

ICSE Class 10 Chemistry

Comprehensive Chapter-wise Solutions & Practice Guide

Based on the Latest Exam Pattern and Syllabus

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Introduction

This comprehensive practice guide provides step-by-step solutions to essential questions across all major chapters of the ICSE Class 10 Chemistry syllabus. It is designed to help students understand foundational concepts, master chemical equations, and excel in analytical chemistry.

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1 Periodic Table, Periodic Properties and Variations

Question 1: Define the modern periodic law and state the cause of periodicity.

Solution:

Modern Periodic Law: The physical and chemical properties of elements are a periodic function of their atomic numbers.

Cause of Periodicity: The periodic repetition of properties is due to the recurrence of similar valence shell electronic configurations after certain regular intervals (atomic numbers).

Question 2: Explain the trend of Ionization Potential (IP) across a period and down a group.

Solution:

- **Across a Period (Left to Right):** Ionization Potential increases. *Reason:* The atomic size decreases and the nuclear charge increases. Thus, the nucleus exerts a stronger pull on the outermost electrons, making it harder to remove an electron.
- **Down a Group (Top to Bottom):** Ionization Potential decreases. *Reason:* The atomic size increases due to the addition of new electron shells. The increased distance from the nucleus and the shielding effect of inner electrons outweigh the increase in nuclear charge, making it easier to remove the outermost electron.

Question 3: Why do noble gases have zero electron affinity?

Solution:

Noble gases have completely filled valence shells (stable octet or duplet in the case of Helium). Because their outermost shells are full, they have no tendency to accept additional electrons. Therefore, energy is not released when an electron is added, resulting in an electron affinity of zero.

2 Chemical Bonding

Question 1: Differentiate between Electrovalent (Ionic) and Covalent compounds.

Solution:

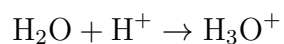
Question 2: Describe the formation of a Coordinate Bond in the Hydronium ion (H_3O^+).

Solution:

A coordinate bond is formed when both shared electrons are provided by one atom. In water (H_2O), the oxygen atom has two lone pairs of electrons. When an acid is dissolved

Property	Electrovalent compounds	Com-	Covalent Compounds
Formation	Transfer of electrons		Sharing of electrons
State at Room Temp	Crystalline solids		Gases, liquids, or soft solids
Melting/Boiling Point	High		Low
Electrical Conductivity	Conduct in molten or aqueous state	or	Do not conduct (except polar covalent in solution)
Solubility	Soluble in water		Insoluble in water, soluble in organic solvents

in water, it releases a proton (H^+), which has no electrons. The oxygen atom in the water molecule donates one of its lone pairs to the empty orbital of the H^+ ion, forming a coordinate (dative) bond.



3 Study of Acids, Bases and Salts

Question 1: Define a normal salt and an acid salt, giving one example of each.

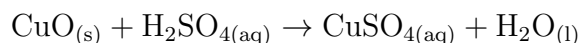
Solution:

- **Normal Salt:** A salt formed by the complete replacement of all the replaceable hydrogen ions of an acid by a metallic or ammonium ion.
Example: Sodium chloride (NaCl), Sodium sulphate (Na_2SO_4).
- **Acid Salt:** A salt formed by the partial replacement of the replaceable hydrogen ions of a polybasic acid by a metallic or ammonium ion. It still contains replaceable hydrogen.
Example: Sodium hydrogen sulphate (NaHSO_4).

Question 2: Write balanced chemical equations for the preparation of Copper(II) sulphate from Copper(II) oxide.

Solution:

Copper(II) sulphate can be prepared by neutralizing insoluble Copper(II) oxide (CuO) with dilute sulphuric acid (H_2SO_4).



The solution is then filtered, evaporated to the point of crystallization, and cooled to obtain blue crystals of Copper(II) sulphate pentahydrate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$).

4 Analytical Chemistry

Question 1: State your observations when Ammonium Hydroxide (NH_4OH) is added dropwise and then in excess to a solution of Copper(II) sulphate.

Solution:

- **Dropwise addition:** A pale blue precipitate of Copper(II) hydroxide is formed.



- **In excess:** The pale blue precipitate dissolves to give a deep blue (inky blue) solution due to the formation of a complex salt, tetrammine copper(II) sulphate.



Question 2: How can you distinguish between Zinc nitrate and Lead nitrate solutions using Sodium Hydroxide?

Solution:

Add Sodium Hydroxide (NaOH) solution dropwise, then in excess, to both solutions:

- **Zinc nitrate:** Gives a white gelatinous precipitate of Zinc hydroxide ($\text{Zn}(\text{OH})_2$) which *dissolves* in excess NaOH to form a colorless solution of Sodium zincate (Na_2ZnO_2).
- **Lead nitrate:** Gives a chalky white precipitate of Lead hydroxide ($\text{Pb}(\text{OH})_2$) which also *dissolves* in excess NaOH to form Sodium plumbite (Na_2PbO_2).

Note: To truly distinguish them, Ammonium Hydroxide is better, as $\text{Zn}(\text{OH})_2$ dissolves in excess NH_4OH , while $\text{Pb}(\text{OH})_2$ remains insoluble.

5 Mole Concept and Stoichiometry

Question 1: Calculate the percentage of Oxygen in Calcium Carbonate (CaCO_3).

Solution:

Step 1: Find the molecular weight of CaCO_3 .

Atomic weights: $\text{Ca} = 40$, $\text{C} = 12$, $\text{O} = 16$.

Molecular Weight = $40 + 12 + (3 \times 16) = 40 + 12 + 48 = 100 \text{ g/mol}$.

Step 2: Calculate the mass of Oxygen in one mole of CaCO_3 .

Mass of Oxygen = $3 \times 16 = 48 \text{ g}$.

Step 3: Calculate the percentage.

$$\text{Percentage of Oxygen} = \left(\frac{\text{Mass of Oxygen}}{\text{Total Mass}} \right) \times 100 = \left(\frac{48}{100} \right) \times 100 = 48\%$$

Question 2: A compound has an empirical formula CH_2O . Its vapor density is 30. Determine its molecular formula.

Solution:

Step 1: Calculate the Molecular Weight.

Molecular Weight = $2 \times \text{Vapor Density} = 2 \times 30 = 60$.

Step 2: Calculate the Empirical Formula Weight.

Empirical formula = CH_2O .

Weight = $12 + (2 \times 1) + 16 = 30$.

Step 3: Find the value of 'n'.

$$n = \frac{\text{Molecular Weight}}{\text{Empirical Formula Weight}} = \frac{60}{30} = 2$$

Step 4: Determine the Molecular Formula.

Molecular Formula = (Empirical Formula)_n = $(\text{CH}_2\text{O})_2 = \text{C}_2\text{H}_4\text{O}_2$ (Acetic Acid).

6 Metallurgy

Question 1: Name the chief ore of Aluminium and outline the steps of Baeyer's Process.

Solution:

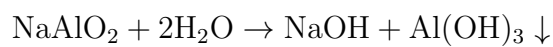
Chief Ore: Bauxite ($\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$).

Baeyer's Process (Concentration of Bauxite):

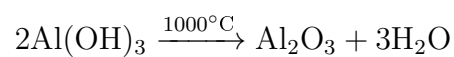
1. **Conversion of Bauxite to Sodium Aluminate:** Impure bauxite is heated with concentrated Sodium Hydroxide under pressure.



2. **Precipitation of Aluminium Hydroxide:** The sodium aluminate solution is diluted with water and seeded with freshly precipitated aluminium hydroxide to induce precipitation.



3. **Calcination:** The precipitate is filtered, washed, dried, and ignited at 1000°C to obtain pure alumina.



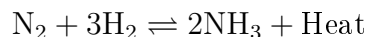
7 Study of Compounds

Question 1: Describe the Haber Process for the manufacture of Ammonia.

Solution:

Reactants: Nitrogen and Hydrogen in a 1:3 ratio by volume.

Equation:



Conditions required for maximum yield:

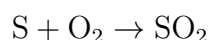
- **Temperature:** Optimum temperature of $450^\circ\text{C} - 500^\circ\text{C}$. (The reaction is exothermic, so low temperature favors yield, but a moderate temperature is needed for a viable reaction rate).
- **Pressure:** High pressure of $200 - 900 \text{ atm}$.
- **Catalyst:** Finely divided iron.
- **Promoter:** Molybdenum or Aluminum oxide (Al_2O_3), to increase the efficiency of the catalyst.

Question 2: Explain the Contact Process for the manufacture of Sulphuric Acid.

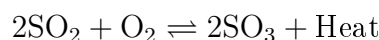
Solution:

The Contact Process involves three main steps:

1. **Production of Sulphur Dioxide:** Burning sulphur or roasting iron pyrites in air.

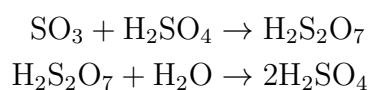


2. **Catalytic Oxidation of SO_2 to SO_3 (The Contact Step):**



Conditions: Temperature of 450°C , Pressure of $1 - 2 \text{ atm}$, Catalyst: Vanadium Pentoxide (V_2O_5).

3. **Absorption of SO_3 :** SO_3 is absorbed in concentrated H_2SO_4 to form Oleum ($\text{H}_2\text{S}_2\text{O}_7$), which is then diluted with water to get the desired concentration of Sulphuric Acid. (Direct absorption in water is highly exothermic and forms a dangerous acid mist).



8 Organic Chemistry

Question 1: Define Catenation and Isomerism.

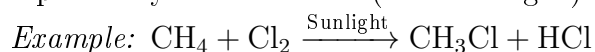
Solution:

- **Catenation:** The unique property of carbon atoms to link with one another via covalent bonds to form long straight chains, branched chains, or closed rings.
- **Isomerism:** The phenomenon where two or more organic compounds have the same molecular formula but different structural arrangements of atoms, and consequently different physical and chemical properties.

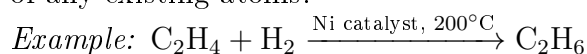
Question 2: Differentiate between Alkanes and Alkenes based on their chemical reactions.

Solution:

Alkanes (Saturated Hydrocarbons): They undergo *Substitution Reactions*. Because all valencies of carbon are fully satisfied by single bonds, a hydrogen atom must be replaced by another atom (like a halogen).



Alkenes (Unsaturated Hydrocarbons): They undergo *Addition Reactions*. The double bond breaks, and new atoms are added across the carbons without the removal of any existing atoms.



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