# CBSE Class 10 Science 2026 — Set 4 — Answer Key

English Medium

Time Allowed: 3 Hours | Maximum Marks: 80

General Instructions:

1. This question paper contains 39 questions. All questions are compulsory.
2. Section A has 20 MCQs carrying 1 mark each.
3. Section B has 6 questions carrying 2 marks each.
4. Section C has 7 questions carrying 3 marks each.
5. Section D has 3 questions carrying 5 marks each.
6. Section E has 3 case-study based questions carrying 4 marks each.
7. Draw neat diagrams wherever required.

# Section A

## Multiple Choice Questions (1 mark each)

Q.1 [1 mark]

Observe the given figure and select the statement that correctly states how these fungi obtain nutrition.

(a) By eating the bread on which it is growing.

(b) By using nutrients from the bread to prepare their own food.

(c) By breaking down the nutrients of bread outside the body and then absorbing them. <<

(d) By allowing other organisms to grow on the bread and then consuming them.

Explanation:

Fungi (like bread mould) are saprophytes.

They secrete digestive enzymes onto the food, break down nutrients outside the body (extracellular digestion), and then absorb the simpler substances.

Q.2 [1 mark]

If the part 'P' of the flower is removed, which of the following processes will not take place ?

(a) Formation of pollens <<

(b) Formation of flower

(c) Formation of fruit

(d) Formation of seed

Explanation:

In the printed figure the label P points to the filament (base) of a stamen, i.e. the stamen carrying the anther.

Removing the stamen removes the anthers, so no pollen is formed.

The ovary and ovules remain, so the flower, fruit and seed are not directly affected by this part's removal.

Q.3 [1 mark]

Given below are some of the statements regarding our environment : (i) Change in our life-styles have resulted in greater amounts of waste material generation. (ii) Changes in attitude have resulted in use of more disposable things. (iii) Changes in packaging has resulted in much of our waste becoming non-biodegradable. (iv) Organic farming. Which amongst these is not leading to any damage of environment ?

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

Explanation:

Statements (i), (ii) and (iii) describe practices that increase waste and non-biodegradable pollution, damaging the environment.
Organic farming (iv) is eco-friendly and does not damage the environment.

Q.4 [1 mark]

Identify the traits that cannot be transmitted from parents to the off-springs : (i) Swimming technique (ii) Blood group (iii) Eye colour (iv) Dancing skills

(a) (i) and (ii)
(b) (i) and (iv) <<
(c) (iii) and (iv)
(d) (ii) and (iii)

Explanation:

Swimming technique (i) and dancing skills (iv) are acquired (learned) traits, not encoded in genes, so they are not inherited.
Blood group (ii) and eye colour (iii) are genetically determined and are inherited.

Q.5 [1 mark]

Following are the statements about the different parts of the brain. Select the correct statements. (i) The thinking part of the brain is the forebrain. (ii)

Centres for smell, hearing, memory, sight are located in forebrain. (iii) Salivation, vomiting, blood pressure are controlled by medulla in the hind brain. (iv) Cerebellum does not control the posture and balance of the body.

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

Explanation:
(i), (ii) and (iii) are correct.
(iv) is wrong because the cerebellum DOES control posture and balance.
Hence the correct statements are (i), (ii) and (iii).

Q.6 [1 mark]

Two pea plants, one with round green seeds (RRyy) and another with wrinkled yellow (rrYY) seeds were crossed with each other which produced F1 progeny that have only round yellow (RrYy) seeds. When F1 plants are self-pollinated, the F2 progeny will have which new combination of characters, as compared to the parents : (i) Round, yellow (ii) Round, green (iii) Wrinkled, yellow (iv) Wrinkled, green

(a) (i) and (ii)
(b) (i) and (iv) <<
(c) (ii) and (iv)
(d) (i) and (iii)

Explanation:
The parental phenotype combinations were round-green (RRyy) and wrinkled-yellow (rrYY).
In the F2 generation the NEW (non-parental/recombinant) combinations of characters are round-yellow (i) and wrinkled-green (iv).
Hence the answer is (i) and (iv) — option (B).

Q.7 [1 mark]

In human beings the oxygen rich blood is pumped out to the body by :

(a) contraction of right atrium
(b) relaxation of left ventricle
(c) contraction of right ventricle
(d) contraction of left ventricle <<

Explanation:

Oxygen-rich (oxygenated) blood enters the left atrium, passes to the left ventricle, and is pumped out to the body by contraction of the left ventricle.

Q.8 [1 mark]

Assertion (A) : Variations are not often seen in off-springs produced by asexual reproduction. Reason (R) : DNA molecule generated by replication is not similar to the original DNA. Select the appropriate option: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.

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

Explanation:

Assertion is true: asexual reproduction produces nearly identical offspring, so variations are rare.

Reason is false: DNA generated by replication IS similar (nearly identical) to the original DNA.

Hence A true, R false — option (C).

Q.9 [1 mark]

Assertion (A) : Highest percentage of pesticides is found in tertiary consumers in a food chain. Reason (R) : Chemicals / pesticides get accumulated progressively at each trophic level. Select the appropriate option: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.

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

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

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

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

Explanation:

Both statements are true.

Biomagnification causes pesticides to accumulate progressively at each trophic level, so the highest concentration is in tertiary consumers (top of the chain).

The Reason correctly explains the Assertion — option (A).

Q.10 [1 mark]

"Transpiration in plants is a necessary evil." Comment on the statement giving two reasons.

Answer: Necessary: creates suction pull for water/mineral transport and cools the plant; Evil: causes loss of large amounts of water

Explanation:

Necessary (advantages): (1) Transpiration pull creates the suction force that transports water and dissolved minerals upward from roots to leaves.

(2) It cools the plant / regulates temperature.

Evil (disadvantage): It leads to loss of large amounts of water, which can cause wilting, especially when water is scarce.
Hence a 'necessary evil'.

Q.11 [1 mark]

Explain why food chains generally consist of three or four steps.

Answer: Only ~10% of energy is transferred to the next trophic level (10% law), so energy is exhausted after 3–4 steps

Explanation:
At each trophic level only about 10% of the energy is passed on to the next level; the rest is lost as heat and used in life processes (10% law).
After 3–4 levels the available energy becomes too little to support another trophic level, so food chains are limited to three or four steps.

Q.12 [1 mark]

(A) Varun is diabetic. His latest ultrasound reports showed a blockage in his pancreatic duct. How will this affect the dual functioning of the pancreas ?

Answer: Exocrine (digestive) function is blocked so pancreatic juice/enzymes cannot reach the duodenum, impairing digestion; endocrine (insulin) function via blood is unaffected

Explanation:
The pancreas has dual functions: exocrine (secretes pancreatic juice with digestive enzymes like trypsin, lipase, amylase through the pancreatic duct into the small intestine) and endocrine (secretes hormones insulin/glucagon directly into the blood).
A blockage of the pancreatic duct stops the exocrine secretion from reaching the duodenum, so digestion of proteins, fats and carbohydrates is impaired.
The endocrine function (hormone release into blood) is not affected by the duct blockage.

OR

Q.12 [1 mark]

(B) Sunil unconsciously touched the hot iron rod and immediately withdrew

his hand. Which type of action is involved ? Also define this action. Draw a flow chart to show the path followed for this action.

Answer: Reflex action; Path: Receptor (skin) → Sensory neuron → Spinal cord (relay/interneuron) → Motor neuron → Effector (muscle of hand)

Explanation:

This is a reflex action — a sudden, involuntary, rapid response to a stimulus that does not involve conscious thought by the brain, controlled by the spinal cord.

Flow chart (reflex arc): Stimulus (hot rod) →

Receptor in skin →

Sensory (afferent) neuron →

Spinal cord (relay neuron) →

Motor (efferent) neuron →

Effector (arm muscle) →

Response (hand withdrawn).

Q.13 [1 mark]

Give reasons for the following : (a) Adrenal gland is known as the stress gland of the body. (b) Prenatal sex determination is banned in India. (c) Vegetative propagation is advantageous in some plants.

Answer: (a) It secretes adrenaline during emergencies/stress to prepare the body for fight or flight; (b) To prevent female foeticide and maintain a healthy sex ratio; (c) Faster reproduction and offspring identical to parent, retaining desirable traits

Explanation:

(a) The adrenal gland secretes adrenaline in stress/emergency situations, increasing heart rate, breathing and blood supply to muscles (fight-or-flight), so it is called the stress gland.

(b) Prenatal sex determination is banned to stop female foeticide/female infanticide, which was causing a skewed (declining female) sex ratio.

(c) Vegetative propagation lets plants that don't produce viable seeds still reproduce, is faster, and produces offspring genetically identical to the parent, preserving desirable characters (e.g., seedless fruits like banana).

Q.14 [1 mark]

Study the given table and answer the following questions : Parents — A pea plant with red flowers was crossed with a pea plant with white flowers. F1 — 30 seeds were sown and all bore plants with red flowers. F2 — 44 seeds were sown, 33 plants bore red flowers and 11 plants bore white flowers. (a) Depict the information given in the table in the form of a cross. (b) Deduce the F2 phenotypic ratio/F2 ratio showing external look as well as genotypic /genetic makeup, ratio.

Answer: (a) RR (red) × rr (white) → F1 all Rr (red) → F1 self × F1 self → F2: 1 RR : 2 Rr : 1 rr; (b) Phenotypic ratio = 3 red : 1 white; Genotypic ratio = 1 RR : 2 Rr : 1 rr

Explanation:

Red is dominant (R), white recessive (r).

Parents: RR (red) × rr (white) → F1 all Rr, red.

F1 selfed: Rr × Rr gives genotypes 1 RR : 2 Rr : 1 rr.

Phenotypes: 3 red : 1 white.

Matches observed 33 red : 11 white = 3 : 1.

Q.15 [1 mark]

Plants exhibit movements in response to various environmental stimuli to adopt and survive in their surroundings. These movements, influenced by external factors such as light, gravity, water and chemicals are regulated by specific plant hormones. For example, the differential growth of plant parts allows them to bend, grow or orient themselves in particular directions. Roots and shoots often show contrasting response to the same stimulus, highlighting the complex mechanisms involved in plant growth and development. (a) Why is hydrotropism essential for plants ?

Answer: Hydrotropism lets roots grow towards water/moisture, ensuring adequate water and mineral absorption for survival

Explanation:

Hydrotropism is the growth movement of a plant part in response to water.

It is essential because it directs roots to grow towards the source of water and moisture in the soil, ensuring the plant absorbs sufficient water and dissolved minerals needed for survival and growth.

Q.16 [1 mark]

(b) What role does auxin play in the growth of plants ?

Answer: Auxin promotes cell elongation; it accumulates on the shaded side of a shoot causing that side to grow faster and the shoot to bend towards light (phototropism)

Explanation:

Auxin is a plant hormone synthesized at the shoot tip that promotes cell elongation.

When light falls on one side, auxin diffuses to the shaded side, causing cells there to elongate more, so the shoot bends towards the light.

Thus auxin controls directional (tropic) growth and elongation of plant parts.

Q.17 [1 mark]

(c) Differentiate between movement shown by the sensitive plant and tropic movement by plants (Two points).

Answer: Sensitive plant movement (nastic): non-directional, independent of stimulus direction, not a growth movement (fast, reversible, due to turgor change); Tropic movement: directional (towards/away from stimulus), a growth movement (slow, permanent, due to differential growth)

Explanation:

Sensitive plant (touch/nastic) movement: (1) It is non-directional — the direction is independent of the direction of the stimulus.

(2) It is not due to growth;

it results from sudden changes in turgor/water in cells, is fast and reversible.

Tropic movement: (1) It is directional — towards or away from the stimulus.

(2) It is a growth movement caused by differential (unequal) growth of cells, is slow

and generally permanent.

OR

Q.16 [1 mark]

(c) How does movement of roots differ from that of shoots in response to gravity and light ?

Answer: Roots: positively geotropic (grow towards gravity/downward) and negatively phototropic (grow away from light); Shoots: negatively geotropic (grow against gravity/upward) and positively phototropic (grow towards light)

Explanation:

In response to gravity, roots are positively geotropic (grow downward, towards gravity) while shoots are negatively geotropic (grow upward, against gravity).

In response to light, roots are negatively phototropic (grow away from light) while shoots are positively phototropic (grow towards light).

Q.17(b) [1 mark]

16. (A) (a) Draw a labelled diagram showing open and closed stomatal pore. (b) List the main events that occur during the process of photosynthesis. (c) Write a balanced chemical equation showing photosynthesis in plants.

Answer: (a) Diagram: guard cells swollen (turgid) with open pore; guard cells flaccid with closed pore. (b) Absorption of light by chlorophyll; conversion of light energy to chemical energy and splitting of water into hydrogen and oxygen; reduction of carbon dioxide to carbohydrates. (c) $6CO_2 + 6H_2O \rightarrow$(sunlight, chlorophyll) $C_6H_{12}O_6 + 6O_2$

Explanation:

(a) A stoma is bounded by two bean-shaped guard cells;

when turgid (water enters) the pore opens, when flaccid it closes.

(b) Main events of photosynthesis: (1) Absorption of light energy by chlorophyll.

(2) Conversion of light energy to chemical energy and splitting (photolysis) of water molecules into hydrogen and oxygen.

(3) Reduction of carbon dioxide to carbohydrates (glucose).

(c) Balanced equation: $6CO_2 + 6H_2O \rightarrow (sunlight/chlorophyll)\ C_6H_{12}O_6 + 6O_2$.

Q.0

16. (B) (a) Draw a well-labelled diagram of nephron and label atleast 4 of its parts. (b) Write the role of capillary cluster inside Bowman's capsule. (c) What is meant by selective reabsorption ?

Answer: (a) Nephron labels: Glomerulus, Bowman's capsule, proximal/distal convoluted tubule, Loop of Henle, collecting duct. (b) The capillary cluster (glomerulus) filters the blood under pressure, so water, glucose, salts, urea etc. are filtered into Bowman's capsule. (c) Selective reabsorption is the process by which useful substances (glucose, amino acids, most water, some salts) are reabsorbed back into the blood from the filtrate in the tubule, while wastes are retained.

Explanation:

(a) A nephron consists of the glomerulus, Bowman's capsule, proximal convoluted tubule, Loop of Henle, distal convoluted tubule and collecting duct (any four to be labelled).

(b) The capillary cluster (glomerulus) inside Bowman's capsule acts as a filter: blood entering under high pressure is filtered so that water, glucose, amino acids, salts and urea pass into Bowman's capsule (glomerular filtration).

(c) Selective reabsorption is the process in the tubule where useful substances such as glucose, amino acids, most water and some salts are selectively reabsorbed back into the blood, so only wastes and excess water are excreted as urine.

Q.18 [1 mark]

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

(a) 1 : 1

(b) 2 : 1 <<

(c) 4 : 1

(d) 1 : 2

Explanation:

Electrolysis of water: $2H_2O \rightarrow 2H_2 + O_2$.

Two volumes of hydrogen are liberated for every one volume of oxygen, so the ratio of hydrogen to oxygen is 2 : 1.

Q.19 [1 mark]

$C_6H_{12}O_6(aq) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(l)$. The above reaction is an example of -

(a) Displacement Reaction

(b) Endothermic Reaction

(c) Exothermic Reaction <<

(d) Neutralisation Reaction

Explanation:

This is respiration — the oxidation of glucose that releases energy (heat).

A reaction that releases energy is exothermic.

Hence it is an exothermic reaction.

Q.20 [1 mark]

An aqueous solution turns red litmus blue. Excess addition of which of the following solution would reverse the change ?

(a) Sodium hydroxide

(b) Hydrochloric acid <<

(c) Baking soda

(d) Slaked lime

Explanation:

A solution turning red litmus blue is basic.

To reverse it (make it acidic, turning blue litmus red again) an acid must be added in excess.

Among the options only hydrochloric acid is an acid; the others are basic.

Hence hydrochloric acid.

## Section B

Very Short Answer Questions (2 marks each)

Q.21 [2 marks]

While washing dirty clothes by soap, micelles are formed. Select the correct statement about micelles.

(a) The hydrophobic tail of the soap molecule is in the interior of the cluster, whereas hydrophilic end is on the surface of the cluster. <<

(b) The hydrophobic tail is on the surface of the cluster, whereas hydrophilic end is in the interior of cluster.

(c) Both hydrophobic tail and hydrophilic end are in the interior of the cluster.

(d) Both hydrophobic tail and hydrophilic end are on the surface of the cluster.

Explanation:

In a micelle, the hydrophobic (oil-loving) tails point inward towards the dirt/grease at the centre, while the hydrophilic (water-loving) heads face outward on the surface, in contact with water.

Hence option (A).

Q.22 [2 marks]

Which one of the following metals does not react with cold water ?

(a) Sodium

(b) Potassium

(c) Calcium

(d) Magnesium <<

Explanation:

Sodium and potassium react vigorously with cold water, and calcium reacts (less vigorously).

Magnesium does not react with cold water; it reacts only with hot water/steam.

Hence magnesium.

Q.23 [2 marks]

Alloys are homogeneous mixture of metal with a metal or non-metal. Which among the following alloys contain non-metal as one of its constituents ?

(a) Brass
(b) Bronze
(c) Amalgam
(d) Steel <<

Explanation:

Brass = copper + zinc (both metals);
Bronze = copper + tin (both metals);
Amalgam = a metal + mercury (both metals).
Steel = iron + carbon, where carbon is a non-metal.
Hence steel.

Q.24 [2 marks]

How will you protect yourself from the heat generated while diluting a concentrated acid ?

(a) By adding acid to water with constant stirring. <<
(b) By adding water to acid with constant stirring.
(c) By adding water to acid followed by base.
(d) By adding base to acid with constant stirring.

Explanation:

Diluting a concentrated acid is highly exothermic.
Always add acid slowly to water with constant stirring so the large volume of water absorbs the heat safely.
Adding water to acid can cause the mixture to spurt out.
Hence option (A).

Q.25 [2 marks]

Assertion (A) : Pure ethanoic acid is also known as glacial acetic acid.
Reason (R) : Pure ethanoic acid often freezes during winter due to its low

melting point of 290 K. Select the appropriate option: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.

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

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

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

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

Explanation:

Both statements are true.

Pure ethanoic acid is called glacial acetic acid precisely because it freezes (forms ice-like crystals) in cold weather due to its melting point of 290 K (~17°C).

The Reason correctly explains the Assertion — option (A).

Q.26 [2 marks]

25. (a) A compound 'A' is used in soda-lime fire-extinguisher and decomposes on heating to form compound 'B'. Compound 'B' is used for removing permanent hardness of water. Identify 'A' and 'B'.

Answer: A = Sodium bicarbonate/baking soda ($NaHCO_3$); B = Sodium carbonate/washing soda ($Na_2CO_3$)

Explanation:

Sodium bicarbonate (baking soda, $NaHCO_3$) is used in soda-acid fire extinguishers.

On heating it decomposes: $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$.

The product B, sodium carbonate (washing soda, $Na_2CO_3$), is used to remove permanent hardness of water.

So A = $NaHCO_3$, B = $Na_2CO_3$.

## Section C

Short Answer Questions (3 marks each)

Q.27 [3 marks]

25. (b) Write chemical formula of Plaster of Paris. At what temperature gypsum is heated to obtain Plaster of Paris ?

Answer: Formula: $CaSO_4 \cdot \frac{1}{2}H_2O$ (calcium sulphate hemihydrate); Gypsum is heated to about 373 K (100°C)

Explanation:

Plaster of Paris is calcium sulphate hemihydrate, $CaSO_4 \cdot \frac{1}{2}H_2O$.

It is made by heating gypsum ($CaSO_4 \cdot 2H_2O$) to about 373 K (100°C), which drives off part of the water: $CaSO_4 \cdot 2H_2O \rightarrow CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O$.

Q.28 [3 marks]

Account for the following : (a) White silver chloride turns grey when exposed to sunlight. (b) Lead (II) nitrate on heating releases brown fumes. (c) Bags of oil and fat containing food items are flushed with nitrogen gas.

Answer: (a) Sunlight decomposes AgCl into silver metal (grey) and chlorine: $2AgCl \rightarrow 2Ag + Cl_2$ (photodecomposition); (b) Lead nitrate decomposes to give brown $NO_2$ fumes: $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$; (c) Nitrogen is inert/unreactive and displaces oxygen, preventing oxidation (rancidity) of oils and fats

Explanation:

(a) Silver chloride undergoes photochemical decomposition in sunlight: $2AgCl \xrightarrow{\text{(light)}} 2Ag + Cl_2$.

The finely divided silver metal formed is grey.

(b) On heating, lead(II) nitrate decomposes: $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2\uparrow + O_2\uparrow$.

Nitrogen dioxide ($NO_2$) is the brown gas released.

(c) Oils and fats become rancid on oxidation by atmospheric oxygen.

Flushing the bag with unreactive nitrogen removes/replaces oxygen, preventing oxidation and thus rancidity, keeping the food fresh.

Q.29 [3 marks]

27. (A) (i) Which method will be used to convert each of them to their respective metal oxides ? (a) Carbonate ore (b) Sulphide ore (ii) Write a chemical reaction to illustrate the use of aluminium for joining cracked railway tracks. (iii) During extraction of metals, electrolytic refining is used to obtain pure metals. Which material will be used as anode and cathode for the refining of copper metal by this process ?

Answer: (i)(a) Carbonate ore → Calcination; (b) Sulphide ore → Roasting. (ii) Thermite reaction: $2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3 + heat$. (iii) Anode = impure copper (thick block of impure Cu); Cathode = pure/thin strip of copper.

Explanation:

(i)(a) Carbonate ores are converted to oxides by calcination (heating strongly in limited/absence of air), e.g.

$ZnCO_3 \rightarrow ZnO + CO_2$.

(b) Sulphide ores are converted to oxides by roasting (heating strongly in excess air), e.g.

$2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$.

(ii) The thermite reaction is used to weld cracked railway tracks: $2Al + Fe_2O_3 \rightarrow 2Fe + Al_2O_3 + heat$; the molten iron produced fills the crack.

(iii) In electrolytic refining of copper, the anode is impure copper and the cathode is a strip of pure copper;

an aqueous copper sulphate solution is the electrolyte.

OR

Q.29 [3 marks]

27. (B) (i) Write all the reactions involved in the extraction of Zn from ZnS. (ii) Hydrogen gas is not evolved when most of the metals react with nitric acid. Give reason.

Answer: (i) Roasting: $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$; Reduction: $ZnO + C \rightarrow Zn + CO$. (ii) $HNO_3$ is a strong oxidising agent; it oxidises the $H_2$ that would form to water and is itself reduced to nitrogen oxides ($NO_2$/NO/$N_2O$), so hydrogen gas is

not evolved.

Explanation:

(i) Zinc is extracted from its sulphide ore (zinc blende, ZnS): first roasting converts sulphide to oxide, $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$; then reduction of the oxide with carbon (coke), $ZnO + C \rightarrow Zn + CO$.

(ii) Nitric acid is a strong oxidising agent.

When metals react with it, the hydrogen produced is immediately oxidised to water by $HNO_3$, while nitric acid itself is reduced to oxides of nitrogen ($NO_2$, NO or $N_2O$). Therefore hydrogen gas is generally not liberated.

Q.30 [3 marks]

The pH plays an important role in our daily life. Strength of acids and bases depends on the number of $H^+$ ions and $OH^-$ ions produced by these respectively. pH scale helps in predicting the strength of acids and bases by measuring hydrogen ion concentration in a solution. Answer the following :

(a) What type of indicator is used to predict how strong an acid or base is ?

Answer: Universal indicator (a mixture of indicators showing different colours over the whole pH range)

Explanation:

To predict how strong an acid or base is, a universal indicator is used.

It is a mixture of several indicators that shows a range of different colours over the entire pH scale (0–14), so the exact pH — and hence the strength — can be estimated from the colour.

Q.31 [3 marks]

(b) Three solutions A, B and C showed pH as 3, 5 and 7. Which solution has the highest concentration of $H^+$ ions ?

Answer: Solution A (pH = 3)

Explanation:

The lower the pH, the higher the hydrogen-ion (H+) concentration.

Solution A has the lowest pH (3), so it has the highest concentration of H+ ions.

Q.32 [3 marks]

(c) What are strong acids and weak acids ?

Answer: Strong acids ionise completely in water producing a large number of H+ ions; weak acids ionise only partially producing few H+ ions

Explanation:

A strong acid is one that ionises (dissociates) completely in aqueous solution, releasing a large number of H+ ions (e.g.

HCl, $H_2SO_4$, $HNO_3$).

A weak acid ionises only partially in water, releasing comparatively few H+ ions (e.g. acetic acid, carbonic acid).

OR

Q.32 [3 marks]

(c) (i) Under what condition is rainwater called acid rain ? (ii) In the following acids, identify weak acids : Nitric acid, hydrochloric acid, acetic acid, sulphuric acid, formic acid.

Answer: (i) When the pH of rainwater falls below 5.6 (due to dissolved oxides of nitrogen and sulphur), it is called acid rain. (ii) Weak acids: acetic acid and formic acid.

Explanation:

(i) Rainwater is called acid rain when its pH is less than 5.6, caused by oxides of sulphur and nitrogen ($SO_2$, $NO_2$) in the air dissolving to form sulphuric and nitric acids.

(ii) Among the given acids, nitric acid, hydrochloric acid and sulphuric acid are strong acids (fully ionised), while acetic acid and formic acid are weak acids (only partially ionised).

Q.33 [3 marks]

29. (A) (i) Carbon cannot form C4+ cation and C4– anion. Explain. (ii) Define homologous series of carbon compounds. Why are the melting and boiling points of C4H10 higher than C3H8 or C2H6 ? (iii) What happens when ethanol is heated with acidified potassium dichromate ?

Answer: (i) To form C4+ it would need to remove 4 electrons (needs very large energy) and to form C4– it would need to gain 4 electrons (unstable with 6 protons holding 10 electrons); so carbon shares electrons (covalent bonds) instead. (ii) A homologous series is a group of organic compounds with the same general formula, similar chemical properties, in which successive members differ by a –CH2– unit. C4H10 has a higher molecular mass/larger size than C3H8 and C2H6, so stronger intermolecular forces → higher melting/boiling points. (iii) Ethanol is oxidised to ethanoic (acetic) acid; the orange dichromate is reduced (turns green).

Explanation:

(i) Carbon has 4 valence electrons.

Losing 4 electrons to form C4+ requires a very large amount of energy (not feasible), and gaining 4 electrons to form C4– is unstable because 6 protons cannot hold 10 electrons.

So carbon completes its octet by sharing electrons, forming covalent bonds.

(ii) Homologous series: a series of carbon compounds having the same general formula and similar chemical properties, where consecutive members differ by a CH2 group (and a molecular mass of 14 u).

As molecular size and mass increase from C2H6 →

C3H8 →

C4H10, van der Waals forces increase, so C4H10 has higher melting and boiling points.

(iii) On heating with acidified potassium dichromate (an oxidising agent), ethanol (C2H5OH) is oxidised to ethanoic acid (CH3COOH);

the orange colour of dichromate changes to green.

OR

Q.33 [3 marks]

29. (B) (i) How would you name the following : I. CH3 – CH2 – C(=O)H (i.e. CH3–CH2–CHO) II. CH3 – C≡CH (ii) When ethanol reacts with ethanoic acid in the presence of conc. H2SO4, a substance with sweet smell is produced. Answer the following : I. State the class of compounds to which the sweet smelling compounds belong. II. Write the chemical equation for the reaction. (iii) Why soaps do not produce foam with hard water ?

Answer: (i) I. Propanal ; II. Propyne. (ii) I. Esters. II. CH3COOH + C2H5OH →(conc. H2SO4) CH3COOC2H5 + H2O (ethyl ethanoate/ester). (iii) Hard water contains Ca2+/Mg2+ ions which react with soap to form insoluble scum, so soap does not lather/foam.

Explanation:

(i) I.

CH3–CH2–CHO has 3 carbons with a –CHO group → propanal (an aldehyde).

II.

CH3–C≡CH has 3 carbons with a triple bond → propyne (an alkyne).

(ii) The reaction of an alcohol with a carboxylic acid in conc.

H2SO4 is esterification; the sweet-smelling product is an ester.

Equation: CH3COOH + C2H5OH →(conc.

H2SO4) CH3COOC2H5 (ethyl ethanoate) + H2O.

(iii) Hard water contains calcium and magnesium salts.

Soap reacts with these Ca2+ and Mg2+ ions to form an insoluble precipitate called scum, so it does not produce lather/foam and cleaning is poor.

## Section D

Long Answer Questions (5 marks each)

Q.34 [5 marks]

The pair of eye parts responsible for admitting different amount of light in to the eyes is

(a) Iris and pupil <<

(b) Ciliary muscles and pupil

(c) Retina and Iris

(d) Ciliary muscles and cornea

Explanation:

The iris controls the size of the pupil, and the pupil is the opening that regulates and admits the amount of light entering the eye.

Hence the pair is iris and pupil.

Q.35 [5 marks]

The vision defect which arises due to gradual weakening of the ciliary muscles and diminishing flexibility of eye lens is :

(a) Myopia

(b) Hypermetropia

(c) Presbyopia <<

(d) Myopia and hypermetropia both

Explanation:

Presbyopia is the age-related defect caused by gradual weakening of the ciliary muscles and loss of flexibility (elasticity) of the eye lens, making it hard to focus on near objects.

Hence presbyopia.

Q.36 [5 marks]

Assertion (A) : With the help of compass, magnetic field lines can be traced outside the bar magnet. Reason (R) : The north pole of a compass needle always points towards the south pole of the magnet when brought close to it. Select the appropriate option: (A) Both Assertion (A) and Reason (R) are true and Reason (R) is the correct explanation of the Assertion (A). (B) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A). (C) Assertion (A) is true, but Reason (R) is false. (D) Assertion (A) is false, but Reason (R) is true.

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

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

correct explanation of the Assertion (A).

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

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

Explanation:

Both statements are true.

A compass is used to trace magnetic field lines around a bar magnet because its needle aligns along the field.

The needle's north pole is attracted to (points towards) the magnet's south pole, which is exactly why it can trace the field direction.

The Reason correctly explains the Assertion — option (A).

## Section E

Case Study Based Questions (4 marks each)

Q.37 [4 marks]

33. (A) A fuse in electric circuit is rated 4 A. Can it be used with an electric heater of rating 2 kW, 200 V ? Explain your answer.

Answer: No. The heater draws I = P/V = 2000/200 = 10 A, which is greater than the 4 A fuse rating, so the 4 A fuse would blow. A fuse of higher rating (at least 10 A) is needed.

Explanation:

Current drawn by the heater = Power / Voltage = 2000 W / 200 V = 10 A.

Since 10 A is much greater than the fuse rating of 4 A, the fuse would melt/blow immediately.

Therefore a 4 A fuse cannot be used with this heater;

a fuse rated at least 10 A (in practice slightly higher) is required.

OR

Q.37 [4 marks]

33. (B) How is an electromagnet made ? Write any two ways by which the strength of electromagnet can be increased.

Answer: Made by winding an insulated copper wire (coil/solenoid) around a soft

iron core and passing electric current through it. Strength increased by: (1) increasing the number of turns in the coil, (2) increasing the current through the coil.

Explanation:

An electromagnet is made by winding an insulated copper wire in the form of a coil (solenoid) around a soft iron core and passing an electric current through the coil, which magnetises the iron.

Two ways to increase its strength: (1) increase the number of turns of the coil;

(2) increase the current flowing through the coil.

(Using a soft-iron core of larger cross-section also increases strength.)

Q.38 [4 marks]

34. (a) Define volt, the unit of potential difference. (b) Calculate the work done required to move an electron between two points A and B located at a potential difference of 100 V in an electric field.

Answer: (a) One volt is the potential difference between two points when 1 joule of work is done to move a charge of 1 coulomb between them (1 V = 1 J/C). (b) Work done = q × V = $1.6\times10^{-19}$ C × 100 V = $1.6\times10^{-17}$ J

Explanation:

(a) The volt is defined as the potential difference between two points such that 1 joule of work is done in moving a charge of 1 coulomb from one point to the other: 1 V = 1 J/C.

(b) Work done W = charge × potential difference = q × V.

Charge of an electron q = $1.6\times10^{-19}$ C, V = 100 V.

So W = $1.6\times10^{-19}\times100 = 1.6\times10^{-17}$ J.

Q.39 [4 marks]

35. (a) Observe the given ray diagram and compare : (i) the speed of light in medium A and the speed of light in medium B. (ii) the optical densities of medium B and medium C. (b) Draw a ray diagram for refraction where the optical density of medium 'A' becomes equal to the optical density of medium

'C' and optical density of medium 'B' is greater than the optical density of medium 'A' and medium 'C'.

Answer: (a)(i) Speed of light is greater in the optically rarer medium — the ray bends towards the normal on entering the denser medium; from the diagram light bends towards the normal going A→B, so B is denser and speed of light in A > speed of light in B. (ii) Comparing B and C from the bending: the medium in which the ray bends towards the normal is denser; per the diagram optical density of B > optical density of C. (b) With A and C equal in density and B denser, the ray bends towards the normal entering B and away from the normal leaving B, emerging parallel to the incident ray (lateral shift) — like light through a rectangular glass slab.

Explanation:

Refraction rule: light bends towards the normal when going from a rarer to a denser medium (and slows down), and away from the normal when going from denser to rarer (speeding up).

(a)(i) Since the ray bends towards the normal on going A→B, medium B is optically denser than A, so light travels faster in the rarer medium: speed in A > speed in B.

(ii) From the diagram the bending shows B is denser than C, so optical density of B is greater than that of C.

(b) When medium A and medium C have equal optical density and B (in between) is denser, the situation is like a glass slab between identical media: the ray bends towards the normal entering B and away from the normal on leaving into C, emerging parallel to the incident ray with only a lateral displacement.

Q.40

36. Explain the phenomenon of rainbow formation in the sky. Draw the labelled ray diagram in support of your explanation.

Answer: A rainbow forms when sunlight is dispersed by tiny water droplets in the atmosphere after rain: each droplet refracts, internally reflects (total internal reflection) and refracts the light again, splitting white light into its seven colours (VIBGYOR). Ray diagram: sunlight enters a droplet (refraction + dispersion),

reflects internally off the back of the droplet, and refracts again on leaving, emerging as a spread spectrum.

Explanation:

A rainbow is formed by dispersion of sunlight by water droplets suspended in the atmosphere after rain.

Sunlight entering a water droplet is refracted and dispersed into its component colours (different colours bend by different amounts).

This dispersed light undergoes total internal reflection at the inner back surface of the droplet, and is refracted again as it emerges.

The net effect is that each droplet spreads white light into the spectrum VIBGYOR, and light from many droplets reaches the observer's eye to form the arc of the rainbow, with red on the outer edge and violet on the inner edge.

A labelled ray diagram shows: incident sunlight →
refraction (with dispersion) at first surface →
total internal reflection at back →
refraction at exit →
dispersed colours to observer.

Q.41

37. On the basis of the given circuit arrangement, answer the following questions : (a) What happens to the rod AB when the key K is closed and why ? (b) Name and state the rule that determines this behaviour of the rod AB in the above situation.

Answer: (a) When the key K is closed, current flows through the rod AB which is placed in a magnetic field; it experiences a force (given by F on a current-carrying conductor in a magnetic field) and hence moves/is displaced (deflects). (b) Fleming's left-hand rule: stretch the thumb, forefinger and middle finger of the left hand mutually perpendicular; if the forefinger points in the direction of the magnetic field and the middle finger in the direction of current, then the thumb points in the direction of the force/motion of the conductor.

Explanation:

(a) A current-carrying conductor placed in a magnetic field experiences a mechanical force.

When key K is closed, current flows through rod AB (which lies in the magnetic field of the magnet), so AB experiences a force and is pushed/displaced.

(b) The direction of this force is given by Fleming's left-hand rule: hold the thumb, forefinger and centre finger of the left hand mutually perpendicular;

the forefinger indicates the direction of the magnetic field, the centre (middle) finger the direction of the current, and the thumb then gives the direction of the force (motion) on the conductor AB.

Q.42

38. The above ray diagram is to show image formation by a reflecting telescope. Reflecting telescope revolutionized our way of looking into the sky. Reflecting telescopes employ large mirrors to gather and focus light rather than relying solely on lenses as we do in the refracting telescopes. These telescopes utilize precisely shaped and polished mirrors to capture incoming light and reflect it to a focal point, where the telescope forms an image for observation. (a) What kind of image of a star is seen by the observer in the eye-piece ?

Answer: A magnified, virtual and erect (bright, enlarged) image of the star

Explanation:

In a telescope the eye-piece acts as a magnifier: the observer sees a magnified virtual image of the distant object (star).

The image seen through the eye-piece is enlarged (magnified) and virtual.

Q.43

38. (b) What kind of mirror is used in this reflecting telescope ?

Answer: A concave mirror (large concave/curved mirror as the objective) is used to gather and focus the light

Explanation:

A reflecting telescope uses a large concave mirror as its objective.

The concave mirror gathers the incoming light from the distant object and converges (focuses) it to form an image, which is then viewed through the eye-piece.

Q.44

38. (c) Explain with the reason, what kind of optical device (type of lens or mirror) is used at the eye-piece.

Answer: A convex lens is used at the eye-piece because it acts as a magnifying glass, forming a magnified virtual image of the real image produced by the concave mirror.

Explanation:

A convex (converging) lens is used as the eye-piece.

Reason: the concave objective mirror forms a real image, and the convex lens placed near it acts as a simple magnifying glass — when the image lies within its focal length it produces a magnified, virtual and erect image, enabling clear enlarged viewing of the object.

OR

Q.44

38. (c) What is the role of plane mirror in image formation by this telescope ?

Answer: The plane mirror (secondary mirror) reflects/turns the light gathered by the concave mirror to one side (towards the eye-piece), so the image can be conveniently viewed by the observer.

Explanation:

In a reflecting telescope a small plane mirror (secondary mirror) is placed in the path of the converging light from the large concave mirror.

Its role is to reflect/deflect this light to the side of the telescope tube towards the eye-piece, allowing the observer to view the image conveniently without blocking the incoming light.

Q.45

39. (A) (i) The given electric circuit is a part of an electrical device. Use the information given in the electric circuit diagram to calculate : (I) Potential difference across the ends of resistor R2. (II) Value of resistor R2. (III) Value of resistor R1. (ii) Write the factors on which resistance of a conductor depends and derive the formula for resistance of a given conductor.

Answer: (i)(I) 6 V (II) 12 Ω (III) 1 Ω. (ii) R depends on length, area of cross-section, material (resistivity ρ) and temperature; R = ρl/A.

Explanation:

(i) The 2.0 A passes through R1 and the 2.0 Ω resistor;

in the parallel part 1.5 A flows through the 4.0 Ω resistor, so the current through R2 = 2.0 − 1.5 = 0.5 A.

(I) P.D.

across R2 = P.D.

across 4.0 Ω = 1.5 × 4.0 = 6 V.

(II) R2 = V/I = 6/0.5 = 12 Ω.

(III) P.D.

across the 2.0 Ω resistor = 2.0 × 2.0 = 4 V; P.D.

across R1 = 12 − 6 − 4 = 2 V, so R1 = 2/2.0 = 1 Ω.

(ii) Resistance depends on length ($R \propto l$), area of cross-section ($R \propto 1/A$), nature of material (resistivity ρ) and temperature.

Combining: $R \propto l/A$, so $R = \rho l/A$.

OR

Q.45

39. (B) (i) How much electric current will an electric iron draw from 220 V source if the resistance of its heating element when hot, is 55 Ω ? Calculate the power consumed by the electric iron when it is operated at 220 V. (ii) In a house, 3 bulbs of 100 watt each, are lit for 5 hours daily and an electric heater of 1.0 kW is used for half an hour daily. Calculate the total energy consumed in a month of 30 days and its cost at the rate of Rs. 3.60 per kWh. (iii) With reason explain, why are alloys commonly used to make elements of

electrical heating devices.

Answer: (i) I = V/R = 220/55 = 4 A; Power P = VI = 220 × 4 = 880 W. (ii) Bulbs: 3 × 100 W × 5 h = 1500 Wh = 1.5 kWh/day; Heater: 1.0 kW × 0.5 h = 0.5 kWh/day; total = 2.0 kWh/day; in 30 days = 60 kWh; cost = 60 × Rs.3.60 = Rs.216. (iii) Alloys have high resistivity and high melting point and do not oxidise (burn) readily at high temperature, so they produce a lot of heat without melting or burning.

Explanation:

(i) By Ohm's law, current I = V/R = 220/55 = 4 A.

Power P = V × I = 220 × 4 = 880 W.

(ii) Energy by bulbs per day = 3 × 100 W × 5 h = 1500 Wh = 1.5 kWh.

Energy by heater per day = 1000 W × 0.5 h = 500 Wh = 0.5 kWh.

Total per day = 1.5 + 0.5 = 2.0 kWh.

For 30 days = 2.0 × 30 = 60 kWh (units).

Cost = 60 × Rs.3.60 = Rs.216.

(iii) Alloys are used for heating elements because they have high resistivity (so they produce more heat, H = $I^2Rt$), a high melting point (so they don't melt at the high operating temperature), and they do not oxidise or burn readily at high temperatures, giving durability.