Metals and Non-metals

1. Classification of Elements

Elements are classified into:

Metals Non-metals

2. Physical Properties of Metals

Main Properties:

Lustrous → Shiny surface (metallic lustre)

Malleable → Can be beaten into thin sheets

Ductile → Can be drawn into wires

Good conductors → Heat and electricity

Sonorous → Produce sound when struck

State:

Generally **solid** at room temperature

Exception: **Mercury** (liquid)

Hardness:

Generally **hard**

Exception: **Sodium, Potassium** → soft

3. Special Points (Metals)

Gold → most ductile metal

Gold & Silver → most malleable

Silver & Copper → best conductors of heat

Lead & Mercury → poor conductors

Gallium & Caesium → very low melting points

4. Chemical Properties of Metals

Metals are **electropositive**

Lose electrons to form **positive ions (cations)**

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

5. Physical Properties of Non-metals

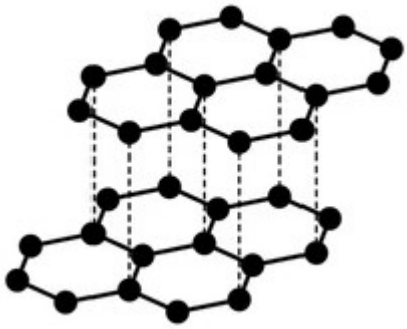
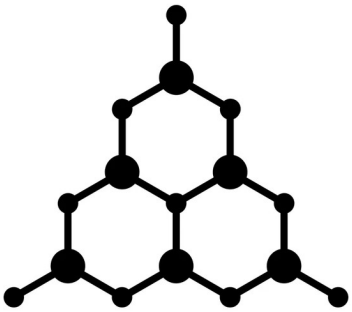
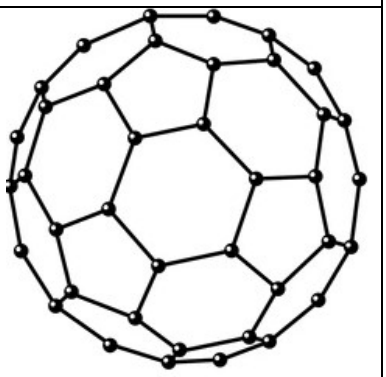
General Properties:

- Dull (non-lustrous)
- Not malleable
- Not ductile
- Poor conductors
- Exceptions: Graphite → conducts electricity , Iodine → lustrous
- State: Can be **solid or gas**
- Exception: **Bromine → liquid**

6. Chemical Properties of Non-metals

- Non-metals are **electronegative**
- Gain electrons to form **negative ions (anions)**
- Example: $Cl + e^- \rightarrow Cl^-$

1. **Allotropes -** Different forms of the same element with different properties are called **allotropes**.

Graphite (soft, conductor)	Diamond (hard)	Fullerence
		

Oxides of Metals and Non-metals

Metals	Amphoteric Oxides	Non-metals

basic oxides	acidic and basic nature	acidic or neutral oxides
Magnissium oxide(MgO)	Aluminium oxide (Al_2O_3)	Carbon dioxide (CO_2)
Iron oxide (Fe_2O_3)	Zinc oxide (ZnO)	Sulphur dioxide (SO_2)

Reactivity Series

A list of metals arranged in decreasing order of reactivity.

Key Points:

- Metals above hydrogen → displace hydrogen from acids
- More reactive metal → displaces less reactive metal

Reaction with Acids

Metal + Acid → Salt + Hydrogen gas

Exception: Nitric acid (HNO_3)

Does not release H_2 gas (strong oxidising agent)

Ionic Compounds (Electrovalent Compounds)

Formation: Formed by transfer of electrons (metal → non-metal)

Properties:

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

Occurrence of Metals

Mineral: Naturally occurring substances in the earth's crust.

Ore: Minerals from which metals can be extracted economically.

Metallurgy (Extraction of Metals)

Steps:

- **Enrichment of Ore**: Removal of impurities (gangue)
- **Calcination**: Heating carbonate ores in limited air
- **Roasting**: Heating sulphide ores in excess air
- **Refining**: Purification of metals

→ Most common method: **Electrolytic refining**

Alloys: Homogeneous mixture of:

- Two or more metals or metal + non-metal
- Examples: **Brass (Cu + Zn)** **Steel (Fe + C)**

Corrosion: Slow deterioration of metals due to air and moisture.

Example: Rusting of iron

Prevention: Painting , Oiling , Galvanization

Protection by Oxide Layer

Metals like Mg, Al, Zn, Pb form a protective oxide layer that prevents further corrosion.

- **Anodising :** Process of forming a thick oxide layer on aluminium for protection and decoration.