

CBSE Class 10 2023 English 31-C-1 Question Paper With Solutions

Time Allowed :3 Hour	Maximum Marks :70	Total questions :39
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General Instructions

Read the following instructions very carefully and strictly follow them:

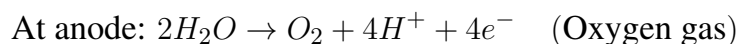
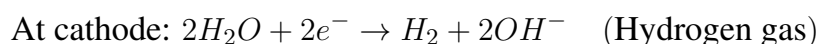
1. This question paper contains 33 questions. All questions are compulsory.
2. This question paper is divided into five sections Sections A, B, C, D and E.
3. In Section A Questions no. 1 to 16 are Multiple Choice type questions. Each question carries 1 mark.
4. In Section B Questions no. 17 to 21 are Very Short Answer type questions. Each question carries 2 marks.
5. In Section C Questions no. 22 to 28 are Short Answer type questions. Each question carries 3 marks.
6. In Section D Questions no. 29 and 30 are case study based questions. Each question carries 4 marks.
7. In Section E Questions no. 31 to 39 are Long Answer type questions. Each question carries 5 marks.
8. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions in all the Sections except Section A.
9. Kindly note that there is a separate question paper for Visually Impaired candidates.
10. Use of calculators is not allowed.

1. In the electrolysis of water, if the mass of the gas collected at the anode is m_a and the mass of the gas collected at the cathode is m_c , the value of $\frac{m_c}{m_a}$ is :

- (A) 8
- (B) 16
- (C) $\frac{1}{16}$
- (D) $\frac{1}{8}$

Correct Answer: (A) 8

Solution: During the electrolysis of water:



Hydrogen and oxygen are produced in the ratio of 2:1 by volume. Molar mass of hydrogen (H_2) = 2 g/mol

Molar mass of oxygen (O_2) = 32 g/mol

So, the mass ratio:

$$m_c : m_a = \frac{2 \times 2}{1 \times 32} = \frac{4}{32} = \frac{1}{8}.$$

Therefore,

$$\frac{m_c}{m_a} = 8.$$

So, the correct answer is (A).

Quick Tip

Always remember: In the electrolysis of water, hydrogen (light gas) is collected at the cathode and oxygen (heavier gas) at the anode in a 2:1 volume ratio. Convert volume to mass using molar masses.

2.

Consider the following substances : (i) Acidified $K_2Cr_2O_7$

(ii) Alkaline $KMnO_4$

(iii) Oxygen

(iv) Hydrogen

Out of these, the commonly used oxidising agents are :

- (a) (i) and (ii) only
- (b) (ii) and (iii) only
- (c) (i), (ii) and (iii)
- (d) (i), (ii) and (iv)

Correct Answer: (c) (i), (ii) and (iii)

Solution: Acidified potassium dichromate ($\text{K}_2\text{Cr}_2\text{O}_7$) and alkaline potassium permanganate (KMnO_4) are strong oxidising agents commonly used in redox reactions to oxidise various compounds. Oxygen is also a powerful oxidising agent because it readily accepts electrons and supports combustion and oxidation processes.

Hydrogen, on the other hand, acts as a reducing agent since it donates electrons. Therefore, (i), (ii) and (iii) are the correct choices.

Quick Tip

Remember: Substances that gain electrons and help other substances lose electrons are called oxidising agents. Hydrogen is a reducing agent.

3. Select from the following compounds which is not a base :

- (a) Sodium hydroxide
- (b) Calcium hydroxide
- (c) Sodium sulphate
- (d) Zinc oxide

Correct Answer: (c) Sodium sulphate

Solution: Sodium hydroxide (NaOH) and calcium hydroxide [$\text{Ca}(\text{OH})_2$] are strong bases commonly used in laboratories and industries. Zinc oxide (ZnO) is an amphoteric oxide, meaning it can behave both as a base and as an acid.

Sodium sulphate (Na_2SO_4) is a neutral salt formed by the reaction of a strong acid (sulphuric acid) and a strong base (sodium hydroxide). It does not exhibit basic properties. Therefore, the correct answer is Sodium sulphate.

Quick Tip

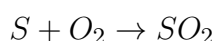
Always check if a substance releases OH^- ions in water — only then is it classified as a base.

4. 2 g of yellow sulphur powder is burnt in a china dish and the fumes are collected in a test tube. Water is added in the test tube and the solution is tested separately with blue and red litmus paper. The correct option is :

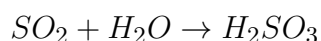
- (a) Blue litmus remains blue and red litmus turns blue.
- (b) Blue litmus turns red and red litmus remains red.
- (c) Blue litmus turns red and red litmus turns blue.
- (d) Blue litmus remains blue and red litmus remains red.

Correct Answer: (b) Blue litmus turns red and red litmus remains red.

Solution: When sulphur is burnt in air, it forms sulphur dioxide gas (SO_2):



When SO_2 dissolves in water, it forms sulphurous acid (H_2SO_3), which is acidic:



An acidic solution turns blue litmus red but has no effect on red litmus paper. Therefore, the blue litmus will turn red and the red litmus will remain red.

Quick Tip

Remember: Burning non-metals like sulphur forms acidic oxides that turn blue litmus red.

5. Which one of the following metals is malleable and a poor conductor of electricity ?

- (a) Copper
- (b) Zinc
- (c) Lead
- (d) Silver

Correct Answer: (c) Lead

Solution: Metals are generally good conductors of electricity and malleable. Copper and silver are excellent conductors and highly malleable. Zinc is also a good conductor.

Lead, however, is a metal that is malleable but is a poor conductor of electricity compared to other metals. Therefore, the correct answer is Lead.

Quick Tip

Most metals are good conductors, but lead is an exception — it's malleable but a poor conductor.

6. You want to test for hardness of water but hard water is not available in the laboratory. Which of the following compounds may be dissolved in pure water to make it hard ?

- (i) Hydrogen Carbonate of Sodium
- (ii) Sulphate of Magnesium
- (iii) Chloride of Calcium
- (iv) Carbonate of Sodium
- (a) (i) and (ii)
- (b) (ii) and (iii)
- (c) (iii) and (iv)
- (d) (i) and (iv)

Correct Answer: (b) (ii) and (iii)

Solution: Temporary and permanent hardness of water is due to the presence of soluble salts of calcium and magnesium. Magnesium sulphate (Sulphate of Magnesium) and calcium chloride (Chloride of Calcium) are soluble salts that cause permanent hardness in water. Hydrogen carbonate of sodium and carbonate of sodium do not cause hardness as they do not contain calcium or magnesium ions. Therefore, to make pure water hard, sulphate of magnesium and chloride of calcium can be added.

Quick Tip

Hardness of water is mainly caused by soluble calcium and magnesium salts like chlorides, sulphates and bicarbonates.

7. Which one of the following properties of Carbon is *not* responsible for its formation of large number of compounds ?

- (a) Tetravalency
- (b) Isomerism
- (c) Allotropy
- (d) Catenation

Correct Answer: (c) Allotropy

Solution: Carbon shows tetravalency, which allows it to form four covalent bonds with other atoms. Catenation is the property of carbon to form long chains by bonding with other carbon atoms. Isomerism is the property that allows compounds with the same molecular formula to have different structures, increasing the number of possible compounds.

Allotropy, however, is the existence of carbon in different physical forms like diamond, graphite and fullerene. Allotropy does not contribute to the formation of a large number of chemical compounds. Therefore, the correct answer is Allotropy.

Quick Tip

Tetravalency, catenation and isomerism are the key reasons for carbon's vast number of compounds — allotropy only explains its different physical forms.

8. Which one of the following molecules is produced initially when glucose breaks down in the cytoplasm of a cell in aerobic as well as anaerobic respiration ?

- (a) Lactic acid
- (b) Ethanol
- (c) Carbon dioxide
- (d) Pyruvate

Correct Answer: (d) Pyruvate

Solution: When glucose breaks down in the cytoplasm of a cell, the first step is glycolysis, which occurs in both aerobic and anaerobic respiration.

In glycolysis, one molecule of glucose (6-carbon) is broken down into two molecules of pyruvate (3-carbon) along with the release of a small amount of energy (ATP).

Further breakdown of pyruvate depends on the presence or absence of oxygen: - In aerobic respiration, pyruvate enters mitochondria and is converted into carbon dioxide and water. - In anaerobic respiration, pyruvate is converted into lactic acid (in animals) or ethanol and carbon dioxide (in yeast).

Therefore, the first molecule formed is always pyruvate.

Quick Tip

Remember: Glycolysis produces pyruvate in the cytoplasm before any other products are formed.

9. As compared to daytime, the amount of carbon dioxide released by the plants during night is more because :

- (a) It is not produced during daytime.
- (b) It is stored in the leaves of plants during daytime.
- (c) Major amount of carbon dioxide produced is used up for photosynthesis during daytime.
- (d) Plants do not respire during daytime.

Correct Answer: (c) Major amount of carbon dioxide produced is used up for photosynthesis during daytime.

Solution: Plants respire throughout the day and night. During respiration, they produce carbon dioxide.

However, during daytime, photosynthesis takes place in the presence of sunlight. In this process, plants use up the carbon dioxide produced during respiration to make food. As a result, the net carbon dioxide released is less during the day.

At night, photosynthesis stops due to the absence of sunlight, but respiration continues. So, the carbon dioxide produced during respiration is not used up and is released into the atmosphere, making the release of CO₂ higher at night.

Quick Tip

Plants respire all the time but photosynthesis happens only in sunlight — this balances CO₂ levels.

10. The organism in which an outgrowth on the parent body develops into a new individual is :

- (a) Amoeba
- (b) Paramecium
- (c) Rhizopus
- (d) Yeast

Correct Answer: (d) Yeast

Solution: Yeast reproduces by the method of budding. In budding, an outgrowth called a bud develops on the parent body. This bud gradually grows in size, gets detached and develops into a new individual.

Amoeba reproduces by binary fission, Paramecium reproduces by binary fission and conjugation, and Rhizopus reproduces by spore formation.

Therefore, the correct answer is Yeast.

Quick Tip

Budding is an asexual mode of reproduction seen in yeast and hydra.

11. In a cross between pure tall pea plants (TT) and pure dwarf pea plants (tt) the offsprings of F₁ generation were all tall. When F₁ generation was self-crossed, the gene combinations of the offsprings of F₂ generation will be :

- (a) TT : Tt : tt
- (b) TT : tt
- (c) Tt : tt
- (d) TT : Tt

Correct Answer: (a) TT : Tt : tt

Solution: When a pure tall plant (TT) is crossed with a pure dwarf plant (tt), all F₁ plants

have the genotype Tt and are tall (because tallness is dominant).

When the F_1 plants (Tt) are self-crossed:

Parent: $Tt \times Tt$

The Punnett square shows:

	T	t
T	TT	Tt
t	Tt	tt

So, the genotypes in F_2 generation are: - 1 TT : 2 Tt : 1 tt

Therefore, the gene combinations will be TT , Tt , and tt .

Quick Tip

In a monohybrid cross, the genotype ratio in F_2 is always 1:2:1.

12. When an object is placed beyond $2F$ of a convex lens, the nature of the image formed is :

- (a) Real, inverted and diminished
- (b) Real, erect and magnified
- (c) Virtual, erect and magnified
- (d) Real, inverted and magnified

Correct Answer: (a) Real, inverted and diminished

Solution: A convex lens forms different types of images depending on the position of the object: - When an object is placed beyond $2F$ (twice the focal length), the image is formed between F and $2F$ on the other side. - The image formed is real, inverted and smaller than the object (diminished).

So, when an object is beyond $2F$, the nature of the image is real, inverted and diminished.

Quick Tip

Remember the ray diagram: Object beyond $2F$ gives a diminished, inverted, real image between F and $2F$.

13. When a narrow beam of white light passes through a glass prism it splits into its component colours. This phenomenon is called :

- (a) Diffusion of light
- (b) Total reflection of light
- (c) Scattering of light
- (d) Dispersion of light

Correct Answer: (d) Dispersion of light

Solution: When white light passes through a glass prism, it splits into its seven constituent colours (VIBGYOR). This happens because different colours of light bend by different amounts when they pass through the prism due to differences in their wavelengths.

This splitting of light into its colours is called dispersion. Newton's prism experiment is the classic demonstration of dispersion of light.

Quick Tip

Dispersion = Splitting of white light into different colours. Refraction = Bending. Scattering = Spreading in all directions.

14. A material used for making heating elements of electrical heating devices should have :

- (a) High resistivity and high melting point.
- (b) High resistivity and low melting point.
- (c) Low resistivity and high melting point.
- (d) Low resistivity and low melting point.

Correct Answer: (a) High resistivity and high melting point.

Solution: A good heating element (like nichrome) used in electrical appliances must have: - High resistivity, so that it can produce more heat when current passes through it (according to Joule's law of heating: $H = I^2 R t$). - High melting point, so that it does not melt or get damaged at high temperatures when it gets heated up.

Materials like nichrome have high resistivity and a high melting point, which makes them suitable for use in heating elements such as electric irons, heaters, and toasters.

Therefore, the correct answer is High resistivity and high melting point.

Quick Tip

A heating element must resist current well and withstand high temperatures without melting.

15. The resistance of a wire does *not* depend on its :

- (a) Length
- (b) Area of cross-section
- (c) Shape
- (d) Material

Correct Answer: (c) Shape

Solution: The resistance (R) of a wire is given by:

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

where: - ρ is the resistivity of the material (depends on the material) - l is the length of the wire - A is the area of cross-section of the wire

Thus, resistance depends on the length, the cross-sectional area, and the material (through resistivity).

The *shape* of the wire (like whether it's coiled or bent) does not affect its resistance as long as its length, area of cross-section and material remain the same.

Therefore, the correct answer is Shape.

Quick Tip

Resistance depends on length, area, and material — not on how the wire is bent or shaped.

16. The shape of magnetic field lines produced (i) inside a solenoid (ii) around a straight conductor, both carrying current of the same magnitude are, respectively :

- (a) (i) straight, (ii) circular
- (b) (i) circular, (ii) circular

(c) (i) straight, (ii) straight

(d) (i) circular, (ii) straight

Correct Answer: (a) (i) straight, (ii) circular

Solution: (i) Inside a solenoid, the magnetic field lines are parallel and straight, indicating that the magnetic field is uniform inside the solenoid.

(ii) Around a straight current-carrying conductor, the magnetic field lines form concentric circles around the wire, as given by the right-hand thumb rule.

Therefore, the correct shapes are: - Solenoid: straight field lines - Straight conductor: circular field lines

So, the correct answer is (a) straight and circular.

Quick Tip

Remember: Solenoid = straight field lines inside; Straight wire = circular field lines around it.

17. Assertion (A) : In the reaction, $\text{Na}_2\text{SO}_4 + \text{BaCl}_2 \longrightarrow \text{BaSO}_4 + 2\text{NaCl}$, sodium chloride is precipitated.

Reason (R) : When an aqueous solution is added to another aqueous solution, an insoluble substance is formed, which is called precipitate.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (c) Assertion (A) is true, but Reason (R) is false.

Solution: In this double displacement reaction, barium sulphate (BaSO_4) is the insoluble white precipitate formed, not sodium chloride. Sodium chloride remains soluble in water. Therefore, the Assertion is true about the reaction but it incorrectly says NaCl is the precipitate.

The Reason is true in general — an insoluble substance formed in an aqueous reaction is

called a precipitate — but it does not correctly explain the wrong Assertion. So, Assertion is true, Reason is false.

Quick Tip

Precipitation reaction: Insoluble salt (BaSO_4) precipitates, not the soluble salt (NaCl).

18. Assertion (A) : A hormone called abscisic acid inhibits growth in plants.

Reason (R) : The role of auxins is opposite to that of abscisic acid in plants.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

Solution: Abscisic acid is known as a growth-inhibiting hormone in plants; it promotes dormancy and causes leaves to fall. Auxins are growth promoters and stimulate cell elongation. Hence, the roles of auxins and abscisic acid are indeed opposite. So, the Assertion is true, and the Reason correctly explains the Assertion.

Quick Tip

Remember: Auxins promote growth, abscisic acid inhibits it.

19. Assertion (A) : Each human trait is influenced by both paternal and maternal DNA.

Reason (R) : As compared to the father, the mother contributes more amount of genetic material to the child.

- (a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation

of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (c) Assertion (A) is true, but Reason (R) is false.

Solution: Traits in humans are indeed influenced by DNA contributed equally by both parents — half from the father's sperm and half from the mother's egg. Therefore, the Assertion is true. However, the Reason is false because both parents contribute equal amounts of nuclear genetic material.

Quick Tip

In sexual reproduction, genetic material comes equally from both parents.

20. Assertion (A) : A rainbow is an artificial spectrum of white light appearing in the sky after a rain shower.

Reason (R) : The water droplets act like small prisms.

(a) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A).

(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).

(c) Assertion (A) is true, but Reason (R) is false.

(d) Assertion (A) is false, but Reason (R) is true.

Correct Answer: (d) Assertion (A) is false, but Reason (R) is true.

Solution: A rainbow is a *natural* spectrum formed due to dispersion, refraction and reflection of sunlight by water droplets acting like tiny prisms. The Assertion is incorrect because the rainbow is not artificial, but the Reason is true — the droplets act like prisms.

Quick Tip

A rainbow is a natural phenomenon caused by dispersion through water droplets.

21. (a) A metal 'A' reacts violently with cold water and the gas evolved catches fire.

Another metal 'B' when dipped in water starts floating. The metal 'C' does not react either with cold or hot water, but reacts with steam. The metal 'D' does not react with water at all. Identify the metals 'A', 'B', 'C' and 'D'.

Solution: A: Potassium (K)

B: Sodium (Na)

C: Magnesium (Mg)

D: Gold (Au) or any noble metal like Platinum (Pt)

- Metal 'A' reacts violently with cold water and the gas catches fire: Potassium reacts vigorously with water producing hydrogen gas, which catches fire due to heat evolved.

- Metal 'B' floats on water: Sodium reacts with cold water and forms hydrogen gas. The hydrogen bubbles stick to the metal, making it float.

- Metal 'C' does not react with cold or hot water but reacts with steam: Magnesium does not react with cold or hot water but reacts with steam to form magnesium oxide and hydrogen gas.

- Metal 'D' does not react with water at all: Metals like gold or platinum are noble metals and do not react with water under normal conditions.

Quick Tip

Metals like potassium and sodium are highly reactive with water, magnesium reacts with steam, while noble metals like gold do not react with water.

OR

(b) When two compounds namely sodium chloride and calcium chloride are heated directly, one by one on the flame of a burner, they impart different colours to the flame.

(b) (i) Name the colour imparted by (1) sodium chloride and (2) calcium chloride.

Solution:

1. Sodium chloride: Yellow flame

2. Calcium chloride: Brick red or orange-red flame

(b) (ii) Are these compounds soluble in organic solvents such as kerosene or petrol?

Justify your answer.

Solution: No, sodium chloride and calcium chloride are ionic compounds. Ionic compounds are soluble in polar solvents like water but insoluble in organic solvents like kerosene or petrol because organic solvents are non-polar.

- Sodium salts give a bright yellow colour to the flame test due to the excitation of sodium electrons.
- Calcium salts impart a brick red colour to the flame.
- Both compounds are ionic, so they dissolve well in polar solvents (like water) but not in non-polar organic solvents like kerosene or petrol.

Therefore, they are not soluble in kerosene or petrol.

Quick Tip

Remember: Ionic compounds dissolve in polar solvents, not in non-polar ones like petrol.

22. Name the glands which add their secretions to the sperms. List two functions of these secretions.

Solution: The glands that add their secretions to the sperms are:

1. Seminal vesicles
2. Prostate gland

The secretions of the seminal vesicles and prostate gland together form the fluid part of semen. These secretions serve two main functions:

1. They provide a fluid medium which transports the sperms smoothly through the male reproductive tract.
2. They supply nutrients (like fructose) to the sperms and make the path alkaline, protecting the sperms from the acidic environment of the female reproductive tract.

Quick Tip

Seminal vesicles and prostate gland secretions nourish and protect sperms, ensuring better mobility and survival.

23. “In human beings, the sex of a newborn child depends on the father and not the mother.” Justify this statement with the help of a flow diagram.

Solution: Humans have 23 pairs of chromosomes, out of which one pair are sex chromosomes: - Females have XX chromosomes. - Males have XY chromosomes.

The mother always contributes an X chromosome through the egg. The father’s sperm may carry either an X or a Y chromosome: - If the sperm carrying an X chromosome fertilises the egg (X), the child will be XX (female). - If the sperm carrying a Y chromosome fertilises the egg (X), the child will be XY (male).

Father (XY) $\xrightarrow{\text{produces}}$ X-sperm or Y-sperm

Mother (XX) $\xrightarrow{\text{produces}}$ only X-egg

Flow Diagram:

Sperm (X) + Egg (X) $\longrightarrow$ XX (Girl)

Sperm (Y) + Egg (X) $\longrightarrow$ XY (Boy)

Therefore, the sex of the child depends on whether an X or Y carrying sperm fertilises the egg. Hence, it is determined by the father.

Quick Tip

Only the father’s sperm determines the sex because the mother only contributes X chromosomes.

24. (a) Find the magnification of the image formed by a spherical mirror from the following data :

$u = -20$ cm, $f = -15$ cm.

Solution: Using the mirror formula:

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

Given:

$$f = -15 \text{ cm}, \quad u = -20 \text{ cm}$$

Substitute:

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-15} - \frac{1}{-20} = -\frac{1}{15} + \frac{1}{20} = -\frac{4}{60} + \frac{3}{60} = -\frac{1}{60}$$

So,

$$v = -60 \text{ cm}$$

Magnification (m) is given by:

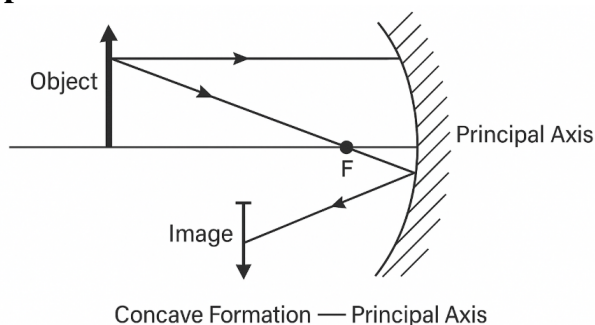
$$m = -\frac{v}{u} = -\left(\frac{-60}{-20}\right) = -3$$

So, the magnification is -3 (image is real, inverted and magnified).

Quick Tip

Use the sign convention: distances towards the mirror are negative for real objects and concave mirrors.

24. (b) Draw a labelled ray diagram for the image formation by a concave mirror when an object is placed between its centre of curvature and focus.



Solution:

When an object is placed between the centre of curvature (C) and the focus (F) of a concave mirror, the image formed has the following characteristics:

- The image is formed beyond the centre of curvature (C).
- The image is real and inverted.
- The image is magnified (larger than the object).

Quick Tip

A concave mirror forms a real, inverted and magnified image beyond C when the object is between C and F.

25. What will happen if an electric oven of rating 3 kW; 220 V is operated in a domestic electric circuit (220 V) that has a current rating of 10 A? Give reason to justify your

answer.

Solution: The fuse of the circuit will blow and the circuit will break.

First, calculate the current drawn by the oven:

$$P = VI \implies I = \frac{P}{V}$$

Given: $P = 3000 \text{ W}$, $V = 220 \text{ V}$

$$I = \frac{3000}{220} \approx 13.64 \text{ A}$$

So, the oven will draw about 13.6 A, which is higher than the circuit's current rating of 10 A. The fuse wire in the circuit is designed to melt when the current exceeds 10 A to protect the circuit from overheating or fire hazards. Therefore, the fuse will blow and the circuit will open.

Quick Tip

Always check the appliance's current requirement to avoid overloading the circuit.

26. (a) State any one advantage of using cloth bags over plastic bags.

Solution: Cloth bags are reusable, biodegradable and do not cause pollution like plastic bags. Unlike plastic bags, cloth bags are eco-friendly. They can be reused many times, reduce plastic waste and do not harm the environment when discarded, because they are biodegradable.

Quick Tip

Switching to cloth bags helps reduce plastic pollution.

26. (b) List any two methods by which the solid wastes generated in urban areas can be safely disposed off.

Solution: 1. Composting

2. Landfilling or incineration

1. **Composting:** Biodegradable waste like food and garden waste can be converted into useful manure through composting.

2. Landfilling or Incineration: Non-biodegradable solid waste can be safely buried in scientifically managed landfills or burnt in incinerators to reduce volume and hazards.

Quick Tip

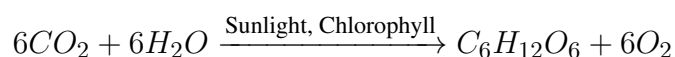
Safe disposal reduces pollution and keeps cities clean.

27. What is photosynthesis? Name the organelle and the organs in which photosynthesis takes place. Where does the oxygen liberated come from during this process? What happens to the carbohydrates which are not immediately used by the plant?

Solution: Photosynthesis is the process by which green plants prepare their own food (glucose) using sunlight, carbon dioxide and water. It is an anabolic, endothermic process.

- Organelle: Photosynthesis takes place inside the chloroplasts which contain the green pigment chlorophyll.

- Organs: The main organs where photosynthesis occurs are the green leaves of the plant. During photosynthesis, oxygen is produced from the photolysis of water molecules. The water molecules are split by sunlight into hydrogen and oxygen:



The oxygen released comes from water, not from carbon dioxide.

Carbohydrates that are not immediately used by the plant are stored as starch in leaves, stems, roots or fruits for later use.

Quick Tip

Chloroplasts are the sites of photosynthesis; oxygen is released from water splitting.

28. (a) An organic compound 'X' when reacts with sodium liberates hydrogen. The same compound 'X' when heated at 443 K in the presence of concentrated sulphuric acid gives an unsaturated hydrocarbon.

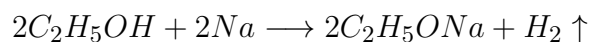
(i) Identify 'X'.

Correct Answer: Ethanol (C_2H_5OH)

(ii) Write the chemical equations for the above mentioned reactions and state the role of concentrated sulphuric acid in the second reaction.

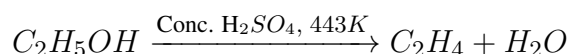
Correct Answer:

Solution: (1) Reaction with sodium:



Here, ethanol reacts with sodium metal to liberate hydrogen gas and forms sodium ethoxide.

(2) Dehydration reaction:



When heated with concentrated sulphuric acid at 443 K, ethanol gets dehydrated to form ethene (an unsaturated hydrocarbon).

Role of Conc. H_2SO_4 : It acts as a dehydrating agent and removes a molecule of water from ethanol.

Quick Tip

Alcohol reacts with sodium to release hydrogen; conc. H_2SO_4 removes water to form alkenes.

28. (i) (b) Why are carbon compounds exceptionally stable?

Correct Answer:

Solution: Carbon compounds are exceptionally stable because carbon-carbon bonds are strong and stable. This is due to the small size of the carbon atom, which allows the nucleus to hold the shared pair of electrons strongly, making the covalent bonds strong.

Also, carbon forms four stable covalent bonds (tetravalency) with other atoms, resulting in stable molecules.

Quick Tip

Strong covalent bonds and tetravalency make carbon compounds stable.

(ii) Differentiate between saturated and unsaturated compounds. Give structures of

both the types of compounds having three carbon atoms in their molecules.

Correct Answer:

Solution:

Difference:

- **Saturated compounds** contain only single bonds between carbon atoms (C–C).
- **Unsaturated compounds** contain at least one double or triple bond (C=C or CC) between carbon atoms.

Examples with three carbon atoms:

Saturated compound (Propane):



Unsaturated compound (Propene):



Therefore, propane is a saturated hydrocarbon (alkane) and propene is an unsaturated hydrocarbon (alkene).

Quick Tip

Saturated: only single bonds (alkanes); Unsaturated: double/triple bonds (alkenes/alkynes).

29. (a) Give the structure and function of alveoli in human respiratory system.

Solution: Structure: Alveoli are tiny, balloon-like sacs present at the end of the bronchioles in the lungs. They have very thin walls and are surrounded by a dense network of capillaries.

Function: Alveoli provide a large surface area for the exchange of gases. Oxygen diffuses from the alveoli into the blood, and carbon dioxide diffuses from the blood into the alveoli to be exhaled.

Quick Tip

Large surface area and thin walls make alveoli efficient for gaseous exchange.

29. (b) What is meant by residual volume of air in the lungs?

Solution: The residual volume of air is the amount of air that remains in the lungs even after forceful exhalation. This prevents the lungs from collapsing and allows continuous exchange of gases between breaths.

Quick Tip

Residual air keeps alveoli partially inflated at all times.

30. Write any two ways by which plants obtain carbon dioxide. What causes the opening and closing of the stomata?

Solution: Two ways by which plants obtain CO₂: 1. From the atmosphere through tiny pores called stomata present in the leaves. 2. Through respiration of plant cells, which produces carbon dioxide internally that can be reused in photosynthesis.

Opening and Closing of Stomata: The opening and closing of stomata is controlled by the turgidity of guard cells. When guard cells are full of water (turgid), stomata open. When they lose water (flaccid), stomata close.

Quick Tip

Guard cells regulate stomatal movement based on water availability.

31. What is Tyndall effect? Give two examples where this phenomenon is observed. Give reason to explain this phenomenon.

Solution: Definition: The Tyndall effect is the scattering of light by colloidal particles in its path, making the light beam visible.

Examples:

1. Sunlight passing through a forest and appearing as visible beams due to dust and water droplets.
2. A beam of light entering a dark room through a small hole appears visible due to dust particles scattering the light.

Reason: Colloidal particles or dust particles are large enough to scatter the light in all

directions, making the path of the light visible.

Quick Tip

True solutions do not show Tyndall effect; only colloidal-sized particles do.

32. (a) (i) Differentiate between a solenoid and a circular coil.

Correct Answer:

Solution: Solenoid: A solenoid is a long coil made by winding many turns of insulated wire in the shape of a cylinder

. **Circular Coil:** A circular coil consists of only one or a few turns of wire wound in the shape of a circle.

Difference: - A solenoid produces a uniform magnetic field inside it similar to that of a bar magnet.

- A single circular coil produces a magnetic field only at its centre and the field is not uniform like that of a solenoid.

Quick Tip

A solenoid acts like a magnet, a circular coil does not.

(ii) Explain how a solenoid can be made in a school laboratory.

Correct Answer:

Solution: Take a long insulated copper wire and wind it tightly in many turns around a cylindrical tube made of cardboard or plastic. This arrangement forms a solenoid. When an electric current passes through the wire, it behaves like a bar magnet.

Quick Tip

The more turns and tighter winding, the stronger the solenoid's magnetic field.

(iii) Write one use of the strong magnetic field produced inside a current carrying solenoid.

Correct Answer:

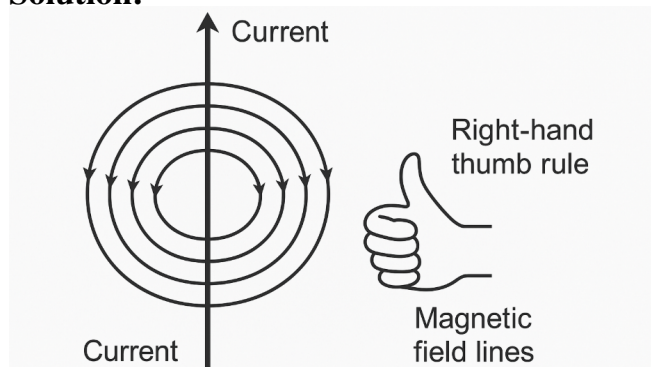
Solution: The strong magnetic field produced inside a solenoid is used to make

electromagnets which are widely used in electric bells, loudspeakers, cranes for lifting heavy iron scrap, and in MRI machines.

OR

32. (b) With the help of a labelled circuit diagram, illustrate the pattern of the magnetic field lines of the magnetic field produced around a straight current carrying conductor. Explain how, with the help of right-hand thumb rule, we can determine and mark the direction of magnetic field lines due to a current.

Solution:



Pattern: The magnetic field lines around a straight current carrying conductor are concentric circles centered on the wire. The strength of the field decreases as the distance from the wire increases.

Right-Hand Thumb Rule: If you hold the conductor in your right hand such that the thumb points in the direction of the current, then the curled fingers show the direction of the magnetic field lines.

Quick Tip

Use right-hand thumb rule for direction: thumb = current, fingers = field lines.

33. Define trophic levels. At which trophic level do we find (i) secondary and (ii) tertiary consumers in a food chain? What will happen if all the organisms of a trophic level die? Give reasons to justify your answer.

Correct Answer:

Solution: A trophic level is the position or step that an organism occupies in a food chain,

representing the flow of energy and nutrients from producers to various levels of consumers.

Trophic Levels:

(i) Secondary consumers occupy the third trophic level in a food chain.

(ii) Tertiary consumers occupy the fourth trophic level in a food chain.

Effect if all organisms of a trophic level die:

If all the organisms of a trophic level die, it will disturb the entire food chain. For example:

- If all secondary consumers die, primary consumers will multiply rapidly because they will not be eaten by secondary consumers.
- This will lead to overgrazing or overuse of producers (plants).
- The imbalance will eventually cause the collapse of the food chain, affecting all other trophic levels.

Therefore, every trophic level is important for maintaining balance in an ecosystem.

Quick Tip

Energy flows through trophic levels — removing one level disrupts the whole chain.

34 (a). (i) An aqueous solution turns blue litmus red. Which of the following solutions when added in excess would reverse the change?

Solution: A solution that turns blue litmus red is acidic in nature. To reverse this change, a basic solution must be added to neutralize the acid and make the solution basic again so that the red litmus turns blue. Among the given options, **magnesium hydroxide** is a base, so it will neutralize the acid and reverse the change.

Quick Tip

Bases turn red litmus blue; acids turn blue litmus red.

(ii) Out of the following, which compound/compounds will turn the phenolphthalein solution pink?

Solution: Phenolphthalein is a chemical indicator that turns pink in basic solutions and remains colourless in acidic solutions. - $\text{Ca}(\text{OH})_2$ (calcium hydroxide) and NaOH (sodium hydroxide) are bases, so they turn phenolphthalein pink. - CH_3COOH (acetic acid) and HCl

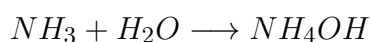
(hydrochloric acid) are acids and do not change the colour of phenolphthalein.

Quick Tip

Phenolphthalein shows pink colour only in alkaline solutions.

(iii) **Name a gas whose aqueous solution is basic. Write the formula/name of this solution.**

Solution: Ammonia gas dissolves in water to form ammonium hydroxide, which is basic in nature.



This solution turns red litmus blue, confirming its basic nature.

Quick Tip

Ammonia gas is a common example of a gas giving a basic solution.

(iv) **A basic substance is used to treat a honey-bee sting. Why?**

Solution: Honey-bee sting injects formic acid into the skin, causing pain and irritation. A mild base like baking soda (sodium hydrogen carbonate) is applied to neutralize the acid and reduce the pain.

Quick Tip

Acids are neutralized by bases to relieve stings.

(v) **Name the acid which is present in (1) Tomato and (2) Tamarind.**

Solution: (1) Tomato: Oxalic acid and citric acid

(2) Tamarind: Tartaric acid

Tomatoes contain oxalic and citric acids which give them a sour taste. Tamarind is rich in tartaric acid which is responsible for its sourness.

Quick Tip

Many fruits contain natural organic acids giving them their tangy taste.

34. (b) (i) Define water of crystallisation.

Solution: Water of crystallisation is the fixed number of water molecules present in a crystalline compound. These water molecules are chemically combined with the substance and give it a definite crystalline structure and colour.

Quick Tip

Water of crystallisation makes hydrated salts appear coloured.

(ii) **Write the chemical name and formula of a compound having water of crystallisation in its molecule and appears blue.**

Solution: The compound is Copper(II) sulphate pentahydrate.

Chemical name: Copper sulphate

Formula: $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ The five water molecules of crystallisation give it a characteristic blue colour.

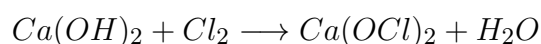
Quick Tip

Anhydrous copper sulphate is white; hydrated form is blue.

(iii) **Write the chemical formula of bleaching powder. Write a balanced chemical equation of the reaction involved in its preparation. List its three uses.**

Solution: Chemical formula: $\text{Ca}(\text{OCl})_2$ (Calcium oxychloride)

Preparation: Bleaching powder is prepared by passing chlorine gas over dry slaked lime (calcium hydroxide):



Uses of bleaching powder: 1. Used for bleaching cotton, linen and wood pulp in textile and paper industries. 2. Used as a disinfectant for water purification to make drinking water germ-free. 3. Used as an oxidising agent in chemical industries.

Quick Tip

Bleaching powder is widely used for disinfection and bleaching.

35.(a) (i) Name the parts in the human female reproductive system where the following functions take place:

- (1) Maturation of eggs
- (2) Fusion of the egg and the sperm
- (3) Implantation of the zygote

Solution: 1. Maturation of eggs: Ovary — The ovaries produce and release mature eggs (ova) every month.

2. Fusion of the egg and sperm: Fallopian tube (also called oviduct) — Fertilisation occurs here when a sperm fuses with an ovum.

3. Implantation of the zygote: Uterus — The fertilised zygote travels to the uterus and gets implanted in its thick, soft lining to develop into an embryo.

Quick Tip

Ovary = eggs mature, Fallopian tube = fertilisation, Uterus = implantation.

(ii) What happens to the egg

- (1) **when it is fertilised?**
- (2) **when it is not fertilised?**

Correct Answer:

Solution: 1. When fertilised: The egg fuses with a sperm to form a zygote. The zygote divides repeatedly and travels to the uterus where it implants in the uterine wall and develops into an embryo and later a foetus.

2. When not fertilised: The unfertilised egg disintegrates and the thick lining of the uterus breaks down and is shed along with blood and mucous through the vagina. This is called menstruation and occurs approximately every 28 days.

Quick Tip

No fertilisation = menstruation; fertilisation = pregnancy.

35. (b) (i) Explain by giving one example each:

- (1) Unisexual flowers

(2) Bisexual flowers

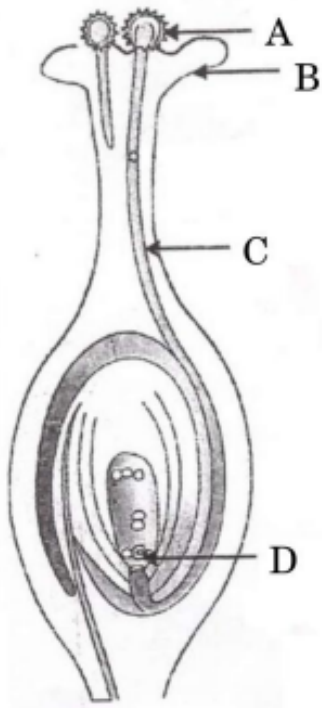
Solution: 1. Unisexual flowers: These are flowers which have either stamens (male reproductive part) or pistils (female reproductive part), but not both. **Example:** Papaya and watermelon have unisexual flowers.

2. Bisexual flowers: These are flowers which contain both male (stamens) and female (pistils) reproductive organs in the same flower. **Example:** Hibiscus and mustard have bisexual flowers.

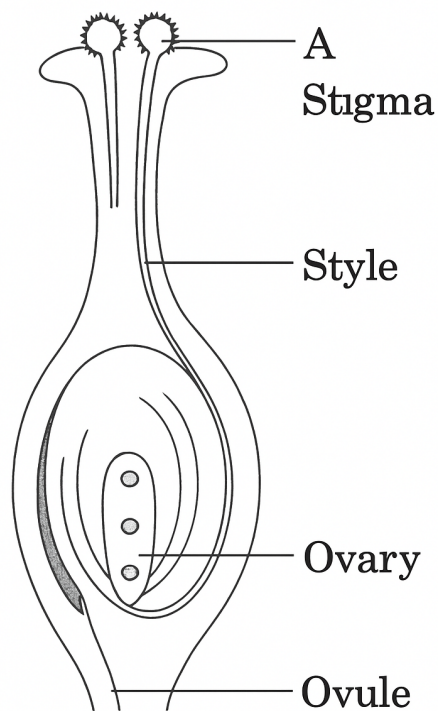
Quick Tip

Unisexual = single sex parts, Bisexual = both sex parts in same flower.

(ii) Name the labelled parts A, B, C and D in the diagram given below.



Solution:



- Stigma (A): The sticky surface at the top of the pistil which receives pollen grains.
- Style (B): The stalk that connects the stigma to the ovary.
- Ovary (C): The enlarged basal portion that contains ovules.
- Ovule (D): The structure inside the ovary where fertilisation occurs and seeds develop.

Quick Tip

The pistil = stigma + style + ovary, with ovules inside.

(iii) **“Pollination may occur without fertilisation but fertilisation will not take place without pollination.” Give reason to justify this statement.**

Solution: Pollination is the process of transfer of pollen grains from the anther to the stigma. Fertilisation occurs only when the male gamete in the pollen fuses with the female gamete (egg) in the ovule.

- Pollination can take place but if the pollen grain fails to germinate or if fertilisation does not happen, seeds will not form.
- However, fertilisation cannot occur unless pollination

happens first, because pollination brings the male gamete to the female part. Without pollination, there is no transfer of male gametes and hence no fertilisation. Therefore, pollination is a prerequisite for fertilisation.

Quick Tip

Pollination first → fertilisation next → seeds and fruits form.

36. (a) The commercial unit of electric energy is commonly known as ‘unit’. Write its actual name and establish the relationship between this unit and the SI unit of energy.

Correct Answer:

Solution: The commercial unit of electric energy is called the kilowatt-hour (kWh). - 1 unit of electricity = 1 kilowatt-hour

Relationship with SI unit: The SI unit of energy is the Joule (J).

$$1 \text{ kWh} = 1 \text{ kilowatt} \times 1 \text{ hour} = 1000 \text{ W} \times 3600 \text{ s} = 3,600,000 \text{ J} = 3.6 \times 10^6 \text{ J}$$

Therefore,

$$1 \text{ unit} = 1 \text{ kWh} = 3.6 \times 10^6 \text{ Joules.}$$

Quick Tip

Commercial meters measure energy in kWh, SI units in Joules.

(b) The current rating of a circuit is 1.0 A. How many LED lamps of power rating 8 W; 220 V can safely be used simultaneously in this circuit?

Correct Answer:

Solution: First, calculate the current drawn by one lamp:

$$P = VI \implies I = \frac{P}{V}$$

Given: $P = 8 \text{ W}$, $V = 220 \text{ V}$

$$I = \frac{8}{220} = 0.0364 \text{ A (approx)}$$

Maximum safe current = 1 A

Number of lamps that can be connected safely:

$$n = \frac{1}{0.0364} \approx 27.5$$

Since we cannot use a fraction of a lamp, maximum number = 27 lamps can be used safely.

Quick Tip

Always check the total current to avoid overloading household circuits.

37. (a) Where is iron placed in the reactivity series of metals? Write the form/forms in which its ores are found in nature.

Correct Answer:

Solution: Iron is placed in the middle of the reactivity series of metals.

Its ores are mainly found in the form of: - Haematite (Fe_2O_3) - Magnetite (Fe_3O_4)

Quick Tip

Iron is moderately reactive and is found as oxide ores.

(b) Differentiate between roasting and calcination.

Correct Answer:

Solution:

— Roasting — Calcination — — — — — Ore is heated strongly in the presence of excess air or oxygen. — Ore is heated strongly in the absence or limited supply of air. — — Used for sulphide ores. — Used for carbonate and hydrated ores. — — Example: $\text{ZnS} \rightarrow \text{ZnO} + \text{SO}_2$ — Example: $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ —

Quick Tip

Roasting = air present, Calcination = air absent.

(c) Explain any two methods that are employed to prevent rusting/corrosion of metals.

Correct Answer:

Solution: 1. Galvanisation: Iron or steel is coated with a thin layer of zinc metal which prevents air and moisture from coming in contact with the iron surface.

2. Painting/Oiling/Greasing: The surface of iron objects is coated with paint, oil or grease to create a protective barrier which prevents moisture and oxygen from reaching the metal surface.

Quick Tip

Rusting needs air and moisture; coatings prevent contact.

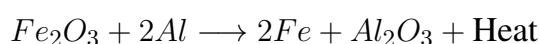
OR (c) Why is aluminium used to join railway tracks or the cracked machine parts of ‘iron’? Write a balanced chemical equation for the reaction which occurs.

Correct Answer:

Solution: Aluminium is used in the thermite welding process because it is highly reactive and displaces iron from its oxide due to its higher affinity for oxygen.

The heat generated melts the iron and joins the broken parts.

Balanced chemical equation:



This reaction is called the Thermite reaction. The molten iron fills the gap and solidifies to join the metal parts.

Quick Tip

Thermite reaction: Aluminium reduces iron oxide producing heat.

38. (a) How is the brain protected from shocks and injuries?

Correct Answer:

Solution: The brain is protected by the bony skull (cranium) which forms a hard outer covering. Inside the skull, the brain is further protected by three layers of membranes called meninges and is cushioned by the cerebrospinal fluid (CSF) which absorbs shocks and prevents injuries.

Quick Tip

Skull + meninges + CSF = full brain protection.

(b) Write the main functions of (i) sensory neuron and (ii) motor neuron in a reflex arc.

Correct Answer:

Solution: (i) Sensory neuron: It carries nerve impulses from the sense organs or receptors to the spinal cord or brain.

(ii) Motor neuron: It carries the response impulses from the spinal cord or brain to the effectors (muscles or glands) to produce a reaction.

Quick Tip

Sensory = to CNS, Motor = from CNS.

(c) Which part of the brain is involved in activities like (i) picking a pencil and (ii) vomiting? State whether these actions are voluntary or involuntary.

Correct Answer:

Solution: (i) Picking a pencil: Controlled by the cerebrum. This is a voluntary action as it is under conscious control.

(ii) Vomiting: Controlled by the medulla oblongata (hindbrain). This is an involuntary action as it is not under conscious control.

Quick Tip

Cerebrum = voluntary; Medulla = involuntary.

OR (c) How does the central nervous system communicate with other parts of the body to carry out various activities? Name two components of this system.

Correct Answer:

Solution: The Central Nervous System (CNS) communicates with other parts of the body through the Peripheral Nervous System (PNS) and the Autonomous Nervous System (ANS). The PNS consists of cranial nerves and spinal nerves that connect the CNS to different body parts. The ANS controls involuntary actions like heartbeat and breathing by sending signals to internal organs.

Two components: 1. Brain 2. Spinal cord

Quick Tip

CNS + PNS + ANS = full control and coordination.

39. (a) Define the term absolute refractive index of a medium.

Correct Answer:

Solution: The absolute refractive index of a medium is the ratio of the speed of light in vacuum (or air) to the speed of light in that medium.

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

where, n = absolute refractive index, c = speed of light in vacuum, v = speed of light in the given medium.

Quick Tip

More refractive index means light slows down more.

(b) Absolute refractive indices of water and glass are $\frac{4}{3}$ and $\frac{3}{2}$ respectively.

(i) In which one of the two media is the speed of light more?

Correct Answer: Water

Solution: A lower refractive index means higher speed of light. Since the refractive index of water ($\frac{4}{3} = 1.33$) is less than that of glass ($\frac{3}{2} = 1.5$), the speed of light is more in water.

(ii) If a ray of light enters obliquely from glass to water, will it bend towards the normal or away from the normal?

Correct Answer: Away from the normal

Solution: When light passes from a denser medium (glass) to a rarer medium (water), it bends away from the normal because its speed increases.

Quick Tip

Denser to rarer = away from normal.

(c) The absolute refractive indices of water and glass are $\frac{4}{3}$ and $\frac{3}{2}$ respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in (i) water and (ii) vacuum.

Correct Answer:

Solution: Given:

$$n_g = \frac{3}{2} = 1.5, \quad v_g = 2 \times 10^8 \text{ m/s}$$

Speed of light in vacuum:

$$c = n_g \times v_g = 1.5 \times 2 \times 10^8 = 3 \times 10^8 \text{ m/s}$$

Speed of light in water:

$$v_w = \frac{c}{n_w} = \frac{3 \times 10^8}{1.33} \approx 2.26 \times 10^8 \text{ m/s}$$

So, (i) Speed in water = $2.26 \times 10^8 \text{ m/s}$ (ii) Speed in vacuum = $3 \times 10^8 \text{ m/s}$

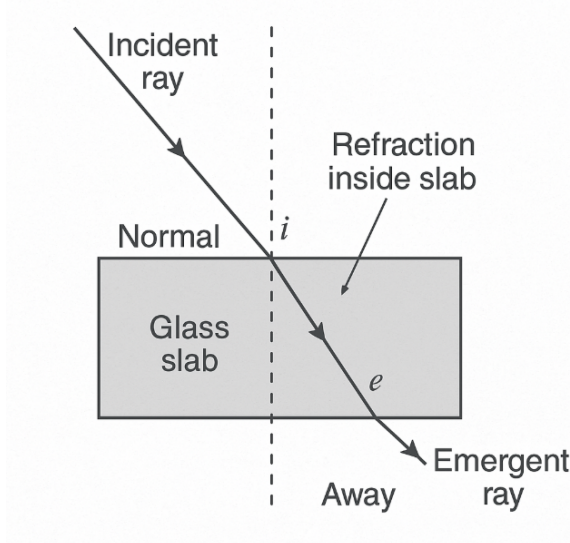
Quick Tip

Use $n = \frac{c}{v}$ for calculations.

OR (c) “A ray of light incident on a rectangular glass slab immersed in any medium emerges parallel to itself.” Draw a labelled ray diagram to justify this statement.

Correct Answer:

Solution:



When a light ray enters a rectangular glass slab, it bends towards the normal when entering the denser medium (glass) and away from the normal when leaving it. The emergent ray is parallel to the incident ray but displaced sideways.

Quick Tip

Emergent ray is parallel but shifted due to lateral displacement.