

UP Board 10 Science Code 824 IP 2024 Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :70	Total questions :35
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General Instructions

Instruction:

- i) *All* questions are compulsory. Marks allotted to each question are given in the margin.
- ii) In numerical questions, give all the steps of calculation.
- iii) Give relevant answers to the questions.
- iv) Give chemical equations, wherever necessary.

1. From which lens the image of object formed is virtual, erect and smaller than the object?

- (A) Concave lens
- (B) Convex lens
- (C) Plane lens
- (D) None of these

Correct Answer: (A) Concave lens

Solution:

Step 1: Understanding the property of lenses.

A concave lens diverges light rays that pass through it. The image formed by a concave lens is always **virtual, erect, and smaller** than the object.

Step 2: Analyzing the options.

(A) Concave lens: Correct — forms a virtual, erect, and diminished image.

(B) Convex lens: Incorrect — usually forms a real and inverted image, except when the object is between the focus and lens.

(C) Plane lens: Incorrect — produces an image of the same size and orientation as the object.

(D) None of these: Incorrect — since the correct lens is concave.

Step 3: Conclusion.

Therefore, the lens that forms a virtual, erect, and smaller image is the **concave lens**.

Quick Tip

A concave lens always forms a virtual, erect, and diminished image irrespective of the object position.

2. In a spherical mirror the distance between its centre of curvature and pole is 20 cm. What is the distance of focus from the pole of the mirror?

- (A) 5 cm

- (B) 10 cm
- (C) 15 cm
- (D) 20 cm

Correct Answer: (B) 10 cm

Solution:

Step 1: Recall the relationship between radius of curvature and focal length.

For any spherical mirror, the relation is given by:

$$f = \frac{R}{2}$$

where f is the focal length and R is the radius of curvature.

Step 2: Substitute the given values.

Given that $R = 20$ cm, we get

$$f = \frac{20}{2} = 10 \text{ cm}$$

Step 3: Conclusion.

Therefore, the focal length of the mirror (distance of focus from the pole) is **10 cm**.

Quick Tip

For all spherical mirrors, the focal length is half of the radius of curvature, i.e., $f = \frac{R}{2}$.

3. Due to which phenomenon of light does the sky appear blue?

- (A) Reflection
- (B) Refraction
- (C) Dispersion
- (D) Scattering

Correct Answer: (D) Scattering

Solution:

Step 1: Understanding the phenomenon.

When sunlight enters the Earth's atmosphere, it interacts with the air molecules and dust particles. These particles scatter the light in all directions. This scattering is more effective for shorter wavelengths (blue and violet light) than for longer wavelengths (red and orange light).

Step 2: Reason for blue color of the sky.

Although violet light is scattered even more, our eyes are more sensitive to blue light and part of violet is absorbed by the upper atmosphere. Hence, the sky appears blue to us.

Step 3: Analysis of options.

(A) Reflection: This occurs when light bounces off a surface — not responsible for the blue color of the sky.

(B) Refraction: This is bending of light through a medium; unrelated to sky color.

(C) Dispersion: It causes splitting of light into colors (as in a prism), but doesn't explain the blue sky.

(D) Scattering: Correct — scattering of light (Rayleigh scattering) causes the blue color of the sky.

Step 4: Conclusion.

Hence, the blue color of the sky is due to the **scattering of sunlight** by air molecules.

Quick Tip

Shorter wavelengths of light (like blue) scatter more than longer wavelengths (like red). This is why the sky appears blue and the sunset appears reddish.

4. The power of a lens is +2 dioptre. What will be its focal length in cm?

- (A) +50
- (B) -50
- (C) +25
- (D) -25

Correct Answer: (A) +50

Solution:

Step 1: Recall the formula for power of a lens.

The power of a lens is defined as the reciprocal of its focal length in meters:

$$P = \frac{1}{f(\text{in meters})}$$

Step 2: Substitute the given value.

Given, $P = +2\text{ D}$

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

Step 3: Convert to centimeters.

$$0.5\text{ m} = 0.5 \times 100 = 50\text{ cm}$$

Step 4: Sign convention.

Since the power is **positive**, the lens is a **convex lens**, and therefore the focal length is **positive**.

Step 5: Conclusion.

The focal length of the lens is **+50 cm**.

Quick Tip

For lenses: $P = \frac{100}{f(\text{cm})}$. A positive power means a convex lens, and a negative power means a concave lens.

5. In which of the following wires of domestic electric distribution is the fuse wire connected in series?

- (A) Earth-connected wire
- (B) Neutral wire
- (C) Live wire
- (D) None of these

Correct Answer: (C) Live wire

Solution:

Step 1: Understanding fuse connection.

A fuse is a safety device that protects electrical circuits from excessive current. It is always connected in series with the circuit to ensure that when excessive current flows, the fuse melts and breaks the circuit.

Step 2: Reason for connecting with live wire.

The live wire carries the current from the supply to the appliance. If the fuse were placed in the neutral wire instead, the appliance could remain connected to high potential even after the fuse blows — posing an electric shock risk.

Step 3: Conclusion.

Hence, the fuse wire is always connected in series with the **live wire**.

Quick Tip

Always connect the fuse in the live wire, not in the neutral wire. This ensures that the circuit is completely disconnected from the supply when the fuse blows.

6. If the units of power, work, and time are represented by x_1, x_2, x_3 respectively, then which of the following relations is correct?

- (A) $x_1 \times x_2 = x_3$
- (B) $x_1 \times x_3 = x_2$
- (C) $x_2 \times x_3 = x_1$
- (D) $x_1 \times x_2 \times x_3 = 1$

Correct Answer: (B) $x_1 \times x_3 = x_2$

Solution:

Step 1: Recall the relation between power, work, and time.

Power is defined as work done per unit time:

$$P = \frac{W}{t}$$

or, rearranging,

$$W = P \times t$$

Step 2: Represent in given symbols.

If the units of power, work, and time are x_1, x_2, x_3 respectively, then:

$$x_2 = x_1 \times x_3$$

Step 3: Conclusion.

Hence, the correct relation is $x_1 \times x_3 = x_2$.

Quick Tip

Always remember the fundamental formula: $P = \frac{W}{t}$. Rearranging this gives $W = P \times t$, which is helpful for unit-based questions.

7. In a conductor, 10 ampere of current is flowing. What will be the amount of charge flowing in 2 seconds corresponding to it?

- (A) 10 coulomb
- (B) 5 coulomb
- (C) 20 coulomb
- (D) 25 coulomb

Correct Answer: (C) 20 coulomb

Solution:**Step 1: Recall the formula for electric current.**

Electric current (I) is defined as the rate of flow of electric charge (Q):

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

or rearranging,

$$Q = I \times t$$

Step 2: Substitute the given values.

Given, $I = 10$ A and $t = 2$ s:

$$Q = 10 \times 2 = 20 \text{ Coulomb}$$

Step 3: Conclusion.

Therefore, the total charge passing through the conductor in 2 seconds is **20 coulomb**.

Quick Tip

Use the relation $Q = I \times t$. Always ensure the units are consistent — current in amperes, time in seconds, charge in coulombs.

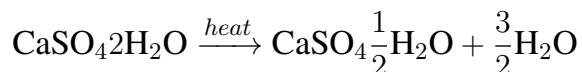
8. The formula of plaster of Paris is —

- (A) $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$
- (B) $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$
- (C) $\text{CaSO}_4 \cdot \text{H}_2\text{O}$
- (D) $\text{CaSO}_4 \cdot 5\text{H}_2\text{O}$

Correct Answer: (A) $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$

Solution:**Step 1: Recall the composition of plaster of Paris.**

Plaster of Paris (POP) is a white powder obtained by heating gypsum at 373 K. Gypsum has the formula $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. On heating, it loses 1.5 molecules of water and forms POP.

Step 2: Chemical reaction.**Step 3: Conclusion.**

Hence, the chemical formula of plaster of Paris is $\text{CaSO}_4 \cdot \frac{1}{2} \text{H}_2\text{O}$.

Quick Tip

POP is formed by partial dehydration of gypsum. When mixed with water, it reforms gypsum, which hardens quickly.

9. The solution with pH 8.5 is —

- (A) Alkaline
- (B) Acidic
- (C) Neutral
- (D) None of these

Correct Answer: (A) Alkaline

Solution:

Step 1: Recall the pH scale.

The pH scale ranges from 0 to 14. - pH less than 7 → Acidic solution.

- pH equal to 7 → Neutral solution.

- pH greater than 7 → Alkaline (basic) solution.

Step 2: Given value of pH.

Since the pH of the given solution is 8.5, which is greater than 7, it indicates that the solution is basic or alkaline in nature.

Step 3: Conclusion.

Thus, a solution with pH 8.5 is **alkaline**.

Quick Tip

Remember: $\text{pH} < 7 \rightarrow \text{Acidic}$, $\text{pH} = 7 \rightarrow \text{Neutral}$, $\text{pH} > 7 \rightarrow \text{Alkaline}$.

10. IUPAC name of $\text{CH}_3\text{--CH}(\text{CH}_3)\text{--CHO}$ is —

- (A) Butanal
- (B) Butanol
- (C) 2-Methyl propanal
- (D) 2-Methyl propanol

Correct Answer: (C) 2-Methyl propanal

Solution:

Step 1: Identify the functional group.

The given compound contains an $-CHO$ group, which is an **aldehyde** functional group. Hence, the suffix will be “-al”.

Step 2: Select the parent chain.

The longest chain containing the $-CHO$ group has three carbon atoms (propane chain). Thus, the base name is “propanal”.

Step 3: Identify the substituent.

There is a methyl group ($-CH_3$) attached to the second carbon atom.

Step 4: Combine the name.

Adding the substituent's position gives the name **2-Methyl propanal**.

Step 5: Conclusion.

Therefore, the correct IUPAC name of $CH_3-CH(CH_3)-CHO$ is **2-Methyl propanal**.

Quick Tip

For aldehydes, always include the $-CHO$ group in the main chain and number the chain from that end.

11. The element having 7 electrons in its outermost orbit is —

- (A) Non-metal
- (B) Metal
- (C) Metalloid
- (D) Inert gas

Correct Answer: (A) Non-metal

Solution:**Step 1: Recall the electronic configuration rule.**

Elements that have 7 electrons in their outermost shell belong to Group 17 of the periodic table, known as the **halogen group** (e.g., Fluorine, Chlorine, Bromine, Iodine).

Step 2: Determine their properties.

These halogens are highly reactive non-metals. They gain one electron to achieve noble gas configuration, forming negative ions.

Step 3: Conclusion.

Thus, any element having 7 electrons in its outermost orbit is a **non-metal**.

Quick Tip

Halogens (Group 17 elements) are non-metals with 7 valence electrons and show high reactivity.

12. Chemical formula of calcium nitrate is —

- (A) CaNO_3
- (B) $\text{Ca}(\text{NO}_3)_2$
- (C) Ca_3NO_3
- (D) Ca_2NO_3

Correct Answer: (B) $\text{Ca}(\text{NO}_3)_2$

Solution:

Step 1: Write the ions.

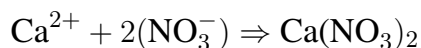
Calcium ion: Ca^{2+}

Nitrate ion: NO_3^-

Step 2: Balance the charges.

To balance the +2 charge of calcium, two nitrate ions (each with –1 charge) are required.

Step 3: Write the formula.



Step 4: Conclusion.

Hence, the correct chemical formula of calcium nitrate is **$\text{Ca}(\text{NO}_3)_2$** .

Quick Tip

Always use the criss-cross method to balance ionic charges when writing chemical formulas.

13. An unsaturated hydrocarbon in the following is —

- (A) C_2H_2
- (B) CH_4
- (C) C_2H_6
- (D) C_3H_8

Correct Answer: (A) C_2H_2

Solution:

Step 1: Understanding unsaturated hydrocarbons.

Hydrocarbons that contain double or triple bonds between carbon atoms are called **unsaturated hydrocarbons**. They do not contain the maximum number of hydrogen atoms possible.

Step 2: Analyzing each compound.

- (A) $C_2H_2 \rightarrow$ Ethyne (acetylene) contains a **triple bond**, hence unsaturated.
- (B) $CH_4 \rightarrow$ Methane, contains only single bonds, so saturated.
- (C) $C_2H_6 \rightarrow$ Ethane, all single bonds, saturated.
- (D) $C_3H_8 \rightarrow$ Propane, all single bonds, saturated.

Step 3: Conclusion.

Hence, C_2H_2 is the correct answer as it is an unsaturated hydrocarbon (alkyne).

Quick Tip

Unsaturated hydrocarbons contain double or triple bonds — alkenes have $C=C$, and alkynes have CC bonds.

14. Blood pressure is measured by —

- (A) Sphygmomanometer
- (B) Stethoscope
- (C) Microscope
- (D) Micrometer

Correct Answer: (A) Sphygmomanometer

Solution:

Step 1: Understanding blood pressure measurement.

Blood pressure is the force exerted by circulating blood upon the walls of blood vessels. It is measured using a device known as a **sphygmomanometer**.

Step 2: Working principle.

A sphygmomanometer consists of a cuff, an inflatable rubber bladder, a pressure gauge, and a stethoscope for listening to arterial sounds. The cuff is wrapped around the upper arm and inflated to stop blood flow temporarily, then slowly released to measure systolic and diastolic pressures.

Step 3: Typical values.

Normal blood pressure in humans is about 120/80 mmHg, where 120 mmHg is systolic and 80 mmHg is diastolic pressure.

Step 4: Conclusion.

Hence, blood pressure is measured by a **sphygmomanometer**.

Quick Tip

Remember: 120/80 mmHg is the normal blood pressure range for adults.

15. Which of the following is a plant hormone?

- (A) Thyroxin
- (B) Insulin
- (C) Cytokinin

(D) Oestrogen

Correct Answer: (C) Cytokinin

Solution:

Step 1: Recall the concept of hormones.

Plant hormones are naturally occurring chemical substances that regulate growth, development, and various physiological processes in plants.

Step 2: Analyze each option.

- (A) Thyroxin → Animal hormone secreted by thyroid gland.
- (B) Insulin → Animal hormone that regulates blood sugar.
- (C) Cytokinin → **Plant hormone** that promotes cell division, tissue growth, and delays leaf senescence.
- (D) Oestrogen → Female sex hormone in animals.

Step 3: Conclusion.

Thus, the plant hormone among the given options is **Cytokinin**.

Quick Tip

Major plant hormones include Auxin, Gibberellin, Cytokinin, Absciscic acid, and Ethylene.

16. Unisexual flower is —

- (A) Hibiscus
- (B) Papaya
- (C) Mustard
- (D) Rose

Correct Answer: (B) Papaya

Solution:

Step 1: Understanding unisexual and bisexual flowers.

A **unisexual flower** contains either stamens (male reproductive parts) or pistils (female reproductive parts), but not both.

Step 2: Examples.

- Papaya and watermelon produce unisexual flowers.
- Hibiscus, mustard, and rose are **bisexual** as they contain both stamens and pistils.

Step 3: Conclusion.

Hence, **Papaya** is an example of a unisexual flower.

Quick Tip

Unisexual flowers have either male or female reproductive organs, while bisexual flowers have both.

17. Example of regeneration is —

- (A) Hydra
- (B) Bryophyllum
- (C) Amoeba
- (D) Planaria

Correct Answer: (D) Planaria

Solution:

Step 1: Understanding regeneration.

Regeneration is the biological process through which an organism restores or regrows lost body parts. It involves the division and differentiation of specialized cells.

Step 2: Examples.

- Hydra reproduces by budding, not regeneration.
- Bryophyllum reproduces by vegetative propagation.
- Amoeba reproduces by binary fission.
- Planaria can regenerate its entire body from small fragments, showing true regeneration.

Step 3: Conclusion.

Hence, the best example of regeneration is **Planaria**.

Quick Tip

Regeneration is seen in simple multicellular organisms like Planaria and Hydra, but it's most prominent in Planaria.

18. Depletion of ozone layer is caused by which of the following?

- (A) Oxygen
- (B) Vapour
- (C) Sulphur dioxide
- (D) Chlorofluorocarbon

Correct Answer: (D) Chlorofluorocarbon

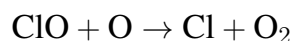
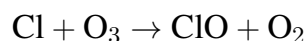
Solution:

Step 1: Understanding the ozone layer.

The ozone layer is present in the stratosphere and protects life on Earth by absorbing most of the Sun's harmful ultraviolet (UV) radiation.

Step 2: Identifying the cause of ozone depletion.

The primary agents responsible for ozone depletion are **chlorofluorocarbons (CFCs)**, which are used in air conditioners, refrigerators, and aerosol sprays. When released into the atmosphere, CFCs rise up and break down under UV radiation, releasing chlorine atoms. These chlorine atoms react with ozone molecules, breaking them apart.



Each chlorine atom can destroy thousands of ozone molecules.

Step 3: Conclusion.

Hence, the depletion of the ozone layer is caused by **chlorofluorocarbons (CFCs)**.

Quick Tip

CFCs are the major contributors to ozone layer depletion. Use of eco-friendly refrigerants helps reduce ozone damage.

19. Natural ecosystem is —

- (A) Flower pots
- (B) Aquarium
- (C) Farm
- (D) Forest

Correct Answer: (D) Forest

Solution:

Step 1: Understanding ecosystems.

An ecosystem includes all living organisms (biotic components) and their interactions with the non-living environment (abiotic components) such as air, water, and soil.

Step 2: Distinguishing between natural and artificial ecosystems.

- **Natural ecosystems** develop on their own without human interference (e.g., forests, ponds, lakes).
- **Artificial ecosystems** are created and maintained by humans (e.g., aquariums, crop fields).

Step 3: Analyzing options.

- (A) Flower pots → Artificial ecosystem.
- (B) Aquarium → Artificial ecosystem.
- (C) Farm → Artificial ecosystem (man-made).
- (D) Forest → Natural ecosystem.

Step 4: Conclusion.

Hence, the correct answer is **Forest**, as it is a natural ecosystem.

Quick Tip

Natural ecosystems maintain ecological balance on their own, while artificial ones require human care and control.

20. Producer in a food chain is —

- (A) Rat
- (B) Cat
- (C) Rabbit
- (D) Green plant and blue-green algae

Correct Answer: (D) Green plant and blue-green algae

Solution:

Step 1: Understanding the food chain.

A food chain shows how energy flows through living organisms — starting from producers, then consumers, and finally decomposers.

Step 2: Role of producers.

Producers are organisms that prepare their own food using sunlight through the process of **photosynthesis**. They convert solar energy into chemical energy, which is then passed through the food chain.

Step 3: Examples.

- **Green plants** and **blue-green algae (cyanobacteria)** contain chlorophyll and use sunlight to synthesize food.
- Animals like rats, cats, and rabbits depend on these producers for their food.

Step 4: Conclusion.

Hence, the producers in a food chain are **green plants and blue-green algae**.

Quick Tip

Producers are autotrophs that form the foundation of every food chain, converting solar energy into usable chemical energy.

PART B

1. What are the defects of vision? Write down the names of the lenses used for the correction of vision defect of three persons P, Q, and R if —

- (i) *P* can see only near objects clearly but cannot see far objects.
- (ii) *Q* can see only far objects clearly but cannot see near objects.
- (iii) *R* can neither see far objects nor near objects clearly.

Correct Answer:

- (i) *P*: Myopia (Short-sightedness) — corrected by **Concave lens**.
- (ii) *Q*: Hypermetropia (Long-sightedness) — corrected by **Convex lens**.
- (iii) *R*: Presbyopia — corrected by **Bifocal lens**.

Solution:

Step 1: Understanding the defects of vision.

There are three common defects of vision — Myopia, Hypermetropia, and Presbyopia.

These occur due to improper focusing of light on the retina by the eye lens.

(i) Myopia (Short-sightedness):

A person with myopia can see nearby objects clearly but not distant objects. This defect occurs when the image of a distant object is formed in front of the retina because the eyeball is elongated or the eye lens is too curved.

Correction: A concave lens (diverging lens) is used to diverge the incoming light rays so that the image forms correctly on the retina.

(ii) Hypermetropia (Long-sightedness):

A person with hypermetropia can see distant objects clearly but not near objects. This happens when the image of a nearby object is formed behind the retina due to a short eyeball or less converging power of the eye lens.

Correction: A convex lens (converging lens) is used to converge the incoming light rays before they enter the eye.

(iii) Presbyopia:

This defect occurs in old age due to loss of flexibility of the eye lens. The person cannot see both near and distant objects clearly.

Correction: Bifocal lenses are used — the upper part is concave (for distant vision) and the lower part is convex (for near vision).

Step 2: Conclusion.

P — Myopia → Concave lens

Q — Hypermetropia → Convex lens

R — Presbyopia → Bifocal lens

Quick Tip

Remember: - Myopia → Concave lens (short-sightedness) - Hypermetropia → Convex lens (long-sightedness) - Presbyopia → Bifocal lens (both near & far defects)

2. The speeds of light in water and glass are respectively 2.25×10^8 m/s and 2.0×10^8 m/s.

Calculate the following refractive indices:

- (i) The glass relative to water.
- (ii) The glass relative to air.

Correct Answer:

- (i) Refractive index of glass relative to water = 1.125
- (ii) Refractive index of glass relative to air = 1.5

Solution:

Step 1: Formula for refractive index.

The refractive index of one medium with respect to another is given by

$$n_{21} = \frac{v_1}{v_2}$$

where v_1 and v_2 are the speeds of light in the two media.

(i) Refractive index of glass relative to water:

Let $v_{\text{water}} = 2.25 \times 10^8 \text{ m/s}$ and $v_{\text{glass}} = 2.0 \times 10^8 \text{ m/s}$.

$$n_{\text{glass/water}} = \frac{v_{\text{water}}}{v_{\text{glass}}} = \frac{2.25 \times 10^8}{2.0 \times 10^8} = 1.125$$

Hence, refractive index of glass relative to water = 1.125.

(ii) Refractive index of glass relative to air:

The speed of light in air is approximately $3.0 \times 10^8 \text{ m/s}$.

$$n_{\text{glass/air}} = \frac{v_{\text{air}}}{v_{\text{glass}}} = \frac{3.0 \times 10^8}{2.0 \times 10^8} = 1.5$$

Thus, refractive index of glass relative to air = 1.5.

Step 2: Conclusion.

$n_{\text{glass/water}} = 1.125, \quad n_{\text{glass/air}} = 1.5$
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Quick Tip

The greater the refractive index, the slower light travels in that medium. Always use the ratio of light speeds to find relative refractive indices.

3. The resistance of a conductor depends on which factors and how? The resistance of a wire is R . What will be the resistance of the wire when the wire is of double length and half the radius of the same material?

Correct Answer: The new resistance $R' = 8R$

Solution:

Step 1: Factors affecting resistance.

The resistance R of a wire depends on:

$$R = \rho \frac{L}{A}$$

where, ρ = resistivity of material (depends on the substance),

L = length of the wire,

A = cross-sectional area of the wire.

Step 2: Dependence on dimensions.

- Resistance is **directly proportional to the length** of the wire.
- Resistance is **inversely proportional to the area of cross-section** of the wire.

Step 3: Given condition.

Original resistance = $R = \rho \frac{L}{A}$.

New wire has: Length $L' = 2L$, and radius $r' = \frac{r}{2}$.

Therefore, area of cross-section $A' = \pi(r')^2 = \pi \left(\frac{r}{2}\right)^2 = \frac{A}{4}$.

Step 4: Calculate new resistance.

$$R' = \rho \frac{L'}{A'} = \rho \frac{2L}{A/4} = \rho \frac{2L \times 4}{A} = 8\rho \frac{L}{A} = 8R$$

Step 5: Conclusion.

Hence, when the length is doubled and radius is halved, the new resistance becomes

$$R' = 8R$$

Quick Tip

Resistance increases with increase in length and decreases with increase in thickness (area). Use $R \propto \frac{L}{r^2}$ for quick estimation.

4. State the following laws with the help of labelled diagram. With the help of the following, the direction of which physical quantity can be known?

- (i) Fleming's Left Hand Rule
- (ii) Right Hand Thumb Rule

Correct Answer:

- (i) Fleming's Left Hand Rule — gives the direction of **force (motion)** on a current-carrying conductor in a magnetic field.
- (ii) Right Hand Thumb Rule — gives the direction of the **magnetic field** around a current-carrying conductor.

Solution:

(i) Fleming's Left Hand Rule:

When the thumb, forefinger, and middle finger of the left hand are stretched mutually perpendicular to each other: - The **Forefinger** points in the direction of the **magnetic field (B)**.

- The **Middle finger** points in the direction of the **current (I)**.

- The **Thumb** gives the direction of the **force (motion)** acting on the conductor.

This rule helps to determine the direction of the motion of a current-carrying conductor placed in a magnetic field.

Labelled Diagram (Fleming's Left Hand Rule):

A simple diagram shows a left hand with the thumb, forefinger, and middle finger mutually perpendicular.

Thumb → Force, Forefinger → Magnetic Field, Middle Finger → Current.

Physical Quantity Determined: Direction of **force** on the conductor.

(ii) Right Hand Thumb Rule:

If a current-carrying conductor is held in the right hand such that the **thumb** points in the direction of current, then the **fingers** encircling the wire give the direction of the **magnetic field lines**.

Labelled Diagram (Right Hand Thumb Rule):

A right hand gripping a straight conductor — thumb points in direction of current, and curved fingers show circular magnetic field lines around it.

Physical Quantity Determined: Direction of the **magnetic field** around a conductor.

Step 3: Conclusion.

Fleming's Left Hand Rule is used to determine the direction of **motion or force**, while the Right Hand Thumb Rule is used to determine the direction of the **magnetic field**.

Quick Tip

Remember: - Left hand → For electric motors (motion). - Right hand → For current-carrying conductors (magnetic field direction).

OR

4. Three wires A, B and C are emerging out from the main source of a house. What will be the name, function, and colour of the insulation for each wire?

Correct Answer:

The three wires are: Live wire, Neutral wire, and Earth wire. Their functions and insulation colours are as follows —

Wire	Name	Function	Colour of Insulation
A	Live (Phase) Wire	Carries current from the source to the appliance	Red or Brown
B	Neutral Wire	Completes the circuit by carrying current back to the source	Black or Blue
C	Earth Wire	Provides safety by conducting leakage current to the ground	Green or Green-Yellow

Solution:

Step 1: Understanding household wiring.

In domestic electrical wiring, three types of wires are used to ensure safe and efficient operation of electrical appliances. These are the **Live wire**, **Neutral wire**, and **Earth wire**. Each has a distinct function and insulation colour for easy identification.

Step 2: Function of each wire.

- The **Live (Phase) wire** carries current from the power supply to the appliance. It has high potential and must be handled with care.
- The **Neutral wire** completes the circuit by returning current from the appliance to the power source. It has zero potential relative to the ground.
- The **Earth wire** is a safety wire that directs leakage current safely to the ground, preventing electric shocks.

Step 3: Colour coding.

Each wire is coated with insulation of a specific colour for easy identification: - Live wire →

Red or Brown

- Neutral wire → **Black or Blue**

- Earth wire → **Green or Green-Yellow**

Step 4: Conclusion.

Hence, the wires A, B, and C correspond to Live, Neutral, and Earth wires respectively, each having a specific colour and purpose in electrical safety and operation.

Quick Tip

Always connect the fuse in the Live wire, not in the Neutral wire. This ensures that the circuit is fully disconnected from the supply when the fuse blows.

5(i). Write the chemical equations for two chemical properties of ethanol.

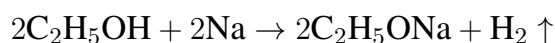
Correct Answer:

1. Reaction with sodium metal.
2. Oxidation of ethanol to acetic acid.

Solution:

Step 1: Reaction with Sodium.

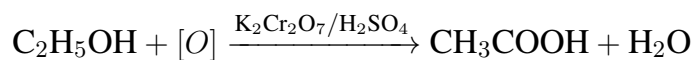
When ethanol reacts with sodium metal, hydrogen gas is evolved and sodium ethoxide is formed.



Observation: Bubbles of hydrogen gas are seen during the reaction.

Step 2: Oxidation of Ethanol.

On oxidation with acidified potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$), ethanol is oxidized to acetic acid.



Step 3: Conclusion.

Ethanol exhibits the properties of alcohols by reacting with metals to form alkoxides and by oxidation to form carboxylic acids.

Quick Tip

Ethanol reacts with active metals like sodium to produce hydrogen gas and undergoes oxidation to form acetic acid.

5(ii). Write the chemical equations for two chemical properties of acetic acid.

Correct Answer:

1. Reaction with sodium carbonate (Na_2CO_3).
2. Reaction with ethanol (esterification).

Solution:

Step 1: Reaction with Sodium Carbonate.

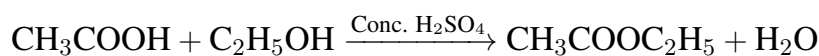
When acetic acid reacts with sodium carbonate, carbon dioxide gas is evolved along with sodium acetate and water.



Observation: Effervescence due to evolution of carbon dioxide gas.

Step 2: Reaction with Ethanol (Esterification).

When acetic acid reacts with ethanol in the presence of concentrated sulphuric acid, an ester (ethyl acetate) is formed along with water.



Observation: The ester formed has a pleasant fruity smell.

Step 3: Conclusion.

Acetic acid reacts with carbonates to produce CO_2 and forms esters when heated with alcohols — demonstrating acidic and esterification properties.

Quick Tip

Acetic acid shows both acidic and esterification properties — it reacts with carbonates to release CO_2 and forms esters with alcohols in presence of acid.

6. Explain the following:

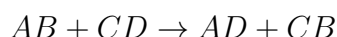
- (a) Double decomposition reaction
- (b) Neutralization reaction

Correct Answer:

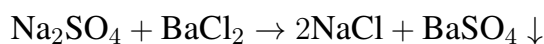
- (a) A double decomposition reaction is one in which two compounds react by exchanging their ions to form two new compounds.
- (b) A neutralization reaction is a chemical reaction between an acid and a base that results in the formation of salt and water.

Solution:**(a) Double Decomposition Reaction:****Step 1: Definition.**

A double decomposition reaction is a type of chemical reaction in which two compounds exchange their ions or radicals to form two new compounds. It generally occurs in aqueous solutions.

Step 2: General equation.

Here, the positive and negative ions of the two reactants interchange their partners.

Step 3: Example.

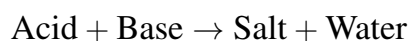
Observation: A white precipitate of barium sulphate (BaSO_4) is formed.

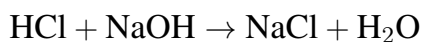
Step 4: Conclusion.

This reaction shows ion exchange between reactants, producing a precipitate — hence it is a **double decomposition (precipitation) reaction**.

(b) Neutralization Reaction:**Step 1: Definition.**

A neutralization reaction is the reaction between an acid and a base to form salt and water. The reaction neutralizes both the acid and the base.

Step 2: General equation.

Step 3: Example.

Observation: The solution becomes neutral ($\text{pH} = 7$) after reaction.

Step 4: Conclusion.

In a neutralization reaction, hydronium ions (H^+) from acid combine with hydroxide ions (OH^-) from base to form water, leading to neutralization.

Quick Tip

Double decomposition involves ion exchange between two salts, while neutralization involves acid-base reaction forming salt and water.

7. Write short notes on the following:

- (i) pH value
- (ii) Oxidation reaction
- (iii) Combustion reaction

Correct Answer:

Each part is explained below with proper definition, concept, and example.

Solution:**(i) pH Value:****Step 1: Definition.**

The pH value of a solution is a measure of its hydrogen ion concentration. It determines whether the solution is acidic, neutral, or basic.

Step 2: Formula.

$$\text{pH} = -\log[\text{H}^+]$$

where $[\text{H}^+]$ is the hydrogen ion concentration in moles per litre.

Step 3: Scale of pH.

- $\text{pH} < 7 \rightarrow$ Acidic solution
- $\text{pH} = 7 \rightarrow$ Neutral solution
- $\text{pH} > 7 \rightarrow$ Basic (alkaline) solution

Step 4: Example.

The pH of pure water is 7 (neutral), lemon juice has a pH around 2 (acidic), and soap solution has a pH around 9 (basic).

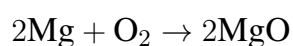
(ii) Oxidation Reaction:

Step 1: Definition.

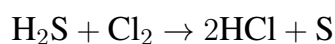
An oxidation reaction is a chemical process in which a substance gains oxygen, loses hydrogen, or loses electrons.

Step 2: General Examples.

1. Addition of oxygen:



2. Loss of hydrogen:



Step 3: Conclusion.

Oxidation always involves an increase in oxidation number or the addition of oxygen to a substance.

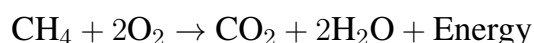
(iii) Combustion Reaction:

Step 1: Definition.

A combustion reaction is a process in which a substance reacts rapidly with oxygen, releasing heat and light (energy).

Step 2: Example.

When methane burns in oxygen:



Observation: The reaction produces flame and heat — an exothermic reaction.

Step 3: Conclusion.

Combustion reactions are always **exothermic** and involve oxidation of the fuel substance.

Quick Tip

pH measures acidity or basicity; oxidation involves oxygen addition or electron loss; combustion is a rapid oxidation that releases heat and light.

OR

7(i). Write the use of bleaching powder in purification of water.

Correct Answer:

Bleaching powder is used as a disinfectant for purifying drinking water by killing harmful bacteria and germs.

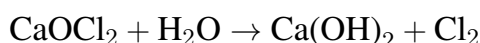
Solution:

Step 1: Understanding bleaching powder.

Bleaching powder is chemically known as **calcium oxychloride (CaOCl₂)**. It is prepared by passing chlorine gas over dry slaked lime [Ca(OH)₂].

Step 2: Action in water purification.

When bleaching powder is added to water, it releases chlorine, which kills bacteria and other microorganisms present in the water.



Step 3: Conclusion.

Thus, bleaching powder acts as a disinfectant by releasing chlorine, which destroys harmful germs in water and makes it safe for drinking.

Quick Tip

Bleaching powder is an effective and inexpensive disinfectant widely used for sterilizing drinking water and public places.

7(ii). Write the chemical equation for obtaining gypsum from plaster of Paris.

Correct Answer:

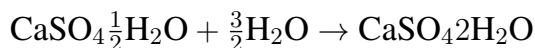
When plaster of Paris ($\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$) is mixed with water, it forms gypsum ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$).

Solution:**Step 1: Recall the formula of plaster of Paris.**

Plaster of Paris (POP) is chemically calcium sulphate hemihydrate — $\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$.

Step 2: Reaction with water.

When POP is mixed with water, it reacts to form gypsum (calcium sulphate dihydrate):

**Step 3: Conclusion.**

Hence, plaster of Paris sets and hardens by absorbing water to form gypsum.

Quick Tip

Plaster of Paris converts back into gypsum on mixing with water, making it useful for casting and repairing purposes.

7(iii). Explain corrosion by giving example.**Correct Answer:**

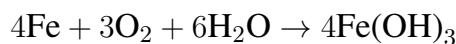
Corrosion is the gradual deterioration of metals when they react with moisture, air, or chemicals, forming unwanted compounds like oxides.

Solution:**Step 1: Definition.**

Corrosion is a slow process in which metals are eaten away by the action of air, water, or chemicals present in the surroundings. It results in the formation of undesirable compounds like metal oxides or carbonates.

Step 2: Example — Rusting of Iron.

When iron is exposed to moist air, it reacts with oxygen and water to form a reddish-brown flaky layer of hydrated ferric oxide (rust).



On drying, it forms $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$ (rust).

Step 3: Prevention methods.

Corrosion can be prevented by painting, galvanizing, oiling, greasing, or electroplating the metal surface.

Step 4: Conclusion.

Thus, corrosion weakens metals and causes damage to structures like bridges, ships, and iron railings.

Quick Tip

Corrosion is most common in metals like iron; preventive coatings like paint or galvanization can significantly reduce it.

8. What is ozone and how does it affect any ecosystem?

Correct Answer:

Ozone is a triatomic molecule of oxygen (O_3) present in the Earth's atmosphere. It protects living organisms by absorbing harmful ultraviolet (UV) rays from the Sun. However, depletion of the ozone layer adversely affects the ecosystem.

Solution:

Step 1: Definition of ozone.

Ozone is an allotrope of oxygen composed of three oxygen atoms (O_3). It is found mainly in the stratosphere and forms the **ozone layer**. This layer acts as a protective shield around the Earth.

Step 2: Formation of ozone.

Ozone is formed when ultraviolet rays split oxygen molecules (O_2) into individual oxygen atoms, which then combine with other oxygen molecules.



Step 3: Function of ozone layer.

The ozone layer absorbs harmful ultraviolet (UV) radiation from the Sun. Without this layer, living organisms would be exposed to dangerous UV rays leading to skin cancer, eye damage, and harm to plants and aquatic life.

Step 4: Effect of ozone depletion on ecosystem.

- Excessive UV radiation damages DNA and cells in organisms.
- It reduces crop productivity and affects phytoplankton in oceans, disrupting the food chain.
- Animals and humans suffer from higher risks of diseases due to radiation exposure.

Step 5: Conclusion.

Ozone is essential for life on Earth as it maintains the ecological balance by filtering harmful UV radiation. Protecting the ozone layer ensures the stability of the ecosystem.

Quick Tip

Ozone protects life on Earth from harmful UV radiation. Use of CFC-free products helps in reducing ozone depletion.

9. Describe the food chain and food web with examples.

Correct Answer:

A food chain shows the linear flow of energy from one organism to another, while a food web is a complex network of interconnected food chains within an ecosystem.

Solution:

Step 1: Definition of food chain.

A food chain is a sequence of organisms where one organism is eaten by another for energy transfer. Energy flows from producers to consumers in a single pathway.

Step 2: Example of food chain.

Grass → Grasshopper → Frog → Snake → Eagle

Here, energy flows from plants (producers) to herbivores (primary consumers), then to carnivores (secondary and tertiary consumers).

Step 3: Definition of food web.

A food web is a network of interlinked food chains where different organisms depend on multiple sources of food. It represents how energy flows through an entire ecosystem in multiple directions.

Step 4: Example of food web.

In a grassland ecosystem:

Grass → Deer → Tiger

and

Grass → Grasshopper → Frog → Snake → Hawk

These interconnected food chains form a food web.

Step 5: Importance of food web.

- Maintains ecological balance.
- Provides stability to the ecosystem.
- Helps in recycling nutrients through various organisms.

Step 6: Conclusion.

A food chain shows a single energy pathway, whereas a food web provides a complete picture of energy transfer and interdependence among organisms in an ecosystem.

Quick Tip

A food chain is simple and linear, while a food web is complex and interconnected — both are vital for the flow of energy in an ecosystem.

10. Write short notes on the following:

- (a) Vegetative propagation
- (b) Budding

Correct Answer:

- (a) Vegetative propagation is a type of asexual reproduction in plants where new individuals are formed from vegetative parts like stem, root, or leaf.

(b) Budding is a method of asexual reproduction in which a small outgrowth (bud) develops on the parent body and grows into a new organism.

Solution:

(a) Vegetative Propagation:

Step 1: Definition.

Vegetative propagation is the process by which new plants grow from the vegetative parts of a plant such as roots, stems, or leaves instead of seeds. It is a type of asexual reproduction.

Step 2: Explanation.

In this method, the vegetative parts like tubers, bulbs, rhizomes, and runners give rise to new plants identical to the parent.

Step 3: Examples.

- Potato → through tubers.
- Onion → through bulbs.
- Bryophyllum → through leaves.
- Ginger → through rhizomes.

Step 4: Advantages.

- New plants are genetically identical to the parent plant.
- Faster and more reliable method of reproduction.
- Useful for producing plants that do not form viable seeds.

Step 5: Conclusion.

Vegetative propagation is a natural as well as artificial method (e.g., cutting, grafting, layering) for reproducing plants efficiently.

Quick Tip

Vegetative propagation allows identical plants to be produced quickly — used in crops like sugarcane, rose, and potato.

10. (b) Budding:

Solution:

(b) Budding:

Step 1: Definition.

Budding is a type of asexual reproduction in which a small bud develops on the parent organism, grows, and then detaches to form a new individual.

Step 2: Explanation.

In this process, the bud is formed by cell division on the parent's body. The bud receives nutrients from the parent organism until it becomes mature. After maturation, it separates and lives independently.

Step 3: Example.

- In **Yeast**, a small bud grows on the parent cell, enlarges, and separates as a new yeast cell.
- In **Hydra**, a small outgrowth appears on the parent body and grows into a new organism.

Step 4: Diagram Description (for Overleaf).

A diagram would show a parent Hydra with a small bud growing on its side, which eventually detaches to form a new Hydra.

Step 5: Conclusion.

Budding is a simple and efficient process for unicellular and simple multicellular organisms to reproduce quickly.

Quick Tip

Budding occurs in organisms like Yeast and Hydra — it is a fast and energy-efficient method of asexual reproduction.

11. Describe the structure and function of the human brain in brief.

Correct Answer:

The human brain is the control center of the body, made up of three major parts — the cerebrum, cerebellum, and medulla oblongata (brain stem). Each part performs distinct functions necessary for body coordination, thinking, and vital regulation.

Solution:

Step 1: Structure of the Human Brain.

The human brain is divided into three main parts:

1. **Cerebrum:** - The largest part of the brain. - Responsible for intelligence, memory, learning, emotions, and voluntary actions. - It is divided into two hemispheres (right and left) that control opposite sides of the body.
2. **Cerebellum:** - Located below the cerebrum at the back of the skull. - Controls balance, posture, and coordination of muscles. - Ensures smooth and precise body movements.
3. **Medulla Oblongata (Brain Stem):** - Found below the cerebellum, connecting the brain to the spinal cord. - Controls involuntary activities such as heartbeat, breathing, digestion, and blood pressure.

Step 2: Diagram Description (for Overleaf).

A labeled diagram shows: - Cerebrum (top large part) - Cerebellum (below cerebrum, small oval shape) - Medulla oblongata (stem-like lower part connecting to the spinal cord).

Step 3: Function Summary.

The brain coordinates all activities of the body — voluntary and involuntary — and is responsible for maintaining homeostasis, thinking, and body control.

Step 4: Conclusion.

Thus, the human brain is a complex organ that acts as the command center of the nervous system, regulating thoughts, emotions, and vital functions.

Quick Tip

Remember the three parts of the brain — Cerebrum (thinking), Cerebellum (balance), and Medulla (involuntary actions).

OR

Describe energy flow in an ecosystem with diagram.

Correct Answer:

Energy flow in an ecosystem refers to the transfer of energy from one trophic level to another in a food chain. Energy always flows in one direction — from the Sun to producers, then to consumers and decomposers.

Solution:

Step 1: Definition.

Energy flow in an ecosystem is the movement of energy through various organisms as they consume and are consumed. This energy originates from the Sun and passes through different trophic levels.

Step 2: Path of energy flow.

1. **Sun:** The ultimate source of energy for all living organisms.
2. **Producers (plants):** Convert solar energy into chemical energy via photosynthesis.
3. **Primary Consumers:** Herbivores that eat plants to obtain energy.
4. **Secondary Consumers:** Carnivores that feed on herbivores.
5. **Tertiary Consumers:** Top predators that feed on other carnivores.
6. **Decomposers:** Break down dead organisms, recycling nutrients back into the environment.

Step 3: Diagram Description.

A simple diagram showing:

Sun → Green Plants (Producers) → Herbivores → Carnivores → Top Consumers

An arrow pointing in one direction shows energy decreasing at each level due to loss as heat.

Step 4: Important Rule.

According to the **10% law**, only about 10% of energy is transferred from one trophic level to the next, while 90% is lost as heat.

Step 5: Conclusion.

Energy flow maintains the balance of the ecosystem and supports the survival of organisms. It ensures continuous recycling of nutrients and sustains life on Earth.

Quick Tip

Energy flows in one direction — from the Sun to producers, then to consumers and decomposers — following the 10% energy transfer law.