JK Board Class 10 Science(Chemistry) Question Paper with Solutions(Memory Based)

Time Allowed :3 Hour	Maximum Marks :60	Total Questions :24

General Instructions

Read the following instructions very carefully and strictly follow them:

- Answers to this Paper must be written on the paper provided separately.
- You will not be allowed to write during the first 15 minutes
- This time is to be spent in reading the question paper.
- The time given at the head of this Paper is the time allowed for writing the answers,
- The paper has four Sections.
- Section A is compulsory - All questions in Section A must be answered.
- You must attempt one question from each of the Sections B, C and D and one other question from any Section of your choice.

1. Define Corrosion and Rancidity and suggest methods for their prevention.

Correct Answer: Corrosion is the gradual destruction of metals due to chemical reactions with the environment, while rancidity is the spoilage of fats and oils due to oxidation.

Solution:
Concept: Many substances undergo chemical changes when exposed to air, moisture, or other environmental conditions. Two common examples are **corrosion** in metals and **rancidity** in food substances.
Step 1: Corrosion
Corrosion is the slow deterioration or destruction of metals due to chemical reactions with substances in the environment such as **oxygen, moisture, or acids**.
Example: Rusting of iron when it reacts with oxygen and water to form **iron oxide (rust)**.
Prevention Methods:

- Painting or coating the metal surface
- Galvanization (coating with zinc)
- Electroplating
- Applying oil or grease

Step 2: Rancidity
Rancidity is the process in which **fats and oils get oxidized** when exposed to air, resulting in unpleasant smell and taste of food.

Example: Butter or oily foods left open for a long time develop a bad smell and taste.
Prevention Methods:

- Storing food in **air-tight containers**
- Adding **antioxidants**
- Refrigeration
- Packing food with **nitrogen gas**

Quick Tip

Corrosion → Damage of metals due to chemical reactions.
Rancidity → Spoilage of fats and oils due to oxidation.

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2. Explain the difference between displacement and double displacement reactions with equations.

Correct Answer: In a displacement reaction, one element replaces another element from a compound, while in a double displacement reaction, two compounds exchange their ions to form two new compounds.

Solution:
Concept: Chemical reactions are classified into different types based on the way reactants form products. Two important types are **displacement reactions** and **double displacement reactions**.
Step 1: Displacement Reaction
A **displacement reaction** is a chemical reaction in which a more reactive element displaces a less reactive element from its compound.
Example:

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

In this reaction, **zinc** displaces **copper** from copper sulphate because zinc is more reactive.
Step 2: Double Displacement Reaction
A **double displacement reaction** is a chemical reaction in which two compounds react and exchange their ions to form two new compounds.
Example:

$$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2NaCl$$

In this reaction, the ions of sodium sulphate and barium chloride exchange to form **barium sulphate** and **sodium chloride**.
Step 3: Main Differences

Feature	Displacement Reaction	Double Displacement Reactio
Number of compounds involved	One element and one compound	Two compounds
Process	One element replaces another	Exchange of ions between compou
Example	$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$	$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4 + 2N$

Quick Tip

Displacement Reaction → One element replaces another.
Double Displacement Reaction → Exchange of ions between two compounds.

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3. Balance the following chemical equations: $H_2 + O_2 \rightarrow H_2O$ and $NaOH + HCl \rightarrow NaCl + H_2O$.

Correct Answer: $2H_2 + O_2 \rightarrow 2H_2O$ and $NaOH + HCl \rightarrow NaCl + H_2O$.

Solution:
Concept: According to the **law of conservation of mass**, the number of atoms of each element must be the same on both sides of a chemical equation. Therefore, chemical equations must be **balanced**.
Step 1: Balancing the equation $H_2 + O_2 \rightarrow H_2O$
Unbalanced equation:

$$H_2 + O_2 \rightarrow H_2O$$

Number of oxygen atoms on the left side is 2, while on the right side it is 1. To balance oxygen atoms, multiply H_2O by 2.

$$H_2 + O_2 \rightarrow 2H_2O$$

Now hydrogen atoms become 4 on the right side, so multiply H_2 by 2.

$$2H_2 + O_2 \rightarrow 2H_2O$$

This is the **balanced equation**.

Step 2: Balancing the equation $NaOH + HCl \rightarrow NaCl + H_2O$
Unbalanced equation:

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Counting atoms on both sides:

- Na: 1 on both sides
- Cl: 1 on both sides
- H: 2 on both sides
- O: 1 on both sides

Since all atoms are already equal, the equation is **already balanced**.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Quick Tip

Always balance the chemical equation by ensuring that the number of atoms of each element is the same on both sides of the equation.

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4. Define Oxidation and Reduction reactions with suitable examples (Redox reactions).

Correct Answer: Oxidation is the process of loss of electrons or addition of oxygen, while reduction is the process of gain of electrons or removal of oxygen. Both occur together in a redox reaction.

Solution:
Concept: In many chemical reactions, one substance loses electrons while another gains electrons. Such reactions are called **oxidation-reduction reactions** or **redox reactions**. Oxidation and reduction always occur simultaneously.
Step 1: Oxidation Reaction
Oxidation is defined as the process in which a substance:

- **loses electrons**, or
- **gains oxygen**, or
- **loses hydrogen**.

Example:

$$2Mg + O_2 \rightarrow 2MgO$$

In this reaction, magnesium combines with oxygen to form magnesium oxide. Here, **magnesium is oxidized** because it gains oxygen.
Step 2: Reduction Reaction
Reduction is defined as the process in which a substance:

- **gains electrons**, or
- **loses oxygen**, or
- **gains hydrogen**.

Example:

$$CuO + H_2 \rightarrow Cu + H_2O$$

In this reaction, copper oxide loses oxygen and forms copper. Hence, **copper oxide is reduced**.
Step 3: Redox Reaction

A **redox reaction** is a chemical reaction in which **oxidation and reduction occur simultaneously**.
Example:

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

Here:

- Zinc loses electrons and is **oxidized**.
- Copper ions gain electrons and are **reduced**.

Quick Tip

Oxidation = Loss of electrons
Reduction = Gain of electrons
Both processes occur together in a **redox reaction**.

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5. Define Acids and Bases according to the Arrhenius theory.

Correct Answer: According to Arrhenius theory, acids are substances that produce hydrogen ions (H^+) in aqueous solution, while bases are substances that produce hydroxide ions (OH^-) in aqueous solution.

Solution:
Concept: The Arrhenius theory was proposed by the Swedish scientist **Svante Arrhenius**. It explains the nature of acids and bases based on the ions they produce when dissolved in water.
Step 1: Arrhenius Definition of Acids
According to Arrhenius, an **acid** is a substance that produces **hydrogen ions** (H^+) when dissolved in water.
Example:

$$HCl \rightarrow H^+ + Cl^-$$

In this reaction, hydrochloric acid dissociates in water to produce hydrogen ions.
Step 2: Arrhenius Definition of Bases
According to Arrhenius, a **base** is a substance that produces **hydroxide ions** (OH^-) when dissolved in water.
Example:

$$NaOH \rightarrow Na^+ + OH^-$$

Here, sodium hydroxide dissociates in water to produce hydroxide ions.

Quick Tip

Arrhenius Acid $\rightarrow$ Produces H^+ ions in water
Arrhenius Base $\rightarrow$ Produces OH^- ions in water

6. What is the pH scale, and why is pH important in everyday life?

Correct Answer: The pH scale is a measure used to determine the acidity or basicity of a solution. It is important in everyday life because it helps maintain balance in biological systems, agriculture, medicine, and environmental processes.

Solution:
Concept: The strength of acids and bases in aqueous solutions is measured using the **pH scale**. It indicates the concentration of hydrogen ions (H^+) present in a solution.
Step 1: Definition of pH Scale
The **pH scale** is a scale used to measure the acidity or alkalinity of a solution. It ranges from **0 to 14**.

- $pH < 7 \rightarrow$ Acidic solution
- $pH = 7 \rightarrow$ Neutral solution
- $pH > 7 \rightarrow$ Basic (alkaline) solution

Lower pH values indicate stronger acids, while higher pH values indicate stronger bases.
Step 2: Importance of pH in Everyday Life

- **pH of soil:** Plants grow well in soil with a suitable pH. Farmers use fertilizers or lime to adjust soil pH.
- **pH in the human body:** The pH of blood must remain around 7.4 for proper functioning of the body.
- **Tooth decay:** When the pH in the mouth falls below 5.5, tooth enamel begins to decay. Toothpaste is basic and helps neutralize acids.
- **pH of water bodies:** The pH of rivers and lakes must remain balanced to support aquatic life.
- **Stomach digestion:** Hydrochloric acid in the stomach helps in digestion by maintaining a low pH.

Quick Tip

The **pH scale ranges from 0 to 14**: 0–6 $\rightarrow$ Acidic, 7 $\rightarrow$ Neutral, 8–14 $\rightarrow$ Basic.

7. Write the chemical formula and two uses of Washing Soda and Plaster of Paris (POP).

Correct Answer: Washing Soda has the chemical formula $Na_2CO_3 \cdot 10H_2O$, and Plaster of Paris has the chemical formula $CaSO_4 \cdot \frac{1}{2}H_2O$.

Solution:

Concept: Washing soda and Plaster of Paris are important chemical compounds widely used in domestic and industrial applications.
Step 1: Washing Soda
Chemical Formula:

$$Na_2CO_3 \cdot 10H_2O$$

Washing soda is also known as **sodium carbonate decahydrate**.
Uses:

- Used as a **cleaning agent** for washing clothes.
- Used in the **manufacture of glass, soap, and paper**.
- Used for **softening hard water**.

Step 2: Plaster of Paris (POP)
Chemical Formula:

$$CaSO_4 \cdot \frac{1}{2}H_2O$$

Plaster of Paris is obtained by heating **gypsum**.
Uses:

- Used in making **moulds, statues, and decorative items**.
- Used in **plaster casts** to support fractured bones.
- Used for making **false ceilings and wall finishing**.

Quick Tip

Washing Soda $\rightarrow Na_2CO_3 \cdot 10H_2O$
Plaster of Paris $\rightarrow CaSO_4 \cdot \frac{1}{2}H_2O$

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8. Explain the neutralisation reaction with an example and its utility in daily life.

Correct Answer: A neutralisation reaction is a chemical reaction in which an acid reacts with a base to form salt and water.

Solution:
Concept: When an **acid** reacts with a **base**, the acidic and basic properties cancel each other and form **salt and water**. This type of reaction is known as a **neutralisation reaction**.
Step 1: Definition of Neutralisation Reaction
A **neutralisation reaction** is defined as a chemical reaction in which an **acid reacts with a base** to produce **salt and water**.

$$\text{Acid} + \text{Base} \rightarrow \text{Salt} + \text{Water}$$

Example:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

In this reaction, hydrochloric acid reacts with sodium hydroxide to form sodium chloride (salt) and water.

Step 2: Utility in Daily Life

- **Indigestion:** Excess acid in the stomach is neutralised by taking antacids such as magnesium hydroxide.
- **Soil treatment:** Farmers add lime (a base) to acidic soil to neutralise it and improve crop production.
- **Tooth decay:** Toothpaste is basic in nature and neutralises the acids produced by bacteria in the mouth.
- **Industrial waste treatment:** Basic or acidic industrial wastes are neutralised before releasing them into the environment.

Quick Tip

Neutralisation Reaction: **Acid + Base → Salt + Water**

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9. What are amphoteric oxides? Give two examples.

Correct Answer: Amphoteric oxides are oxides that react with both acids and bases to form salt and water.

Solution:

Concept: Oxides are compounds formed when elements react with oxygen. Based on their chemical behavior, oxides can be classified as acidic, basic, and amphoteric oxides.

Step 1: Definition of Amphoteric Oxides

Amphoteric oxides are those oxides that show both acidic and basic properties. They react with both **acids** and **bases** to form **salt and water**.

Step 2: Examples of Amphoteric Oxides

- **Aluminium oxide** (Al_2O_3)
- **Zinc oxide** (ZnO)

Example Reactions:

Reaction with acid:

$$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$$

Reaction with base:

$$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$$

These reactions show that amphoteric oxides can react with both acids and bases.

Quick Tip

Common amphoteric oxides include **Aluminium oxide (Al_2O_3)** and **Zinc oxide (ZnO)**.

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10. Differentiate between metals and non-metals based on their chemical properties.

Correct Answer: Metals and non-metals differ in their chemical behavior such as reaction with oxygen, water, acids, and their tendency to lose or gain electrons.

Solution:
Concept: Metals and non-metals show different chemical properties due to their tendency to either **lose electrons** (metals) or **gain electrons** (non-metals) during chemical reactions.
Step 1: Differences based on chemical properties

Property	Metals	
Reaction with oxygen	Form basic or amphoteric oxides	F
Reaction with water	Many metals react with water to form hydroxides and hydrogen gas	Gen
Reaction with acids	React with dilute acids to produce salt and hydrogen gas	Usual
Electron tendency	Lose electrons to form positive ions (cations)	Gain elec
Nature of compounds	Usually form ionic compounds	Usu

Quick Tip

Metals → Lose electrons and form cations.
Non-metals → Gain electrons and form anions.

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11. Explain the formation of Ionic Compounds (e.g., $NaCl$ or $MgCl_2$) and state their properties.

Correct Answer: Ionic compounds are formed by the transfer of electrons from a metal atom to a non-metal atom, resulting in the formation of positively and negatively charged ions which are held together by electrostatic forces.

Solution:
Concept: Ionic compounds are formed when electrons are transferred from one atom to another. This transfer results in the formation of **cations (positive ions)** and **anions (negative ions)**. The strong electrostatic force of attraction between these oppositely charged ions forms an **ionic bond**.
Step 1: Formation of Sodium Chloride ($NaCl$)

Sodium (Na) has one electron in its outermost shell, while chlorine (Cl) has seven electrons in its outer shell.

- Sodium loses one electron to form a positive ion:

$$Na \rightarrow Na^+ + e^-$$

- Chlorine gains one electron to form a negative ion:

$$Cl + e^- \rightarrow Cl^-$$

The oppositely charged ions attract each other to form the ionic compound:

$$Na^+ + Cl^- \rightarrow NaCl$$

Step 2: Formation of Magnesium Chloride ($MgCl_2$)
Magnesium loses two electrons to form Mg^{2+}, and two chlorine atoms each gain one electron to form Cl^-.

$$Mg \rightarrow Mg^{2+} + 2e^-$$

$$2Cl + 2e^- \rightarrow 2Cl^-$$

These ions combine to form magnesium chloride:

$$Mg^{2+} + 2Cl^- \rightarrow MgCl_2$$

Step 3: Properties of Ionic Compounds

- They have **high melting and boiling points**.
- They are generally **hard and brittle**.
- They are **soluble in water**.
- They **conduct electricity in molten state or in aqueous solution** but not in solid state.

Quick Tip

Ionic compounds are formed by **transfer of electrons** and the **electrostatic attraction between oppositely charged ions**.

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12. Explain the mechanism of cleaning action of soap (micelle formation).

Correct Answer: Soap cleans by forming micelles in water, where the hydrophobic tail dissolves grease and the hydrophilic head remains in water, allowing dirt to be washed away.

Solution:

Concept: Soap molecules have a special structure with two different parts: a **hydrophobic (water-repelling) tail** and a **hydrophilic (water-attracting) head**. This property allows soap to remove grease and dirt from surfaces.

Step 1: Structure of Soap Molecule

A soap molecule consists of:

- **Hydrophilic head:** Ionic part that is attracted to water.
- **Hydrophobic tail:** Long hydrocarbon chain that is attracted to oil and grease.

Step 2: Formation of Micelles

When soap is added to water containing grease or oily dirt:

- The hydrophobic tails attach themselves to the oil or grease particles.
- The hydrophilic heads remain outside, facing the surrounding water.

Many soap molecules surround the grease particle and form a spherical structure called a **micelle**.

Step 3: Removal of Dirt

The grease particle gets trapped in the center of the micelle. When the surface is rinsed with water, the micelles carrying the dirt are washed away, thereby cleaning the surface.

Quick Tip

Soap molecules form **micelles** where the **hydrophobic tails trap grease** and the **hydrophilic heads interact with water**, allowing dirt to be removed easily.
