

Class 10 Chemistry Notes

Based on the Latest Exam Pattern & Syllabus

Chapter 1: Chemical Reactions and Equations

1.1 Chemical Reactions

A chemical reaction is a process in which new substances with new properties are formed.

- **Reactants:** The substances which take part in a chemical reaction.
- **Products:** The new substances produced as a result of a chemical reaction.

Characteristics of Chemical Reactions: Evolution of a gas, formation of a precipitate, change in color, change in temperature, and change in state.

1.2 Chemical Equations

A chemical equation is the symbolic representation of a chemical reaction using symbols and formulae of the substances involved.

- **Balanced Chemical Equation:** An equation in which the number of atoms of each element on the reactant side is equal to that on the product side. This follows the *Law of Conservation of Mass*.
- **Example:** $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

1.3 Types of Chemical Reactions

1. **Combination Reaction:** Two or more substances combine to form a single product.
 $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)} + \text{Heat}$ (Slaked lime formation)
2. **Decomposition Reaction:** A single reactant breaks down to give simpler products. Requires energy (heat, light, or electricity).
 $2\text{FeSO}_4\text{(s)} \xrightarrow{\text{Heat}} \text{Fe}_2\text{O}_3\text{(s)} + \text{SO}_2\text{(g)} + \text{SO}_3\text{(g)}$
3. **Displacement Reaction:** A more reactive element displaces a less reactive element from its compound.
 $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{Cu(s)}$
4. **Double Displacement Reaction:** Exchange of ions between the reactants.
 $\text{Na}_2\text{SO}_4\text{(aq)} + \text{BaCl}_2\text{(aq)} \rightarrow \text{BaSO}_4\text{(s)} + 2\text{NaCl(aq)}$

1.4 Oxidation and Reduction (Redox Reactions)

- **Oxidation:** Gain of oxygen or loss of hydrogen.
- **Reduction:** Loss of oxygen or gain of hydrogen.
- **Corrosion:** Gradual destruction of metals by the action of air, moisture, or chemicals (e.g., Rusting of iron: $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).
- **Rancidity:** Oxidation of fats and oils when exposed to air, leading to bad smell and taste. Prevented by adding antioxidants or flushing with nitrogen gas.

Chapter 2: Acids, Bases and Salts

2.1 Acids and Bases

- **Acids:** Sour in taste, turn blue litmus red, and release H^+ (or H_3O^+) ions in aqueous solutions. Examples: HCl , H_2SO_4 , CH_3COOH .
- **Bases:** Bitter in taste, soapy to touch, turn red litmus blue, and release OH^- ions in aqueous solutions. Water-soluble bases are called *alkalis*. Examples: NaOH , KOH , $\text{Ca}(\text{OH})_2$.

2.2 Indicators

Substances that change color or odor in acidic or basic media.

- **Natural Indicators:** Litmus (Purple dye from lichen), Turmeric.
- **Synthetic Indicators:** Phenolphthalein (Colorless in acid, pink in base), Methyl Orange (Red in acid, yellow in base).
- **Olfactory Indicators:** Vanilla, Onion, Clove oil (Odor changes in basic media).

2.3 The pH Scale

A scale for measuring hydrogen ion concentration in a solution. Range: 0 to 14.

- $\text{pH} < 7$: Acidic nature (Lower pH = Stronger acid).
- $\text{pH} = 7$: Neutral solution (e.g., Pure water).
- $\text{pH} > 7$: Basic nature (Higher pH = Stronger base).

2.4 Important Chemical Compounds (Salts)

1. **Bleaching Powder (CaOCl_2):** Produced by the action of chlorine on dry slaked lime. Used for disinfecting drinking water.
2. **Baking Soda (NaHCO_3):** Sodium hydrogencarbonate. Used as an antacid and in making baking powder (mixture of baking soda and a mild edible acid like tartaric acid).

3. **Washing Soda** ($\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$): Used in glass, soap, and paper industries, and for removing permanent hardness of water.
4. **Plaster of Paris** ($\text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O}$): Obtained by heating Gypsum at 373 K. Used by doctors for supporting fractured bones.

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Chapter 3: Metals and Non-Metals

3.1 Physical Properties

- **Metals:** Solid at room temp (except Mercury), lustrous, malleable (beaten into sheets), ductile (drawn into wires), good conductors of heat and electricity, sonorous.
- **Non-Metals:** Can be solid, liquid (Bromine), or gas. Non-lustrous (except Iodine), non-malleable, non-ductile, poor conductors (except Graphite).

3.2 Chemical Properties of Metals

- **Reaction with Oxygen:** $\text{Metal} + \text{Oxygen} \rightarrow \text{Metal Oxide}$ (Basic in nature). Some oxides like Al_2O_3 and ZnO are amphoteric (show both acidic and basic behavior).
- **Reaction with Water:** Highly reactive metals (K, Na) react violently with cold water. Mg reacts with hot water. Fe, Zn, Al react with steam.
- **Reaction with Acids:** $\text{Metal} + \text{Dilute Acid} \rightarrow \text{Salt} + \text{Hydrogen gas}$.

3.3 Reactivity Series

Arrangement of metals in decreasing order of their reactivity:

$\text{K} \succ \text{Na} \succ \text{Ca} \succ \text{Mg} \succ \text{Al} \succ \text{Zn} \succ \text{Fe} \succ \text{Pb} \succ [\text{H}] \succ \text{Cu} \succ \text{Hg} \succ \text{Ag} \succ \text{Au}$

3.4 Ionic Compounds

Formed by the transfer of electrons from a metal to a non-metal.

- **Properties:** Solid and hard, high melting and boiling points, soluble in water but insoluble in organic solvents. They conduct electricity in molten state or in aqueous solution (due to free-moving ions).

3.5 Metallurgy (Extraction of Metals)

- **Roasting:** Heating sulfide ores in excess air to convert them into oxides.
- **Calcination:** Heating carbonate ores in limited air to convert them into oxides.
- **Alloys:** Homogeneous mixture of two or more metals (or metal and non-metal).
Examples: Brass (Cu + Zn), Bronze (Cu + Sn), Solder (Pb + Sn).

Chapter 4: Carbon and its Compounds

4.1 Bonding in Carbon

Carbon (Atomic number 6, configuration 2,4) forms **covalent bonds** by sharing its four valence electrons to attain noble gas configuration. It cannot easily lose 4 electrons (requires huge energy) nor gain 4 electrons (nucleus cannot hold 10 electrons).

4.2 Versatile Nature of Carbon

- **Catenation:** The unique ability of carbon to form bonds with other carbon atoms, giving rise to large molecules (long chains, branched chains, or rings).
- **Tetravalency:** Having a valency of 4, it is capable of bonding with 4 other atoms of carbon or atoms of other monovalent elements.

4.3 Allotropes of Carbon

- **Diamond:** Hardest natural substance, non-conductor of electricity (each C bonded to 4 other C atoms).
- **Graphite:** Soft and slippery, good conductor of electricity (each C bonded to 3 other C atoms, leaving one free electron).
- **Fullerene:** Hollow cage-like molecules (e.g., C-60, Buckminsterfullerene).

4.4 Hydrocarbons

Compounds containing only Carbon and Hydrogen.

- **Saturated (Alkanes):** Single bonds between carbon atoms. Formula: C_nH_{2n+2} .
Examples: Methane (CH_4), Ethane (C_2H_6).
- **Unsaturated (Alkenes & Alkynes):** Double or triple bonds between carbon atoms.
 - Alkenes (Double bond): C_nH_{2n} (e.g., Ethene C_2H_4)
 - Alkynes (Triple bond): C_nH_{2n-2} (e.g., Ethyne C_2H_2)

4.5 Functional Groups & Homologous Series

- **Functional Group:** An atom or group of atoms that largely determines the chemical properties of a compound. Examples: Alcohol ($-\text{OH}$), Aldehyde ($-\text{CHO}$), Ketone ($-\text{CO}-$), Carboxylic acid ($-\text{COOH}$).
- **Homologous Series:** A series of compounds with the same general formula and functional group, where successive members differ by a $-\text{CH}_2$ unit (14 atomic mass units). Example: CH_3OH , $\text{C}_2\text{H}_5\text{OH}$, $\text{C}_3\text{H}_7\text{OH}$.

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