

# CBSE EXAMINATION PAPER-2025

## SCIENCE

(Solved)

Time allowed : 3 hours

Maximum Marks : 75

### General Instructions :

Read the following instructions carefully and follow them :

- i. This question paper contains **35 questions**. All questions are **compulsory**.
- ii. This question paper is divided into **5 sections**.
- iii. **Section A** – questions number **1 to 15** are multiple choice questions Each question carries **1 marks**.
- iv. **Section B** – questions number **16 to 22** are very short answer Each question carries **2 marks**.
- v. **Section C** – questions number **23 to 29** are short answer Each question carries **3 marks**.
- vi. **Section D** – questions number **30 to 30** are case based questions
- vii. **Section E** – questions number **31 to 35** are long answer Each question carries **5 marks**.
- viii. There is no overall choice given in the question paper. However, an internal choice has been provided in few questions.
- ix. Use of calculator is NOT allowed.

## Section A

### Question 1.

The most common method of extraction of metals from their oxide ores is :

[1 Marks]

(A) Reduction with carbon

(B) Reduction with aluminium

(C) Electrolytic reduction

(D) Reduction with hydrogen

**Explanation:** The correct answer is 'Reduction with carbon' because the context describes how metal oxides can be reduced to obtain the respective metals, and using carbon as a reducing agent is a common approach for many metal oxides, such as zinc oxide, which can be reduced to metallic zinc using carbon. This reduction is easier and more feasible compared to other methods described.

### Question 2.

Choose the incorrect statement about the common reaction used in hydrogenation of vegetable oils.

[1 Marks]

(A) It is an addition reaction.

(B) It takes place in the presence of nickel or palladium catalyst.

(C) The product contains only single bonds between carbon atoms.

(D) It is an addition reaction which occurs in the presence of an acid catalyst.

**Explanation:** The incorrect statement is: 'It is an addition reaction which occurs in the presence of an acid catalyst.' This is incorrect because the hydrogenation of vegetable oils occurs in the presence of nickel or palladium as catalysts, not acid catalysts. The process involves adding hydrogen to unsaturated hydrocarbons to convert them into saturated hydrocarbons.

### Question 3.

Match Column-I with Column-II and select the correct option from the choices provided.

[1 Marks]

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

(B) a-(iii), b-(i), c-(v), d-(iv)

(C) a-(ii), b-(i), c-(v), d-(iv)

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

**Explanation:**

The correct option is a-(iii), b-(ii), c-(i), d-(iv) because it accurately matches the items listed in Column-I with their corresponding descriptions in Column-II based on the context of bonding in carbon and the distinctions between mixtures, solutions, suspensions, and colloidal solutions.

**Question 4.**

The part of the brain which maintains the posture and balance of the body is :

[1 Marks]

(A) Cerebellum

(B) Cerebrum

(C) Pons

(D) Medulla

**Explanation:** The correct answer is 'Cerebellum' because it is specifically mentioned in the context that the cerebellum is responsible for precision of voluntary actions and maintaining the posture and balance of the body.

**Question 5.**

The plant hormone present in greater concentration in the areas of rapidly dividing cells is :

[1 Marks]

(A) Gibberellins

(B) Abscisic acid

(C) Cytokinins

(D) Auxin

**Explanation:** The correct option is Cytokinins because, as stated in the context, cytokinins promote cell division and are found in greater concentration in areas where cells are dividing rapidly, such as in fruits and seeds.

### Question 6.

Select a pair of bisexual flowers from the following :

[1 Marks]

(A) Papaya and mustard

(B) Hibiscus and mustard

(C) Hibiscus and watermelon

(D) Hibiscus and papaya

**Explanation:** The correct pair of bisexual flowers is Hibiscus and mustard. Both of these flowers contain both stamens (the male reproductive structures that produce pollen) and pistils (the female reproductive structures), making them bisexual. In contrast, papaya and watermelon are unisexual flowers, containing either stamens or pistils but not both.

### Question 7.

The gastric glands present in the wall of the stomach release :

[1 Marks]

(A) Mucus and Trypsin

(B) Pepsin and Salivary amylase

(C) Pepsin and Trypsin

(D) Mucus and Pepsin

**Explanation:** The correct answer is 'Mucus and Pepsin'. The gastric glands in the stomach release hydrochloric acid, pepsin (a protein digesting enzyme), and mucus. Mucus serves to protect the stomach lining from the harsh effects of the acid, and pepsin is essential for digesting proteins. The provided context explicitly mentions these components being released by the gastric glands.

### Question 8.

Absolute refractive index of water and glass is  $\frac{4}{3}$  and  $\frac{3}{2}$  respectively. If the speed of light in glass is  $2 \times 10^8$  m/s, the speed of light in water is:

[1 Marks]

(A)  $\frac{9}{4}$  m/s

(B)  $\frac{16}{9}$  m/s

(C)  $7/3$  m/s

(D)  $9/8$  m/s

**Explanation:**

$$n = vc \Rightarrow v = nc$$

So,

$$vw = c/nw = 3 \times 10^8 / 4/3 = 3 \times 10^8 \times 3/4 = 9/4 \times 10^8$$

**Question 9.**

When a beam of white light passes through a region of very fine dust particles, the colour of light that scatters the most in that region is :

[1 Marks]

(A) red

(B) orange

(C) blue

(D) yellow

**Explanation:** The correct answer is blue. This is because very fine particles scatter light of shorter wavelengths more effectively, and blue light has a shorter wavelength compared to red, orange, or yellow light. The context states that very fine particles mainly scatter blue light, which directly supports this conclusion.

**Question 10.**

A wire of length 'l' is gradually stretched so that its length increases to 3l. If its original resistance is R, then its new resistance will be :

[1 Marks]

(A) 9R

(B) 27R

(C) 6R

(D) 3R

**Explanation:** The resistance of a wire is directly proportional to its length and inversely proportional to its cross-sectional area. When the length of the wire is increased to 3l, its

resistance will increase according to the formula  $R' = R * (\text{new length}/\text{original length})^2$ . Since the length increases by a factor of 3, the new resistance  $R' = R * (3)^2 = 9R$ .

### Question 11.

Which one of the following statements is not true about a bar magnet ?

[1 Marks]

- (A) It produces magnetic field lines.
- (B) It has attractive power for iron filings.
- (C) The direction of magnetic field lines inside a bar magnet is from its north pole to its south pole.**
- (D) It sets itself in north-south direction when suspended freely.

**Explanation:** The correct answer is 'The direction of magnetic field lines inside a bar magnet is from its north pole to its south pole.' This statement is not true because, according to the context, magnetic field lines actually emerge from the north pole and merge at the south pole, indicating that the field lines inside the magnet are directed from the south pole to the north pole.

### Question 12.

Other than the abiotic components, which of the given biotic components are not required to make an aquarium with small herbivorous fishes a self-sustaining system ?

- (i) Aquatic plants and aquatic animals
- (ii) Terrestrial plants and terrestrial animals
- (iii) Decomposers as bacteria and fungi
- (iv) Consumers as clown fishes and sea urchins

[1 Marks]

- (A) (ii) and (iv)**
- (B) (ii) and (iii)
- (C) (i) and (iv)
- (D) (i) and (iii)

**Explanation:** The correct options are (ii) and (iv). Terrestrial plants and animals are not suitable for an aquarium with aquatic herbivorous fishes because they cannot survive in

water. Additionally, while consumers like clown fishes and sea urchins are important in general ecosystems, they are not needed to sustain a system specifically featuring small herbivorous fish, which rely on aquatic plants and primary producers.

### Question 13.

Assertion (A) : Hydrogen gas is not evolved when a metal reacts with nitric acid.

Reason (R) : Nitric acid is a strong reducing agent and reduces the hydrogen produced in the reaction to water.

[1 Marks]

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

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

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

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

### Explanation:

The correct option is 'Assertion (A) is true, but Reason (R) is false.' Assertion (A) is true because hydrogen gas is indeed not evolved when metals react with nitric acid due to its strong oxidizing properties. However, Reason (R) is false as nitric acid acts as an oxidizing agent, not a reducing agent, and it oxidizes the hydrogen gas produced to water.

### Question 14.

Assertion (A) : In our actions of writing or talking, our nervous system communicates with the muscles.

Reason (R) : Cranial nerves and spinal nerves form the peripheral nervous system.

[1 Marks]

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

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

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

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

**Explanation:** Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of Assertion (A). While it is true that the nervous system communicates with muscles during actions like writing or talking, the fact that cranial and spinal nerves form the peripheral nervous system does not specifically explain how this communication happens.

### Question 15.

Assertion (A) : Use of jute bags for shopping reduces pollution.

Reason (R) : Jute is biodegradable and its bag may be reused as and when needed.

[1 Marks]

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

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

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

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

**Explanation:** Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of Assertion (A) because using jute bags indeed reduces pollution as jute is biodegradable, which means it decomposes naturally and can also be reused, thereby minimizing waste in the environment.

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## Section B

**Question 16.** List the possible sources of energy required in decomposition reactions. Illustrate any one with a suitable example.

[2 Marks]

**Answer:** Decomposition reactions require energy sources like heat, light, or electricity to break down reactants. For example, during the electrolysis of water, an electrical current decomposes water into hydrogen and oxygen gases. This reaction is endothermic as it absorbs energy to occur, showcasing the necessity of energy input in decomposition processes.

### Question 17.

- (a) Write the formula of the ions which (i) acids, and (ii) bases generate in water solutions.
- (b) Dry HCl gas does not change the colour of dry litmus paper. Why ?

[2 Marks]

**Answer:** Acids produce hydrogen ions ( $H^+$ ) in aqueous solutions, while bases generate hydroxide ions ( $OH^-$ ). Dry HCl gas does not change the color of dry litmus paper because there are no water molecules available to convert HCl into its ionized form ( $H^+ + Cl^-$ ). Litmus paper only reacts with ions in a solution, so without water, the acidic character of HCl is not demonstrated.

**Question 18.** State the main function of veins in human circulatory system. Why do they not need thick walls?

[2 Marks]

**Answer:** The main function of veins in the human circulatory system is to collect carbon dioxide-rich blood from various organs and transport it back to the heart. Unlike arteries, veins do not require thick walls because the blood is under lower pressure. Instead, veins have valves that prevent the backflow of blood, ensuring that it flows in one direction towards the heart, facilitating efficient circulation.

**Question 19.**

(a) Explain how the proteins control the 'characteristics' in an organism with the help of an example of 'tallness' trait in pea plant.

(b) Name the section of DNA that controls the 'characteristics' in an organism.

[2 Marks]

**Answer:** Proteins control characteristics in organisms by influencing specific traits, like tallness in pea plants. The tallness trait is influenced by a gene that encodes an enzyme responsible for hormone production, promoting growth. A dominant allele 'T' produces sufficient hormone for tallness, while the recessive allele 't' results in less hormone, leading to shortness. Thus, the presence of the 'T' allele determines tallness. The DNA section that controls this is called a gene.

**Question 20.** A student has difficulty in reading his textbooks but can read the blackboard clearly while sitting in the last row. Name the defect of vision the student is suffering from. List two reasons due to which this defect arises. Write the nature of the lenses required to correct this defect.

[2 Marks]

**Answer:** The student is suffering from hypermetropia, also known as farsightedness. This defect arises due to the eyeball being too short or the cornea having insufficient curvature, causing difficulty in focusing on nearby objects. It can also occur from aging, where the lens loses its flexibility. To correct hypermetropia, convex lenses are required, which help to converge light rays before they enter the eye, enabling the student to see nearby objects clearly.

**Question 21.** Draw a ray diagram to show the path of a ray of light falling obliquely on one of the refracting faces of a triangular glass prism and mark the angle of deviation on it.

[2 Marks]

**Answer:** To illustrate the refraction of light through a triangular prism, draw a triangle representing the prism's outline. Mark the incident ray, PE, inclined to face AB. Draw the refracted ray, EF, entering the prism at angle of incidence,  $\angle i$ . At point E, the ray bends towards the normal. Upon exiting face AC, sketch the emergent ray, FS, forming angle of emergence,  $\angle e$ . The angle of deviation,  $\angle D$ , is marked between PE and FS.

**Question 22.** An electric kettle is rated 230 V; 1000 W. Calculate the resistance of its heating element when in operation.

[2 Marks]

**Answer:** To calculate the resistance of the heating element of the electric kettle, we use the formula  $P = V \cdot I$ . First, find the current I using  $I = P/V$ , so  $I = 1000 \text{ W} / 230 \text{ V} = 4.35 \text{ A}$ . Next, calculate the resistance R using  $R = V/I$ , which gives  $R = 230 \text{ V} / 4.35 \text{ A} = 52.87 \Omega$ . Therefore, the resistance of the heating element is approximately 52.87 ohms.

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## Section C

**Question 23.**

(a) What is a reactivity series of elements? How is it developed? Arrange the following elements as they are arranged in the reactivity series: Aluminum, Calcium, Copper, Lead

(b) Write balanced chemical equation to show the reaction of iron (III) oxide ( $\text{Fe}_2\text{O}_3$ ) with aluminium.

[3 Marks]

**Answer:** The reactivity series is a ranking of metals based on their reactivity, placed in order from most reactive to least reactive. It is developed through displacement experiments that observe how metals interact with solutions of other metals. In the given series, Calcium is the most reactive, followed by Aluminum, then Lead, and finally Copper, which is the least reactive. This order is significant in predicting reactions in chemistry. The balanced chemical equation for the reaction of iron (III) oxide with aluminum is  $2\text{Al} + \text{Fe}_2\text{O}_3 \rightarrow 2\text{Fe} + \text{Al}_2\text{O}_3$ . This reaction, known as thermite reaction, is highly exothermic and demonstrates aluminum's strong reducing ability.

**Question 24.**

On the basis of the characteristics of the processes given in the brackets in each case, differentiate between the following:

(a) Products of breakdown of pyruvate in aerobic and anaerobic respiration in human beings (product(s) of the processes)

(b) Respiration and photosynthesis in plants (gas released)

(c) Respiration in terrestrial animals and fishes (organs involved)

[3 Marks]

**Answer:** (a) In aerobic respiration in human beings, pyruvate is broken down into carbon dioxide and water with the release of a large amount of energy. In anaerobic respiration, pyruvate is converted into lactic acid, and energy released is much less.

(b) In respiration, plants release carbon dioxide gas as a byproduct. In photosynthesis, plants release oxygen gas while making food.

(c) Terrestrial animals respire using lungs which allow exchange of gases with the air. Fishes respire using gills which extract oxygen dissolved in water.

### Question 25.

A pure pea plant having round (R), yellow (Y) seeds is crossed with another pure pea plant having wrinkled (r), green (y) seeds. Subsequently  $F_1$  progeny is self-pollinated to obtain  $F_2$  progeny.

(a) What do the seeds of  $F_1$  generation look like?

(b) Give the possible combinations of traits in seeds of  $F_2$  generation. Also give their ratio.

(c) State the reason of obtaining seeds of new combination of traits in  $F_2$  generation.

[3 Marks]

**Answer:** (a) All seeds of the  $F_1$  generation have round and yellow seeds because round (R) is dominant over wrinkled (r) and yellow (Y) is dominant over green (y). Hence, the genotype of  $F_1$  seeds is  $RrYy$  and the phenotype is round and yellow.

(b) The  $F_2$  generation shows four types of seed traits combinations: round yellow (RY), round green (Ry), wrinkled yellow (rY), and wrinkled green (ry). Their phenotypic ratio is 9 : 3 : 3 : 1, respectively.

(c) The new combinations of traits in  $F_2$  generation occur due to independent assortment of alleles during gamete formation. Alleles for seed shape and seed color segregate independently and recombine randomly during fertilization, producing new trait combinations.

### Question 26. What is a rainbow? Draw a labelled diagram to show its formation.

[3 Marks]

**Answer:** A rainbow is a natural spectrum that appears in the sky after rainfall when sunlight shines on water droplets in the atmosphere. It presents a beautiful arc of colors: red, orange, yellow, green, blue, indigo, and violet, which result from the dispersion of

sunlight. The process begins with sunlight entering a water droplet, where it bends (refracts) and spreads into its component colors. The light reflects off the inner surface of the droplet and refracts again as it exits, creating the visual spectrum we see. This phenomenon is typically observed when the Sun is low and positioned opposite the direction of the rainbow. A labelled diagram can illustrate how sunlight interacts with water droplets to form the arc of colors.

### Question 27.

Consider a rectangular cardboard having two holes P and Q through which a current carrying circular loop has been inserted as shown in the diagram.

- (a) Make this diagram on your answer sheet and draw three magnetic field lines, one each passing through the points 1 (near P), 2 (at the centre of the loop) and 3 (near Q).
- (b) List two factors on which the intensity of the magnetic field produced at the centre of the loop depends.
- (c) Name the rule you will apply to determine the direction of magnetic field produced due to a current carrying straight conductor.

[3 Marks]

**Answer:** (a) The diagram of a circular current carrying loop passing through holes P and Q on a rectangular cardboard is drawn. Three magnetic field lines are drawn with arrows showing direction: one passing near point 1 (close to hole P), another passing through point 2 (centre of the loop), and the third passing near point 3 (close to hole Q). The lines are circular around the wire and inside the loop, they are nearly straight and go from one side of the loop to the other.

(b) The two factors on which the intensity of the magnetic field at the centre of the loop depends are:

1. The magnitude of the current flowing through the loop.
2. The radius of the circular loop.

(c) The rule used to determine the direction of the magnetic field produced by a current carrying straight conductor is the **Right-Hand Thumb Rule**. According to this rule, if the thumb of the right hand points in the direction of the current, then the curled fingers show the direction of the magnetic field around the conductor.

### Question 28.

(a) "In a food chain energy flow is unidirectional." Give two reasons for the given statement.

(b) If 10,000 J energy is available at the producer level, how much energy will be available to the secondary consumers ? Give reason to justify your answer.

[3 Marks]

#### Answer:

In a food chain, energy flow is unidirectional due to two main reasons: Firstly, autotrophs or producers convert solar energy into chemical energy through photosynthesis. This energy is not returned to the original source but continues to flow to the next trophic levels. Secondly, as energy transitions from one trophic level to another, approximately 90% is lost at each step due to metabolic processes, heat production, and waste, which limits energy availability for subsequent consumers. For part (b), if 10,000 J of energy is available at the producer level, only about 1,000 J will be available to secondary consumers. This is derived from the 10% rule, where only 10% of the energy from one trophic level is passed to the next level, illustrating the inefficiency in energy transfer through the food chain.

### Question 29.

Design an experimental set-up to demonstrate that "Alcohol and glucose contain hydrogen but are not categorised as acids". Also give the reason to justify this fact.

[3 Marks]

**Answer:** To demonstrate that alcohol and glucose contain hydrogen but are not classified as acids, we can set up a simple experiment. First, prepare two solutions: one with glucose and the other with alcohol, alongside a solution of hydrochloric acid. Use two nails attached to a cork, placing the cork in a 100 mL beaker filled with each solution. Connect the nails to a bulb. The bulb will glow in the acid solution, indicating the presence of ions that conduct electricity. In contrast, the glucose and alcohol solutions will not cause the bulb to glow, proving they do not dissociate into ions in solution and do not show acidic properties. Thus, even though they contain hydrogen, they do not produce hydrogen ions ( $H^+$ ), which are responsible for acidity.

## Section D

### Question 30.

A person while climbing up a rocky hill comes into a panic state and fear. His body starts reacting in a 'flight-or-flight' condition to adjust to the dangerous and stressful situation.

Based on the above facts, answer the questions that follow.

(1) Name the hormone secreted in the blood of the person in this situation.

[2 Marks]

**Answer:** In this situation, the hormone secreted in the blood is adrenaline. Adrenaline, produced by the adrenal glands, plays a crucial role in the body's response to stress and triggers the 'fight-or-flight' mechanism. This hormone helps the body adjust to danger by increasing heart rate, dilating air passages, and mobilizing energy reserves to prepare the individual for a quick response.

**Key Points:** adrenaline - produced by adrenal glands - prepares body for fight-or-flight response - increases heart rate - enhances oxygen supply

(2) State any two responses in the body of the person as a result of the secretion of this hormone.

[1 Marks]

**Answer:** In response to the secretion of adrenaline during a panic state, the person's body exhibits several physiological changes. Firstly, the heart rate increases, allowing for quicker blood circulation to muscles and vital organs, preparing the body for either fight or flight. Secondly, the breathing rate accelerates, enabling more oxygen to be taken in, which is essential for peak physical performance in high-stress situations.

**Key Points:** Heart rate increases-Breathing rate accelerates

(3) How does the action of the chemical signal in terms of hormones differ from the electrical impulses via nerve cells?

[1 Marks]

**Answer:** The action of chemical signals in terms of hormones, such as adrenaline, differs significantly from electrical impulses sent via nerve cells. Hormones are transmitted through the bloodstream and can affect multiple target cells throughout the body, resulting in widespread and prolonged changes in physiological activity. For example, adrenaline prepares the body for a 'fight-or-flight' response by increasing heart rate, dilating air passages, and redirecting blood flow to essential organs. In contrast, electrical impulses are quick and localized, transmitting signals directly along

nerve cells for immediate responses, such as reflex actions. While hormonal responses take longer to initiate, they are essential for coordinating complex and sustained bodily changes in response to stress, allowing organisms to adapt effectively to challenging situations.

**Key Points:** Hormonal signals via adrenaline affect multiple target cells; Electrical impulses are quick and localized; Hormonal responses are slower but result in widespread changes; 'Fight-or-flight' responses require coordinated actions involving hormones.

(4)

Name the source gland of the hormone secreted in this condition.

[2 Marks]

**Answer:** The source gland of the hormone secreted in this condition is the adrenal gland. The adrenal glands produce adrenaline (also known as epinephrine), which plays a crucial role in the body's fight-or-flight response. When faced with a stressful situation, like climbing a rocky hill, the adrenal glands release adrenaline into the bloodstream, preparing the body to respond to the perceived threat. This hormone increases heart rate, enhances oxygen supply to the muscles, and helps the body to react promptly.

**Key Points:** adrenal glands-adrenaline-fight-or-flight response

## Section E

Question 31.

(i) Consider the following metals : K, Ca, Al, Cu, Ag, Fe Select from the above metals, a metal which

I. does not react with oxygen even at high temperature.

II. reacts with oxygen at ordinary temperature and forms a protective oxide layer which prevents the metal from further oxidation.

III. catches fire when kept in the open.

IV. does not burn in oxygen but the hot metal is coated with a black coloured oxide layer.

(ii) What are amphoteric oxides ? With the help of balanced chemical equations show that aluminium oxide is an amphoteric oxide.

(iii) What are alkalis ? Give one example.

[5 Marks]

**Answer: (i) Selection of metals based on their reaction with oxygen:**

I. Metal which does not react with oxygen even at high temperature is **Ag (Silver)**. Silver is less reactive and resistant to oxidation.

II. Metal which reacts with oxygen at ordinary temperature and forms a protective oxide layer is **Al (Aluminium)**. Aluminium oxide layer protects the metal from further oxidation.

III. Metal which catches fire when kept in the open is **K (Potassium)**. It is highly reactive and reacts vigorously with oxygen.

IV. Metal which does not burn in oxygen but the hot metal is coated with a black coloured oxide layer is **Cu (Copper)**. Copper forms black copper(II) oxide on heating.

**(ii) Amphoteric oxides:**

Amphoteric oxides are metal oxides that react with both acids and bases to form salt and water, showing both acidic and basic properties.

Aluminium oxide ( $\text{Al}_2\text{O}_3$ ) is amphoteric because it reacts with acids and bases as shown below:

Reaction with acid (HCl):  $\text{Al}_2\text{O}_3 + 6\text{HCl} \rightarrow 2\text{AlCl}_3 + 3\text{H}_2\text{O}$

Reaction with base (NaOH):  $\text{Al}_2\text{O}_3 + 2\text{NaOH} \rightarrow 2\text{NaAlO}_2 + \text{H}_2\text{O}$

These reactions prove aluminium oxide behaves both as acid and base.

**(iii) Alkalis:**

Alkalis are bases that dissolve in water to give hydroxide ions ( $\text{OH}^-$ ) making the solution basic. An example of an alkali is sodium hydroxide (NaOH).

**Question 32.**

(i) Identify the parts 'X' and 'Y' in the figure given below :

(ii) Name the yellowish coloured structures produced by the part labelled as 'Y'.

(iii) Write the name of the process by which these are transferred to the part labelled as 'X'.

(iv) Explain the process of seed formation in a flowering plant.

[5 Marks]

**Answer:** (a) The part labelled as 'X' is the **pistil** or **carpel**, which is the female reproductive part of the flower. The part labelled as 'Y' is the **anther**, which is the male reproductive part of the flower.

(b) The yellowish coloured structures produced by the anther (part 'Y') are called **pollen grains**.

(c) The process by which pollen grains are transferred from the anther (Y) to the stigma of the pistil (X) is called **pollination**.

(d) **Process of seed formation in a flowering plant:** After pollination, a pollen grain lands on the stigma of the pistil (X). It germinates and forms a pollen tube that grows down through the style to reach the ovary. The male gametes travel through the pollen tube to the ovule inside the ovary. One male gamete fuses with the egg cell in the ovule thereby fertilization takes place and a zygote is formed. The zygote develops into an embryo. The ovule develops into a seed containing the embryo, and the ovary develops into a fruit surrounding the seed. This process of fertilization leading to seed formation ensures the formation of new plants.

### Question 33.

(i) "In refraction of light through a rectangular glass slab, the emergent ray is always parallel to the direction of the incident ray." Why? Explain with the help of a ray diagram. What happens when a ray of light falls normally on one of the faces of a rectangular glass prism? Draw diagram.

(ii) An object is placed at a distance of 30 cm from the optical centre of a concave lens of focal length 20 cm. Use Lens formula to determine the position of the image formed in this case.

[5 Marks]

**Answer:** (i) When light passes through a rectangular glass slab, it undergoes refraction at two parallel surfaces. At the first surface, the ray bends towards the normal as it enters the denser medium, and at the second surface, it bends away from the normal as it comes out to the rarer medium. Due to the parallel nature of the two surfaces, the emergent ray is parallel to the incident ray but is laterally shifted. This means the light ray does not deviate in direction but shifts sideways.

If a ray of light falls normally (at 90 deg) on one face of a rectangular glass prism, it passes straight without any refraction because the angle of incidence is zero and light does not bend when passing through a boundary at normal incidence.

Ray diagram for refraction through glass slab:

Incident ray → Refracted ray bending towards normal inside glass slab → Emergent ray parallel to incident ray but shifted laterally.

Ray diagram for ray falling normally on prism:

Incident ray → passes straight through without bending.

(ii) Given: Object distance  $u = -30$  cm (since object distance is taken opposite to the direction of incident light), focal length  $f = -20$  cm (concave lens has negative focal length).

Using lens formula:  $1/f = 1/v - 1/u$

$$\Rightarrow 1/v = 1/f + 1/u = 1/(-20) + 1/(-30) = -1/20 - 1/30 = -(3/60 + 2/60) = -5/60 = -1/12$$

Therefore,  $v = -12$  cm.

This means the image is formed at 12 cm on the same side as the object (virtual image). The image is erect, diminished, and virtual as is typical of a concave lens.

Hence, the position of the image is 12 cm in front of the lens on the same side as the object.

#### Question 34.

- (i) Name the type of asexual mode of reproduction shown in the given figure.
- (ii) Identify the unicellular organism in the diagram.
- (iii) List any two advantages of asexual reproduction over sexual reproduction.
- (iv) Name and explain any one mode of asexual reproduction observed in Hydra.

[5 Marks]

**Answer:** (a) The type of asexual reproduction shown in the figure is **budding**.

(b) The unicellular organism in the diagram is **amoeba**.

(c) Two advantages of asexual reproduction over sexual reproduction are:

1. It does not require a mate, so reproduction can occur rapidly and easily.
2. Offspring are genetically identical to the parent, ensuring stability of traits.

(d) One mode of asexual reproduction in Hydra is **budding**. In budding, a new small outgrowth called a bud develops on the body of the parent Hydra. The bud grows by cell division and develops tentacles and a mouth. Once fully formed, the bud detaches from the parent and lives independently as a new Hydra. This process allows Hydra to reproduce quickly without the need for fertilization.

#### Question 35.

(i) A student wishes to study the image formation by a concave mirror using candle flame as object. State the type of the image formed by the mirror and mention the change in the image formed, if any, that he observes when the candle flame is gradually moved away

from the pole of the mirror. Draw a ray diagram to show the image formation when the object distance is nearly equal to the radius of curvature of the mirror.

(ii) A convex mirror used for rear-view on an automobile has a focal length of 3.0 m. If a bus is located at 6.0 m from this mirror, use mirror formula to find the position of the image of the bus as seen in the mirror.

[5 Marks]

**Answer: (i)** When a candle flame is placed in front of a concave mirror, the type of image formed depends on the position of the candle relative to the mirror's focal point (F) and center of curvature (C). When the candle flame is at the radius of curvature (at C), the image formed is real, inverted and of the same size as the object.

As the candle flame is gradually moved away from the pole of the mirror from a position closer than the focal point, the image changes from being virtual, erect and enlarged (when object is closer than F), to real, inverted and magnified (between F and C), then to real, inverted and same size (at C), and then to real, inverted and diminished (beyond C).

**Ray diagram:** For the object at C, draw two rays from the top of the candle flame: one parallel to the principal axis which after reflection passes through the focal point, and another passing through C which reflects back on itself. The point where rays meet after reflection is the image location.

(ii) Given focal length,  $f = +3.0$  m (for convex mirror focal length is positive), object distance,  $u = -6.0$  m (object distances are taken negative in mirror formula conventions).

Using mirror formula:

$$1/f = 1/v + 1/u$$

$$\Rightarrow 1/v = 1/f - 1/u = 1/3.0 - 1/(-6.0) = 1/3 + 1/6 = (2 + 1)/6 = 3/6 = 1/2$$

$$\Rightarrow v = 2 \text{ m}$$

The positive value of  $v$  indicates that the image is virtual and formed behind the mirror, at 2 m from the mirror.

So, the image of the bus is formed at 2 m behind the convex mirror.

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