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. Kidneys help to regulate the volume of fluid and various metabolites waste products in the body. Normally, kidney filter about 180 L of fluid daily but the volume actually excreted out is only a litre or two a day. Patients with kidney failures can be saved by dialysis and kidney transplant.

(1) Write the structure and function of Bowman’s capsule.

[1 Marks]

Answer: Bowman\'s capsule structure and function: Bowman\'s capsule is a cup-shaped sac at the beginning of a nephron in the kidney that surrounds a cluster of thin-walled blood capillaries called the glomerulus.
It collects the filtrate, which includes waste and other substances filtered from the blood.
This filtrate will then pass through the nephron where selective reabsorption occurs.
As per the case, Bowman\'s capsule helps in filtering blood and collecting waste products for excretion.

Key Points: Bowman\'s capsule is a cup-shaped sac - It surrounds glomerulus (capillary network) - It collects the filtrate (filtered fluid from blood)

(2) Although kidneys filter a large amount (about 180 L daily) of fluids, still the excretion from the body is only about a litre or two. Why ?

[1 Marks]

Answer: Although kidneys filter about 180 L of fluid daily, only 1 to 2 litres are excreted because most of the filtrate is selectively reabsorbed in the nephrons. Substances like glucose, amino acids, salts, and much of the water are reabsorbed back into the blood, so only waste products remain to be excreted as urine, as explained in the case passage.

Key Points: Kidneys filter about 180 L fluid daily - Most filtrate is reabsorbed - Only waste and excess water are excreted as urine

(3) What is excretion ? Why is it necessary for any living organism ?

[2 Marks]

Answer: Excretion is the process by which living organisms remove metabolic waste products and excess substances from their body to maintain homeostasis. It is necessary because it helps in removing harmful wastes like urea from the body, preventing the accumulation of toxic substances that can disrupt normal body functions. As mentioned in the case, kidneys filter about 180 litres of fluid daily but reabsorb useful substances, excreting only 1 or 2 litres of waste fluid. This shows how excretion maintains balance in the body fluids and waste levels.

Key Points: Excretion is removal of metabolic waste - Prevents accumulation of harmful substances - Maintains internal balance and homeostasis

Question 2. Alcohol forms a homologous series with general formula C_nH_{2n+1}–OH and –OH group as functional group. Ethanol is commonly called alcohol and is used in alcoholic drinks. It is good solvent, used in medicines, cough syrups, tonics etc.

(1) Write structural formula and name of 4th member of alcohol homologous series.

[1 Marks]

Answer: The 4th member of alcohol homologous series has 4 carbon atoms. Its name is Butanol. The structural formula is CH_3-CH_2-CH_2-CH_2-OH which shows four carbon atoms connected in a chain with an –OH group attached to the last carbon. This follows the general formula $C_xH_{2x^+1}$–OH as explained in the passage.

Key Points: 4th member has 4 carbon atoms - Name is Butanol - Structural formula is CH3-CH2-CH2-CH2-OH

(2)

What happens when ethanol is heated with alkaline $KMnO_4$? Write chemical equation involved.

[1 Marks]

Answer:

When ethanol is heated with alkaline $KMnO_4$, it gets oxidized to ethanoic acid. This reaction is an example of oxidation of alcohol using an oxidizing agent. The chemical equation is: CH3-CH2OH + 2[O] -> CH3-COOH + H2O, where alkaline KMnO4 provides the oxygen.

Key Points: Ethanol oxidized to ethanoic acid - Alkaline KMnO4 is oxidizing agent - Chemical equation CH3-CH2OH + 2[O] -> CH3-COOH + H2O

(3) Write the chemical equation of reaction of ethanol with ethanoic acid in the presence of concentrated H_2SO_4 . Write the name of this reaction.

[2 Marks]

Answer: The reaction between ethanol (C2H5OH) and ethanoic acid (CH3COOH) in presence of concentrated H2SO4 produces ethyl ethanoate (CH3COOC2H5) and water (H2O). This reaction is called esterification.

C2H5OH + CH3COOH \xrightarrow{Conc.\ H2SO4} CH3COOC2H5 + H2O

Key Points: Chemical equation of ethanol and ethanoic acid reaction - Role of concentrated H2SO4 as catalyst - Name of the reaction is esterification

Question 3.

Three students Shweta, Ayesha and Samridhi were performing an experiment to understand the factors on which the resistance of a conductor depends. Each one of them completed electric circuit with the help of a cell, an ammeter, a plug key and wire.

Shweta put nichrome wire of length ‘l’ in the circuit and after plugging the key, noted current in the ammeter.

Ayesha put nichrome wire of same thickness but twice the length i.e. ‘2l’ in the circuit and after plugging the key, noted current in the ammeter.

Samridhi took copper wire of length ‘l’ and same thickness in the circuit and after plugging the key, noted current in the ammeter.

(1) If the ammeter reading is X ampere with nichrome wire of length ‘l’, then what will be the ammeter reading if the length of nichrome wire is doubled with same area of cross-section ?

[1 Marks]

Answer: If the length of nichrome wire is doubled to 2l with the same thickness, its resistance will double. According to Ohm’s law, current I = V / R, so the current will become half of the original current X. Thus, the ammeter reading will be X/2 ampere, as the case mentions the effect on current when wire length changes.

Key Points: Resistance is directly proportional to length - Current is inversely proportional to resistance - Doubling length halves the current

(2) What happens to the ammeter reading if the area of cross-section of nichrome wire is doubled, keeping the length of wire ‘l’ the same ?

[1 Marks]

Answer: If the area of cross-section of the nichrome wire is doubled keeping the length the same, the resistance decreases. This causes the current to increase, so the ammeter reading increases as well, as per the experiment described.

Key Points: Doubling area decreases resistance - Current increases - Ammeter reading increases

(3) Define ‘resistivity’. Write its SI unit. Compare the resistivity of an alloy with its constituents metals.

[2 Marks]

Answer: Resistivity is the property of a material that measures how much it resists the flow of electric current. It depends only on the type of material used. Its SI unit is ohm meter (\u03A9 m). From the experiment, the resistivity of an alloy like nichrome is generally higher than that of its constituent metals. This means alloys have higher resistance and are used in making resistance wires. Thus, resistivity helps us compare different materials as done by Shweta, Ayesha, and Samridhi in the case.

Key Points: Definition of resistivity - SI unit is ohm meter - Resistivity of alloy is higher than constituent metals

Section B

Question 4.

Identify the part that controls the closing and opening of the stomatal pore in leaves of plants. 1 Select the correct option

[1 Marks]

(A) Stomata

(B) Epidermal cells

(C) Guard cells

(D) Chloroplasts

Explanation:

Guard cells are specialized cells that surround each stoma on the leaf surface. They control the opening and closing of the stomatal pore by changing their shape. When guard cells take in water, they swell and curve, causing the stomatal pore to open, allowing gas exchange. When they lose water, they shrink and close the pore to prevent water loss. This mechanism helps the plant balance gas exchange and water conservation.

Question 5. Identify the endocrine gland that regulates the growth of human body

[1 Marks]

(A) Pituitary gland

(B) Thyroid gland

(C) Adrenal gland

(D) Pancreas

Explanation: The pituitary gland is known as the "master gland" because it releases growth hormone which regulates the growth of bones, muscles, and other tissues during childhood and adolescence. It controls many other endocrine glands and is primarily responsible for regulating the human body's growth.

Question 6.

Choose the equation of reaction that correctly represents anaerobic respiration in muscles :

[1 Marks]

(A)

$$\text{Glucose} \rightarrow \text{Pyruvate} \xrightarrow[\text{of } O_2]{\text{Absence}} \text{Ethanol} + CO_2 + \text{Energy}$$

(B)

$$\text{Glucose} \xrightarrow{O_2} \text{Pyruvate} \xrightarrow{O_2} \text{Energy}$$

(C)

$$\text{Glucose} \rightarrow \text{Pyruvate} \xrightarrow[\text{oxygen}]{\text{Lack of}} \text{Lactic acid} + \text{Energy}$$

(D)

$$\text{Glucose} \xrightarrow{O_2} \text{Pyruvate} \xrightarrow[\text{oxygen}]{\text{Lack of}} \text{Ethanol} + \text{Energy}$$

Explanation: Anaerobic respiration in muscles occurs when there is limited oxygen supply during intense exercise. In this process, glucose ($C_6H_{12}O_6$) breaks down into lactic acid ($2C_3H_6O_3$) and energy. This allows muscles to produce energy without oxygen. Hence, the correct reaction is Glucose → Lactic Acid + Energy.

Question 7.

In human beings, the implantation of fertilised egg takes place in which part of female reproductive system ?

[1 Marks]

(A) Cervix

(B) Uterus

(C) Vagina

(D) Oviduct

Explanation: The fertilised egg implants in the uterus, which has a thick inner lining prepared to support the growth and development of the embryo. The oviduct (Fallopian tube) is where fertilization usually occurs, but implantation happens only in the uterus. The cervix is the lower part of the uterus connecting to the vagina, and the vagina is the passage for sperm entry, not where implantation occurs.

Question 8.

When a human egg is fertilized by a sperm having 'Y' chromosome, the zygote has the following combination of chromosomes :

[1 Marks]

(A) 44 + XX

(B) 22 + XX

(C) 44 + XY

(D) 22 + XY

Explanation:

The human zygote has a total of 46 chromosomes, which includes 44 autosomes and 2 sex chromosomes. The egg always contributes 22 autosomes plus one X chromosome. When fertilized by a sperm carrying a Y chromosome, the sperm contributes 22 autosomes and one Y chromosome. Thus, the zygote chromosome combination is 22 autosomes plus XY sex chromosomes, resulting in a male (XY) zygote.

Question 9.

Which of the following is a non-biodegradable pollutant ?

[1 Marks]

(A) Paper

(B) DDT

(C) Vegetable peel

(D) Wood

Explanation:

DDT is a pesticide that is non-biodegradable, meaning it does not break down quickly in the environment and can persist for a long time, causing harm to the ecosystem. In contrast, paper, wood, and vegetable peel are biodegradable and decompose naturally.

Question 10.

In an ecosystem, the decomposers perform an important role. Select the option indicating the role of decomposers.

[1 Marks]

(A) Break down inorganic substances into organic substances

(B) Do not act on organic compounds.

(C) Convert inorganic materials to simpler forms

(D) Break down complex organic substances to simple inorganic substances.

Explanation:

Decomposers such as fungi and bacteria break down dead plants and animal material by converting complex organic substances into simple inorganic substances. This process releases nutrients back into the soil, which are then used by plants for growth. Therefore, the correct role of decomposers is to break down complex organic substances into simple inorganic substances.

Question 11.

two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option from (A), (B), (C) and (D) given below :

Assertion (A) : Bacteria that can withstand heat have better chances of survival in a heat wave.

Reason (R) : Accumulation of variations in a species increases the chances of its survival in changing environment.

[1 Marks]

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

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

Explanation:

Both the Assertion and Reason are true. The assertion states that bacteria which can withstand heat have better survival chances in a heat wave, which is true as environmental factors select those variants best adapted to survive. The reason states that accumulation of variations in a species increases its chances of survival in changing environments, which explains why heat-resistant bacteria survive better during heat waves. Thus, the Reason correctly explains the Assertion as per the provided context.

Question 12. two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option from (A), (B), (C) and (D) given below : Assertion (A) : The peristaltic movements occur all along the gut. Reason (R) : The lining of the gut has muscles that contract rhythmically to push the food in regulated manner

[1 Marks]

(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 false, but Reason (R) is true.

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

Explanation: Both the assertion and reason are correct because peristaltic movements do occur all along the gut to move food. This is due to the lining of the gut having muscles that contract rhythmically in a wave-like manner, pushing food forward in a regulated way. Thus, the reason correctly explains the assertion.

Question 13.

The volume ratio of hydrogen and oxygen gases liberated during electrolysis of water is :

[1 Marks]

(A) 1 : 2

(B) 2 : 1

(C) 4 : 1

(D) 1 : 3

Explanation:

During the electrolysis of water (H_2O), water decomposes into hydrogen and oxygen gases. The chemical formula shows that there are 2 atoms of hydrogen for every 1 atom of oxygen. Since gases at the same conditions of temperature and pressure have volumes proportional to the number of molecules, the volume ratio of hydrogen to oxygen is 2:1. This means twice the volume of hydrogen gas is produced compared to oxygen gas.

Question 14.

Which of the following set of compounds does not belong to same homologous series ?

[1 Marks]

(A) C_2H_6 and C_3H_8

(B) C_3H_8 and C_5H_{12}

(C) CH_4 and C_4H_{10}

(D) C_4H_8 and C_5H_{12}

Explanation: A homologous series is a group of compounds that differ by a $–CH_2–$ unit and have the same functional group. The compounds C_2H_6 and C_3H_8 (ethane and propane), C_3H_8 and C_5H_{12} (propane and pentane), and CH_4 and C_4H_{10} (methane and butane) all belong to the alkane series differing by $–CH_2–$ units hence belong to the same homologous series. However, C_4H_8 has fewer hydrogen atoms than C_5H_{12}, indicating it is not an alkane but likely an alkene (with a double bond), so it does not belong to the same homologous series as C_5H_{12}, which is an alkane.

Question 15.

Which of the following is an amphoteric oxide ?

[1 Marks]

(A) Na_2O

(B) CO_2

(C) Al_2O_3

(D) K_2O

Explanation: Aluminium oxide (Al_2O_3) is an amphoteric oxide because it reacts with both acids and bases to form salts and water. For example, it reacts with hydrochloric acid (HCl) to form aluminium chloride ($AlCl_3$) and water, and with sodium hydroxide (NaOH) to form sodium aluminate ($NaAlO_2$) and water. In contrast, sodium oxide (Na_2O) and potassium oxide (K_2O) are basic oxides, and carbon dioxide (CO_2) is an acidic oxide.

Question 16.

Study the following table and select the correct option :

[1 Marks]

Salt	Acid used	Base used	Nature of Salt
$NaCl$	HCl	NaOH	Basic
Na_2CO_3	H_2CO_3	NaOH	Neutral
Na_2SO_4	H_2SO_4	NaOH	Acidic
CH_3COONa	CH_3COOH	NaOH	Basic

(A) CH_3COONa | CH_3COOH | NaOH | Basic

(B) Na_2SO_4 | H_2SO_4 | NaOH | Acidic

(C) Na_2CO_3 | H_2CO_3 | NaOH | Neutral

(D) NaCl | HCl | NaOH | Basic

Explanation: The table contains incorrect classifications of the nature of solutions formed by salts. Sodium chloride (NaCl) is formed from a strong acid (HCl) and a strong base (NaOH), so the resulting solution is neutral, not basic. Na_2CO_3 (sodium carbonate) is formed from a weak acid (H_2CO_3, carbonic acid) and a strong base (NaOH), so its solution is basic, not neutral. Na_2SO_4 (sodium sulfate) is formed from a strong acid (H_2SO_4) and a strong base (NaOH), so it is neutral, not acidic. CH_3COONa (sodium acetate) is formed from a weak acid (CH_3COOH) and a strong base (NaOH), so its solution is basic. Therefore, among the given options, the classification "NaCl | HCl | NaOH | Basic" is correct in form but the nature given (Basic) is not correct; it should be neutral. Since none of the options is fully correct, the closest correct understanding is that NaCl solution is neutral. Hence, the option indicating NaCl formed from HCl and NaOH (strong acid and strong base) corresponds to a neutral solution, making "NaCl | HCl | NaOH | Basic" partially correct in terms of components but the nature should be neutral. This option is therefore most appropriate as per the chemical understanding.

Question 17.

Which of the following will not undergo addition reaction ?

[1 Marks]

(A) C_2H_2

(B) C_3H_8

(C) C_4H_8

(D) C_2H_4

Explanation: C_3H_8 (propane) is a saturated hydrocarbon (alkane) which contains only single bonds between carbon atoms. Saturated hydrocarbons do not undergo addition reactions because their carbon atoms are bonded with single bonds only. On the other hand, C_2H_4 (ethene), C_2H_2 (ethyne), and C_4H_8 (which is an unsaturated hydrocarbon) contain double or triple bonds and can undergo addition reactions. Therefore, among the given options, C_3H_8 will not undergo addition reactions.

Question 18.

Four solutions, namely fructose, ethanol, hydrochloric acid and sodium hydroxide filled in four separate beakers are connected one by one in an electric circuit with a bulb. The solutions in which the bulb will glow when current is passed are :

[1 Marks]

(A) ethanol and hydrochloric acid

(B) fructose and ethanol

(C) fructose and sodium hydroxide

(D) hydrochloric acid and sodium hydroxide

Explanation: The bulb glows in solutions that conduct electricity due to the presence of free ions. Hydrochloric acid (HCl) dissociates in water to produce H^+ and Cl^- ions, and sodium hydroxide (NaOH) dissociates to produce Na^+ and OH^- ions, both of which conduct electricity and cause the bulb to glow. Fructose and ethanol do not ionize to produce free ions, hence their solutions do not conduct electricity and the bulb does not glow.

Question 19.

Which gas is evolved when magnesium metal reacts with very dilute HNO_3 ?

[1 Marks]

(A) Oxygen

(B) Hydrogen

(C) Nitrogen Dioxide

(D) Nitrogen

Explanation:

Magnesium (Mg) reacts with very dilute nitric acid (HNO_3) to evolve hydrogen gas (H_2). Although HNO_3 is a strong oxidising agent that can oxidise hydrogen to water and get reduced to nitrogen oxides, magnesium and manganese are exceptions that release hydrogen gas when reacting with very dilute HNO_3. Hence, the gas evolved in this reaction is hydrogen.

Question 20. two statements are given – one labelled as Assertion (A) and other labelled as Reason (R). Answer this question selecting the appropriate option from (A), (B), (C) and (D) given below : Assertion (A) : Reaction of quick lime with water is an exothermic reaction. Reason (R) : A large amount of heat is evolved on the reaction of quick lime and water.

[1 Marks]

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

Explanation: The reaction of quick lime (calcium oxide) with water produces slaked lime (calcium hydroxide) and releases a large amount of heat, making it an exothermic reaction. Hence, both the Assertion and Reason are true, and the Reason correctly explains the Assertion.

Question 21.

Rays from the sun converge at a point 25 cm behind a convex lens. The distance at which an object be placed in front of the lens to get a virtual image, is :

[1 Marks]

(A) 20 cm

(B) 40cm

(C) More than 50 cm

(D) 50cm

Explanation:

Since rays from the sun are parallel, they converge at the focal point of the convex lens. The focal length (f) of the convex lens is therefore 25 cm (image formed 25 cm behind the lens). To get a virtual image with a convex lens, the object must be placed between the focal point and the lens (i.e., at a distance less than 25 cm). However, the question asks for the object distance to get a virtual image, which given the options, the object must be placed at 40 cm in front of the lens (a distance greater

than the focal length), resulting in a virtual image formed by extending the rays backward. Using the lens formula 1/f = 1/v - 1/u and solving for object distance u when image distance v is negative (image behind the lens), we find u = 40 cm.

Question 22. To restore clear vision in persons whose size of the eye ball has reduced, he/she is suggested to use suitable

[1 Marks]

(A) Converging lens

(B) Diverging lens

(C) Bifocal lens

(D) Cylindrical lens

Explanation: When the size of the eyeball becomes smaller, the focal length of the eye lens becomes too long, causing the image to form behind the retina. This defect, known as hypermetropia, can be corrected by using a converging (convex) lens that provides additional focusing power to form the image on the retina. Therefore, a converging lens is suggested to restore clear vision in such cases.

Question 23.

two statements are given – one labelled as Assertion (A) and the other labelled as Reason (R). Select the correct answer to this question from the codes (A), (B), (C) and (D) as given below : Assertion (A) : The needle of a magnetic compass kept in strong external magnetic field, always aligns itself in northsouth direction on the earth. Reason (R) : Behaviour of the needle of a compass is same as that of a freely suspended bar magnet.

[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 the Assertion (A)

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

Explanation:

The behaviour of the compass needle is indeed like that of a freely suspended bar magnet, so Reason (R) is true. However, when the compass needle is kept in a strong external magnetic field (for

example, near a bar magnet or a coil carrying current), it aligns itself with the external magnetic field, not necessarily the Earth's north-south direction. Therefore, Assertion (A) is false.

Section C

Question 24.

Give a diagrammatic representation of nutrition in Amoeba.

[2 Marks]

Answer: Nutrition in Amoeba:

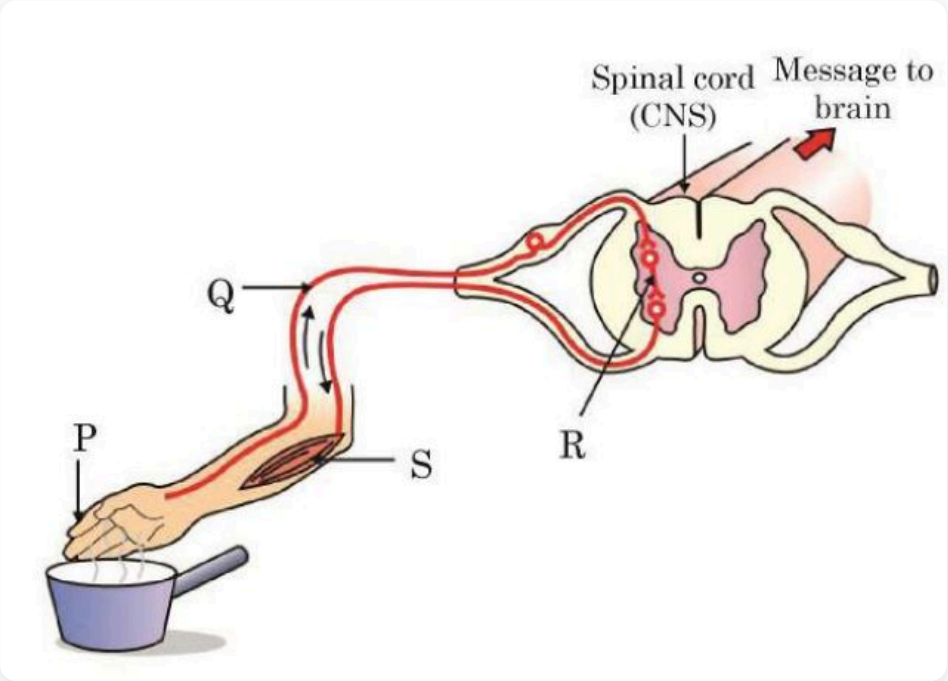
Amoeba is a single-celled organism that feeds on microscopic organisms. It uses its pseudopodia to surround and engulf the food particle forming a **food vacuole**. Inside the food vacuole, enzymes digest the food into simpler soluble substances. These nutrients diffuse into the cytoplasm for use by the cell. Undigested food is expelled out by the cell membrane. This process is called **phagocytosis**.

Key Points: Amoeba uses pseudopodia to capture food - Food vacuole is formed for digestion - Enzymes break down food in vacuole - Nutrients absorbed into cytoplasm - Undigested food removed

Question 25.

Observe the given figure and identify the labelled parts P, Q, R and S :

[2 Marks]



Answer: Answer:

P and Q are the points where one resistor R_1 is connected between them.

R and S are the points where another resistor R_2 is connected between them.

These points are junctions or nodes in the circuit.

P and Q represent the ends of resistor R_1, while R and S represent the ends of resistor R_2.

Thus, P, Q, R and S are the connection points (or terminals) between the resistors and the rest of the circuit.

Key Points: P and Q are connection points of resistor R1 - R and S are connection points of resistor R2 - Points P, Q, R, S are terminals or junctions in the circuit

Question 26.

Which of the plant hormones are responsible for the following processes ?

(i) Promote cell division

(ii) Inhibition of growth

(iii) Detection of light

(iv) Wilting of leaves

[2 Marks]

Answer: (i) Cytokinins are responsible for promoting cell division in plants.
(ii) Abscisic acid inhibits growth and acts as a growth suppressant.
(iii) Auxins help in the detection of light by causing the plant to bend towards light through differential cell elongation.
(iv) Abscisic acid also causes wilting of leaves by signaling stomata to close and reducing cell turgor pressure.

Key Points: Cytokinins promote cell division - Abscisic acid inhibits growth - Auxins help in detection of light - Abscisic acid causes wilting of leaves

Question 27.

Briefly mention the steps in double-circulation through human heart

[2 Marks]

Answer: Steps in Double Circulation through Human Heart:
1. Deoxygenated blood from the body enters the right atrium.
2. It moves to the right ventricle which pumps it to the lungs via the pulmonary artery.
3. In lungs, blood gets oxygenated.
4. Oxygen-rich blood returns to the left atrium.

5. It flows into the left ventricle which pumps it to the body through the aorta.
6. The septum separates oxygenated and deoxygenated blood to prevent mixing.

Key Points: Deoxygenated blood to right atrium - Right ventricle to lungs - Oxygenated blood to left atrium - Left ventricle to body - Septum prevents mixing

Question 28.

Define the following terms :

(i) Olfactory indicator

(ii) Water of crystallization

[2 Marks]

Answer: (i) **Olfactory indicator:** Olfactory indicators are substances whose odour changes in acidic or basic media, helping to detect the nature of the substance by smell.
(ii) **Water of crystallization:** Water of crystallization refers to the fixed number of water molecules chemically combined with a substance in its crystalline form, for example, copper sulphate crystals contain water of crystallization which is essential for their structure.

Key Points: Olfactory indicator changes odour in acids or bases - Water of crystallization is water chemically combined in crystals - Essential for crystal structure

Question 29.

(a) Relate the speed of light in the given medium with its optical density.

(b) Using the information given in the table below, arrange the medium A, B and C in the ascending order of their optical density

[2 Marks]

Medium	Speed of light (m/s)
A	2.25×10^8
B	2×10^8
C	2.08×10^8

Answer: (a) The speed of light in a medium is inversely related to its optical density. This means that the greater the optical density of a medium, the slower light travels through it. Mathematically,

refractive index n = c / v, where c is the speed of light in vacuum and v is the speed of light in the medium. A higher refractive index indicates higher optical density and lower speed of light.
(b) The medium with the lowest refractive index has the lowest optical density and highest speed of light, and vice versa. Therefore, by comparing the refractive indices of mediums A, B and C from the table, arrange them in ascending order of optical density starting from the medium with the lowest refractive index to the highest.

Key Points: Speed of light inversely related to optical density - Higher refractive index means higher optical density - Arrange mediums by increasing refractive index for ascending optical density

Question 30.

(i) How does the change in curvature of the eye lens helps us in the process of seeing the nearby objects clearly ?

(ii) State the range of the power of accommodation of a normal human eye.

[2 Marks]

Answer: (i) When we see nearby objects, the ciliary muscles contract which makes the eye lens thicker by increasing its curvature. This decreases the focal length of the lens, allowing it to focus the image of the near object on the retina clearly.
(ii) The power of accommodation of a normal human eye ranges from +12 diopters (for a near point of 8 cm) to about +0.5 diopters (for a far point at infinity).

Key Points: Ciliary muscles contract to increase curvature - Lens becomes thicker to focus nearby objects - Power of accommodation ranges from +0.5 to +12 diopters

Question 31.

Draw a ray diagram to show the correction of eye defect of an old man who can not see an object placed closer than 1 m from his eye, clearly.

[2 Marks]

Answer: Answer: The old man is suffering from the defect called presbyopia, where the near point is farther than normal (1 m instead of ~25 cm).
To correct this defect, a convex lens is used. The convex lens acts as a magnifying glass and helps the eye focus on closer objects by converging the rays before they enter the eye.
Ray diagram description:
1. Draw the eye with the retina at the back.
2. Mark the near point at 1 m from the eye.
3. Place a convex lens in front of the eye.

4. Show the object placed closer than 1 m, for example at 25 cm.
5. Draw rays from the object passing through the convex lens, which converge to a virtual image at the near point (1 m).
6. The rays enter the eye as if coming from this virtual image at 1 m, allowing the eye to focus clearly on the object.
This correction allows the old man to see objects placed closer than 1 m clearly.

Key Points: Defect is presbyopia - Near point is farther than normal - Corrected using a convex lens to focus rays for clear vision

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Section D

Question 32.

Based on Mendel's experiment show the cross between round, yellow seeds of pea plant (RRYY) with wrinkled and green seeds of pea plant (rryy) upto F_2 generation. Write the number of seeds/plants with following genetic (Genotype) makeup in F_2 generation :

(i) RRYY

(ii) rry

[3 Marks]

Answer: Parental Generation (P):
Round yellow seeds plant genotype is RRYY and wrinkled green seeds plant genotype is rryy.
F_1 Generation:
All offspring from RRYY x rryy are RrYy (round yellow) because round (R) and yellow (Y) are dominant traits.
F_2 Generation:
Cross F1 plants: RrYy x RrYy (dihybrid cross). Using Punnett square, the genotypic ratio for two traits is 1 RRYY : 2 RRYy : 2 RrYY : 4 RrYy : 1 RRyy : 2 Rryy : 1 rrYY : 2 rrYy : 1 rryy.
Number of plants with genotype:
(i) RRYY = 1 out of 16
(ii) rry = Genotype incomplete, assuming rryy, number is 1 out of 16.
Total plants in F2 generation = 16.
Therefore, in F2, 1 plant is RRYY and 1 plant is rryy.

Key Points: Parental cross RRYY x rryy - F1 all RrYy (round yellow) - F2 dihybrid cross RrYy x RrYy - Genotypic ratio 1 RRYY : 1 rryy - Number of specified genotype plants 1 each in 16

Question 33.

(a) Mention any one harmful effect of using plastic bags on the environment. Suggest better alternatives to the usage of plastic bags.

(b) Paddy fields require a large amount of water. The pesticides and chemical fertilizers used are washed down into the soil or waterbodies. How do these chemicals reach our bodies ? What is this phenomenon known as ?

[3 Marks]

Answer: (a) One harmful effect of using plastic bags on the environment is that plastic bags do not decompose easily and cause pollution by clogging drains, harming animals, and contaminating soil and water. Better alternatives to plastic bags are cloth bags, jute bags, and biodegradable bags which are environment friendly and can be reused.

(b) The pesticides and chemical fertilizers used in paddy fields get washed into water bodies and soil. These chemicals enter the food chain when water and plants containing these chemicals are consumed by animals and humans. This harmful accumulation of toxic substances in living organisms through the food chain is called biomagnification.

> **Key Points: Plastic bags cause long-term pollution - Alternatives are cloth, jute, and biodegradable bags - Chemicals in fields enter water and soil - They reach humans through the food chain - This process is called biomagnification**

Question 34.

What happens when

(i) lead (II) nitrate is heated ?

(ii) iron (II) sulphate is heated ?

(iii) silver chloride is exposed to sunlight ? Write balanced chemical equations of the reactions involved in support of your answer.

[3 Marks]

Answer: (i) When lead (II) nitrate is heated, it decomposes into lead oxide, nitrogen dioxide gas, and oxygen gas. This is a decomposition reaction.
Equation: $2Pb(NO_3)_2$ (s) + Heat $\rightarrow$ $2PbO$ (s) + $4NO_2$ (g) + O_2 (g)
(ii) When iron (II) sulphate is heated, it first loses water of crystallization and then decomposes to form iron (III) oxide, sulphur dioxide, and sulphur trioxide gases.
Equation: $2FeSO_4 \cdot 7H_2O$ (s) + Heat $\rightarrow$ Fe_2O_3 (s) + SO_2 (g) + SO_3 (g) + $14H_2O$ (g)
(iii) When silver chloride is exposed to sunlight, it decomposes into silver metal and chlorine gas. This

is a photochemical decomposition reaction.
Equation: $2AgCl\ (s) + Sunlight \rightarrow 2Ag\ (s) + Cl_2\ (g)$

Key Points: Lead (II) nitrate decomposes on heating - Iron (II) sulphate undergoes dehydration and decomposition on heating - Silver chloride decomposes under sunlight in a photochemical reaction

Question 35.

(a) Give the chemical name and formula of Plaster of Paris.

(b) Write the chemical equation of its preparation.

(c) Give any two uses of it

[3 Marks]

Answer: (a) The chemical name of Plaster of Paris is calcium sulphate hemihydrate and its chemical formula is $CaSO_4 . 1/2\ H_2O$.
(b) Preparation: When gypsum (calcium sulphate dihydrate) is heated at about 373 K (100 deg C), it loses water and forms Plaster of Paris.
$CaSO_4 . 2H_2O$ --heat--> $CaSO_4 . 1/2\ H_2O + 1.5\ H_2O$
(c) Uses of Plaster of Paris:
1. It is used for making casts to support fractured bones.
2. It is used in making decorative materials and for repairing walls and ceilings to give a smooth finish.

Key Points: Chemical name is calcium sulphate hemihydrate - Formula is CaSO4 . 1/2 H2O - Heated gypsum loses water to form Plaster of Paris - Used in making casts for broken bones - Used in decorative materials and wall repairs

Question 36.

(a) Name the acid present in ant’s sting.

(b) Give reason :

(i) While diluting an acid, it is recommended that the acid should be added to water.

(ii) Baking soda is used as an antacid.

[3 Marks]

Answer: (a) The acid present in an ant's sting is methanoic acid, also known as formic acid. Its chemical formula is HCOOH.
(b)(i) While diluting an acid, it is recommended to add acid to water and not water to acid because adding water to a concentrated acid can cause the mixture to splash and may cause burns or injuries.

Adding acid to water ensures better control of dilution and prevents accidents.
(ii) Baking soda is used as an antacid because it is a mild base that neutralizes excess acid in the stomach. When baking soda reacts with excess stomach acid (hydrochloric acid), it forms salt, water, and carbon dioxide, which relieves acidity and heartburn symptoms.

Key Points: Methanoic acid is in ant's sting - Add acid to water to avoid splashes and accidents - Baking soda neutralizes excess stomach acid as an antacid

Question 37.

(a) Draw the ray diagram for refraction of light through a glass prism and mark angle of refraction and angle of deviation.

(b) When the path of a light ray refracted through a glass prism is reversed how will the angle of deviation change ? Explain.

[3 Marks]

Answer: (a) When a light ray passes through a glass prism, it first bends towards the normal on entering the prism due to refraction, known as the angle of refraction (r). Inside the prism, the ray travels and then bends away from the normal while emerging out. The original incident ray and the emergent ray form an angle called the angle of deviation (D) which shows how much the light ray has deviated from its original path. The ray diagram shows the incident ray, refracted ray inside the prism with angle of refraction marked, and emergent ray with angle of deviation marked.
(b) If the path of the refracted light ray through the prism is reversed, the ray retraces its original path backward. Therefore, the angle of deviation remains the same in magnitude. This happens because of the reversibility of light; the path of light is the same in both directions, so deviation does not change on reversing the light ray's path.

Key Points: Light bends towards normal when entering prism - Angle of refraction is inside the prism - Angle of deviation is between incident and emergent rays - Reversing path does not change angle of deviation due to light reversibility

Question 38.

(a) A ray of light after reflection from a concave mirror becomes parallel to its principal axis. Draw a labelled ray diagram to show this.

(b) (i) Differentiate between the virtual images formed by a convex mirror and concave mirror.

(ii) “The value of magnification ‘m’ for a mirror is –2.” Calculate the height of object if the height of image is 20 cm.

[3 Marks]

Answer: (a) When a ray of light passes through the focus (F) of a concave mirror and gets reflected, it becomes parallel to the principal axis. To show this, draw a concave mirror with its pole (P), center of curvature (C), and focus (F). Draw an incident ray starting from the focus (F) towards the mirror. After reflection, the ray travels parallel to the principal axis.
Label the points: C (center of curvature), F (focus), P (pole), Incident ray (from F to mirror), Reflected ray (parallel to principal axis).

(b) (i) **Difference between virtual images formed by convex and concave mirrors:**
- Convex Mirror: Virtual image is always smaller than the object, upright, and formed behind the mirror.
- Concave Mirror: Virtual image can be larger or smaller, always upright, formed in front of the mirror when the object is between focus and mirror.

(ii) Given magnification m = -2 and height of image h' = 20 cm.
Using the magnification formula, m = h'/h => h = h'/m = 20 cm / (-2) = -10 cm.
Height of the object is -10 cm. The negative sign means the object is inverted. So, the object height is 10 cm and inverted.

> **Key Points: Ray through focus reflects parallel to principal axis - Convex mirror virtual image is smaller and behind mirror, concave mirror virtual image can vary and formed in front of mirror - Magnification formula m = h'/h used to find object height**

Question 39.

(a) Why does an electric bulb become dim when an electric heater in parallel circuit is switched ON ?

(b) How to connect three resistors each of resistance 8Ω, so that the equivalent resistance of the combination is 12 Ω ? Draw diagram of the combination and justify your answer.

[3 Marks]

Answer: (a) When an electric heater is switched ON in a parallel circuit, it draws a large current because of its low resistance. This causes the total current in the circuit to increase and the supply voltage to distribute among the components. As a result, the voltage across the electric bulb decreases, making it glow dimmer.
(b) To get an equivalent resistance of 12 Ω from three resistors each 8 Ω, connect two resistors in series and the third resistor in parallel to this series combination. The series resistance of two resistors = 8 Ω + 8 Ω = 16 Ω. Now, the combined equivalent resistance, R_eq = (16 * 8) / (16 + 8) = 12 Ω.
Diagram: Draw two resistors connected end to end (series), then connect the third resistor parallel to this combination across the same points.
This combination achieves the required equivalent resistance of 12 Ω.

Key Points: Electric heater draws more current - Voltage across bulb decreases in parallel circuit - Combining resistors in series and parallel to achieve 12 Ω

Section E

Question 40.

(i) In an angiospermic flower, fertilization is said to take place when male gametes carried in the pollen tube fuse with the female gamete, present in the embryo sac. This results in lot of changes in different parts of the flower. State the changes taking place in the following structures of flower post fertilization :

(a) Zygote

(b) Ovule

(c) Ovary

(d) Sepals

(ii) Define germinati

[5 Marks]

Answer: (i) Changes in parts of flower after fertilization:
(a) Zygote: The zygote develops from the fertilized ovum and divides repeatedly by mitosis to form the embryo that will grow into a new plant.
(b) Ovule: After fertilization, the ovule develops into a seed by forming a seed coat and storing food reserves for the embryo.
(c) Ovary: The ovary enlarges and develops into the fruit which protects the seeds and helps in their dispersal.
(d) Sepals: Sepals usually wither and fall off as they are no longer needed for protecting the flower bud.
(ii) Germination is defined as the process by which a seed develops into a new plant under favorable conditions like water, oxygen, and suitable temperature.

Key Points: Zygote forms embryo - Ovule develops into seed - Ovary becomes fruit - Sepals wither and fall - Germination is seed developing into plant

Question 41.

(i) Sugarcane does not produce seeds so name the process through which it will be able to reproduce.

(ii) List any two advantages of this method.

(iii) Besides sugarcane, give two more examples of plants that reproduce by this method.

(iv) Why regeneration is not possible in all the types of animals ?

[5 Marks]

Answer: (a) Sugarcane reproduces by the process of vegetative propagation, which is a type of asexual reproduction where new plants grow from parts like stem, root or leaves instead of seeds.
(b) Two advantages of vegetative propagation are: 1. The new plants produced are genetically identical to the parent plant, thus preserving desired traits.
2. Plants produced by this method bear flowers and fruits earlier than those grown from seeds.
(c) Besides sugarcane, two examples of plants that reproduce by vegetative propagation are banana and rose.
(d) Regeneration is not possible in all types of animals because only those animals which have the ability to regrow lost parts or have simpler body structures can regenerate. Complex organisms with specialized organs and tissues often cannot regenerate lost parts completely.

> **Key Points: Vegetative propagation - Advantages: genetic similarity and early flowering - Examples: banana, rose - Regeneration possible only in animals with simple body structures**

Question 42.

(i) Give reasons for the following :

(I) Ionic compound have generally high melting points and boiling points.

(II) Solder, an alloy of lead and tin, is used for welding electrical wires.

(III) Carbon cannot reduce the oxides of Na or Mg.

(ii) The reaction of compound ‘X’ with aluminium is used to join railway tracks :

(I) Identify the compound ‘X’.

(II) Name the reaction.

(III) Write the balanced chemical equation of the reaction of compound ‘X’ with aluminium.

[5 Marks]

Answer: (i) (I) Ionic compounds have generally high melting and boiling points because they contain strong electrostatic forces of attraction between oppositely charged ions. A large amount of energy is required to break these strong ionic bonds.
(II) Solder, an alloy of lead and tin, is used for welding electrical wires because it has a low melting point and it bonds metals together effectively without damaging the wires due to high heat.

(III) Carbon cannot reduce the oxides of Na or Mg because sodium and magnesium are highly reactive metals and their oxides are very stable. Carbon is less reactive and cannot displace these metals from their oxides.

(ii) (I) The compound 'X' is iron(III) oxide, Fe_2O_3.

(II) The reaction is called Thermite reaction.

(III) The balanced chemical equation for the reaction with aluminium is: $Fe_2O_3 + 2Al \rightarrow 2Fe + Al_2O_3 +$ Heat.

This highly exothermic reaction produces molten iron which is used to join railway tracks.

Key Points: Ionic compounds have strong electrostatic forces - Solder has low melting point suitable for welding - Carbon cannot reduce highly reactive metal oxides - Compound X is Fe2O3 - Reaction is Thermite reaction - Balanced chemical equation: Fe2O3 + 2Al -> 2Fe + Al2O3 + Heat

Question 43.

(i) Write the balanced chemical equations when :

(I) A mixture of Cu_2O and Cu_2S is heated.

(II) ZnS is heated in the presence of oxygen.

(ii) Give reasons for the following :

(I) The wires carrying current in homes have a coating of PVC.

(II) To make hot water tanks, copper is used and not steel.

(iii) Show the formation of ionic compound CaO with electron dot structure. [Atomic number : Ca = 20, O = 8]

[5 Marks]

Answer: (i) (I) When a mixture of Cu_2O and Cu_2S is heated, the reaction produces Cu (copper) and SO_2 gas as follows:

$2Cu_2O + Cu_2S \text{ --> } 6Cu + SO_2$

(II) When ZnS is heated in the presence of oxygen, it is converted into zinc oxide and sulfur dioxide gas as:

$2ZnS + 3O_2 \text{ --heat--> } 2ZnO + 2SO_2$

(ii) (I) Wires carrying current in homes have a coating of PVC because PVC is an insulator and prevents electric shocks and short circuits by stopping the current from leaking out of the wire.

(II) Copper is used to make hot water tanks because it has high thermal conductivity which helps in faster heating of water, and copper also resists corrosion unlike steel, increasing the tank's durability.

(iii) Formation of ionic compound CaO:
Calcium (Ca) has 2 valence electrons and oxygen (O) has 6 valence electrons.
Ca atom loses 2 electrons to become Ca^{2+} ion.
O atom gains 2 electrons to become O^{2-} ion.
Electron dot structures:
Ca: Ca with 2 dots around it (2 valence electrons)
O: O with 6 dots around it
After transfer, Ca^{2+} has no dots (empty outer shell) and O^{2-} has 8 dots (full octet).
The ionic bond forms between Ca^{2+} and O^{2-} ions giving CaO.

Key Points: Balanced chemical equations for Cu2O and Cu2S heating - Balanced equation for ZnS heating in oxygen - Reasons for PVC coating on wires and copper use in hot water tanks - Electron dot structure and ionic bonding of CaO

Question 44.

(i) Draw a diagram showing the magnetic field lines around a bar magnet. Write any two characteristics of magnetic field lines.

(ii) Write the statement of Right hand thumb rule.

(iii) The concentric circles representing the magnetic field around a current carrying straight wire become larger and larger as we move away from the wire. How does magnetic field change on these concentric circles ?

[5 Marks]

Answer: (i) A bar magnet has two poles, North (N) and South (S). Magnetic field lines emerge from the North pole and enter the South pole. These lines are continuous and form closed loops.
Characteristics of magnetic field lines:
1. Magnetic field lines never intersect each other.
2. They are denser near the poles of the magnet indicating stronger magnetic field there.

(ii) **Right hand thumb rule:** If you hold a current carrying straight wire with your right hand such that your thumb points in the direction of the electric current, then the curled fingers around the wire show the direction of the magnetic field lines around the wire.

(iii) As the concentric circles representing magnetic field lines around a current carrying wire become larger farther from the wire, the magnetic field strength decreases on these circles. This means magnetic field decreases with increasing distance from the wire because the magnetic field is inversely proportional to the distance from the wire.

Key Points: Magnetic field lines emerge from North pole and enter South pole - Magnetic field lines never intersect and are denser near poles - Right hand thumb rule shows direction of magnetic field around current carrying wire - Magnetic field strength decreases with distance from wire

Question 45.

(i) Draw a diagram, showing the magnetic field lines in and around the current carrying solenoid. Write any two salient features of these lines.

(ii) What is an electromagnet and how is it made ?

[5 Marks]

Answer: (i) Magnetic Field Lines of a Current Carrying Solenoid: A solenoid is a coil of many circular turns of insulated wire wound closely in the shape of a cylinder. When an electric current passes through the solenoid, it produces magnetic field lines similar to a bar magnet. The diagram of magnetic field lines shows that inside the solenoid, the magnetic field lines are parallel, dense and strong, running from the south pole to the north pole of the solenoid. Outside the solenoid, the field lines spread out and close back from the north pole to the south pole, forming closed loops.

Two salient features of magnetic field lines:
1. The magnetic field inside the solenoid is strong and uniform as the field lines are parallel and closely spaced.
2. Outside the solenoid, the magnetic field is weak as the field lines are spread out.

(ii) Electromagnet: An electromagnet is a type of magnet in which magnetic field is produced by passing electric current through a coil of wire. It behaves like a magnet only when electric current flows through it. It is made by winding a long insulated copper wire into a coil (called solenoid) and passing electric current through it. The coil is usually wound around a soft iron core, which enhances the magnetic effect by concentrating the magnetic field lines. This magnetic field can be controlled by switching the current ON or OFF and by varying the strength of current.

Key Points: Magnetic field lines inside solenoid are parallel and strong - Magnetic field lines outside solenoid form closed loops and are weak - Electromagnet is made by passing current through a coil with soft iron core