Chapter 3: Metals and Non-Metals

CBSE Class 10 Science Notes

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1. Physical Properties of Metals and Non-Metals

Metals

- **Lustrous** (shiny surface)
- **Hard** (except sodium and potassium)
- **Good conductors** of heat and electricity
- **Malleable** (can be hammered into sheets)
- **Ductile** (can be drawn into wires)
- **Sonorous** (produce sound when struck)
- **High melting and boiling points**

Non-Metals

- **Dull** (non-lustrous)
- **Brittle** (breaks on hammering)
- **Poor conductors** of heat and electricity (except graphite)
- **Not malleable or ductile**
- **Low melting and boiling points**

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2. Chemical Properties of Metals

(a) Reaction with Oxygen

Metals react with oxygen to form **metal oxides**.
Example:

$4Na + O_2 \rightarrow 2Na_2O$
$2Mg + O_2 \rightarrow 2MgO$

- Metal oxides are **basic** in nature.

(b) Reaction with Water

Metals form **metal hydroxide** and release **hydrogen gas**.
Example:

$2Na + 2H2O \rightarrow 2NaOH + H2\uparrow$

- Magnesium reacts with hot water.
- Iron reacts with steam.
- Copper, silver, gold do not react with water.

(c) Reaction with Acids

Metals react with dilute acids to produce **salt and hydrogen gas**.
Example:

$Zn + 2HCl \rightarrow ZnCl2 + H2\uparrow$

Note: H_2 gas burns with a 'pop' sound.

(d) Reaction with Other Metal Salts (Displacement Reaction)

A more reactive metal displaces a less reactive metal.
Example:

$Zn + CuSO4 \rightarrow ZnSO4 + Cu$

3. Reactivity Series of Metals

A list of metals arranged in **decreasing order of reactivity**:
K > Na > Ca > Mg > Al > Zn > Fe > Pb > Cu > Hg > Ag > Au

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4. Properties of Non-Metals

(a) Reaction with Oxygen

Non-metals form **acidic or neutral oxides**.
Example:

$C + O_2 \rightarrow CO_2$(acidic)
$H_2 + O_2 \rightarrow H_2O$(neutral)

(b) Reaction with Water/Acids

Non-metals **do not react** with water or acids as they do not lose electrons easily.

(c) Reaction with Chlorine

Non-metals react with chlorine to form **covalent chlorides**.
Example:

$H_2 + Cl_2 \rightarrow 2HCl$

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5. Ionic Compounds

Formation

Formed by **transfer of electrons** from metals to non-metals.

- Metal loses electrons → forms **cation**
- Non-metal gains electrons → forms **anion**
  Example:
  Na + Cl → NaCl

Properties

- **Hard and brittle**
- **High melting and boiling points**
- Conduct electricity in **molten** or **aqueous state**

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6. Occurrence of Metals

- Found in earth's crust as **minerals**
- **Ores**: Minerals from which metals are extracted profitably

Steps in Metallurgy:

1. **Enrichment of ore** (removal of impurities)
2. **Extraction** of metal from ore
   - **Calcination** (heating in absence of air)
   - **Roasting** (heating in presence of air)
3. **Reduction** (by carbon, displacement, electrolysis)
4. **Refining** (electrolytic refining)

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7. Corrosion

Gradual destruction of metals by reacting with air and moisture.
Example:
Iron → Rust ($Fe_2O_3 \cdot xH_2O$)
Prevention:

- Painting
- Galvanization
- Oiling
- Alloying

8. Alloys

A mixture of **two or more metals** or **metal + non-metal**.

- Improves strength, hardness, resistance
  Example:
- **Brass** = Copper + Zinc
- **Bronze** = Copper + Tin
- **Stainless steel** = Iron + Chromium + Nickel