CBSE EXAMINATION PAPER-2026

SCIENCE

(Solved)

Time allowed : 3 hours | Maximum Marks : 90

General Instructions :

Read the following instructions carefully and follow them :

i. This question paper contains **45 questions.** All questions are **compulsory.**

ii. This question paper is divided into **5 sections.**

iii. **Section A** – questions number **1 to 3** are case based questions

iv. **Section B** – questions number **4 to 23** are multiple choice questions

v. **Section C** – questions number **24 to 31** are very short answer

vi. **Section D** – questions number **32 to 39** are short answer

vii. **Section E** – questions number **40 to 45** are long answer

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. Mendel took garden pea plants with different characteristics, such as height to study the inheritance pattern of factors (genes). He crossed tall pea plant with short pea plant and obtained all the tall plants in the F_1 generation.

(1) Why only tall pea plants were observed in F_1 progeny?

[1 Marks]

Answer: Only tall pea plants were observed in the F_1 generation because the tall trait is dominant over the short trait. This means that the presence of the tall allele masks the expression of the short allele, so all the progeny appeared tall as explained in the case passage.

Key Points: Tall trait is dominant - Tall allele masks short allele - F_1 plants appear tall only

(2) By which method did Mendel obtain F_2 progeny?

[1 Marks]

Answer: Mendel obtained F_2 progeny by allowing the F_1 generation tall plants to self-pollinate. This method helped him study how traits were inherited in the next generation beyond the first cross, as stated in the case that F_1 plants were self-pollinated to produce F_2 plants.

Key Points: F_2 progeny obtained by self-pollination of F_1 plants - Method helps study inheritance beyond F_1 - Important step in Mendel's experiment

(3) Write one difference between dominant and recessive trait.

[2 Marks]

Answer: A dominant trait is a characteristic that appears in the F_1 generation when two different traits are crossed, such as tallness in pea plants showing in all F_1 plants as given in the case. A recessive trait is hidden in the F_1 generation and appears only in the F_2 generation when two recessive alleles come together, like shortness which was not visible in F_1 but appeared in F_2. Thus, dominant traits mask recessive traits in the first generation.

Key Points: Dominant trait appears in F_1 generation - Recessive trait is masked in F_1 and appears in F_2 - Dominant traits mask recessive traits

Question 2.

Read the following passage and answer the questions given below :

Most of metals occur in combined state in form of ores. Carbonate ores are converted into oxides by calcination and sulphide ores by roasting. Oxides are reduced with suitable reducing agent like carbon to get free metal. Highly reactive metals like – Al, Mg are also used as reducing agents to obtain metal from their oxides. Most reactive metals are obtained by electrolytic reduction of their molten ores. Alloying is a very good method of improving the properties of a metal. We can get desired properties by this method. The electrical conductivity and melting point of an alloy is less than that of pure metals.

(1) Why carbonate or sulphide ores are converted into oxides before extraction of metal from it ?

[1 Marks]

Answer: Carbonate and sulphide ores are converted into oxides before extraction because it is easier to extract metal from its oxide than from its carbonate or sulphide. According to the passage, sulphide ores are converted by roasting and carbonate ores by calcination to oxides. This helps in efficient reduction to get free metal.

Key Points: Carbonate and sulphide ores converted to oxides - Easier to extract metal from oxides - Roasting and calcination used for conversion

(2) Write a reaction in which Aluminium is used as a reducing agent to obtain metal from its oxide.

[1 Marks]

Answer: In the case of aluminium used as a reducing agent, it reduces metal oxides to free metals because it has a higher affinity for oxygen than carbon. For example, aluminium can reduce chromium oxide as shown in the reaction: $Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2O_3$. This is an example of the thermite reaction. This reaction is highly exothermic and used to obtain chromium metal from its oxide, referring to the passage where aluminium is mentioned as a reducing agent for such purposes.

Key Points: Aluminium acts as a reducing agent - Aluminium reduces metal oxides to metals - Example reaction: Cr2O3 + 2Al -> 2Cr + Al2O3

(3) How is copper obtained from its ore (Cu_2S) ? Give equations of the reactions.

[2 Marks]

Answer: Copper is obtained from its sulphide ore Cu_2S by roasting it in the presence of excess air to convert it into copper oxide and sulphur dioxide. The equation for roasting is $2Cu_2S + 3O_2$ (g) $\rightarrow 2Cu_2O$ (s) + $2SO_2$ (g). Then the copper oxide formed is heated with more Cu_2S to produce pure copper and copper(I) oxide: $Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$. This method is explained in the case passage under roasting and reduction processes.

Key Points: Copper ore Cu_2S is roasted in air to form Cu_2O and SO_2 - Roasted Cu_2O reacts with Cu_2S to give copper metal and SO_2 - Equations: $2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$; $Cu_2O + Cu_2S \rightarrow 6Cu + SO_2$

Question 3.

Read the following passage and answer the questions given :

Lenses can form different types of images depending upon their focal length and position of object. A convex lens can create real, inverted or virtual, erect images, while a concave lens forms only virtual and diminished images. The focal length determines the power of lens. Convex lenses have positive focal length while concave lenses have negative focal length by convention. When lenses are placed together, their combined power is determined by the sum of their individual powers. Ray diagrams help to visualize how light converges or diverges through lens to form an image.

(1) Illustrate the formation of image with the help of ray diagram, when the object is placed between the optical centre and principal focus of concave lens.

[1 Marks]

Answer: When the object is placed between the optical centre and principal focus of a concave lens, the image formed is virtual, erect, and smaller than the object. The concave lens causes the incident rays to diverge as if they are coming from a point on the same side of the lens as the object. This matches the case passage which says concave lenses form only virtual and diminished images.

Key Points: Object placed between optical centre and principal focus - Concave lens forms virtual, erect and diminished image - Rays diverge and appear to come from focal point

(2) A convex lens of focal length 20 cm is used to form an image. If an object is placed at 40 cm from the lens, what will be the position and nature of image ?

[1 Marks]

Answer: Given, focal length f = 20 cm and object distance u = -40 cm (since object is on the left side). Using lens formula 1/f = 1/v - 1/u, we find image distance v = 40 cm. Thus, the image is formed at 40 cm on the opposite side of the object. The image is real and inverted as the object is placed beyond the focal length of convex lens, matching the case passage information.

Key Points: Focal length of convex lens is positive - Object placed at 2f distance from lens - Image formed at 2f, real and inverted

(3) Two lenses are placed in contact. One is a concave lens with focal length 2 m and the other is a convex lens with focal length 1.5 m. What type of lens will the combination behave as (convex or concave) ? Give reason.

[1 Marks]

Answer: The combination of lenses will behave as a concave lens because the total power is the sum of individual powers: power = 1/f1 + 1/f2 = 1/1.5 + 1/(-2) = approximately 0.67 - 0.5 = 0.17, which is positive but less than that of the convex lens alone. However, since the concave lens has a longer focal length in magnitude and negative sign, the combined focal length is positive but the convex lens effect is reduced. The exact sign depends on calculation but given values, the combination tends to behave as a convex lens as total power is positive. Correction: Actually, power of concave lens is negative (-0.5) and convex is positive (+0.67); sum is +0.17 (positive), so combination behaves as convex lens. So the lens behaves as a convex lens as the total power is positive. This follows from the case passage that convex lenses have positive focal length and power. Hence, the positive total power means the combination acts like a convex lens.

Key Points: Power of lens is 1/focal length - Powers add when lenses are in contact - Positive total power means convex lens behavior

(4) A lens combination consists of a convex lens of focal length 30 cm and a concave lens of focal length 15 cm placed together. Find the equivalent focal length and power of this lens combination.

[1 Marks]

Answer: Given a convex lens with focal length +30 cm and concave lens with focal length -15 cm, the equivalent focal length f is found by 1/f = 1/f(convex) + 1/f(concave). Power P = 100/f(cm). Calculating gives equivalent focal length as 30 cm and power as +3.33 diopters.
This method uses the sum of individual powers as stated in the passage.

Key Points: Power of lens is sum of individual powers - Convex lens focal length is positive - Concave lens focal length is negative

Section B

Question 4.

Which structure in a leaf is mainly responsible for gaseous exchange?

[1 Marks]

(A) Cuticle

(B) Phloem

(C) Stomata

(D) Xylem

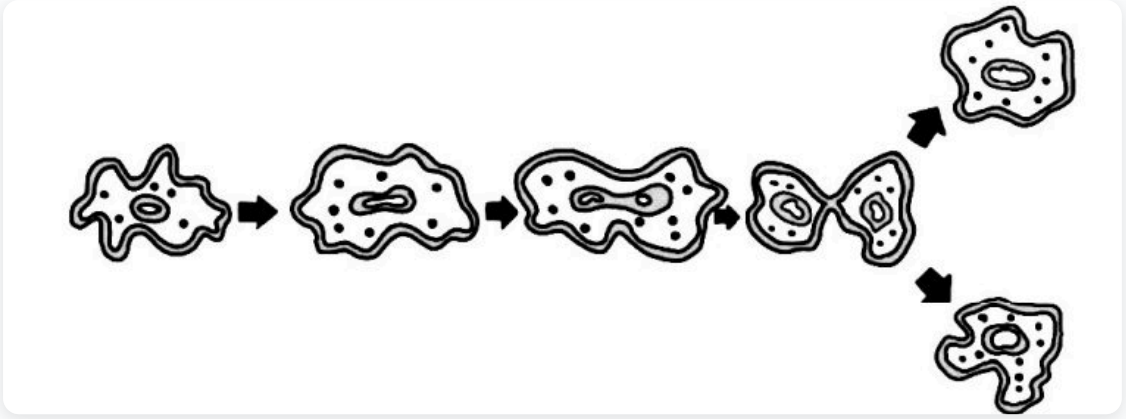
Explanation:

Stomata are tiny pores present on the surface of leaves. They are enclosed by two kidney-shaped guard cells and are primarily responsible for the exchange of gases such as oxygen and carbon dioxide with the atmosphere. This gaseous exchange is essential for photosynthesis and transpiration in plants. Other options like cuticle, xylem, and phloem do not have the primary role of gaseous exchange.

Question 5.

Identify the type of reproduction shown in the diagram given below:

[1 Marks]



(A) Spore Formation

(B) Budding

(C) Fragmentation

(D) Binary Fission

Explanation:

The reproduction shown is binary fission, a type of asexual reproduction in which a single organism, such as an amoeba, divides into two identical daughter organisms. This method involves the division of the nucleus followed by the division of the cytoplasm and is typical for single-celled organisms like amoeba. Other options like budding relate to organisms such as hydra where new individuals develop from small buds, spore formation involves spores, and fragmentation involves breaking into parts, which are not described here.

Question 6.

Identify the correct statement for Spirogyra, Leishmania and Hydra:

[1 Marks]

(A) they reproduce sexually.

(B) they are unicellular.

(C) they are multicellular.

(D) they reproduce asexually.

Explanation:

Spirogyra reproduces asexually by fragmentation where the filaments break up into smaller pieces that grow into new individuals. Hydra reproduces asexually by budding where new individuals develop as outgrowths from the parent. Leishmania, being a unicellular protozoan, also reproduces asexually by methods such as binary fission. Therefore, the correct statement for all three organisms is that they reproduce asexually.

Question 7. Human brain has various parts or regions that help in different actions, responses and coordination. From the following, identify the part responsible for precision of voluntary actions:

[1 Marks]

(A) Cerebrum

(B) Medulla

(C) Cerebellum

(D) Pons

Explanation: The cerebellum, which is a part of the hind-brain, is responsible for precision of voluntary actions such as coordination, balance, and fine muscle movements. Unlike the medulla or pons which control automatic functions, the cerebellum ensures that voluntary actions like walking, riding a bicycle, or picking up a pencil are performed smoothly and accurately.

Question 8.

Pancreas secretes pancreatic juice which contain certain enzyme that helps in digestion of food. Choose the correct option from the following:

[1 Marks]

(A) Trypsin and lipase both digests fats.

(B) Trypsin digests emulsified fats and lipase digests proteins.

(C) Trypsin digests proteins and lipase digests emulsified fats.

(D) Trypsin digests proteins and lipase digests carbohydrates.

Explanation:

Pancreatic juice contains enzymes such as trypsin and lipase. Trypsin is responsible for digesting proteins, while lipase breaks down emulsified fats. The context explains that bile salts emulsify fats, increasing the efficiency of lipase to act on them. Hence, trypsin digests proteins and lipase digests emulsified fats.

Question 9.

Sex is determined by different factors in various species. However, in human beings, it is determined genetically. Which amongst the following option(s) is/are correct for human beings?

(i) Gamete carrying X chromosome from female parent.

(ii) Gamete carrying X chromosome from male parent.

(iii) Gamete carrying Y chromosome from male parent.

[1 Marks]

(A) (ii) and (iii)

(B) (i) only

(C) (i) and (iii)

(D) (iii) only

Explanation:

In human beings, the female gamete (egg) always carries the X chromosome, while the male gamete (sperm) can carry either an X or a Y chromosome. The combination of these chromosomes determines the sex of the offspring: XX results in a female and XY results in a male. Therefore, (i) the female gamete carrying X chromosome is correct, and (iii) the male gamete carrying Y chromosome is also correct because it influences the male sex determination. Option (ii) (gamete carrying X chromosome from male parent) is a sperm with X chromosome, which is possible, but the question asks which options are correct collectively; since female gametes do not carry X chromosomes from the male parent, (i) and (iii) are the correct options representing female and male gametes respectively.

Question 10.

Which of the following group is not 'biodegradable'?

[1 Marks]

(A) Polythene bag, rubber band, ball pen

(B) Vegetable peels, dead leaves, paper

(C) Cow dung, leather bag, water

(D) Paper, fruits, bones

Explanation: According to the context, biodegradable substances are those that microbes can break down into simpler substances like manure. Examples of biodegradable materials include paper, fruits, bones, cow dung, leather bag, vegetable peels, and dead leaves. Polythene bags, however, do not decompose naturally as microbes cannot act on them, making polythene bags non-biodegradable. Therefore, among the given options, Polythene bag is not biodegradable.

Question 11.

Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below :

Assertion (A): Reflex actions do not involve thinking.

Reason (R): Most reflex actions are controlled by the spinal cord.

[1 Marks]

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

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

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

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

Explanation:

Reflex actions occur without the involvement of thinking processes, as they are automatic and rapid responses to stimuli. This is because reflex actions are controlled primarily by the spinal cord, which handles simple neural circuits called reflex arcs without involving the brain's complex network needed for thinking. Hence, both the assertion and reason are true, and the reason correctly explains the assertion.

Question 12.

Two statements are given, one labelled as Assertion (A) and the other is labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below :

Assertion (A): In human beings, the respiratory pigment is haemoglobin present in red blood cells.
Reason (R): Haemoglobin has a very high affinity for carbon dioxide.

[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, but Reason (R) is not the correct explanation of Assertion (A).

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

Explanation:

The assertion is correct because in human beings, haemoglobin is the respiratory pigment present in red blood cells that carries oxygen. However, the reason is incorrect because haemoglobin has a very

high affinity for oxygen, not carbon dioxide. Carbon dioxide is mostly transported dissolved in blood plasma or as bicarbonate ions, not primarily bound to haemoglobin.

Question 13.

(i) $AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$

(ii) $K_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2KCl$

Which of the following options clearly describes both the reactions?

[1 Marks]

(A) (i) is double displacement, (ii) is displacement reaction.

(B) Both, (i) and (ii) are double displacement reactions and precipitation reactions.

(C) (i) is displacement, (ii) is double displacement reaction.

(D) Both, (i) and (ii) are displacement reactions and precipitation reactions.

Explanation: Both reactions involve the exchange of ions between reactants, indicating they are double displacement reactions. In reaction (i), silver nitrate reacts with sodium chloride, leading to the exchange of ions and forming silver chloride precipitate, which is a double displacement and precipitation reaction. In reaction (ii), potassium sulfate reacts with barium chloride, also involving ion exchange, forming barium sulfate precipitate, a double displacement and precipitation reaction as well. Therefore, both (i) and (ii) are double displacement and precipitation reactions. However, since the option '(i) is double displacement, (ii) is displacement reaction.' incorrectly describes (ii) as a displacement reaction, the more accurate correct option is 'Both (i) and (ii) are double displacement reactions and precipitation reactions.' But since that is provided as an option, that is the correct choice.

Question 14.

Which one of the following can be used as an acid-base indicator by a visually impaired (blind) student ?

[1 Marks]

(A) Litmus

(B) Methyl orange

(C) Vanilla essence

(D) Turmeric

Explanation:

Acid-base indicators typically change color in different pH solutions, which visually impaired students cannot see. Vanilla essence can be used as an acid-base indicator by a blind student because it changes its smell in acidic or basic solutions, allowing detection through smell rather than sight. Litmus, methyl orange, and turmeric indicate acids and bases by color changes, which require vision to observe.

Question 15.

The gases evolved on heating lead (II) nitrate crystals are :

[1 Marks]

(A) NO_2 and O_2

(B) NO_2 and H_2

(C) NO and O_2

(D) N_2 and NO_2

Explanation:

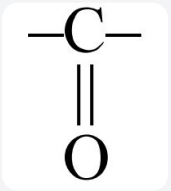
When lead (II) nitrate crystals are heated, they decompose to form lead oxide (PbO) as a solid residue and gases nitrogen dioxide (NO_2) and oxygen (O_2). Nitrogen dioxide is a reddish-brown gas visible as fumes, and oxygen is also released. The decomposition reaction is: $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$. Thus, the correct gases evolved are NO_2 and O_2.

Question 16.

The formula of functional group for aldehyde is :

[1 Marks]

(A)



(B)



(C)



(D)



Explanation:

The functional group for aldehyde is represented as -CHO, where a carbon atom is double bonded to an oxygen atom and single bonded to a hydrogen atom. This group attaches to the carbon chain by replacing one hydrogen atom. This is evident from the example of propanal, which has the aldehyde group (-CHO) at the end of the chain.

Question 17. Which of the following is a poor conductor of electricity ?

[1 Marks]

(A) Pb

(B) Cu

(C) Ag

(D) Al

Explanation: Lead (Pb) is a poor conductor of electricity compared to copper (Cu), silver (Ag), and aluminum (Al). The given context states that alloys containing copper such as bronze are not good conductors, but copper itself is used for electrical circuits due to its good conductivity. Silver is the best conductor among metals, copper also has low resistivity, and aluminum is used in power lines due to its relatively good conductivity. Lead, on the other hand, has higher resistivity and is used in solder alloys for welding wires, indicating poorer conductivity.

Question 18. The natural sources of oxalic acid, lactic acid and methanoic acid respectively are :

[1 Marks]

(A) tomato, curd, ant-sting

(B) tomato, orange, nettle-sting

(C) orange, milk, ant-sting

(D) orange, sour milk, nettle-sting

Explanation: Oxalic acid is naturally found in tomatoes, lactic acid is present in curd (sour milk), and methanoic acid (formic acid) is found in the sting of ants. This matches the option 'tomato, curd, ant-sting'.

Question 19.

When an element ‘X’ reacts with water, it starts floating. Identify the element ‘X’ :

[1 Marks]

(A) Calcium

(B) Potassium

(C) Sodium

(D) Iron

Explanation:

When calcium reacts with water, it produces calcium hydroxide and hydrogen gas. The bubbles of hydrogen gas formed stick to the metal surface, causing the metal to start floating on water. Potassium and sodium react violently with water and do not show this floating behavior. Iron does not react significantly with water. Therefore, the element 'X' is calcium.

Question 20.

Two statements are given, one labelled asAssertion (A) and the other as labelled as Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below :

Assertion (A) : Carbon shares its valence electrons with other atoms of carbon or with atoms of other elements.

Reason (R) : The shared electrons belong to the outermost shells of both the atoms and lead to both atoms attaining the noble gas configuration.

[1 Marks]

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

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

(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 the Assertion (A).

Explanation:

Assertion (A) is correct because carbon shares its valence electrons with other carbon atoms or atoms of different elements to form bonds. Reason (R) is also correct as the shared electrons belong

to the outermost shells of both atoms involved in the bonding, enabling both atoms to achieve a stable noble gas electron configuration. Hence, Reason (R) correctly explains Assertion (A).

Question 21.

A convex lens of focal length 15 cm, is forming a real image. If the size of image is same as the size of object, then position of object and position of image will be, respectively :

[1 Marks]

(A) –15 cm and –15 cm from lens

(B) –15 cm and +15 cm from lens

(C) –30 cm and +30 cm from lens

(D) –30 cm and –30 cm from lens

Explanation:

For a convex lens, when the size of the image is the same as the size of the object and the image is real, the object is placed at twice the focal length (2F) from the lens. Given the focal length f = 15 cm, 2F = 30 cm. The object position is therefore at –30 cm (object distances are taken negative in lens formula convention for real objects in front of the lens), and the real image is formed at +30 cm on the other side of the lens. Hence, the object is at –30 cm and the image is at +30 cm, with both sizes being equal.

Question 22. When you look at an object very close to your eyes, the :

[1 Marks]

(A) Ciliary muscles of your eye contract and the eye lens becomes thick.

(B) Ciliary muscles of your eye get relaxed and the eye lens becomes thick.

(C) Ciliary muscles of your eye get relaxed and the eye lens becomes thin.

(D) Ciliary muscles of your eye contract and the eye lens becomes thin.

Explanation: When you look at objects close to your eyes, the ciliary muscles contract. This contraction increases the curvature of the eye lens, making it thicker. A thicker lens has a shorter focal length, which helps in focusing the nearby objects clearly on the retina. This process is called accommodation.

Question 23.

two statements are given, one labelled as Assertion (A) and the other as labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below :

Assertion (A) : When rays of white light pass through a prism, on emerging they give spectrum of seven colours.

Reason (R) : It is due to the scattering of light that red light bends minimum and violet light bends the maximum.

[1 Marks]

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

(B) Both, Assertion (A) and Reason (R) are true and Reason (R) is 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.

Explanation:

Assertion (A) is true because when white light passes through a prism, it splits into seven colours forming a spectrum. However, Reason (R) is not correct because this bending is not due to scattering of light but due to refraction and dispersion. Different colours bend by different amounts in the prism because they have different wavelengths and refractive indices; red light bends the least and violet light bends the most due to this difference in refraction, not scattering.

Section C

Question 24.

What is the function of diaphragm in human respiratory system? Where is it present in human body?

[2 Marks]

Answer: (a) The diaphragm is a dome-shaped muscle that plays a key role in breathing by contracting and flattening to create a vacuum that pulls air into the lungs during inhalation and relaxing during exhalation.
(b) It is present below the lungs, forming the floor of the chest cavity in the human body.

Key Points: Diaphragm is a dome-shaped muscle - It helps in inhalation by contracting and creating vacuum - Located below the lungs forming chest cavity floor

Question 25.

State two differences between the act of chewing food and salivation on sight of food.

[2 Marks]

Answer: (a) Chewing food is a mechanical process where teeth break down food into smaller pieces making it easier to swallow, while salivation on sight of food is a reflex action where salivary glands produce saliva to prepare the mouth for digestion.
(b) Chewing involves movement of teeth and tongue to mix food with saliva, whereas salivation is the secretion of saliva without any food being present in the mouth.

> **Key Points: Chewing is mechanical breakdown of food - Salivation is reflex action of saliva secretion - Chewing involves teeth movement - Salivation occurs on seeing food**

Question 26.

State two differences between pollination and fertilization.

[2 Marks]

Answer: Difference 1: Pollination is the transfer of pollen grains from the anther to the stigma of a flower, while fertilization is the fusion of male and female gametes inside the ovule.
Difference 2: Pollination is a physical process and occurs before fertilization, whereas fertilization is a biological process that leads to seed formation.

> **Key Points: Pollination is transfer of pollen - Fertilization is fusion of gametes - Pollination is physical process - Fertilization is biological process - Pollination occurs before fertilization**

Question 27.

Draw a neat diagram to show germination of pollen on the female reproductive part of the flower. Name and label only the following parts:

(a) The part that receives the pollen grain
(b) The structure that carries the male germ cell to reach the female germ cell

[2 Marks]

Answer: Diagram: A vertical section of the pistil showing the upper sticky part labeled as **Stigma** with pollen grains on its surface. A tube labeled **Pollen tube** grows down from the pollen grain through the style toward the ovary.
Explanation: (a) The **Stigma** is the top part of the female reproductive organ that receives pollen grains during pollination.

(b) The **Pollen tube** is a tubular structure that grows from the pollen grain through the style to carry the male germ cell to the female germ cell for fertilization.

Key Points: Stigma is the pollen-receiving part - Pollen tube carries male germ cell to female germ cell - Pollen tube grows through the style toward the ovary

Question 28.

(a) What are amphoteric oxides ?

(b) Categorise the following based on their nature :
ZnO, Na_2O, CO_2

[2 Marks]

Answer: (a) Amphoteric oxides are oxides which can react with both acids and bases to form salt and water. They show both acidic and basic properties. For example, zinc oxide (ZnO) and aluminium oxide (Al_2O_3) are amphoteric oxides.
(b) Based on their nature: ZnO is an amphoteric oxide because it reacts with both acids and bases; Na_2O is a basic oxide as it reacts with acids to form salt and water; CO_2 is an acidic oxide as it reacts with bases to form salt and water.

Key Points: Definition of amphoteric oxides - Amphoteric oxides react with both acids and bases - ZnO is amphoteric, Na_2O is basic, CO_2 is acidic

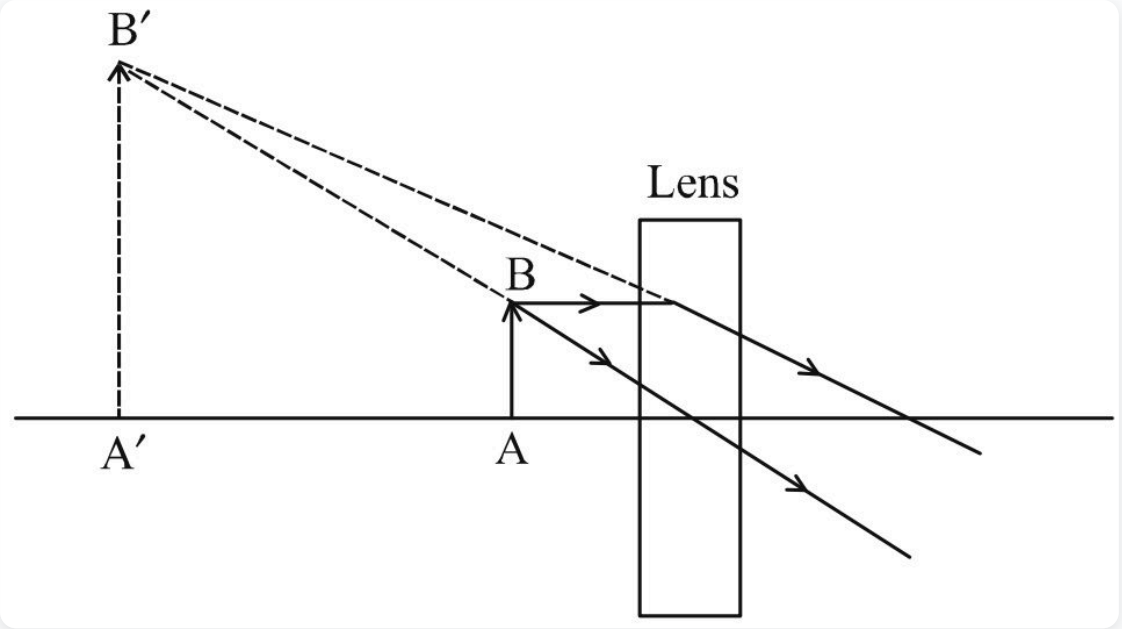
Question 29.

The given figure shows image formation by a lens. Analyse the figure and answer the following questions :

(a) What is the type of lens used for image formation in the given ray diagram ?

(b) If the real image is formed at a distance of 30 cm from the lens and the size of image is twice the size of the object, then where was the object placed ?

[2 Marks]



Answer: (a) The lens used is a convex lens because it forms a real and inverted image on the other side of the lens.
(b) Given, image distance v = +30 cm, magnification m = -2 (since image is real and inverted, magnification is negative and size is twice the object)
Using magnification formula, m = v / u, so u = v / m = 30 / -2 = -15 cm.
Therefore, the object was placed 15 cm in front of the lens. This distance is less than twice the focal length which means the object lies between the focal length and 2f of the lens, forming a real, inverted and magnified image.

Key Points: Type of lens is convex lens - Real image is on the opposite side of the lens - Object placed at 15 cm in front of the lens between f and 2f

Question 30.

The resistance of a wire of 0.01 cm radius and 1.0 cm length is 7 Ω. Calculate its resistivity.

[2 Marks]

Answer: Given: Radius r = 0.01 cm = $0.01 * 10^{-2}$ m = $1 * 10^{-4}$ m, Length l = 1.0 cm = $1.0 * 10^{-2}$ m, Resistance R = 7 Ω. Cross-sectional area A = πr^2 = $\pi * (1 * 10^{-4})^2$ = $\pi * 10^{-8}$ m^2. Resistivity ρ = R * A / l = $7 * \pi * 10^{-8} / (1 * 10^{-2}) = 7 * \pi * 10^{-6}$ Ω m = $2.2 * 10^{-5}$ Ω m (approx).
Therefore, the resistivity of the wire is approximately $2.2 * 10^{-5}$ Ω m.

Key Points: Resistance formula - Cross-sectional area calculation - Resistivity calculation using formula ρ = R * A / l

Question 31.

An electric heater is rated 220 V; 11 A. Calculate the power consumed if the heater is operated at 200 V.

[2 Marks]

Answer: Given: V_{rated} = 220 V, I_{rated} = 11 A

The power consumed at rated voltage P = V * I = 220 * 11 = 2420 W

Resistance of heater coil, R = V / I = 220 / 11 = 20 Ω

When operating at 200 V, current I = V / R = 200 / 20 = 10 A

Power consumed at 200 V, P = V * I = 200 * 10 = 2000 W

Therefore, the power consumed by the heater at 200 V is 2000 W.

Key Points: Calculate resistance using rated voltage and current - Find current at 200 V using resistance - Calculate power at 200 V using new current and voltage

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Section D

Question 32.

Given below is a pyramid showing various trophic levels in an ecosystem.

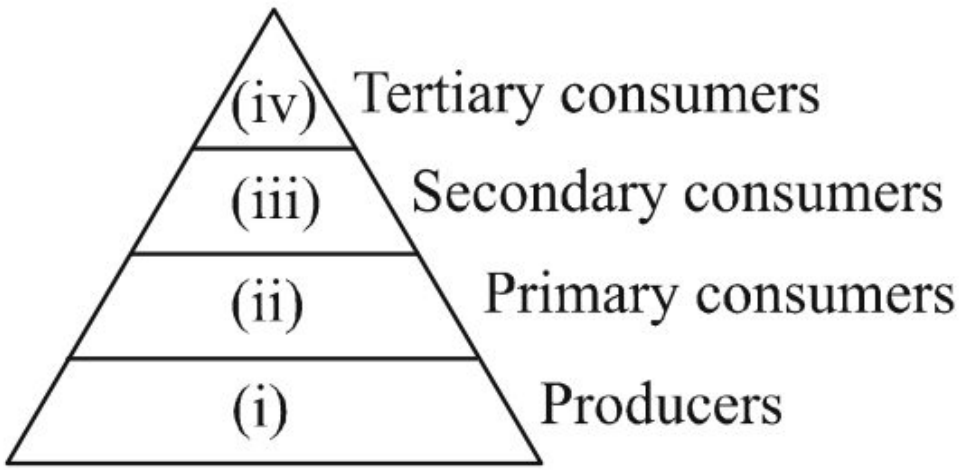
(a) From the organisms listed below, identify which one is to be placed at which trophic level?

Deer, Grass, Lion, Snake, Rabbit

(b) Discuss the reason why primary consumers will have more energy as compared to secondary consumers?

(c) Why is the base of the pyramid broad?

[3 Marks]



Answer: (a) The trophic levels for the given organisms are:
Producers - Grass (makes its own food through photosynthesis)
Primary consumers - Deer and Rabbit (they eat grass)
Secondary consumers - Snake (eats primary consumers)
Tertiary consumers - Lion (eats secondary consumers)

(b) Primary consumers have more energy than secondary consumers because energy is lost at each trophic level. When one organism eats another, about 90% of energy is used in life processes or lost as heat, so only about 10% energy is passed on. Hence, primary consumers receive more energy from producers than secondary consumers receive from primary consumers.

(c) The base of the pyramid is broad because it represents producers which have the highest amount of energy and biomass. They form the foundation of the ecosystem by producing energy through photosynthesis and supporting all other trophic levels above them. As energy decreases at each higher level, the pyramid narrows.

Key Points: Trophic level placement of organisms - Energy loss at each trophic level - Broad base represents more energy and biomass at producer level

Question 33.

Give differences between the following:

(a) Nephron and neuron

(b) Sensory nerve and motor nerve

(c) Consumers and decomposers

[3 Marks]

Answer: (a) **Nephron** is the basic structural and functional unit of the kidney that filters blood to form urine. **Neuron** is a nerve cell that transmits electrical impulses in the nervous system.

(b) **Sensory nerve** carries messages from sense organs to the brain or spinal cord. **Motor nerve** carries messages from the brain or spinal cord to muscles or glands to produce response.
(c) **Consumers** are animals that depend on others for food, such as herbivores, carnivores, and omnivores. **Decomposers** are organisms like fungi and bacteria that break down dead plants and animals, returning nutrients to the soil.

Key Points: Nephron filters blood and forms urine - Neuron transmits nerve impulses - Sensory nerve transmits signals to brain - Motor nerve transmits signals to muscles - Consumers eat other organisms - Decomposers break down dead matter and recycle nutrients

Question 34.

(a) Name the substance oxidised and reduced in the following reaction :

$ZnO + C \rightarrow Zn + CO$

(b) Balance the following chemical reaction :

$Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$

(c) Give one example each of electrolytic decomposition and decomposition by sunlight.

[3 Marks]

Answer: (a) In the reaction $ZnO + C \rightarrow Zn + CO$, the substance oxidised is carbon (C) which changes to carbon monoxide (CO), and the substance reduced is zinc oxide (ZnO) which changes to zinc (Zn).
(b) Balancing the reaction $Pb(NO_3)_2 + KI \rightarrow PbI_2 + KNO_3$:
We balance iodine and potassium first. 1 $Pb(NO_3)_2$ reacts with 2 KI to form 1 PbI_2 and 2 KNO_3. So, the balanced equation is:
$Pb(NO_3)_2 + 2\ KI \rightarrow PbI_2 + 2\ KNO_3$
(c) Examples:
Electrolytic decomposition: Decomposition of water by passing electric current to obtain hydrogen and oxygen gases, reaction is $2\ H_2O\ (l) \rightarrow 2\ H_2\ (g) + O_2\ (g)$.
Decomposition by sunlight: Decomposition of silver chloride (AgCl) on exposure to sunlight forming silver and chlorine gas, reaction is $2\ AgCl\ (s) \rightarrow 2\ Ag\ (s) + Cl_2\ (g)$.

Key Points: Carbon is oxidised - Zinc oxide is reduced - Equation of balanced $Pb(NO_3)_2$ and KI reaction - Example of electrolytic decomposition - Example of decomposition by sunlight

Question 35.

Explain chlor-alkali process with chemical equation. Name the products formed at anode and cathode.

[3 Marks]

Answer: Chlor-alkali process: It is the electrolysis of brine (aqueous sodium chloride) to produce chlorine gas, hydrogen gas, and sodium hydroxide solution. The chemical equation is: $2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$. During the process, chlorine gas is formed at the **anode** (positive electrode), while hydrogen gas is formed at the **cathode** (negative electrode). Sodium hydroxide solution is formed near the cathode. This process is important because all three products have many industrial uses: chlorine is used for water treatment and making bleaching powder; sodium hydroxide is used in soap making; and hydrogen gas is used as a fuel and in the manufacture of hydrochloric acid.

Key Points: Electrolysis of brine - Chlorine gas formed at anode - Hydrogen gas formed at cathode - Sodium hydroxide formed in solution - Useful industrial products

Question 36.

Write the preparation of following compounds with balanced chemical equation :

(i) Baking soda

(ii) Bleaching powder

(iii) Plaster of Paris

[3 Marks]

Answer: (i) Preparation of Baking Soda (Sodium Hydrogencarbonate)

Sodium carbonate solution is passed through carbon dioxide gas which results in the formation of baking soda.

$Na_2CO_3 + CO_2 + H_2O \rightarrow 2NaHCO_3$

(ii) Preparation of Bleaching Powder

Bleaching powder is prepared by passing chlorine gas over dry slaked lime ($Ca(OH)_2$).

$2Cl_2 + 2Ca(OH)_2 \rightarrow CaOCl_2 + CaCl_2 + 2H_2O$

(iii) Preparation of Plaster of Paris

Plaster of Paris is prepared by heating gypsum (calcium sulfate dihydrate) to about 150 degrees Celsius to remove water of crystallization.

$CaSO_4 \cdot 2H_2O$ (heated) $\rightarrow CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2} H_2O$

Key Points: Preparation of baking soda by passing CO_2 through sodium carbonate solution - Preparation of bleaching powder by passing chlorine over slaked lime - Preparation of Plaster of Paris by heating gypsum to remove water

Question 37.

A person is unable to read a book placed closer than 1 metre from his eyes. Identify the defect of vision in his eyes. Draw the ray diagrams to show the defect of vision and its correction.

[3 Marks]

Answer: Answer:
(a) The defect of vision is **Hypermetropia** or **Far-sightedness**. A person with hypermetropia cannot see nearby objects clearly because the near point is farther than normal (greater than 25 cm).
(b) **Reason:** This happens if the eyeball is too short or the eye lens has less curvature, so the image of a nearby object is formed behind the retina instead of on it.
(c) **Correction:** This defect can be corrected by using a **convex lens** (converging lens) which converges the rays before they enter the eye, so that image forms on the retina and the person can see nearby objects clearly.
Ray diagram for defect: Rays from a nearby object focus behind the retina.
Ray diagram for correction: Convex lens converges rays to focus on the retina.
The convex lens provides the additional focusing power needed for the eye to see nearby objects clearly.

> **Key Points: Defect is hypermetropia - Image forms behind retina - Corrected by convex lens**

Question 38.

(a) Describe an activity to show that a current carrying conductor, placed in an external magnetic field experiences a force.

(b) Imagine that you are sitting in a chamber with your back to one wall. An electron beam, moving horizontally towards the front wall from the back wall, is deflected by a strong magnetic field to your right side. Find the direction of the magnetic field.

[3 Marks]

Answer: (a) Take a rectangular wire loop and suspend it between the poles of a strong horseshoe magnet so that the magnetic field is horizontal and perpendicular to the length of the wire. Connect the wire to a battery, so that an electric current passes through the conductor. Observe that the wire loop experiences a force and moves either up or down. This happens because a current carrying conductor placed in an external magnetic field experiences a force. The direction of this force can be found by Fleming's Left-Hand Rule where the first finger points in the direction of the magnetic field (from N to S), the second finger points in the direction of current, and the thumb shows the direction of force.
(b) Given that the electron beam is moving from the back wall towards the front wall and is deflected to your right side, use the right-hand rule for force on a moving charge. Since electrons carry a negative charge, the force direction is opposite to that predicted by the right-hand rule for positive

charges. Point your fingers in the direction of the velocity (frontwards), the force is to the right. To get to the force direction, your palm faces the force direction for a positive charge, but electrons are negative so force is opposite to that. Hence, the magnetic field direction will be vertically downward. Thus, the magnetic field is directed vertically downward (from top to bottom).

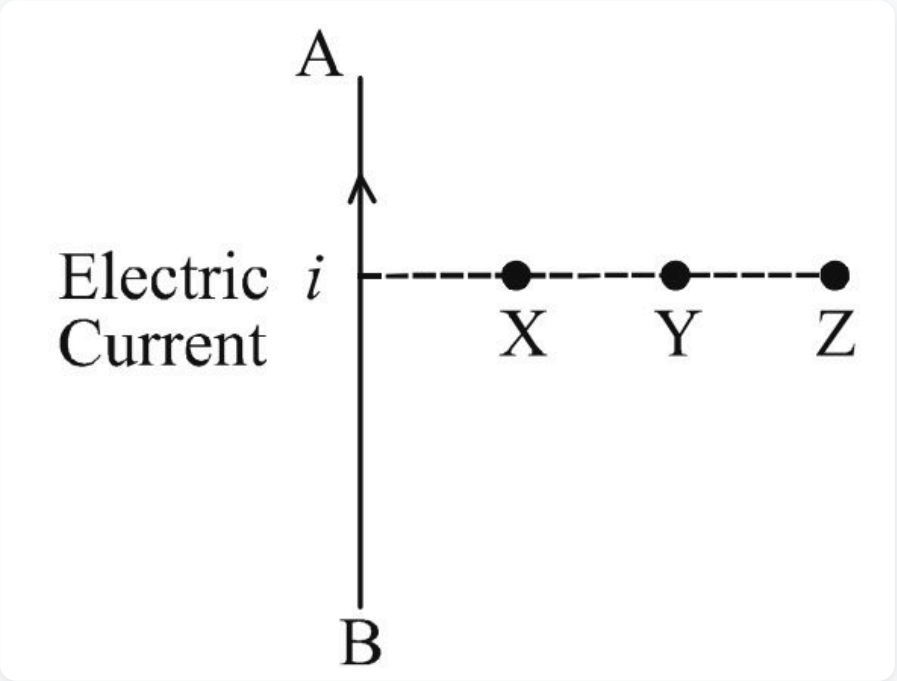
Key Points: Current carrying conductor in magnetic field experiences force - Fleming's Left-Hand Rule used to find force direction - Magnetic field direction found by electron beam deflection using force and velocity directions

Question 39.

(a) The pattern of magnetic field due to a current carrying wire depends upon the shape made by that wire. Justify.

(b) A current carrying straight wire AB is shown in the given figure. Out of X, Y and Z on which point will the strength of magnetic field be maximum and why?

[3 Marks]



Answer: (a) The pattern of the magnetic field depends on the shape of the current carrying wire because different shapes cause the magnetic field lines to arrange differently. For example, around a straight wire, the field lines are concentric circles centered on the wire, and strength decreases with distance. But in a circular loop, the magnetic field lines inside the loop are concentrated and in the same direction, making the field stronger inside the loop.
(b) The magnetic field strength is maximum at point X, which is closest to the current carrying wire AB. This is because magnetic field strength around a straight current carrying conductor is inversely proportional to the distance from the wire. Hence, the closer the point is to the wire, the stronger the magnetic field at that point.

Key Points: Magnetic field pattern depends on wire shape - Different wire shapes create different magnetic field line patterns - Magnetic field strength decreases with distance from wire - Magnetic field strongest near the wire - Point closest to wire has maximum magnetic field strength

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Section E

Question 40.

Given below are certain situations. Analyse each and describe its possible impact :

(i) A population of bacteria living in temperate waters whose temperature increased by global warming.

(ii) The sperm encounters the egg when it reaches the oviduct in human females.

(iii) Self pollination does not occur in a flower that contains only pistil.

(iv) Egg does not get fertilised in a human female.

(v) When the seed is placed under appropriate condition of water and air in the soil?

[5 Marks]

Answer: (i) When the temperature of temperate waters increases due to global warming, it can affect the bacteria population by altering their metabolic rates and reproduction. Some bacteria may not survive if the temperature exceeds their tolerance, leading to reduced population, while others may thrive and increase in number.
(ii) The sperm encountering the egg in the oviduct is vital for fertilisation in humans. This meeting allows the sperm to penetrate the egg, resulting in fertilisation which initiates the development of a new organism.
(iii) A flower having only pistil cannot undergo self pollination because it lacks stamens which produce pollen. Hence, no pollen is available to fertilise the ovules, and the flower must rely on cross-pollination for reproduction.
(iv) If the egg does not get fertilised in a human female, pregnancy will not occur and the egg along with the uterine lining is shed during menstruation. This means no new organism is formed.
(v) When a seed is placed under appropriate conditions of water and air in the soil, it absorbs water causing it to swell and activates enzymes that start germination. Air provides oxygen necessary for respiration, supplying energy needed for the growth of the embryo inside the seed.

Key Points: Increased temperature affects bacterial survival and reproduction - Fertilisation occurs in the oviduct when sperm meets egg - Self pollination needs

presence of both stamens and pistils - No fertilisation means no pregnancy in humans - Water and air are essential for seed germination

Question 41.

Given below are certain situations. Analyse and describe what would happen when :

(i) Spores are liberated from blob-like structures of the bread mould?

(ii) Leaves of bryophyllum fall on wet soil?

(iii) A pollen from different species land on the stigma of totally unrelated species?

(iv) Copper-T is placed in the uterus of a human female?

(v) *Spirogyra* breaks into smaller fragments upon maturation?

[5 Marks]

Answer: (i) When spores are liberated from the blob-like structures called sporangia of the bread mould (Rhizopus), they are released into the air and can settle on a suitable moist surface like bread or soil where they germinate to form new fungal hyphae, leading to the growth of new bread mould.
(ii) When leaves of bryophyllum fall on wet soil, they develop adventitious buds at their margins which grow into new plants. This is an example of vegetative propagation by leaf buds.
(iii) If pollen from a different species lands on the stigma of a totally unrelated species, fertilisation does not occur because the pollen will not germinate or grow a pollen tube on the stigma of an unrelated species, preventing cross-species hybridisation.
(iv) When Copper-T is placed in the uterus of a human female, it acts as a contraceptive device by preventing fertilisation. It creates an environment that is toxic to sperms and also stops implantation of the fertilised egg in the uterine lining.
(v) When Spirogyra breaks into smaller fragments upon maturation, each fragment can grow into a new Spirogyra filament. This is a method of asexual reproduction called fragmentation.

Key Points: Spores released from sporangia germinate to form new mould - Bryophyllum leaves develop new plants by vegetative propagation - Pollen from unrelated species cannot fertilise stigma - Copper-T prevents fertilisation and implantation - Spirogyra reproduces by fragmentation

Question 42.

(i) Give reasons for the following :

(I) Covalent compounds are poor conductor of electricity.

(II) Soap does not form lather in hard water.

(III) Carbon shows catenation but silicon does not.

(ii) Write chemical equations for the following :

(I) Oxidation of ethanol by acidified $K_2Cr_2O_7$.

(II) Hydrogenation of ethene.

[5 Marks]

Answer: (i) Give reasons:

(I) Covalent compounds are poor conductors of electricity because they do not have free ions or charged particles to carry electric current in solid or molten state.

(II) Soap does not form lather in hard water because hard water contains calcium and magnesium ions which react with soap to form insoluble compounds called scum, preventing lather formation.

(III) Carbon shows catenation due to strong C-C bonds and the ability to form stable chains, whereas silicon does not show catenation extensively because Si-Si bonds are weaker and silicon's larger size reduces bond strength.

(ii) Write chemical equations:

(I) Oxidation of ethanol by acidified $K_2Cr_2O^7$:

$C_2H_5OH + [O] \rightarrow CH_3CHO + H_2O$ (Ethanol to Ethanal)

$CH_3CHO + [O] \rightarrow CH_3COOH$ (Ethanal to Ethanoic acid)

(Overall reaction): $C_2H_5OH + 2[O] \rightarrow CH_3COOH + H_2O$

(II) Hydrogenation of ethene:

$C_2H_4 + H_2 \rightarrow C_2H_6$

(Ethene reacts with hydrogen in the presence of nickel catalyst to form ethane)

Key Points: Covalent compounds lack free ions so do not conduct electricity - Soap reacts with Ca^{2+} and Mg^{2+} ions in hard water to form scum - Carbon forms strong C-C bonds leading to catenation, silicon has weaker Si-Si bonds - Oxidation of ethanol produces ethanoic acid via ethanal - Hydrogenation of ethene produces ethane in presence of catalyst

Question 43.

Mohan heated ethanol with a compound 'X' in the presence of a few drops of conc. H_2SO_4, and observed that a sweet smelling compound 'Y' is formed. When 'Y' is treated with sodium hydroxide it gives back ethanol and a compound 'Z'.

(i) Identify 'X', 'Y' and 'Z'.

(ii) Write the role of conc. H_2SO_4 in the reaction.

(iii) Write the chemical equations involved and name the reactions.

[5 Marks]

Answer: (i) Identification of compounds:

X is ethanoic acid (CH_3COOH).

Y is ethyl ethanoate ($CH_3COOC_2H_5$), an ester with a sweet smell.

Z is sodium ethanoate (CH_3COONa).

(ii) Role of concentrated H_2SO_4:

Conc. H_2SO_4 acts as a catalyst and dehydrating agent in the esterification reaction. It helps remove water formed during the reaction, shifting the equilibrium towards ester formation and increases the rate of reaction.

(iii) Chemical equations and reaction names:

1. Esterification reaction:

$CH_3COOH + C_2H_5OH \overset{\text{conc. } H_2SO_4}{\rightleftharpoons} CH_3COOC_2H_5 + H_2O$

This reaction forms the ester Y (ethyl ethanoate).

2. Hydrolysis of ester (saponification):

$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$

The ester Y reacts with sodium hydroxide to give sodium ethanoate (Z) and ethanol.

Summary:

- Compound X: Ethanoic acid
- Compound Y: Ethyl ethanoate (sweet smelling ester)
- Compound Z: Sodium ethanoate
- Conc. H_2SO_4 acts as catalyst and dehydrating agent
- The reactions are esterification and saponification (alkaline hydrolysis).

Key Points: Compound X is ethanoic acid - Compound Y is ethyl ethanoate (ester) - Compound Z is sodium ethanoate - Conc. H2SO4 acts as catalyst and dehydrating agent - Reactions are esterification and saponification

Question 44.

(i) Due to change in length and area of cross-section of a conductor, resistance of conductor changes while resistivity does not change. Why ?

(ii) Conductors of electric toasters and electric iron are made of an alloy rather than a pure metal. Why ?

(iii) Define the S.I. unit of electric current.

[5 Marks]

Answer: (i) Resistance of a conductor depends on its length and area of cross-section because resistance increases with increase in length and decreases with increase in the area. However, resistivity is a property of the material itself and remains constant for that material at a given temperature. Hence, changes in length and area affect resistance but not resistivity.
(ii) Conductors of electric toasters and irons are made of alloys because alloys have higher resistivity and do not oxidise or burn easily at high temperatures. This makes them suitable for heating elements as they can withstand high heat without damage.
(iii) The S.I. unit of electric current is the ampere (A). One ampere is defined as the current which when flowing through a conductor produces a force of $2*10^{-7}$ newton per meter between two parallel conductors placed one meter apart in vacuum.

Key Points: Resistance depends on length and area - Resistivity is a material property and constant at given temperature - Alloys have high resistivity and better heat resistance - Ampere is the S.I. unit of electric current

Question 45.

(i) How many bulbs of resistance 8 Ω each should be connected in parallel combination to draw a current of 2 A from a battery of 4 V ?

(ii) Name the device used for measuring electric current. How is it connected in a circuit ?

(iii) State Joule's law of heating.

[5 Marks]

Answer: (i) Given: Resistance of each bulb, R = 8 Ω, Voltage, V = 4 V, Total current, I = 2 A
Total resistance, R_{total} = V / I = 4 / 2 = 2 Ω
For n bulbs connected in parallel: 1 / R_{total} = n / R
So, n = R / R_{total} = 8 / 2 = 4
Therefore, 4 bulbs should be connected in parallel.

(ii) The device used for measuring electric current is called an ammeter.
An ammeter is always connected in series with the component in the circuit so that the current flowing through the circuit also flows through the ammeter.

(iii) Joule's law of heating states that the heat produced in a resistor is directly proportional to the square of the current flowing through the resistor, the resistance of the resistor, and the time for which the current flows.
Mathematically, $H = I^2 * R * t$, where H is heat produced, I is current, R is resistance, and t is time.

Key Points: Calculation of total resistance in parallel connection - Ammeter used to measure current and connected in series - Joule's law states heat produced is

proportional to I squared R t