rise to ecological problems like flood, drought, soil erosion, loss of wildlife, extinction, imbalances, changes in climatic conditions, desertification, etc,.

## Additional Question

5. **What is 3R approach?** **[PTA - 1]**

   Reduce, Reuse and Recycle methods used for waste management is called 3R approach.

## IX. Higher Order Thinking Skills (HOTS)

1. **Although coal and petroleum are produced by degradation of biomass, yet we need to conserve them. Why?** **[PTA – 2]**
   - ❖ Coal and petroleum are fossil fuels.
   - ❖ Formation of fossil fuel is a very slow process. It takes a very time for renewal.
   - ❖ Degradation of biomass takes millions of years to get converted into coal and petroleum.
   - ❖ They get exhausted if we continue using them at rapid rate. So, we need to conserve them.
2. **What are the objectives for replacing non-conventional energy resources from conventional energy resources?**
   - ❖ They are available easily in unlimited quantity.
   - ❖ They can be renewed quickly.
   - ❖ They produce less pollution.
   - ❖ They can be used continuously.
3. **Why is the Government imposing ban on the use of polythene bags and plastics? Suggest alternatives. How is this ban likely to improve the environment?**

   **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.

## X. Value based questions

1. **Why is it not possible to use solar cells to meet our energy needs? State three reason to support to your answer.**

**Reasons:**

- ❖ High installation cost.
- ❖ Limited availability of silicon to make solar cells.
- ❖ Efficiency of energy conversion and storage is low.
- ❖ Solar energy can be obtained only during day time.

2. **How would you dispose the following wastes?**

**a) Domestic wastes like vegetable peels** **b) Industrial wastes like metallic cans**

**Can the disposal protect the environment? How?**

a) Domestic wastes have to be disposed in **compost pits.** Yes, this protects the environment because it is used as **manure and improves soil fertility**.

b) Industrial wastes like metallic cans can be **recycled**. Yes, this disposal protects the environment because it causes **no pollution** and there is **no left over.**

3. **List any three activities based on 4R approach to conserve natural resources.**

1. Use of public transport instead of personal transport - Reduces fuel consumption.
2. Materials like paper can be reused & recycled.
3. Use of plastics should be reduced, reused and recycled.
4. Recovery – Conversion of waste materials into resources like electricity, fuel etc.,

# 23. VISUAL COMMUNICATION

1. **What is Scratch?**

- ❖ Scratch is used to create animations, cartoons and games easily.
- ❖ It is a visual programming language.
- ❖ Developed in MIT Media Lab to make programming easier and more fun to learn.

2. **Write a short note on script editor and its main parts.**

**Script / costume editor:** It is the place where we edit our programs.

**i)** ***Script area :*** We build scripts here.

**ii)** ***Block menu :*** We choose the category of blocks here.

**iii)** ***Block palette:*** We choose the blocks here.

3. **What is Stage?** **[SEP – 2020]**

- ❖ Stage is the background that appears when we open scratch.
- ❖ Background will mostly be white. We can change it.

4. **What is Sprite?**

- ❖ Characters on the background of a Scratch are known as sprite.
- ❖ Software has facilities to make alternations in sprite.

# 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. $\mathbf{F = ma}$

***c) Newton's third law :***

For every action, there is an equal and opposite reaction. $\mathbf{F_B = - F_A}$

**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 → mass of a moving body u → initial velocity

F → unbalanced external force v → final velocity after a time interval 't'

Initial momentum $P_i = mu$ ,

Final momentum $P_f = mv$

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

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

$$F = \frac{mv-mu}{t} = m\left[\frac{v-u}{t}\right];$$

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

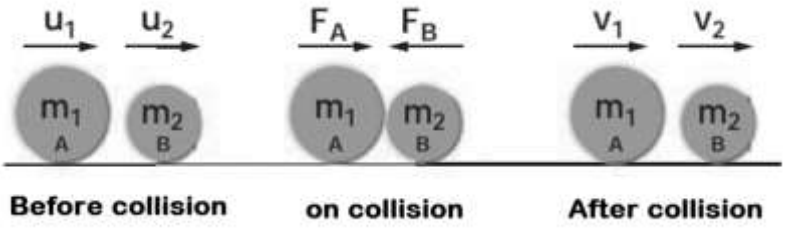
**Force = mass × acceleration**

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

***Law of Conservation of momentum:***

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

***Proof:***




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

$F_A = \frac{m_2(v_2 - u_2)}{t}$ -------- (1) $F_B = \frac{m_1(v_1 - u_1)}{t}$ -------- (2)

By Newton's third law, $F_B = -F_A$

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

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

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

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

Hence the law is proved.

**5. Describe rocket propulsion.** **[AUG – 2022, SEP – 2020, PTA – 4]**

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

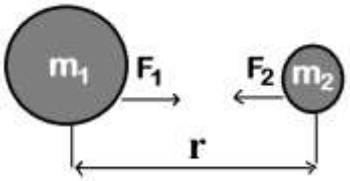
- When rocket is fired, fuel is burnt and hot gas is ejected with high speed & huge momentum.
- To balance this momentum, an equal & opposite force is produced, projecting rocket forward.
- In motion, mass of rocket decreases, until the fuel is completely burnt.
- There is no net external force acting 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.

***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.

$$F \propto \frac{m_1m_2}{r^2} \Rightarrow F = G\frac{m_1m_2}{r^2}$$

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

**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:***

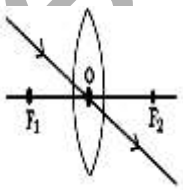
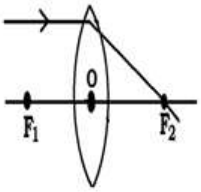
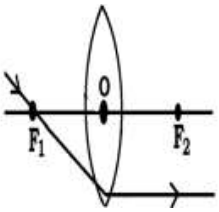
- ❖ **When vehicle stops suddenly, by law of inertia, we will be in motion until a force act on us.**
- ❖ **If we don't wear a seat belt, we would get hurt during this motion.**
- ❖ **If we wear a seat belt, the seat belt gives us an unbalanced force that stops us.**

# 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 $c = 3 \times 10^8\ ms^{-1}$
- Different coloured light has different wavelength and frequency.

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

| | |
|---|---|
| **Rule - 1**<br>When a ray of light strikes the convex lens obliquely at its **optical centre**, it continues to follow its path **without any deviation**. |  |
| **Rule - 2**<br>When rays **parallel to the principal axis** strikes a convex lens, the refracted rays are **converged to the principal focus**. |  |
| **Rule - 3**<br>When a ray **passing through the principal focus** strikes a convex lens, the refracted ray will be **parallel to the principal axis**. |  |

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

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

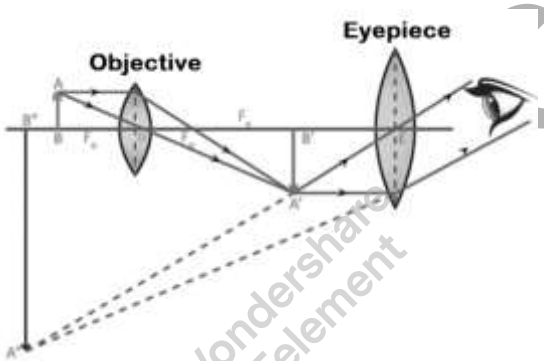
**4. Explain the construction and working of a 'Compound Microscope'.**

***Construction :***

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

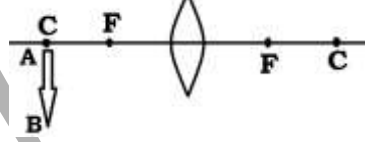
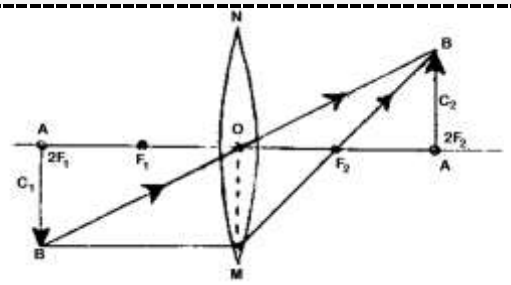
***Working :***

- Object AB is placed beyond the focal length of objective lens ( $u > F_o$)
- A real, inverted and magnified image A' B' is formed at the other side of objective lens.
- 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]**

| Question | Answer |
|---|---|
|  |  |



**6. Write advantages and disadvantages of telescope.**

***Advantages of Telescopes :*** **[PTA – 3]**

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

***Disadvantages of Telescopes :***

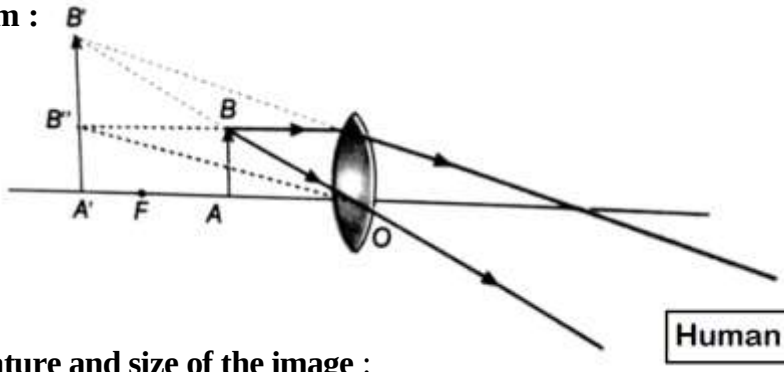
- Frequent maintenances needed.
- It is not easily portable one.

**7. i) Draw the ray diagram of image formation in simple microscope** **[PTA – 2]**

**ii) Find the position and write its nature and size of the image formed by Simple microscope.**

**iii) Mention the uses of simple microscope.**

**i) Ray diagram :**




**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 :** **[SEP – 2020]**

- 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*** $PV = \text{Constant}$ ……(1)

***According to Charles's law*** $\frac{V}{T} = \text{Constant}$ ……(2)

***According to Avogadro's law*** $\frac{V}{n} = \text{Constant}$ ……(3)

Combine (1), (2) & (3) $\frac{\mathbf{PV}}{\mathbf{nT}} = \mathbf{Constant}$ ……(4)

This is called a combined law of gases.

Gas contains $\mu$ moles. $\therefore \mathbf{n = \mu N_A}$ ……(5)

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

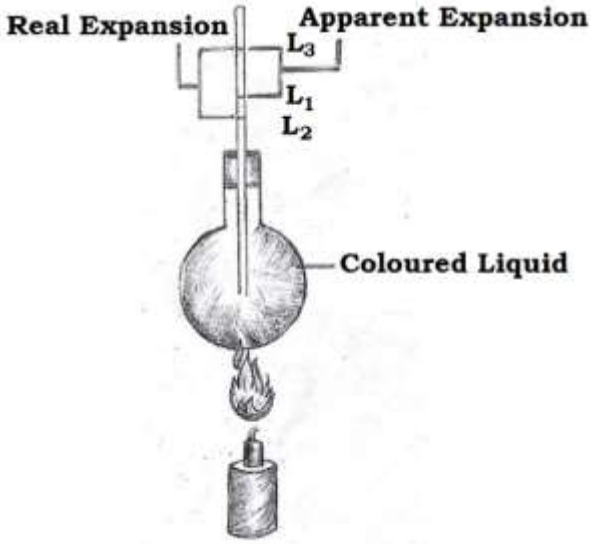
$$\frac{PV}{\mu N_A T} = k_B \quad (k_B = \text{Boltzmann constant} = 1.38 \times 10^{-23} JK^{-1})$$

$$PV = \mu N_A k_B T$$

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

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

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




**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.

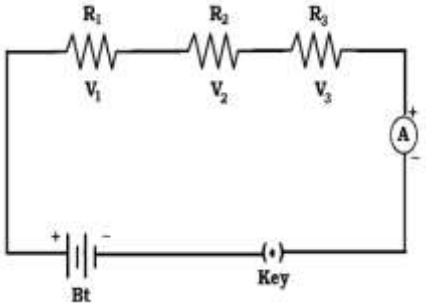
According to ohm's law,

$V_1 = IR_1 \longrightarrow (1)$

$V_2 = IR_2 \longrightarrow (2)$

$V_3 = IR_3 \longrightarrow (3)$

$V = IR_s \longrightarrow (4)$




The sum of the potential differences of each resistor is

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

$IR_s = IR_1 + IR_2 + IR_3$

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

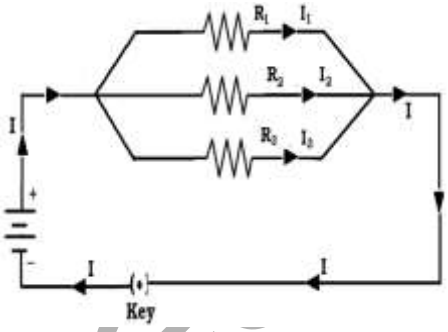
∴ When resistors are in series, resultant resistance is the sum of individual resistances.

***b) Resistance in parallel :*** **[PTA – 4]**

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

Potential difference is same for all resistors.

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




According to ohm's law,

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

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

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

$$I = \frac{V}{R_P} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Total current is

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

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

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

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

**2. a) What is meant by electric current?** **[MAY - 2022,PTA – 1]**

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

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

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

❖ SI unit of electric current is ampere (A).

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

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

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

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

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

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 :**

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

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

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

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

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

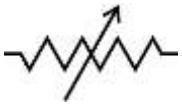
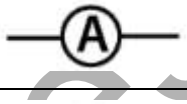
- ❖ It has brighter picture quality.
- ❖ It is thinner in size.
- ❖ It uses less power
- ❖ It consumes less energy.
- ❖ Its life span is more.
- ❖ It is more reliable.

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

- ❖ There is no loss of energy in the form of heat. It 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. |  |
| Voltmeter | Used to measure potential difference. |  |
| Galvanometer | Used to detect current and its direction. |  |
| A diode | It is used in electronic devices. |  **[SEP–21]** |
| Light Emitting Diode (LED) | It is used in seven segment display. |  **[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.

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

***ii) Effect of temperature :***

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

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

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

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

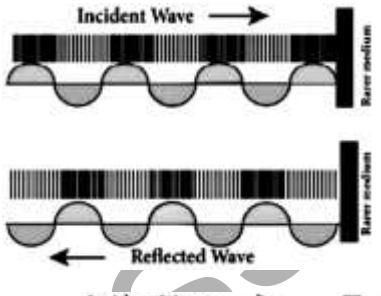
***iii) Effect of relative humidity :***

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 medium b) Reflection at the boundary of a denser medium c) Reflection at curved surfaces**

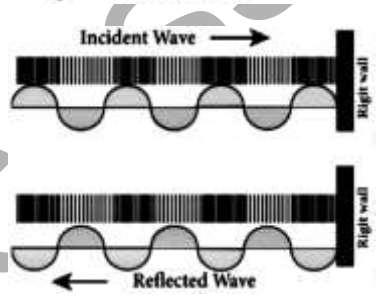
**Reflection of Sound:** It is the bouncing of sound waves from the interface between two media.

**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'? [SEP – 2020]**

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. [PTA – 1]**

**b) What are the medical applications of echo? [PTA – 1, SEP - 2020]**

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

**Echo:** 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 :***

$$\text{Speed of Sound} = \frac{\text{Distance travelled}}{\text{Time taken}} = \frac{2d}{t}$$

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

t → time taken for an echo to be observed

# 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.
- 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 ($_2He^4$). | Electrons ($_{-1}e^0$). | Electromagnetic waves. |
| Charge | Positively charged<br>Charge is +2e. | Negatively charged<br>Charge is –e. | neutral particles<br>Charge is 0. |
| Ionising power | Very high. | Lower than α rays. | Very less. |
| Penetrating power | Low | Greater than α rays. | Very high |
| electric and magnetic field | Deflected by both fields. | Deflected by both fields; but in opposite direction | Not deflected by both fields. |
| Speed | 1/10 to 1/20 times the speed of light. | can go up to 9/10 times 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 manner to produce electricity. The essential components are, | |
| **Fuel** | ❖ A fissile material is used. ***Ex :*** Uranium (or) Radium |
| **Moderator** | ❖ Used to slow down high energy neutrons. ***Ex:*** Graphite, heavy water |
| **Control rod** | ❖ Used to control the number of neutrons, to have sustained chain reaction. ***Ex :*** Boron (or) Cadmium rods |
| **Coolant** | ❖ Used to remove the heat produced in core reactor. ***Ex :*** Water, air, helium<br>❖ 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 ($Na^{24}$):** Used for the effective functioning of heart. **[PTA – 2]**
- **Radio iodine ($I^{131}$):** Used to cure goiter.
- **Radio iron ($Fe^{59}$):** Used to diagnose & treat anaemia.
- **Radio phosphorous ($P^{32}$)**: Used in treatment of skin diseases.
- **Radio cobalt ($Co^{60}$)** and **radio gold ($Au^{198}$)**: 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 Archeological research:** 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

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

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

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

**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 (__g) + 3 moles of hydrogen (__ g) → 2 moles of ammonia (__ g)**

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

$$\text{Mass of } N_2 = 1 \times (14 \times 2) = 28$$

$$\text{Mass of } H_2 = 3 \times (1 \times 2) = 6$$

$$\text{Mass of } NH_3 = 2 \times (14 + (3 \times 1)) = 34$$

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

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

**i) 27g of Al :**

$$\text{Number of moles} = \frac{\text{Mass of } Molecule}{\text{Atomic mass of } Molecule}$$

$$= \frac{27}{27} = 1 \text{ mole}$$

**ii) $1.51 \times 10^{23}$ molecules of $NH_4Cl$ :**

$$\text{Number of moles} = \frac{\text{Number of Molecules}}{\text{Avogadro number}}$$

$$= \frac{1.51 \times 10^{23}}{6.023 \times 10^{23}} = 0.25 \text{ moles}$$

**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 :*** $_{18}Ar^{40}$, $_{20}Ca^{40}$
- ***Artificial transmutation :*** Atom is no longer indestructible.
- Atoms may not always combine in a simple whole number ratio.

  ***Ex :*** Glucose $C_6H_{12}O_6$ C:H:O = 6:12:6 or 1:2:1
- Atom is the smallest particle that takes part in a chemical reaction.
- The mass of an atom can be converted into energy. **$E = mc^2$**

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

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

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

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

Let, number of molecules in the considered volume = n

$\therefore$ 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 $= \frac{\text{Mass of 1 molecule of a gas (or) Vapour at STP}}{\text{mass of 1 molecule of hydrogen}}$

***Hydrogen is diatomic molecule so,***

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

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

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

**Relative Molecular Mass = 2 × Vapour Density**

## Additional Questions

**6. Distinguish between atoms and molecules.** **[MAY - 2022]**

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

**7. What is Avogadro's Hypothesis? and state its application.** **[SEP – 2020]**

**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 kg = $10^6$ g

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

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

**Required Mass of $H_2$** = No. of moles of $H_2$ × Molecular mass

$= \frac{10^6}{17} \times \frac{3}{2} \times (2 \times 1) = 176.47$ kg of $H_2$

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

$= \frac{10^6}{17} \times \frac{1}{2} \times (14 \times 2) = 823.53$ kg of $N_2$

∴ 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.

$$\underset{\textit{Bauxite ore}}{Al_2O_3} + 2\,NaOH \xrightarrow{150^\circ C} \underset{\textit{sodium meta aluminate}}{2\,NaAlO_2} + H_2O$$

$$\underset{\textit{sodium meta aluminate}}{NaAlO_2} + 2\,H_2O \longrightarrow \underset{\textit{Aluminium hydroxide}}{Al(OH)_3} + NaOH$$

$$\underset{\textit{Aluminium hydroxide}}{2Al(OH)_3} \xrightarrow{1000^\circ C} \underset{\textit{Alumina}}{Al_2O_3} + 3\,H_2O$$

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

❖ ***Fluorspar*** is the another substance.

***Reason :*** It lowers the fusion temperature of electrolyte.

**2. The electronic configuration of metal A is 2, 8, 18, 1. The metal A when exposed to air and moisture forms B, a green layered compound. A with con. $H_2SO_4$ forms C and D along with water. D is a gaseous compound. Find A, B, C and D.** **[PTA – 1]**

$$2\ Cu + O_2 + CO_2 + H_2O \longrightarrow CuCO_3.Cu(OH)_2$$

*Copper carbonate (B) green layer*

$$Cu + 2\ H_2SO_4 \longrightarrow CuSO_4 + SO_2\uparrow + 2H_2O$$

*Copper sulphate(C)* *(D)*

**A → Copper (Cu)**
**B → Copper carbonate ($CuCO_3 . Cu(OH)_2$)**
**C → Copper sulphate ($CuSO_4$)**
**D → Sulphur dioxide($SO_2$) gas**

**3. Explain Smelting Process.**

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

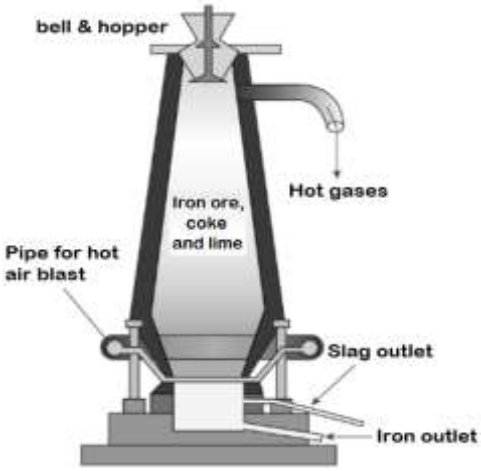
**Smelting of iron:** Charge consisting of roasted ore, coke and limestone in the ratio 8:4:1 is smelted in a blast furnace.

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

- Temperature is at 1500°C.
- In this region, coke burns with $O_2$ to form $CO_2$

$$C + O_2 \xrightarrow{1500^\circ C} CO_2 + Heat$$

*Carbon* *Carbon dioxide*




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

$$CO_2 + C \xrightarrow{1000^\circ C} 2CO + Heat$$

$$\Delta$$

$$CaCO_3 \xrightarrow{1000^\circ C} CaO + CO_2 + Heat$$

$$\Delta$$

$$CaO + SiO_2 \longrightarrow CaSiO_3$$

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

$$Fe_2O_3 + 3CO \xrightarrow{400^\circ C} 2Fe + 3CO_2\uparrow$$

*ferric oxide* *Iron*

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

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

## Additional Questions

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

**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.*** ❋ ***Reason:*** *Due to increase in valence shell number.* | ***a) Atomic radius decreases.*** ❋ ***Reason:*** *Atom shrinks as the attraction of protons over electrons increases.* |
| ***b) Electron affinity decreases.*** ❋ ***Reason:*** *As Atomic radius increases, valence electrons are loosely bound.* | ***b) Electron affinity increases.*** ❋ ***Reason:*** *As Atomic radius decreases.* |
| ***c) Ionisation energy decreases.*** ❋ ***Reason:*** *As Atomic radius increases, Less energy is required to remove the electrons.* | ***c) Ionisation energy increases.*** ❋ ***Reason:*** *As atomic radius decreases, more energy is required to remove the electrons.* |

**5. What is an alloy? Write the reasons for alloying. [MAY - 2022]**

**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 alloying:**

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

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

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

**Methods to Prevent Metal Corrosion.**

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

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

***Electronegativity of given elements are***, H = 2.1, Na = 1.0, Cl = 3.0, I = 2.5, F = 4.0, Br = 2.8

| Question | Electronegativity Difference | Type of bond |
|---|---|---|
| **(i) NaCl** | 3.0 – 1.0 = 2.0 | > 1.7 ⇒ Ionic bond |
| **(ii) NaBr** | 2.8 – 1.0 = 1.8 | > 1.7 ⇒ Ionic bond |
| **(iii) NaI** | 2.5 – 1.0 = 1.5 | < 1.7 ⇒ Covalent bond |
| **(iv) NaF** | 4.0 – 1.0 = 3.0 | > 1.7 ⇒ Ionic bond |
| **(v) NaH** | 2.1 – 1.0 = 1.1 **[PTA– 2]** | < 1.7 ⇒ Covalent bond |
| **(vi) HF** | 4.0 – 2.1 = 1.9 **[PTA – 2]** | > 1.7 ⇒ 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]**

$$\underset{\textit{at red hot condition (A)}}{2Al} + \underset{\textit{steam}}{3H_2O} \longrightarrow \underset{\textit{Aluminium oxide (B)}}{Al_2O_3} + 3H_2\uparrow$$

$$2\,Al + 2\,NaOH + 2\,H_2O \longrightarrow \underset{\textit{sodium meta aluminate(C)}}{2\,NaAlO_2} + 3\,H_2\uparrow$$
*strong caustic alkali*

**A → Aluminium *(Al)***
**B → Aluminium oxide ($Al_2O_3$)**
**C → 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 $25^0C$*

***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 $MgSO_4.7H_2O$ is heated? Write the appropriate equation.**

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

When $MgSO_4.7H_2O$ is heated, it loses its water and become anhydrous magnesium sulphate.

$$\underset{\text{Magnesium sulphate heptahydrate}}{MgSO_4 . 7H_2O} \xrightleftharpoons[\text{Cooling}]{\text{Heating}} \underset{\text{Anhydrous Magnesium sulphate}}{MgSO_4} + 7\,H_2O$$

**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 ***do not dissolve***. | 1. When exposed to atmosphere, they absorb moisture and ***dissolve***. |
| 2. ***Do not change its physical state***. | 2. ***Change its physical state*** on exposure to air. |
| 3. ***Amorphous*** solids or liquids. | 3. ***Crystalline*** solids. |
| 4. ***Do not form saturated solutions***. | 4. ***Form saturated solutions***. |
| 5. ***Ex:*** Quick lime, Silica gel. | 5. ***Ex:*** 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.**

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

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

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

# 10. TYPES OF CHEMICAL REACTIONS

**1. What are called thermolysis reactions?** **[SEP – 2021]**

❖ 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*** $2HgO_{(S)} \xrightarrow{heat} 2Hg_{(l)} + O_{2(g)}$

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

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

***Ex:*** $Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \longrightarrow PbI_{2(S)} + 2KNO_{3(aq)}$

***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:*** $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

**3. Explain the factors influencing the rate of a reaction.** **[PTA – 5]**

***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.*

**4. How does pH play an important role in everyday life?**

***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:*** **[PTA – 3]**

- 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.**

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

$$\underset{\textit{calcium carbonate}}{CaCO_{3(s)}} \xrightarrow{heat} \underset{\textit{Calcium oxide}}{CaO_{(s)}} + \underset{\textit{Carbon dioxide}}{CO_{2(s)}}\uparrow$$

Carbon dioxide (C) is mixed with water to form carbonic acid

$$\underset{\textit{Carbon dioxide}}{CO_{2(g)}} + H_2O_{(g)} \longrightarrow \underset{\textit{Carbonic acid}}{H_2CO_{3(l)}}$$

**Compound A → $CaCO_3$**
**Compound B → CaO**
**Compound C → $CO_2$ gas**

# 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 $-CH_2$ 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 ($-CH_2$) 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: $CH_3$–$CH_2$–$CH_2$–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).

$$\overset{3}{CH_3}\text{-}\overset{2}{CH_2}\text{-}\overset{1}{CH_2}\text{-OH}$$

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

∴The name of the compound is **Propan –1 – 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'.**

$$\underset{\text{sugar}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow{\text{invertase}} \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{glucose (or) fructose}}{C_6H_{12}O_6} \xrightarrow{\text{zymase}} \underset{\text{ethanol}}{2C_2H_5OH} + 2CO_2$$

***(iv) Distillation of Wash:***

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

***Rectified spirit:*** It contains 95.5% ethanol & 4.5% of water. It is the main fraction of 'wash'.

***Absolute alcohol:*** 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]**

$$\underset{\text{ethanoic acid}}{CH_3COOH} + \underset{\text{sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{sodium ethanoate}}{CH_3COONa} + \underset{\text{water}}{H_2O}$$

**(ii) Evolution of carbon dioxide by the action of ethanoic acid with $NaHCO_3$.**

$$\underset{\text{ethanoic acid}}{CH_3COOH} + \underset{\text{sodium bicarbonate}}{NaHCO_3} \longrightarrow \underset{\text{sodium acetate}}{CH_3COONa} + \underset{\text{brisk effervescence}}{CO_2\uparrow} + \underset{\text{water}}{H_2O}$$

**(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.

$$\underset{\text{ethanol}}{CH_3CH_2OH} \xrightarrow[2[O]]{K_2Cr_2O_7/H^+} \underset{\text{ethanoic acid}}{CH_3COOH} + H_2O$$

**(iv) Combustion of ethanol.**

$$\underset{\text{ethanol}}{CH_3CH_2OH} + \underset{\text{oxygen}}{3O_2} \longrightarrow \underset{\text{carbon dioxide}}{2CO_2} + \underset{\text{water}}{3H_2O}$$

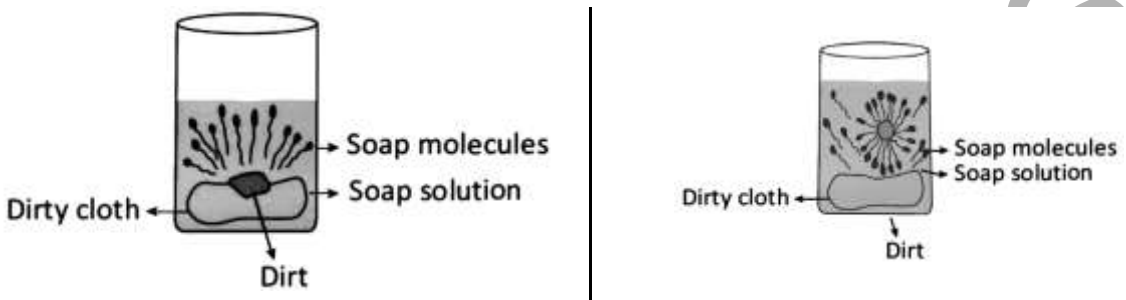
**5. Explain the mechanism of cleansing action of soap. [PTA – 6] (or) Explain how micelles formation take place with a diagram when soap is added to water? [PTA – 5]**

***Structure of Soap :***

❋ ***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.

**Cleansing action of Soap:**




- ❖ 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

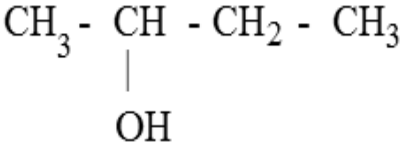
**6. Fill in the blanks in the table using IUPAC nomenclature of organic compounds. [PTA – 2]**

| Name of the compound | Structural formula | Functional group present |
|---|---|---|
| ***2-Propanol*** | $CH_3 - CH - CH_3$ <br> \| <br> OH | −OH |
| Ethanal | $CH_3 - C - H$ <br> ‖ <br> O | **O** <br> \|\| <br> **−C − H** |
| Butanone | **O** <br> \|\| <br> **$CH_3 - CH_2 - C - CH_3$** | > C = O |
| ***Butanoic acid*** | $CH_3 - CH_2 - CH_2 - COOH$ | −COOH |

## 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]**

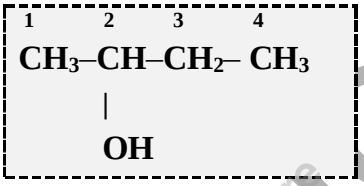


**(ii) Give its IUPAC name.** **[PTA – 1]**

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

***Step 2:*** It has single bond. ∴ Primary suffix is **'ane'**.

***Step 3:*** Functional group is alcohol (–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?** **[PTA – 1]**

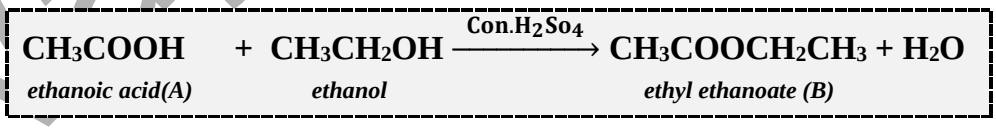
Butan-2-ol is **saturated** as it has only single bonds

**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 **$CH_3COOH$.**

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




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

This process is esterification.

A → Ethanoic acid

B → Ethyl ethanoate

Process → Esterification

# 12. PLANT ANATOMY AND PLANT PHYSIOLOGY

**1. Differentiate the following.** **[MDL – 19]**

**a) Monocot root and Dicot root:** **[SEP – 2020]**

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

**b) Aerobic and Anaerobic respiration:** **[AUG – 2022, SEP – 2021]**

| Aerobic respiration | Anaerobic respiration |
|---|---|
| 1) Takes place in presence of oxygen. | 1) Takes place in absence of oxygen. |
| 2) Occurs in most plants and animals | 2) Occurs in some bacteria. |
| 3) Carbohydrate is completely oxidized into carbon dioxide, water and energy. | 3) Glucose is converted into ethanol (in plants) or 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 $CO_2$ and water in mitochondrial matrix.

**Electron Transport chain (ETC):**

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

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

| Light dependent (Light) Reaction | Light independent (Dark) Reaction |
|---|---|
| Takes place in the presence of light energy | Takes place in the absence of light. |
| Photosynthetic pigments absorb light energy and convert it into ATP & $NADPH_2$ | $CO_2$ is reduced into carbohydrates with the help of ATP & $NADPH_2$ |
| Occures in *thylakoid membrane* 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, $H_2O$, $NADP^+$, 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 $NADPH_2$ are formed by light reactions using sunlight. They are used by Calvin cycle to produce glucose.
- ❖ Calvin cycle oxidizes $NADPH_2$ and ADP to $NADP^+$ and ATP. These are used again by light reaction and reduced to $NADPH_2$ 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? [PTA – 5]**

Locomotion in leech takes place by,

**Looping or crawling movement:**

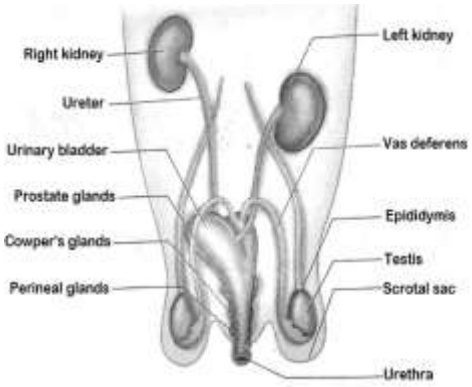
- ❖ It occurs by contraction and relaxation of muscles.
- ❖ The two suckers are used for attachment during movement.

**Swimming movement:**

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

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

- ❖ It consists of a pair of testes, ovoid in shape.
- ❖ Testes are enclosed by scrotal sacs.
- ❖ Each testis consists of seminiferous tubules.
- ❖ This forms epididymis, which leads 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.




# 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. [AUG – 2022]**

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

***Importance of transpiration:***

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

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

✸ Leucocytes are classified as granulocytes and agranulocytes because of its presence and absence of granules in it respectively.

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

| | |
|---|---|
| ***i) Neutrophils*** | They increase during infection and inflammation. |
| ***ii) Eosinophils*** | • They increase during allergy & parasitic infections.<br>• It brings detoxification of toxins. |
| ***iii) Basophils*** | They release chemicals during inflammation. |

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

| | |
|---|---|
| ***i) Lymphocytes*** | They produce antibodies during bacterial and viral infections. |
| ***ii) Monocytes*** | They are phagocytic and can engulf bacteria. |

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

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

***Conduction of heart beat:***

- ❖ Sino – atrial node acts as the pacemaker of heart.
- ❖ SA node initiates an impulse. It 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.

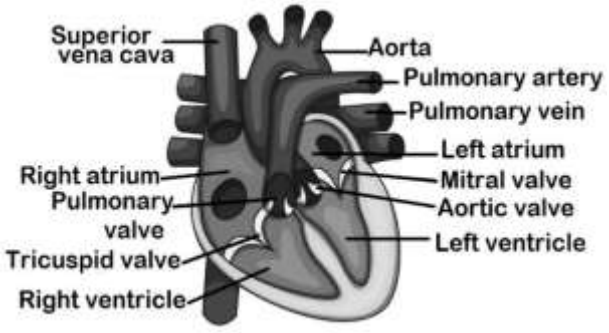
**5. Enumerate the functions of blood.[SEP-21]**

**Functions of blood: [AUG – 2022]**

- ❖ It transports respiratory gases ($O_2$ & $CO_2$).
- ❖ 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.

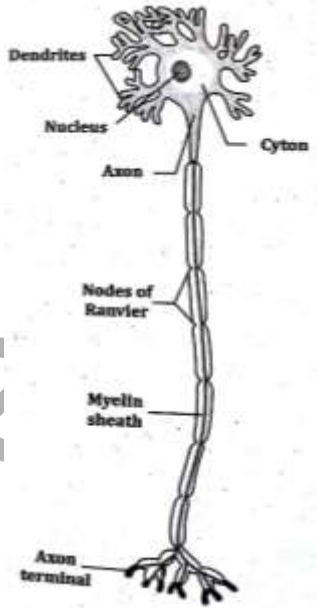
## Additional Question

**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.** **[MDL – 19]**




**(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.** **[PTA – 1]**

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

**i) Forebrain :**

❋ ***Cerebrum:*** Largest portion. Divided into right & left cerebral hemispheres by median cleft.
- **Corpus Callosum:** Connects 2 Cerebral hemisphere.
- **Cerebral Cortex:** Grey outer portion - **Gyri** and **Sulci**
- **Cerebral Medulla:** White inner portion
- **Cerebral Lobes:** Frontal lobe, Parietal lobe, temporal lobe, occipital lobe.

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

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

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

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

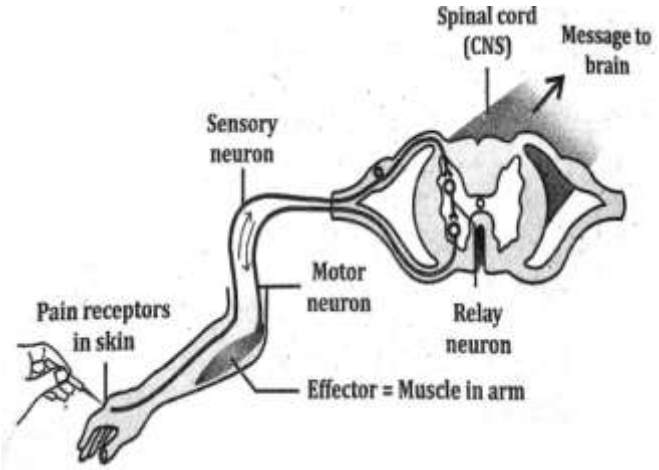
**iii) Hindbrain:**

❋ ***Cerebellum:*** Second largest portion. Has two large sized hemispheres & middle vermis.
*Functions:* Coordinates voluntary movements, maintains body balance.

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

❋ ***Medulla oblongata:*** Connects spinal cord and various parts of brain.
*Functions:* cardiac, respiratory and vasomotor centre. Regulates vomiting & salivation.

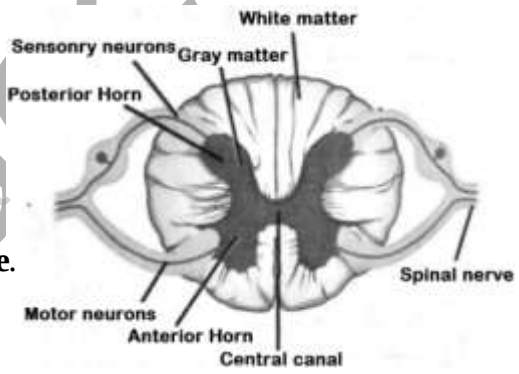
**3. What will you do if someone pricks your hand with a needle? Elucidate the pathway of response with a neat-labelled diagram.**




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

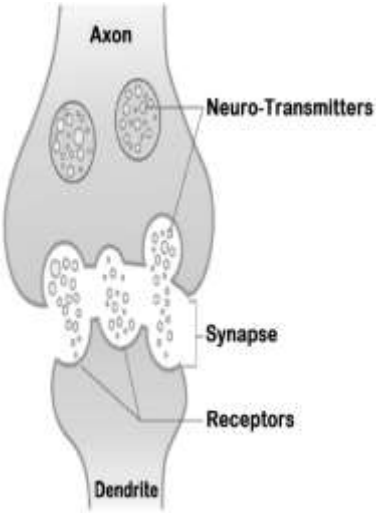
**4. Describe the structure of spinal cord.**

**Structure of spinal cord:**



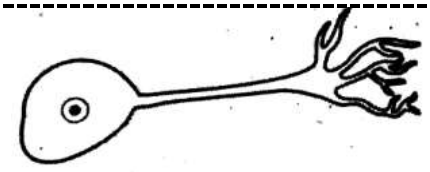
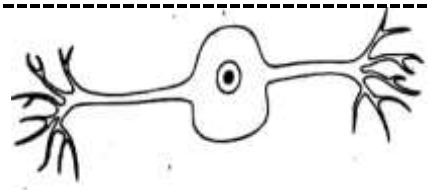
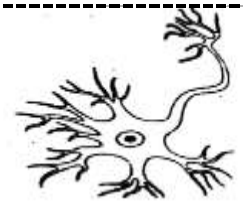

- ❖ It is a cylindrical structure in vertebral column.
- ❖ It is from medulla oblongata to first lumbar vertebra.
- ❖ It is covered by meninges.
- ❖ Thin fibrous thread like posterior end is **filum terminale**.
- ❖ **Central canal** - Cerebrospinal fluid filled cavity.
- ❖ ***It has*** 'H' shaped ***Grey matter.***
  - ❋ Posterior horns(upper end). Fibres 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.

**6. Classify neurons based on its structure.** **[SEP – 2020]**

| | |
|---|---|
| ***i) Unipolar Neurons :***<br>• Only one nerve process arises from cyton,<br>• It acts as both axon and dendron.<br>• Ex: Early embryos. |  |
| ***ii) Bipolar Neurons :***<br>• Two-nerve process arises from the cyton,<br>• One acts as axon while another as dendron.<br>• Ex: Retina of eye. |  |
| ***iii) Multipolar Neurons :***<br>• Cyton gives rise to many dendrons and one axon.<br>• 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.

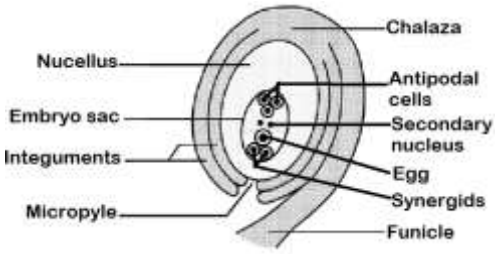
**5. What are the conditions, which occur due to lack of ADH and insulin? How are the conditions different from one another?**

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

# 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.
6. Embryo sac contains seven cells and eighth nuclei within nucellus.
   - Egg apparatus: 1 egg cell and 2 synergids (cells) at micropylar end.
   - Antipodal cells: 3 cells at chalaza end.
   - Polar nuclei in the centre.

**2. What are the phases of menstrual cycle? Indicate the changes in the ovary and uterus.**

**❖ 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.

❖ **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.

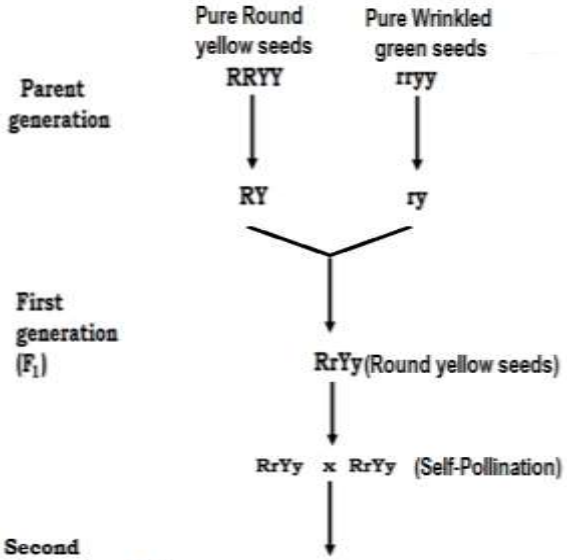
**c) Do you think that Rahini's objection towards her parents was correct? If so, Why?**

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.

# 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 ($F_2$):** When $F_1$ 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 & 1 Recessive
- *Wrinkled yellow* – 3 plants
- *Wrinkle green* – 1 Plant – 2 Recessive Traits

**Phenotypic ratio – 9 : 3 : 3 : 1**

| | RY | rY | Ry | ry |
|---|---|---|---|---|
| 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. ***Ex :*** Tall Plant × Dwarf plant | ***Ex :*** 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 ≡ G)

*iv)* These hydrogen bonds make DNA molecule stable.

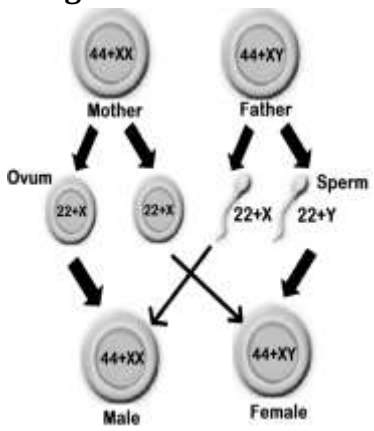
*v)* Each turn of double helix is 34 A°. There are ten base pairs in a turn.

*vi)* Nucleotides in a helix are joined by phosphodiester bonds.

***Significance of DNA:*** **[SEP – 2020]**

- ❖ It transmits hereditary information from one generation to the next.
- ❖ It contains information for the formation of proteins.
- ❖ It controls developmental process and life activities.

**3. The sex of the new born child is a matter of chance and neither of the parents may be considered responsible for it. What would be the possible fusion of gametes to determine the sex of the child?**




- ❖ Human have 22 pairs of autosomes & one pair of allosomes.
- ❖ Female gametes are homogametic (22+XX).
- ❖ Male gametes are heterogametic (22+XY).
  - Sperm bearing (22 + X) chromosomes.
  - Sperm bearing (22 + Y) chromosomes.
- ❖ If egg is fused with X - bearing sperm (22+X) it produces a female child (44+XX).
- ❖ If egg is fused with Y - bearing sperm (22+Y) it produces a male child (44+XY).

# 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. ***Ex :*** Human hand, front leg of cat, | 5. ***Ex:*** 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.<br>• Can preserve hard and soft parts. Ex: Bones and wood fossils. |
| ***ii) Mold & Cast*** | • Organism buried in sediment leaves a mold.<br>• It is the original shape but does not reveal the internal structure.<br>• 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).<br>• They protect them from decay. |
| ***iv) Compression*** | • Hard parts of organism settle at bottom of seabed & covered by sediment.<br>• With continuous sedimentation, fossils are formed. |
| ***v) Infiltration (or) Replacement*** | • Precipitation of minerals takes place, which then infiltrate the cell wall.<br>• This is achieved by elements like silica, calcium and magnesium carbonate.<br>• 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.<br>Life has not changed ever since its origin. |
| **Spontaneous generation (Abiogenesis)** | Life originated spontaneously from lifeless matter.<br>***Ex :*** Fishes from mud; |
| **Biogenesis** | Life originates from pre-existing life. Proposed by Louis Pasteur. |
| **Extraterresterial or Cosmic origin** | Life came from outer space.<br>Units of life - spores (Panspermia) were transferred to different planets. |
| **Chemical evolution of Life** | Proposed by Oparin & Haldane. Life arose by chemical reactions.<br>Non-living inorganic molecule → Diverse organic molecules→Colloidal system→ Life |

# 20. BREEDING AND BIOTECHNOLOGY

**1. What are the effects of hybrid vigour in animals?** **[PTA – 1, 5]**

***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?**

***Biofortification :*** Process of developing plants enriched with high levels of desirable nutrients.

***Hidden Hunger:*** It denotes the lack of micronutrients such as vitamin A, zinc and iron in diet.

***Removal of Hidden hunger :***

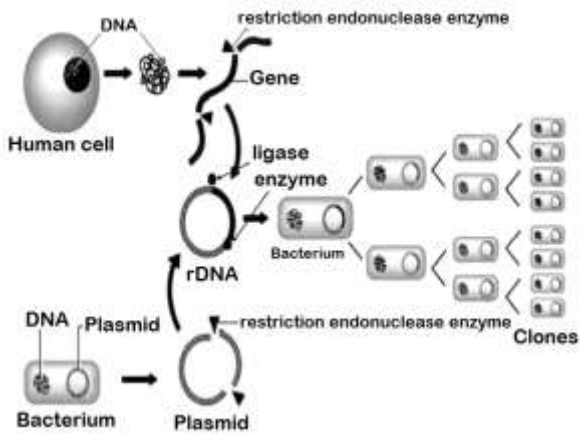
- Bio-fortified foods contribute body to store micronutrients throughout the life cycle.
- Thus, Bio-fortification is effective in removing hidden hunger.

***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.
  - ✓ 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?**

| **P → Beta carotene** | **Q → Ordinary rice plant** | **R → Golden rice** |
|---|---|---|

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

***Important of Golden rice in India :***

- It is used for fighting against cell damage
- 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.<br>❖ This would help them to share their feeling and get rid of the habit. |
| ***Medical assistance*** | ❖ They should see psychologists and psychiatrists.<br>❖ 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):**

❖ 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? [PTA – 3]**

❖ 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:** **R**educe→**R**euse→**R**ecover→**R**ecycle.

**4. Enumerate the importance of forest.** **[MDL – 19]**

- 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.

## 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 :*** **[PTA – 5]**

(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.