

CLASS X
CHAPTER 3
METALS AND NON-METALS-PROPERTIES
PART -I



PHYSICAL PROPERTIES OF METALS



- ▶ Metals are solids. (except Mercury)
- ▶ Metals are hard. (except Lithium, Potassium, Sodium)
- ▶ Metals have metallic lustre. (shine)
- ▶ Metals are malleable. (can be beaten into thin sheets)
- ▶ Metals are ductile. (can be drawn into long wires)
- ▶ Metals have high melting points. (Gallium and Caesium have low melting points. They melt in the palm of the hand)
- ▶ Metals are good conductors of heat. (Best conductors are Silver and Copper. Poor conductors are Lead and Mercury)
- ▶ Metals are good conductors of electricity. (Best conductors are Silver and Copper)
- ▶ Metals are sonorous. (produce sound when beaten)

PHYSICAL PROPERTIES OF NON METALS



- ▶ Non metals may be solids, liquids or gases. (Solids - Carbon, Sulphur, Phosphorus etc. Liquid - Bromine, Gases - Oxygen, Hydrogen, Nitrogen etc.)
- ▶ Non metals are soft. (except Diamond which is the hardest natural substance)
- ▶ Non metals do not have lustre.(except Iodine)
- ▶ Non metals are not malleable.
- ▶ Non metals are not ductile.
- ▶ Non metals have low melting points and low boiling points.
- ▶ Non metals are bad conductors of heat.
- ▶ Non metals are bad conductors of electricity. (except Graphite)
- ▶ Non metals are not sonorous.



CHEMICAL PROPERTIES OF METALS

1. Metals combine with oxygen to form metal oxides.

▶ Metal + Oxygen → Metal oxide

▶ $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$
(Copper(II) oxide)

▶ $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$
(Magnesium oxide)

▶ $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$
(Aluminium oxide)



Burning of Magnesium ribbon in air



CHEMICAL PROPERTIES OF METALS

NATURE OF METAL OXIDES :

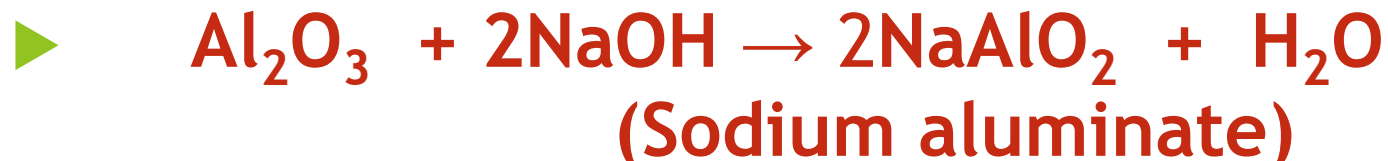
- ▶ Some metal oxides are basic oxides because they react with water to form bases.



- ▶ Some metal oxides show both acidic and basic properties.

They are called Amphoteric oxides.

Eg :- Aluminium oxide, Zinc oxide etc.





CHEMICAL PROPERTIES OF METALS

2. Metal + Water \rightarrow Metal oxide + Hydrogen

► Metal oxide + Water \rightarrow Metal hydroxide



► Metals like potassium and sodium react violently with cold water.



► Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of the metal.



CHEMICAL PROPERTIES OF METALS

- ▶ Metals like Aluminium, Iron and Zinc do not react either with cold or hot water. But they react with steam to form the metal oxide and hydrogen.
- ▶ $2\text{Al}(s) + 3\text{H}_2\text{O}(g) \rightarrow \text{Al}_2\text{O}_3(s) + 3\text{H}_2(g)$
- ▶ $3\text{Fe}(s) + 4\text{H}_2\text{O}(g) \rightarrow \text{Fe}_3\text{O}_4(s) + 4\text{H}_2(g)$
- ▶ Metals such as lead, copper, silver and gold do not react with water at all.



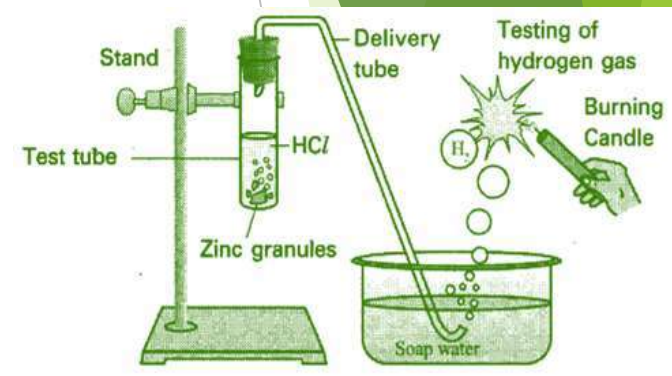
CHEMICAL PROPERTIES OF METALS

3. Metal + Dilute acid \rightarrow Salt + Hydrogen



▶ Copper, silver and gold do not react with dilute HCl.

▶ Hydrogen gas is not evolved when metals react with nitric acid (HNO_3) because it is a strong oxidising agent and it oxidises the H_2 produced to water and is itself reduced to oxides of nitrogen.

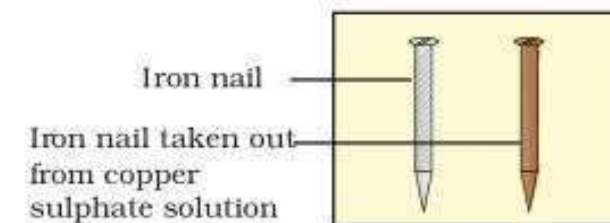
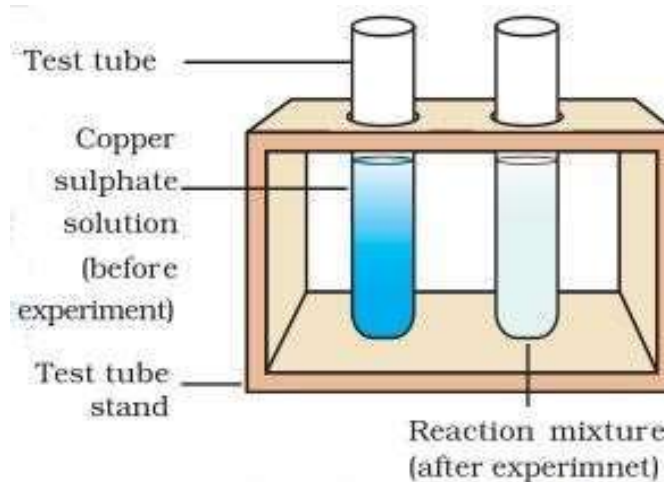
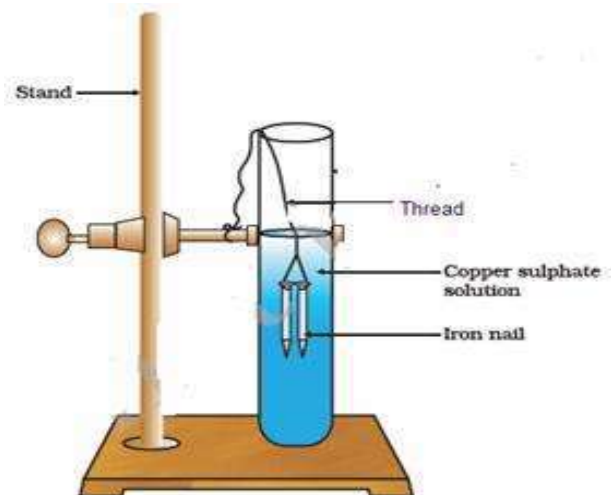




CHEMICAL PROPERTIES OF METALS

4. DISPLACEMENT REACTIONS

- Metal A + Salt solution of B → Salt solution of A + Metal B
(MORE REACTIVE) (LESS REACTIVE)





REACTIVITY SERIES OF METALS

- ▶ K Potassium (Most reactive)
- ▶ Na Sodium
- ▶ Ca Calcium
- ▶ Mg Magnesium
- ▶ Al Aluminium
- ▶ Zn Zinc
- ▶ Fe Iron
- ▶ Pb Lead
- ▶ H Hydrogen
- ▶ Cu Copper
- ▶ Hg Mercury
- ▶ Ag Silver
- ▶ Au Gold (Least reactive)

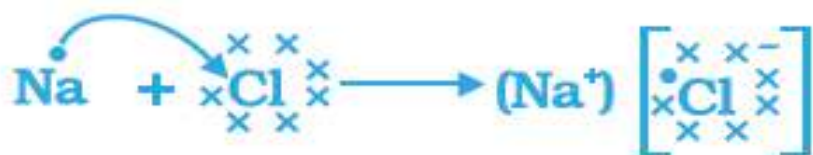
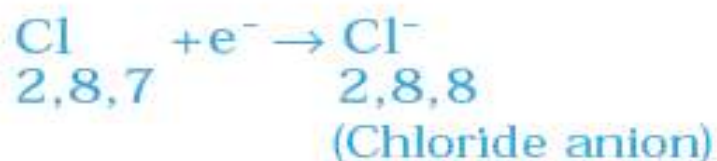
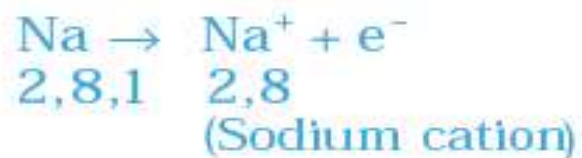
Reactivity decreases





HOW DO METALS AND NON-METALS REACT?

- ▶ Metals :- lose electrons and become positive ions. So, they are **electropositive** in nature.
- ▶ Non metals :- gain electrons and become negative ions. So, they are **electronegative** in nature.



EXAMPLE- FORMATION OF SODIUM CHLORIDE:

- ▶ The atomic number of Na is 11, its electronic configuration is 2,8,1.
- ▶ It has 1 valence electron, so it loses 1 electron to form Na⁺ ion.
- ▶ The atomic number of Cl is 17, its electronic configuration is 2,8,7.
- ▶ It has 7 valence electrons, so it gains 1 electron to form Cl⁻ ion.
- ▶ Then, the attraction between the Na⁺ ion and Cl⁻ ion results in the formation of sodium chloride molecule, NaCl.



Properties of Ionic Compounds

- ▶ They are formed by the transfer of electrons and are made up of ions.
- ▶ They are hard crystalline solids.
- ▶ They have high melting points and boiling points.
- ▶ They are soluble in water but insoluble in organic solvents (like petrol, kerosene etc.)
- ▶ They conduct electricity in molten state or in solution.

