



Class 10th

CHEMISTRY

METALS AND NON-METALS

Elements can be classified as metals and non-metals on the basis of their properties.

Examples of some metals are:

Iron (Fe), Aluminium (Al), Silver (Ag), Copper (Cu)

Examples of some non-metals are:

Hydrogen (H), Nitrogen (N), Sulphur (S), Oxygen (O)

Physical properties of metals:

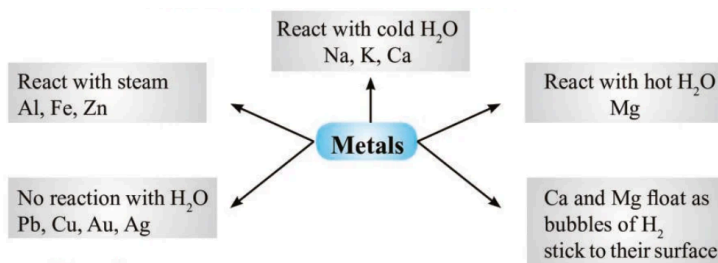
Metals are generally hard, malleable, lustrous, sonorous and have high melting points.

They are good conductors of heat and electricity.

Mercury is a liquid metal at room temperature.

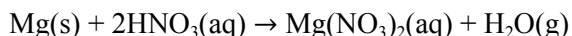
Chemical properties of metals:

1. Metal + Oxygen \rightarrow Metal oxide, example: $2\text{Cu(s)} + \text{O}_2\text{(g)} \rightarrow 2\text{CuO(s)}$
2. Metal + Water \rightarrow Metal hydroxide + Hydrogen, example: $2\text{K(s)} + 2\text{H}_2\text{O(l)} \rightarrow 2\text{KOH(aq)} + \text{H}_2\text{(g)} + \text{heat energy}$

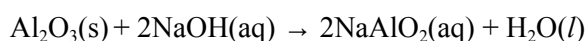
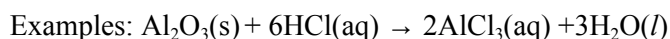


3. Metal oxide + Water \rightarrow Metal hydroxide, example: $\text{CaO(s)} + \text{H}_2\text{O(l)} \rightarrow \text{Ca(OH)}_2\text{(aq)}$
4. Metal + Dilute acid \rightarrow Salt + Hydrogen, example: $\text{Fe(s)} + \text{dil.H}_2\text{SO}_4\text{(aq)} \rightarrow \text{FeSO}_4\text{(aq)} + \text{H}_2\text{(g)}$

Hydrogen gas is not evolved when a metal reacts with nitric acid. This is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O , NO , NO_2). But magnesium (Mg) and manganese (Mn) react with very dilute HNO_3 to evolve H_2 gas.



Amphoteric Oxides: Metal oxides which react with both acids as well as bases to produce salts and water are called amphoteric oxides.



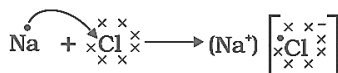
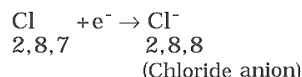
5. Metal A + Salt solution of B → Salt solution of A + Metal B, example: $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \rightarrow \text{Cu(s)} + \text{FeSO}_4\text{(aq)}$

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

Reaction of Metals with Non-metals

Atoms of the metals lose electrons from their valence shell to form cations.

For example: Formation of NaCl



1. Physical nature: They are solid and hard, and brittle.
2. Melting and Boiling Point: They have high melting and boiling point.
3. Solubility: Generally soluble in water and insoluble in solvents such as kerosene, petrol etc.
4. Conductivity: Ionic compounds conduct electricity in molten and aqueous solution but not in solid state.

Minerals: The elements or compounds which occur naturally in the earth's crust are called minerals.

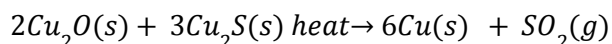
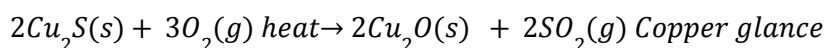
Gangue: Ores mined from the earth are usually contaminated with large amounts of impurities such as soil, sand, etc., called gangue.



Very reactive	K	Not found in free state
	Na	
	Ca	Extraction by electrolysis
	Mg	
	Al	
Moderately reactive	Zn	Occur as sulphides, oxides, carbonates
	Fe	
	Pb	
	Cu	Reduction by using carbon
	Hg	
Least reactive	Ag	Occur in native/free state
	Au	

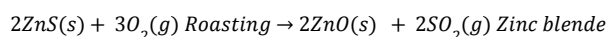
Extraction of Metals

(i) Metals of low reactivity:

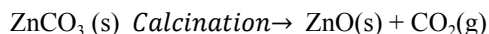


(ii) Metals of medium reactivity:

Roasting: The sulphide ores are converted into oxides by heating strongly in the presence of excess air. This process is known as roasting. Example:

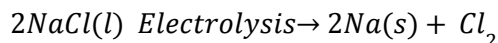


Calcination: The carbonate ores are changed into oxides by heating strongly in limited air or the absence of air. This process is known as calcination.



(iii) Metals of high reactivity.

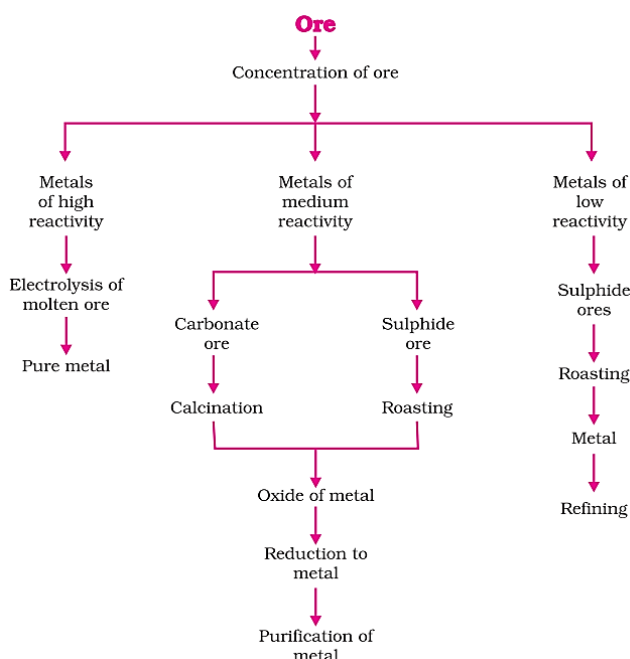
Sodium, magnesium and calcium are obtained by the electrolysis of their molten chlorides and oxides. The metals are deposited at the cathode (the negatively charged electrode), whereas, chlorine or oxygen is liberated at the anode (the positively charged electrode).



Molten

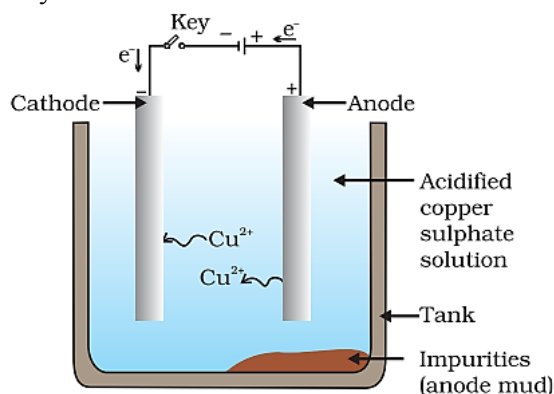


A summary of these steps:



Refining of Metals:

Electrolytic Refining: Many metals, such as copper, zinc, tin, nickel, silver, gold, etc., are refined electrolytically. In this process, the impure metal is made the anode and a thin strip of pure metal is made the cathode. A solution of the metal salt is used as an electrolyte.



Corrosion:

The surface of some metals such as iron, copper etc is corroded when they are exposed to moist air for a long period of time. This is called corrosion.

- (i) Silver becomes black when exposed to air as it reacts with air to form a coating of silver sulphide (Ag_2S).
- (ii) Copper reacts with moist carbon dioxide in the air and gains a green coat of basic copper carbonate ($\text{Cu}(\text{OH})_2 \cdot \text{CuCO}_3$).
- (iii) Iron when exposed to moist air acquires a coating of a brown flaky substance called rust ($\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$).

Prevention of Corrosion:

The rusting of metals can be prevented by painting, oiling, greasing, galvanising, chrome plating, anodising or making alloys.

Galvanisation is a method of protecting steel and iron from rusting by coating them with a thin layer of zinc. The galvanised article is protected against rusting even if the zinc coating is broken.



Alloy: An alloy is a homogenous mixture of two or more metals or a metal and a non-metal.

Steel: Iron + Carbon

Brass: Copper + Zinc

Bronze: Copper + Tin

Solder: Lead + Tin

Amalgam: If one of the metals is mercury (Hg)