

CBSE Class 10 Science Set - 1 (31/6/1) 2025

Question Paper with Solutions

Time Allowed :3 hours	Maximum Marks :80	Total Questions :38
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. This paper consists of 39 questions. All questions are compulsory.
2. This paper is divided into five sections - A, B, C, D and E.
3. Section A Nos. 1 to 20 are Multiple Choice questions. Each carries 1 mark.
4. Section B Nos. 21 to 26 are Very Short Answer type. Each carries 2 marks. Answer to these s should be in the range of 30 to 50 words.
5. Section C Nos. 27 to 33 are Short Answer (SA) type. Each carries 3 marks. Answer to these s should be in the range of 50 to 80 words.
6. Section D Nos. 34 to 36 are Long Answer type. Each carries 5 marks. Answer to these s should be in the range of 80 to 120 words.
7. Section E Nos. 37 to 39 are of 3 source-based/case-based units of assessment carrying 4 marks each with sub-parts.
8. There is no overall choice. However, an internal choice has been provided in some sections. Only one of the alternatives has to be attempted in such s.

Section A

1. In the following experimental setup of electrolysis of water, if P and Q are the gases collected in the test tubes enclosing the electrodes R and S, then select the option/options in which the matching is correct:

- (i) P - Oxygen gas, R - Anode
 - (ii) P - Hydrogen gas, S - Cathode
 - (iii) Q - Hydrogen gas, R - Cathode
 - (iv) Q - Oxygen gas, S - Anode
- (A) (i) and (ii)
 - (B) (iii) and (iv)
 - (C) (i) and (iii)
 - (D) (ii) and (iv)

Correct Answer: (C) (i) and (iii)

Solution:

Step 1: Understanding the setup. In the electrolysis of water, at the anode (R), oxygen gas (O_2) is released, and at the cathode (S), hydrogen gas (H_2) is released.

Step 2: Assigning the correct gases to P and Q.

- P corresponds to oxygen gas, which is released at the anode (R), so P should be associated with oxygen gas and anode.
- Q corresponds to hydrogen gas, which is released at the cathode (S), so Q should be associated with hydrogen gas and cathode.

Step 3: Conclusion. Thus, the correct matching is (i) and (iii), corresponding to option (C).

Quick Tip

During electrolysis, oxidation occurs at the anode (producing oxygen), and reduction occurs at the cathode (producing hydrogen).

2. You have three aqueous solutions A, B, and C as given below:

A - Potassium nitrate

B - Ammonium chloride

C - Sodium carbonate

The ascending order of the pH of these solutions is:

(A) $A < B < C$

(B) $B < C < A$

(C) $C < A < B$

(D) $B < A < C$

Correct Answer: (C) $C < A < B$

Solution:

Step 1: Understanding the solutions.

- Potassium nitrate (A) is a neutral salt, so its pH is near 7.
- Ammonium chloride (B) is an acidic salt, so its pH is less than 7.
- Sodium carbonate (C) is a basic salt, so its pH is greater than 7.

Step 2: Ascending order of pH. Thus, the ascending order of pH is $C < A < B$, corresponding to option (C).

 Quick Tip

When a salt is formed from a weak acid and a strong base, it is basic in nature. When formed from a strong acid and a weak base, it is acidic.

3. Select from the following a statement which is not true about the burning of magnesium ribbon in air:

(A) It burns with a dazzling white flame.

(B) A white powder is formed on burning.

(C) It is an endothermic reaction.

(D) It is an example of a combination reaction.

Correct Answer: (C) It is an endothermic reaction.

Solution:

Step 1: Understanding the burning of magnesium ribbon.

- When magnesium ribbon burns in air, it produces a dazzling white flame and forms a white powder of magnesium oxide (MgO), which is an exothermic reaction.
- The reaction between magnesium and oxygen is a combination reaction where two reactants combine to form a product.

Step 2: Conclusion. The burning of magnesium is an exothermic reaction, not endothermic. Therefore, statement (C) is incorrect.

 Quick Tip

The burning of magnesium in air is a combination reaction ($\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$) and it releases heat, making it exothermic.

4. A hydrocarbon which does not belong to the same homologous series of carbon compounds is:

- (A) C_4H_{10}
- (B) C_6H_{14}
- (C) C_7H_{14}
- (D) $\text{C}_{10}\text{H}_{22}$

Correct Answer: (D) $\text{C}_{10}\text{H}_{22}$

Solution:

Step 1: Identifying the homologous series.

- C_4H_{10} belongs to the alkane series.
- C_6H_{14} also belongs to the alkane series.
- C_7H_{14} belongs to the alkane series.
- $\text{C}_{10}\text{H}_{22}$ is a higher alkane that doesn't belong to the same series.

Step 2: Conclusion. Thus, the correct answer is option (D) $\text{C}_{10}\text{H}_{22}$.

 Quick Tip

Alkanes follow the general formula $\text{C}_n\text{H}_{2n+2}$, and if a compound does not follow this, it belongs to a different homologous series.

5. The colour of the solution observed after about 1 hour of placing iron nails in copper sulphate solution is:

- (A) Blue
- (B) Pale green
- (C) Yellow
- (D) Reddish brown

Correct Answer: (B) Pale green

Solution:

Step 1: Reaction of iron nails with copper sulphate. When iron nails are placed in copper sulphate solution, a displacement reaction occurs, where iron displaces copper from its salt, forming iron(II) sulfate and copper.

Step 2: Conclusion. The resulting colour of the solution changes to pale green, indicating the formation of iron(II) sulfate.

 Quick Tip

In displacement reactions, a more reactive metal can displace a less reactive metal from its salt solution.

6. Juice of tamarind turns blue litmus to red. It is because of the presence of a chemical compound called:

- (A) Acetic acid
- (B) Methanoic acid
- (C) Oxalic acid
- (D) Tartaric acid

Correct Answer: (D) Tartaric acid

Solution:

Step 1: Identifying the chemical compound. Tamarind juice is acidic due to the presence of tartaric acid, which is a weak acid.

Step 2: Conclusion. Therefore, the correct answer is tartaric acid.

 Quick Tip

Tartaric acid is commonly found in tamarind and gives the juice its characteristic sour taste.

7. The water of crystallization is present in:

- (A) Bleaching Powder
- (B) Washing Soda
- (C) Plaster of Paris
- (D) Baking Soda

Correct Answer: (C) (i) and (iii)

Solution:

Step 1: Understanding water of crystallization. Water of crystallization refers to the water molecules that are part of the crystal structure of certain salts.

Step 2: Analyzing each compound. - Bleaching Powder: Contains water of crystallization.

- Washing Soda: Also contains water of crystallization.

- Plaster of Paris: Contains water of crystallization.

- Baking Soda: Does not contain water of crystallization.

Step 3: Conclusion. Therefore, the correct answer is option (C), which includes Bleaching Powder and Washing Soda.

 Quick Tip

Water of crystallization is important in determining the properties of salts, and it is typically lost when salts are heated.

8. A tall pea plant with round seeds (TTRR) is crossed with a short pea plant with wrinkled seeds (ttrr). The F₁ generation will be:

- (A) 25% tall with round seeds
- (B) 50% tall with wrinkled seeds
- (C) 75% tall with wrinkled seeds
- (D) 100% tall with round seeds

Correct Answer: (D) 100% tall with round seeds

Solution:

Step 1: Identifying the traits. - Tall (T) is dominant to short (t), and round (R) is dominant to wrinkled (r).

- The parental genotypes are TTRR (tall, round) and ttrr (short, wrinkled).

Step 2: Analyzing the F₁ generation. - The F₁ generation will inherit one allele from each parent.

- All F₁ plants will have the genotype TtRr, making them heterozygous for both traits.

Step 3: Conclusion. Since tall (T) and round (R) are both dominant, all F₁ plants will be tall with round seeds.

 Quick Tip

In genetic crosses, the dominant trait is always expressed in the offspring if at least one dominant allele is present.

9. A pair of endocrine glands located in the human brain is:

- (A) Parathyroid and Pituitary
- (B) Pineal and Thymus
- (C) Hypothalamus and Thymus
- (D) Hypothalamus and Pineal

Correct Answer: (D) Hypothalamus and Pineal

Solution:

Step 1: Understanding the function of the glands.

- The Hypothalamus is located in the brain and regulates many bodily functions, including hormone release.

- The Pineal gland is also located in the brain and is responsible for regulating sleep-wake cycles by releasing melatonin.

Step 2: Analyzing the options.

- Option (A) includes Parathyroid, which is not located in the brain, so it is incorrect.

- Option (B) includes Thymus, which is located in the chest, not the brain, so it is incorrect.

- Option (C) includes Thymus again, so it is also incorrect.

- Option (D) is correct, as both the Hypothalamus and Pineal gland are located in the brain.

 Quick Tip

Endocrine glands secrete hormones directly into the bloodstream, helping regulate various physiological processes in the body.

10. Select the option having correct matching of the organism given in Column I with the mode of reproduction in Column II:

Column I Column II

- | | |
|-----------------------|---------------------|
| P - Leishmania | 1. Regeneration |
| Q - Spirogyra | 2. Multiple Fission |
| R - Planaria | 3. Binary Fission |
| S - Plasmodium | 4. Fragmentation |
| - | 5. Budding |

- (A) P-4, Q-2, R-1, S-3
(B) P-3, Q-4, R-5, S-2
(C) P-3, Q-4, R-1, S-2
(D) P-4, Q-3, R-2, S-1

Correct Answer: (C) P-3, Q-4, R-1, S-2

Solution:

Understanding the modes of reproduction.

- Leishmania reproduces by Binary fission (P-3).
- Spirogyra reproduces by Fragmentation (Q-4).
- Planaria reproduces by Regeneration (R-1).
- Plasmodium reproduces by Multiple fission (S-2).

Step 2: Conclusion. The correct matching is option (C): P-3, Q-4, R-1, S-2.

 Quick Tip

Different organisms exhibit various modes of asexual reproduction, such as binary fission, fragmentation, and regeneration, depending on the species.

11. The basic filtration unit of the excretory system in human beings is:

- (A) Nephron
(B) Urethra
(C) Neuron
(D) Urinary bladder

Correct Answer: (A) Nephron

Solution:

Step 1: Identifying the basic filtration unit. The nephron is the functional unit of the kidney responsible for filtering the blood and forming urine.

Step 2: Conclusion. Thus, the correct answer is option (A): Nephron.

💡 Quick Tip

The nephron plays a crucial role in regulating the body's fluid and electrolyte balance and in removing waste products through urine.

12. In human alimentary canal, the digestive juice secreted by the gastric glands are:

- (A) Bile, Trypsin, Pepsin
- (B) Hydrochloric acid, Pepsin, Mucus
- (C) Lipase, Bile, Mucus
- (D) Salivary amylase, Pepsin, Bile

Correct Answer: (B) Hydrochloric acid, Pepsin, Mucus

Solution:

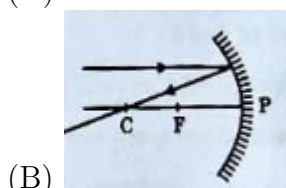
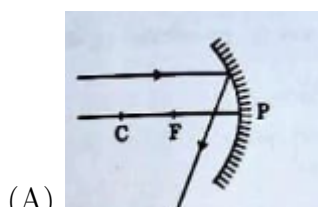
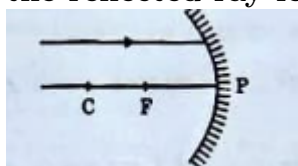
Step 1: Understanding the gastric juice composition. The gastric glands secrete hydrochloric acid (HCl), which helps in the digestion of food and maintains the acidic environment of the stomach. Pepsin, an enzyme, breaks down proteins, and mucus protects the stomach lining from the acid.

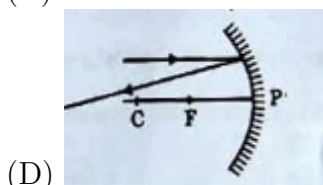
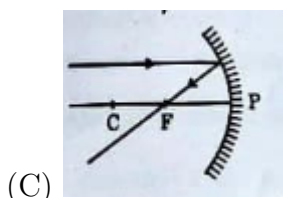
Step 2: Conclusion. Thus, the correct answer is option (B): Hydrochloric acid, Pepsin, Mucus.

💡 Quick Tip

The stomach secretes gastric juices that aid in digestion, and the protective mucus prevents damage to the stomach lining from acidic conditions.

13. Identify from the following the ray diagram which shows the correct path of the reflected ray for the ray incident on a concave mirror as shown:





Correct Answer: (C)

Solution:

Step 1: Understanding the ray diagram. A concave mirror forms an image that is reflected in a path determined by the focus (F) and the center of curvature (C). The correct ray diagram will show the reflected ray passing through the focus or focal point.

Step 2: Analyzing the options. - Option (C) depicts the correct reflected ray path for the concave mirror.

Step 3: Conclusion. Thus, the correct answer is option (C).

💡 Quick Tip

When dealing with concave mirrors, the reflection depends on the incident ray's position relative to the focal point and center of curvature.

14. The part of human eye which controls the amount of light entering into it is:

- (A) Iris
- (B) Cornea
- (C) Ciliary muscles
- (D) Pupil

Correct Answer: (A) Iris

Solution:

Step 1: Identifying the structure. The iris is the part of the human eye that controls the size of the pupil and, in turn, regulates the amount of light entering the eye.

Step 2: Conclusion. Thus, the correct answer is option (A): Iris.

💡 Quick Tip

The iris is a colored part of the eye and controls the dilation and constriction of the pupil to control light intake.

15. Consider the following food chain:

Grass → Grasshopper → Frog → Snake → Eagle

If the amount of energy available at third trophic level is 50 kJ, the available energy at the producer level was:

- (A) 0.5 kJ
- (B) 5 kJ
- (C) 500 kJ
- (D) 5000 kJ

Correct Answer: (D) 5000 kJ

Solution:

Step 1: Understanding energy transfer. In an energy pyramid, energy decreases as you move up trophic levels. Typically, only about 10

Step 2: Calculation. If the energy at the third trophic level is 50 kJ, then the energy available at the producer level (first trophic level) can be calculated by multiplying by 100.

$$\text{Energy at producer level} = 50 \text{ kJ} \times 100 = 5000 \text{ kJ}$$

Step 3: Conclusion. Thus, the correct answer is option (D): 5000 kJ.

💡 Quick Tip

In a food chain, only about 10

16. The incorrect statement about ozone is:

- (A) It is a deadly poisonous gas.
- (B) It shields the surface of the earth from UV radiation from the sun.
- (C) It is used as a refrigerant and in fire extinguishers.
- (D) It is formed by combining oxygen molecules with free oxygen atoms.

Correct Answer: (A) It is a deadly poisonous gas.

Solution:

Step 1: Analyzing the statements.

- Ozone (O_3) is a protective layer in the Earth's atmosphere that absorbs harmful UV radiation.
- While ozone is toxic at high concentrations, it is not considered a "deadly poisonous gas" in the context of the atmosphere.

Step 2: Conclusion. Thus, the incorrect statement is option (A).

💡 Quick Tip

Ozone is essential for life on Earth as it protects the planet from the sun's harmful ultraviolet radiation.

17. Assertion (A): Carbon and its compounds are our major sources of fuels.

Reason (R): Most of the carbon compounds on burning release a large amount of heat and light.

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

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

Solution:

Step 1: Understanding Assertion (A). Carbon and its compounds, such as fossil fuels (coal, petroleum), are major sources of energy and have been used for combustion for heat and power.

Step 2: Understanding Reason (R). The burning of carbon compounds like hydrocarbons releases a significant amount of heat and light due to the energy stored in the chemical bonds.

Step 3: Conclusion. Both Assertion (A) and Reason (R) are true, and Reason (R) correctly explains why carbon compounds are major fuel sources. Hence, the correct answer is option (A).

 Quick Tip

Carbon compounds, when burned, undergo combustion, releasing heat and light due to their high energy content, making them essential as fuel sources.

18. Assertion (A): Xylem tissue moves water and minerals obtained from the soil by the roots.

Reason (R): Xylem tissue is found only in the roots of a plant.

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

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

Solution:

Step 1: Understanding Xylem Tissue. Xylem is responsible for the transport of water and minerals from the roots to the rest of the plant. This function is crucial for plant nutrition and hydration.

Step 2: Analyzing Reason (R). While xylem tissue is indeed found in the roots, it is also present in stems and leaves of plants. Therefore, Reason (R) is false, as xylem is not exclusive to the roots.

Step 3: Conclusion. The correct answer is option (C) since Assertion (A) is true, but Reason (R) is false.

 Quick Tip

Xylem is essential for water and nutrient transport in plants, and it exists in the roots, stems, and leaves.

19. Assertion (A): In the common domestic circuit, the earth wire is connected to a metallic plate buried deep inside the earth.

Reason (R): Earth wire ensures that any leakage of current to the metallic body of the appliance keeps its potential to that of the earth, so the user may not get a severe electric shock.

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

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

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

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

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

Solution:

Step 1: Understanding Assertion (A). In domestic circuits, the earth wire is connected to a metallic plate that is buried in the earth to provide a safe path for electric current in case of a fault.

Step 2: Understanding Reason (R). The earth wire maintains the electrical potential of the appliance at the same level as the earth, ensuring the safety of the user by preventing severe electric shocks.

Step 3: Conclusion. Since both Assertion (A) and Reason (R) are true, and Reason (R) explains why the earth wire is used, the correct answer is option (A).

 Quick Tip

The earth wire is an essential safety feature in electrical circuits, providing a route for excess current to flow safely into the earth.

20. Assertion (A): Food web is a network of several food chains operating in an ecosystem.

Reason (R): Food web decreases the stability of an ecosystem.

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

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

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

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

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

Solution:

Step 1: Understanding Food Web. A food web is a network of interconnected food chains within an ecosystem, illustrating how different species are related through feeding.

Step 2: Analyzing Reason (R). Food webs actually increase the stability of an ecosystem by providing alternative pathways for energy flow, meaning that if one species declines, others can take its place.

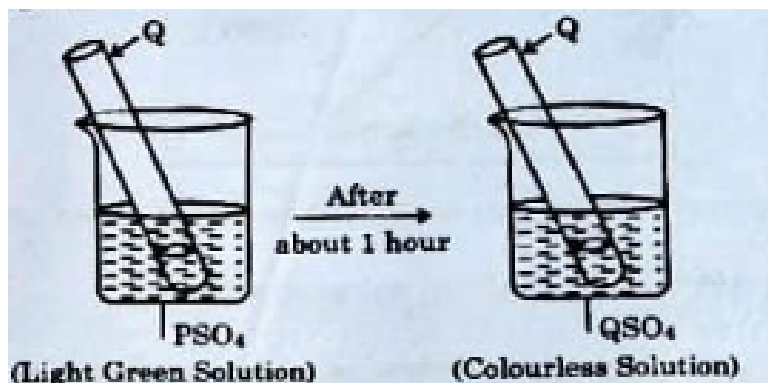
Step 3: Conclusion. Since Assertion (A) is true but Reason (R) is false, the correct answer is option (C).

 Quick Tip

A food web improves ecosystem resilience, as it reduces the impact of species loss on the overall balance of the ecosystem.

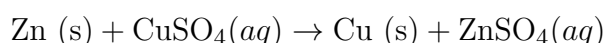
Question number 21 to 26 are very short answer type questions, each question carries 2 marks each

21. A light green coloured solution of sulphate salt of metal 'P' is taken in a beaker, a rod of another metal 'Q' is put in this solution as shown in the following figures:



Identify the metals 'P' and 'Q' and write its chemical equation for the reaction that occurs. State the conclusion of this reaction in terms of reactivity series of metals.

Correct Answer: Metal 'P' is Copper (Cu), and metal 'Q' is Zinc (Zn). The reaction is:

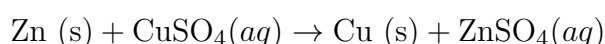


This reaction occurs because Zinc displaces Copper from its sulphate solution. Zinc is more reactive than Copper, which is consistent with the reactivity series.

Solution:

Step 1: Identifying metals. - Metal 'P' (Cu) is displaced by metal 'Q' (Zn) in the solution.
- Zinc (Zn) is more reactive than copper (Cu), as shown in the reactivity series, which allows zinc to displace copper from its sulphate solution.

Step 2: Writing the chemical equation. The reaction can be represented as:



Step 3: Conclusion from the reactivity series. - Zinc (Zn) is more reactive than Copper (Cu), and this is consistent with the reactivity series of metals. More reactive metals can displace less reactive metals from their compounds.

💡 Quick Tip

When a more reactive metal displaces a less reactive metal from its solution, this is called a displacement reaction. The reactivity series can help predict which metal will displace another.

22. (a) How is the brain protected in our body?

Solution: The brain is protected by the skull, which forms a hard, bony protective layer around it. Additionally, the brain is cushioned by the cerebrospinal fluid (CSF), which helps

to absorb shocks and impacts. The meninges, which are three protective membranes, further shield the brain from injury.

 Quick Tip

The brain's protection comes from physical barriers like the skull and membranes, as well as the cushioning effect of cerebrospinal fluid.

(b) A doctor finds in one of his patients that he is not maintaining a proper posture and balance of his body. State the region of brain and also the part of the brain which is responsible for it.

Solution: The part of the brain responsible for maintaining posture and balance is the cerebellum. The cerebellum controls voluntary movements and helps in maintaining body posture and balance by coordinating muscular activity.

 Quick Tip

The cerebellum plays a vital role in balance and coordination. Any damage to this region can lead to loss of balance and difficulty in movement.

23. (a) "Proteins control the expression of various characters." Explain this statement by taking an example of "tallness" as a characteristic in plants.

Solution: Proteins are responsible for the expression of genetic traits through their role in gene expression and regulation. For example, in plants, the height or "tallness" characteristic can be controlled by the production of specific proteins. A gene encoding a growth hormone or related protein will direct the plant to grow taller. This process involves transcription and translation of genetic material to produce the necessary proteins that control cell division and elongation, contributing to the overall height.

 Quick Tip

Proteins are the end products of genes and are directly involved in traits like tallness in plants by regulating growth processes.

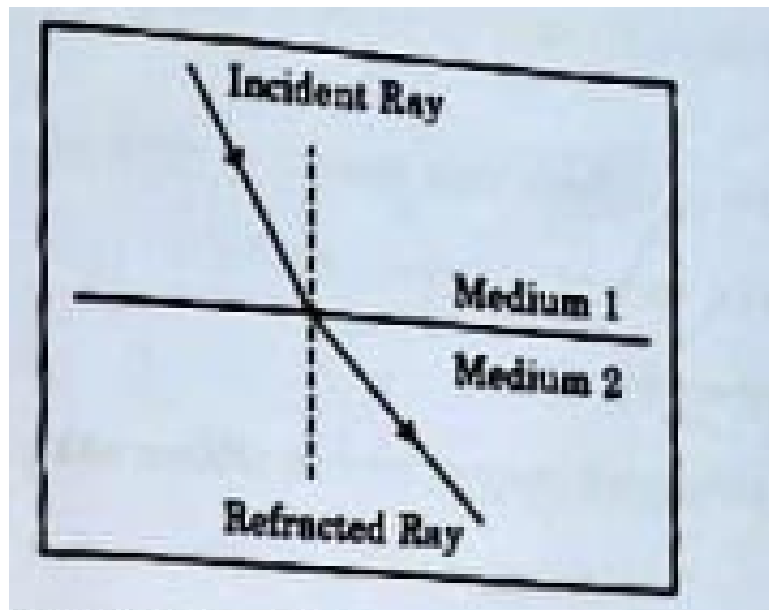
(b) Explain the mechanism of inheritance used by sexually reproducing organisms to ensure the stability of DNA of the species.

Solution: In sexually reproducing organisms, inheritance occurs through the passing of genetic material (DNA) from both parents. DNA from both the father and the mother combines during fertilization, resulting in offspring with a genetic makeup that is a combination of both parents. The process ensures the stability of DNA by maintaining the integrity of genes through generations, with mechanisms such as genetic recombination and mutation correction playing key roles in stabilizing the DNA.

 Quick Tip

Sexual reproduction ensures genetic diversity and stability of DNA through the combination of genetic material from both parents.

24. Study the figure in which the path of a ray of light going from Medium 1 to Medium 2 is shown.



(a) Out of the two Media – Medium 1 and Medium 2, in which is the speed of light more?

Solution: The speed of light is more in Medium 1 as the refracted ray bends away from the normal when it enters Medium 2, which suggests that the speed of light in Medium 1 is higher.

💡 Quick Tip

The refractive index of a medium is the ratio of the speed of light in vacuum to the speed of light in that medium. The bending of light depends on the relative speed in different media.

(b) State reason of bending of the refracted ray away from the normal.

Solution: The bending of the refracted ray away from the normal is due to the difference in the speed of light in the two media. Light travels faster in Medium 1, and when it enters Medium 2, where the speed of light is slower, the ray bends away from the normal as per Snell's Law.

💡 Quick Tip

The refractive index of a medium is the ratio of the speed of light in vacuum to the speed of light in that medium. The bending of light depends on the relative speed in different media.

(c) Express refractive index of Medium 2 with respect to Medium 1 in terms of speed of light in two media.

Solution: The refractive index of Medium 2 with respect to Medium 1 is given by the formula:

$$n_{2/1} = \frac{c_1}{c_2}$$

Where: - c_1 is the speed of light in Medium 1, - c_2 is the speed of light in Medium 2.

💡 Quick Tip

The refractive index of a medium is the ratio of the speed of light in vacuum to the speed of light in that medium. The bending of light depends on the relative speed in different media.

25. Give reasons:

(i) The sky appears dark to passengers flying at very high altitudes.

Solution: At very high altitudes, passengers are above the atmosphere where there is less scattering of sunlight. As a result, they do not see the scattered blue light and the sky appears dark, similar to the condition experienced by astronauts in space.

(ii) 'Danger' signal lights are red in color.

Solution: Red light has the longest wavelength and the least scattering in the atmosphere. This makes red light more visible over longer distances, which is why it is used for 'Danger' signals.

💡 Quick Tip

The refractive index of a medium is the ratio of the speed of light in vacuum to the speed of light in that medium. The bending of light depends on the relative speed in different media.

(b) What is a rainbow? Why do we see a rainbow in the sky only after the rainfall?

Solution: A rainbow is a meteorological phenomenon caused by reflection, refraction, and dispersion of light, which results in a spectrum of light appearing in the sky. It occurs when sunlight passes through raindrops, breaking the light into its constituent colors. We see a rainbow only after rainfall because the raindrops act as prisms, refracting and dispersing the light, and the sky is clear enough for sunlight to shine through.

💡 Quick Tip

A rainbow forms when light is refracted and dispersed in water droplets. It is best observed after rain when sunlight breaks through the clouds and interacts with remaining droplets in the air.

26. We do not clean natural ponds or lakes, whereas an aquarium or a swimming pool needs to be cleaned regularly. Why?

Solution: Natural ponds and lakes have a self-cleaning system where natural processes such as filtration, sedimentation, and biological processes help maintain water quality. However, aquariums and swimming pools are enclosed and do not have these natural processes, which is why they require regular cleaning and maintenance to prevent the accumulation of waste and maintain clean water.

 Quick Tip

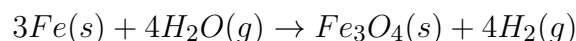
Natural water bodies are self-sustaining with natural processes for cleaning, while artificial water bodies need maintenance due to their controlled environment.

Question number 27 to 33 are short answer type questions . Each carries 3 marks each.

27. Write balanced chemical equations for the reactions that occur when:

(a) Steam is passed over red hot iron.

Solution: When steam is passed over red-hot iron, iron reacts with water vapor to form iron oxide and hydrogen gas. The balanced chemical equation for this reaction is:



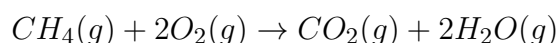
In this reaction, iron (Fe) reacts with steam (water vapor, H_2O) to form iron oxide (Fe_3O_4) and hydrogen gas (H_2).

 Quick Tip

Balancing chemical equations requires ensuring that the number of atoms on both sides of the equation is the same. In combustion and respiration reactions, oxygen is crucial, and the products are often carbon dioxide and water.

(b) Natural gas is burnt in air.

Solution: Natural gas primarily consists of methane (CH_4). When methane is burned in air (which provides oxygen), it reacts to form carbon dioxide and water. The balanced chemical equation for this combustion reaction is:



In this reaction, methane (CH_4) reacts with oxygen (O_2) to form carbon dioxide (CO_2) and water vapor (H_2O).

 Quick Tip

Balancing chemical equations requires ensuring that the number of atoms on both sides of the equation is the same. In combustion and respiration reactions, oxygen is crucial, and the products are often carbon dioxide and water.

(c) Glucose reacts with oxygen in the cells of our body and provides energy.

Solution: In our body, glucose ($C_6H_{12}O_6$) reacts with oxygen (O_2) to produce carbon dioxide (CO_2), water (H_2O), and energy. This reaction is part of cellular respiration, which is an exothermic process that provides energy for our cells. The balanced chemical equation for this process is:



This process provides the energy necessary for the various biological functions of our body.

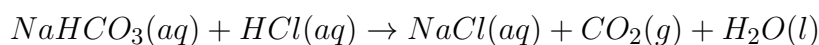
 Quick Tip

Balancing chemical equations requires ensuring that the number of atoms on both sides of the equation is the same. In combustion and respiration reactions, oxygen is crucial, and the products are often carbon dioxide and water.

28. (a) State the chemical property in each case on which the following uses of baking soda are based upon:

(i) As an anti-acid.

Solution: Baking soda (NaHCO_3) acts as an anti-acid due to its ability to neutralize excess stomach acid. When baking soda reacts with hydrochloric acid (HCl) in the stomach, it produces sodium chloride (NaCl), carbon dioxide (CO_2), and water (H_2O), which relieves the acidity. The chemical equation is:



Thus, the chemical property utilized here is its ability to neutralize acids.

 Quick Tip

Baking soda is a versatile compound: It acts as an anti-acid, a leavening agent in baking, and helps extinguish fires by producing carbon dioxide when it reacts with acids.

(ii) As a constituent in making baking powder.

Solution: Baking powder contains baking soda as one of its ingredients. When baking soda reacts with an acid like cream of tartar or vinegar, carbon dioxide gas is produced, causing the dough to rise. This reaction is the basis for baking soda's role in baking powder. The chemical equation is:



Here, the acid-base reaction produces carbon dioxide that helps in leavening the dough.

 Quick Tip

Baking soda is a versatile compound: It acts as an anti-acid, a leavening agent in baking, and helps extinguish fires by producing carbon dioxide when it reacts with acids.

(iii) In soda-acid fire extinguishers.

Solution: In soda-acid fire extinguishers, baking soda reacts with an acid (like sulfuric acid) to release carbon dioxide gas, which helps extinguish the fire by displacing oxygen. The chemical equation for this reaction is:



Thus, the chemical property used here is the production of CO_2 when it reacts with acids.

 Quick Tip

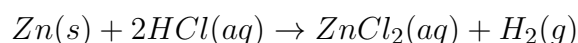
Baking soda is a versatile compound: It acts as an anti-acid, a leavening agent in baking, and helps extinguish fires by producing carbon dioxide when it reacts with acids.

OR

(b) Write chemical equations to show what happens when an acid reacts with:

(i) Metal.

Solution: When an acid reacts with a metal, a salt and hydrogen gas are produced. For example, when zinc (Zn) reacts with hydrochloric acid (HCl), zinc chloride (ZnCl₂) and hydrogen gas (H₂) are formed. The chemical equation is:

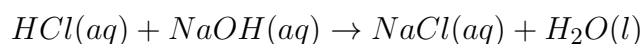


 Quick Tip

Acid-base reactions always produce salt and water. Acids reacting with metals or carbonates can also produce hydrogen gas or carbon dioxide.

(ii) Base.

Solution: When an acid reacts with a base, a salt and water are produced in a neutralization reaction. For example, when hydrochloric acid (HCl) reacts with sodium hydroxide (NaOH), sodium chloride (NaCl) and water (H₂O) are formed. The chemical equation is:

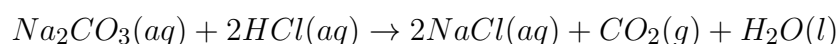


 Quick Tip

Acid-base reactions always produce salt and water. Acids reacting with metals or carbonates can also produce hydrogen gas or carbon dioxide.

(iii) Carbonate.

Solution: When an acid reacts with a carbonate, a salt, carbon dioxide (CO₂), and water are produced. For example, when hydrochloric acid (HCl) reacts with sodium carbonate (Na₂CO₃), sodium chloride (NaCl), carbon dioxide (CO₂), and water (H₂O) are formed. The chemical equation is:



 Quick Tip

Acid-base reactions always produce salt and water. Acids reacting with metals or carbonates can also produce hydrogen gas or carbon dioxide.

29. Name the blood vessel that brings (i) oxygenated blood (ii) deoxygenated blood, to the human heart. Also name that chamber of the heart which receives deoxygenated blood and state how deoxygenated blood from this chamber is sent to the lungs for oxygenation.

Solution:

(i) Oxygenated blood: The blood vessel that brings oxygenated blood to the human heart is the **pulmonary vein**. This vein carries oxygen-rich blood from the lungs to the left atrium of the heart.

(ii) Deoxygenated blood: The blood vessel that brings deoxygenated blood to the human heart is the **superior and inferior vena cava**. These veins carry deoxygenated blood from the body back to the right atrium of the heart.

Chamber receiving deoxygenated blood: The chamber of the heart that receives deoxygenated blood is the **right atrium**. Blood flows into this chamber from the superior and inferior vena cava.

How deoxygenated blood is sent to the lungs for oxygenation: Once deoxygenated blood enters the right atrium, it is pumped into the **right ventricle**, which then contracts to send the blood through the **pulmonary artery** to the lungs for oxygenation. The pulmonary artery carries the deoxygenated blood to the lungs, where it exchanges carbon dioxide for oxygen.

 Quick Tip

The pulmonary circulation moves deoxygenated blood to the lungs for oxygenation, while the systemic circulation moves oxygenated blood to the body. The pulmonary veins and arteries carry blood in the opposite directions compared to other veins and arteries in the body.

30. The gene combination of purple flowered pea plants is denoted as (WW) and that of white flowered pea plants as (ww), when these two plants are crossed, F₁ generation is obtained.

(a) List two observations made by Mendel in F₁ generation plants.

Solution: Mendel made the following observations in the F₁ generation:

1. All plants in F₁ generation had purple flowers, indicating that the purple flower trait was dominant over the white flower trait.
2. The F₁ plants were all hybrids, having a combination of WW and ww genes, but the dominant trait (purple) expressed itself in the phenotype.

 Quick Tip

Mendel's experiments revealed that dominant traits, such as purple flowers, mask the expression of recessive traits, such as white flowers, in F₁ hybrid plants.

(b) Give the (i) percentage of white flowered plants and (ii) ratio of the gene combinations WW, Ww, and ww in F₂ generation.

Solution: When the F₁ generation plants (all Ww) are crossed with each other, the F₂ generation shows the following results:

(i) Percentage of white flowered plants:

- White flowers occur in the F₂ generation when the genotype is ww. According to Mendel's ratio, 25 of the plants in the F₂ generation will have the white flower trait (ww).

(ii) Ratio of gene combinations WW, Ww, and ww in F₂ generation:

- The ratio of gene combinations in F₂ generation is 1:2:1. This means:
- 1 WW (homozygous dominant)
- 2 Ww (heterozygous)
- 1 ww (homozygous recessive)

 Quick Tip

The Mendelian inheritance ratio of 1:2:1 in F₂ generation reflects the segregation of alleles during gamete formation and fertilization.

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

Solution: A dominant trait is one that expresses itself in the phenotype even when only one copy of the allele is present, whereas a recessive trait only expresses itself when both alleles are recessive (i.e., in the homozygous recessive state).

 Quick Tip

Dominant traits mask the expression of recessive traits in heterozygotes, while recessive traits are only visible when both alleles are recessive.

31. A student placed a candle flame at different distances from a convex lens and focused its image on a screen. He recorded his observation in tabular form as given below:

S.No.	Distance of flame from the lens (cm)	Distance of the image from the lens (cm)
1	-90	+18
2	-60	+20
3	-40	+24
4	-30	+30
5	-24	+40
6	-20	+60
7	-18	+90
8	-12	+120

(a) What is the focal length of the convex lens used? Give reason to justify your answer.

Solution: - To determine the focal length of the lens, we need to use the lens formula:

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

Where f is the focal length, v is the image distance, and u is the object distance.

- From the table, we can observe that as the object distance (u) decreases, the image distance (v) increases.
- This behavior is characteristic of a converging (convex) lens and suggests that the object is placed outside the focal length, but the exact focal length can be deduced if specific values for u and v are considered. Given the data, the image moves further as the object distance decreases, which is consistent with a convex lens having a positive focal length.

💡 Quick Tip

In ray diagrams for convex lenses, light rays diverging from an object parallel to the optical axis are refracted through the focal point on the opposite side.

(b) Which one of the sets of observations is not correct and why?

Solution: - Observation (2) shows an image distance of +20 cm for an object distance of -60 cm. This is not correct because the image formed by a convex lens should be at a larger distance when the object is placed farther away.

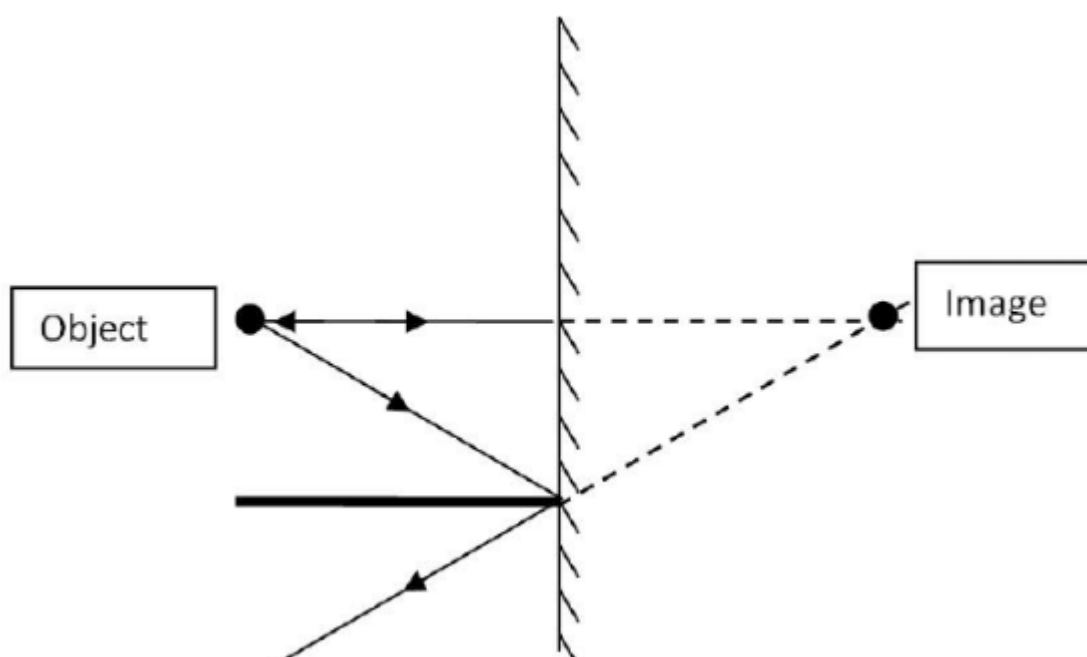
The correct relationship should show the image moving towards the focal point as the object distance decreases. Thus, observation (2) seems to be incorrect.

💡 Quick Tip

In ray diagrams for convex lenses, light rays diverging from an object parallel to the optical axis are refracted through the focal point on the opposite side.

(c) Draw a ray diagram to show image formation for any correct set of observations.

Solution: - Let's consider observation (4), where the object distance is -30 cm and the image distance is +30 cm. The ray diagram for this situation is as follows:



This diagram shows that the image is formed at the same distance as the object from the lens but on the opposite side of the focal point, as expected for a convex lens.

💡 Quick Tip

In ray diagrams for convex lenses, light rays diverging from an object parallel to the optical axis are refracted through the focal point on the opposite side.

32. A person uses lenses of +2.0 D power in his spectacles for the correction of his vision.

(a) Name the defect of vision the person is suffering from.

Solution: The person is suffering from hypermetropia (farsightedness), which is a defect of vision where distant objects are seen more clearly than near objects. This defect occurs when the eye is too short or the cornea has too little curvature, causing light to focus behind the retina. Convex lenses are used to correct this defect by converging light before it enters the eye.

💡 Quick Tip

For correcting hypermetropia, convex lenses are used, and their power is calculated as $P = \frac{1}{f}$. A positive power indicates the use of convex lenses.

(b) List two causes of this defect.

Solution: Two common causes of hypermetropia are:

1. **F₂Shortened eyeball**F₂: The eye's length from the cornea to the retina is too short, which prevents the image from being focused on the retina.
2. **F₂Weak curvature of the cornea or lens**F₂: If the cornea or lens is too flat, it cannot bend

light rays sufficiently to bring them to focus on the retina.

💡 Quick Tip

For correcting hypermetropia, convex lenses are used, and their power is calculated as $P = \frac{1}{f}$. A positive power indicates the use of convex lenses.

(c) Determine the focal length of the lenses used in the spectacles.

Solution: The power of a lens P is related to its focal length f by the formula:

$$P = \frac{1}{f}$$

where P is the power in diopters (D) and f is the focal length in meters.

Given that the power $P = +2.0$ D, we can calculate the focal length:

$$f = \frac{1}{P} = \frac{1}{2.0} = 0.5 \text{ m}$$

Thus, the focal length of the lenses used in the spectacles is 0.5 meters.

💡 Quick Tip

For correcting hypermetropia, convex lenses are used, and their power is calculated as $P = \frac{1}{f}$. A positive power indicates the use of convex lenses.

33. (a) Explain the statement "Potential difference between two points is 1 volt".

Solution: The potential difference between two points is defined as the amount of work required to move a unit positive charge from one point to the other against the electric field. If the potential difference between two points is 1 volt, it means that 1 joule of work is done to move a charge of 1 coulomb from one point to another.

Mathematically, the potential difference V is given by:

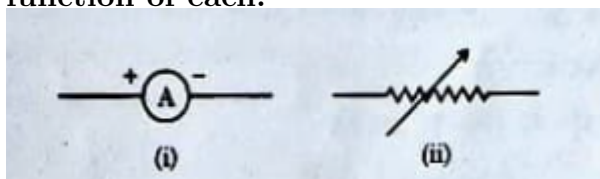
$$V = \frac{W}{Q}$$

where W is the work done in joules and Q is the charge in coulombs. Thus, a potential difference of 1 volt means 1 joule of energy is required to move 1 coulomb of charge between the two points.

💡 Quick Tip

The unit of potential difference is the volt, and 1 volt is the potential difference when 1 joule of energy is used to move 1 coulomb of charge.

(b) What do the symbols given below represent in an electric circuit? Write one function of each.



Solution:

(i) Symbol of a Battery (or Cell): The symbol $+$ $-$ represents a simple electric cell or battery in a circuit.

- **Function:** The function of a battery is to supply electrical energy to the circuit. It provides the voltage or potential difference that drives the current through the circuit.

(ii) Symbol of a Resistor: The symbol Δ represents a resistor in an electric circuit.

- **Function:** The function of a resistor is to limit or control the flow of electric current in the circuit. It converts electrical energy into heat energy and helps in regulating the current in various parts of the circuit.

💡 Quick Tip

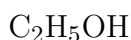
A battery provides the necessary potential difference to drive current, while resistors help control and limit the flow of current in the circuit.

Question number 34 to 36 are long answer type questions. Each question carries 5 marks each.

34. (a) Name an alcohol and a carboxylic acid having two carbon atoms in their structures. Draw their structures and state how this alcohol and carboxylic acid can be converted into a carboxylic acid. What happens when these two compounds react in the presence of an acid? Write chemical equations for the reactions involved in the two cases mentioned above.

Solution: - The alcohol with two carbon atoms is Ethanol (C_2H_5OH), and the carboxylic acid with two carbon atoms is Acetic acid (CH_3COOH).

Ethanol Structure:

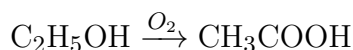


In the presence of oxygen or acid, ethanol can be oxidized to acetic acid (CH_3COOH).

Acetic acid Structure:



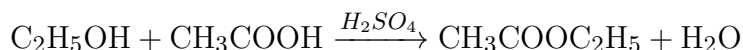
Conversion of Ethanol to Acetic Acid: When ethanol is oxidized, it forms acetic acid. The reaction can be written as:



This is an oxidation reaction where ethanol (an alcohol) is converted to acetic acid (a carboxylic acid) by the addition of oxygen.

Reaction of Ethanol and Acetic Acid in the Presence of Acid: When ethanol and acetic acid react in the presence of an acid (e.g., concentrated H_2SO_4), they undergo

F₂esterificationF₂ to form F₂ethyl acetateF₂ (an ester) and water. The chemical equation for this reaction is:



In this reaction, F₂ethyl acetateF₂ is formed along with water.

💡 Quick Tip

Esterification is a reversible reaction in which an alcohol and a carboxylic acid react in the presence of a catalyst (usually an acid) to form an ester and water.

OR

(b) What are soaps? Write the structure of a soap molecule. Explain the cleansing action of a soap. Why are soaps not considered suitable for washing clothes in a region where water is hard? How is this problem overcome?

Solution: - F₂SoapsF₂ are sodium or potassium salts of fatty acids, which are long-chain carboxylic acids. They are used as cleaning agents because they can remove dirt and oils from surfaces.

F₂Structure of Soap Molecule:F₂ A soap molecule consists of a long hydrocarbon chain (non-polar) attached to a carboxylate group (polar). The general formula for soap is:



Where R is a long hydrocarbon chain .

F₂Cleansing Action of Soap:F₂ Soap molecules have two parts:

- The F₂hydrophobic tailF₂ (non-polar) which is attracted to oils and grease.
- The F₂hydrophilic headF₂ (polar) which is attracted to water.

When soap is added to water, the hydrophobic tail attaches to the grease or dirt, while the hydrophilic head faces outward, forming F₂micellesF₂. The soap molecules surround the dirt or oil, allowing it to be removed by water.

F₂Soaps in Hard Water:F₂ In hard water, soap reacts with calcium (Ca) or magnesium (Mg) ions present in the water to form F₂insoluble scumF₂, which makes the soap less effective. This is why soap is not considered suitable for washing clothes in regions with hard water.

F₂Overcoming Hard Water Problem:F₂ To overcome this problem, water softeners (like washing soda, Na₂CO₃) can be used to remove calcium and magnesium ions from water.

Washing soda reacts with Ca and Mg ions to form insoluble carbonates, thereby softening the water and allowing soap to work effectively.

💡 Quick Tip

The ability of soap to emulsify oils and dirt makes it an effective cleaning agent, but hard water reduces its cleaning efficiency by forming scum.

35. (a) Define Puberty. List any two changes seen in boys at the time of puberty.

Solution: F₂PubertyF₂ is the period of life when an individual becomes capable of sexual

reproduction. It involves a series of physical, hormonal, and emotional changes that prepare the body for reproductive capability.

Two changes seen in boys at the time of puberty include:

1. F_2 Development of secondary sexual characteristics: F_2 This includes the growth of facial and body hair and deepening of the voice.
2. F_2 Increase in height and muscle mass: F_2 Boys experience a growth spurt, and there is an increase in muscle development.

 Quick Tip

Puberty marks the transition from childhood to adulthood, characterized by changes in physical appearance and the ability to reproduce.

(b) Why are testes in human males located outside the abdominal cavity in scrotum?

Solution: The testes are located outside the abdominal cavity in the scrotum to maintain a temperature lower than the body's core temperature, which is essential for the production of healthy sperm. Sperm production requires a temperature of around $2-3^{\circ}\text{C}$ lower than the normal body temperature, and the scrotum helps regulate this temperature by contracting or relaxing in response to environmental conditions.

 Quick Tip

The scrotum's ability to regulate temperature helps ensure the optimal conditions for sperm production.

(c) List any three techniques of contraception used by humans. Which one of these is not meant for males?

Solution: Three techniques of contraception used by humans include:

1. F_2 Condoms F_2 (for both males and females).
2. F_2 Oral contraceptives F_2 (birth control pills) – typically used by females.
3. F_2 Intrauterine device (IUD) F_2 – a device used by females to prevent pregnancy.

The technique that is F_2 not F_2 meant for males is the F_2 intrauterine device (IUD) F_2 , as it is used in females to prevent pregnancy by being placed inside the uterus.

 Quick Tip

Contraceptive methods are essential for family planning and can be hormonal, barrier, or device-based, with options available for both males and females.

OR

(a) Name the part performing the following functions in the human female reproductive system:

- (i) Production of eggs
- (ii) Site of fertilization
- (iii) Site of implantation
- (iv) Entry of the sperms

Solution: - F_2 Production of eggs F_2 : The F_2 ovaries F_2 are the organs responsible for the production of eggs (ova).

- F_2 Site of fertilization F_2 : Fertilization occurs in the F_2 fallopian tubes F_2 (also called oviducts)

. - F_2 Site of implantation F_2 : The fertilized egg implants in the F_2 uterus F_2 .

- F_2 Entry of sperms F_2 : The sperms enter the female reproductive system through the F_2 vagina F_2 .

💡 Quick Tip

The female reproductive system involves the ovaries, fallopian tubes, uterus, and vagina, each playing a critical role in reproduction.

(b) What changes are observed in the uterus:

- (i) Subsequent to the implantation of the zygote and
- (ii) If an egg does not get fertilized?

Solution: - F_2 Subsequent to the implantation of the zygote F_2 : After the zygote implants in the uterine lining, the uterus thickens and remains prepared to support the pregnancy.

Hormones such as progesterone maintain the uterine lining.

- F_2 If an egg does not get fertilized F_2 : If fertilization does not occur, the uterus sheds its lining during menstruation, and the menstrual cycle continues. The egg is expelled from the body along with the uterine lining.

💡 Quick Tip

If fertilization does not occur, the body goes through the menstrual cycle to shed the unused egg and uterine lining.

36. (a) What are magnetic field lines? How is the direction of the magnetic field at a point determined? Draw the pattern of magnetic field lines of the magnetic field produced by a current-carrying circular loop. Mark on it the direction of (i) current and (ii) magnetic field lines. Name the two factors on which the magnitude of the magnetic field due to a current-carrying coil depends.

Solution: F_2 Magnetic Field Lines F_2 : Magnetic field lines represent the direction and strength of a magnetic field. These lines emerge from the north pole and enter the south pole. The denser the field lines, the stronger the magnetic field at that point.

F_2 Direction of Magnetic Field F_2 : The direction of the magnetic field at any point is determined by the F_2 right-hand rule F_2 . If you curl the fingers of your right hand in the direction of the current in a wire, the direction of your thumb gives the direction of the magnetic field lines.

F_2 Magnetic Field Due to a Current-Carrying Circular Loop F_2 : For a circular loop carrying a

current, the magnetic field lines form concentric circles around the wire and they pass through the center of the loop. The magnetic field is strongest at the center of the loop and decreases as you move away from the center.

Current: $\rightarrow$ Clockwise or Counter-clockwise depending on the view.

Magnetic Field Lines: $\rightarrow$ Form circular loops around the current.

F₂ Factors Affecting the Magnitude of the Magnetic Field
F₂: The magnitude of the magnetic field produced by a current-carrying coil depends on:
1. **F₂Current (I)****F₂:** The greater the current, the stronger the magnetic field.
2. **F₂Number of turns (N)****F₂:** More turns in the coil result in a stronger magnetic field.

💡 Quick Tip

The magnetic field around a current-carrying wire can be visualized using the right-hand rule, where your thumb points in the direction of the current and the curl of your fingers shows the magnetic field direction.

OR

(b) Why can't two magnetic field lines cross each other? Draw magnetic field lines showing the direction of the magnetic field due to a current-carrying long straight solenoid. State the conclusion which can be drawn from the pattern of magnetic field lines inside the solenoid.

Solution: **F₂Why can't Two Magnetic Field Lines Cross Each Other?**
F₂ If two magnetic field lines were to cross each other, it would imply that the magnetic field has two different directions at the same point, which is not possible. Therefore, magnetic field lines never intersect.

F₂Magnetic Field Due to a Current-Carrying Long Straight Solenoid
F₂: A solenoid is a coil of wire carrying a current. The magnetic field produced by a solenoid is uniform and parallel inside the solenoid, with the field lines forming straight lines from one end to the other. Outside the solenoid, the field lines are similar to the field of a bar magnet, with distinct north and south poles.

Inside the solenoid: Uniform magnetic field, parallel lines.

Outside the solenoid: Similar to a bar magnet's field, with loops.

F₂Conclusion from Magnetic Field Lines of a Solenoid
F₂: The magnetic field inside the solenoid is uniform and parallel, and its strength depends on the current in the solenoid and the number of turns per unit length.

💡 Quick Tip

A solenoid produces a uniform magnetic field inside, making it useful as a magnet in various applications. The strength of the magnetic field can be increased by increasing the number of turns or the current.

Question number 37 to 39 are Case/Source questions. Each question carries 4 marks.

37. Many pure metals like copper, iron and gold are very soft and as such are considered unsuitable for certain uses. Metallic objects around us such as cooking utensils, statues, ornaments, guns etc. are actually not made up of pure metals. Instead of pure metals, alloys are used in the design of most of the useful objects. Making alloys enhances the basic properties of a metal which is the primary constituent (metal) of an alloy.

(I) How does electrical conductivity and melting point of a metal change when it is converted to its alloy by mixing a small amount of an element in it?

Solution: When a metal is converted to an alloy by mixing a small amount of a different element, several physical properties of the metal change. For example:

- **Electrical Conductivity:** The electrical conductivity of a metal typically decreases when it is turned into an alloy. This happens because the atoms of the added element create irregularities in the atomic structure, which disrupt the free flow of electrons necessary for conduction.
- **Melting Point:** The melting point of an alloy often differs from the melting points of the constituent metals. Typically, alloys have a lower melting point than their pure components, especially if the alloy formation creates a new crystalline structure that requires less energy to break.

 Quick Tip

Alloys are often used to improve the properties of metals for specific applications, such as increased strength or better corrosion resistance, which cannot be achieved by pure metals alone.

(II) Name an alloy used for welding two wires together in an electric circuit. Write its major constituents.

Solution: An alloy commonly used for welding wires together in electrical circuits is solder. Solder is a fusible metal alloy primarily made of:

- **Tin (Sn):** 60-70
- **Lead (Pb):** 30-40

Solder has a low melting point, which makes it ideal for use in electrical circuit board assembly.

 Quick Tip

Soldering is a crucial process in electronics where materials like tin-lead alloy help in making solid electrical connections without damaging sensitive components due to excessive heat.

(III) (a) What are alloys? How is ‘Brass’ (an alloy) prepared?

Solution: Alloys are mixtures of two or more metals or a metal and a non-metal. The properties of alloys differ from those of pure metals, making them useful for various applications. Alloys are typically created by melting the metals together.

Brass is an alloy primarily composed of:

- Copper (Cu): 70-90
- Zinc (Zn): 10-30

Brass is prepared by melting copper and zinc together. It is widely used for making instruments, coins, and decorative items due to its corrosion resistance and aesthetic qualities.

💡 Quick Tip

Brass is known for its high durability and excellent workability, making it ideal for applications that require both strength and resistance to corrosion.

OR

(III) (b) What is stainless steel? How is it prepared? Write one important property which makes it more useful in making cooking utensils as compared to its primary metal.

Solution: Stainless Steel is a corrosion-resistant alloy made primarily of:

- Iron (Fe): 70-90
- Chromium (Cr): 10-20
- Nickel (Ni): 5-10

Stainless steel is prepared by adding chromium and nickel to steel, which enhances its corrosion resistance, especially to rust and staining. It is widely used in cooking utensils and other kitchenware due to its non-reactive nature with food and its high durability.

Important Property: The presence of chromium in stainless steel forms a thin, self-healing layer of chromium oxide on the surface, making it resistant to corrosion and stains. This property makes it much more suitable than pure iron for cooking utensils.

💡 Quick Tip

Stainless steel's ability to resist rust and maintain its strength under high heat is why it is the preferred material for cooking utensils.

38. The growth movements of plant parts in which the direction of the stimulus determines the direction of the response is known as tropic movements or tropism. Plants also have non-directional movements which may not be growth dependent.



(I) Name the movement which causes 'X' and 'Y' to grow downwards and upwards respectively. (Refer above figure)

Solution: - The movement which causes F_2 'X' F_2 (roots) to grow downwards is called F_2 gravitropism F_2 (also known as geotropism), where the plant grows in response to gravity.
 - The movement which causes F_2 'Y' F_2 (stem) to grow upwards is called F_2 negative gravitropism F_2 (also known as geotropism), where the plant grows against gravity.

💡 Quick Tip

Gravitropism is a crucial response for plants to orient their roots downward into the soil for water and nutrients, while the stem grows upward toward light for photosynthesis.

(II) Write the name of a hormone that plays a major role in (i) falling of leaves (ii) rapid cell division.

Solution: - (i) The hormone that plays a major role in F_2 falling of leaves F_2 is F_2 Abscisic acid (ABA) F_2 . ABA promotes leaf abscission, particularly under stress conditions such as drought.
 - (ii) The hormone that plays a major role in F_2 rapid cell division F_2 is F_2 Cytokinins F_2 . Cytokinins promote cell division and are often found in areas of active growth.

💡 Quick Tip

Abscisic acid helps in maintaining plant water balance, while cytokinins are key regulators in stimulating plant cell division.

(III) (a) Leaves of the sensitive plant move very quickly in response to 'touch'. How is this stimulus of touch communicated and explain how the movement takes place?

Solution: The F_2 sensitive plant (Mimosa pudica) F_2 exhibits F_2 thigmotropism F_2 , which is the movement in response to touch. - When the leaves of the sensitive plant are touched, it causes a rapid change in turgor pressure in the cells. - The signal is first detected by mechanoreceptors in the plant's cells, which then trigger an electrical impulse that moves across the plant tissue. - This causes a change in the flow of water in the plant cells, resulting in the leaves folding and drooping. This is a defense mechanism to avoid herbivory.

💡 Quick Tip

Thigmotropism helps plants respond to physical stimuli, and this unique movement is powered by changes in water pressure inside plant cells.

OR

(b) Name the plant hormone which is synthesized at the shoot tip. How does this hormone help the plant to bend towards light?

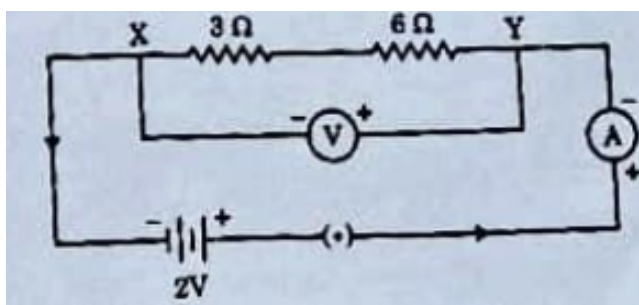
Solution: The plant hormone synthesized at the shoot tip is $\text{F}_2\text{AuxinF}_2$.

- $\text{F}_2\text{AuxinsF}_2$ promote cell elongation on the side of the plant that is away from the light, causing the plant to bend toward the light source.
- This phenomenon is known as $\text{F}_2\text{phototropismF}_2$, where the plant grows towards light to maximize photosynthesis.

💡 Quick Tip

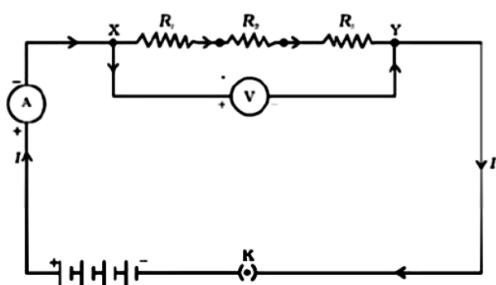
Auxin helps plants adapt to their environment by guiding their growth towards essential resources like light and water.

39. Study the circuit shown in which two resistors X and Y of resistances $3\ \Omega$ and $6\ \Omega$ respectively are joined in series with a battery of 2V .



(I) Draw a circuit diagram showing the above two resistors X and Y joined in parallel with same battery and same ammeter and voltmeter.

Solution: In this case, we would rearrange the resistors into a parallel combination and ensure the same battery is connected along with the ammeter and voltmeter. The circuit diagram for the parallel combination is shown below:



(II) In which combination of resistors will the (i) potential difference across X and Y and (ii) current through X and Y, be the same?

Solution: - In a F_2 parallel combination F_2 , the F_2 potential difference F_2 across each resistor is the same. Therefore, the potential difference across X and Y will be the same in parallel.

- However, in F_2 series combination F_2 , the current through both resistors will be the same as the same current flows through all components in a series circuit.

Thus, the correct combination is the F_2 parallel combination F_2 for the potential difference and the F_2 series combination F_2 for the current.

(III) (a) Find the current drawn from the battery by the series combination of the two resistors (X and Y).

Solution: In a series combination, the total resistance R_{total} is the sum of the individual resistances:

$$R_{\text{total}} = R_X + R_Y = 3\Omega + 6\Omega = 9\Omega$$

Using Ohm's law $I = \frac{V}{R}$, where $V = 2V$ and $R_{\text{total}} = 9\Omega$, we find the current I as:

$$I = \frac{2V}{9\Omega} = 0.222\text{ A}$$

Thus, the current drawn from the battery is 0.222 A.

 Quick Tip

In a series circuit, the current remains the same throughout, but in a parallel circuit, the potential difference across each component is identical.

OR

(b) Determine the equivalent resistance of the parallel combination of the two resistors (X and Y).

Solution: In a parallel combination, the reciprocal of the total resistance R_{total} is the sum of the reciprocals of the individual resistances:

$$\frac{1}{R_{\text{total}}} = \frac{1}{R_X} + \frac{1}{R_Y} = \frac{1}{3\Omega} + \frac{1}{6\Omega}$$

$$\frac{1}{R_{\text{total}}} = \frac{2}{6} + \frac{1}{6} = \frac{3}{6}$$

$$R_{\text{total}} = \frac{6}{3} = 2\Omega$$

Thus, the equivalent resistance of the parallel combination of the two resistors is 2Ω .

 Quick Tip

In a parallel circuit, the total resistance decreases as more resistors are added. The reciprocal of the total resistance is the sum of the reciprocals of individual resistances.