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CHAPTER-3 [Metal and Non-Metal]

→ There are total 118 elements are known.

90+ are metals, 22 are non-metal
and some are metalloids.

Elements

Metal

(Bromine - type)

→ Iron, Copper

gold, silver

→ use → Utensils,
construction,
cars, ships,
Jewelry.

NON-Metal

→ Hydrogen,
Carbon, oxygen
Nitrogen.

→ use → food preservation,
respiration,
electrodes.

★ Metals and Non-Metals on the basis of their
Properties. →

i) Physical Properties

ii) Chemical properties

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* Physical Properties of Metal and Non-metal →

Property	Metal	Non-Metal
① Lustrous	Metals have shining surface.	Non-Metals don't have shining surface (Except Iodine and graphite)
② Hardness	They are generally hard (Except - Sodium, potassium)	They are generally soft (Except - Diamond)
③ State	They are generally solid (Except- Mercury)	They are generally gaseous and liquid. (Except - Iodine, bromine)
④ Malleability	Metals can be beaten into thin sheet Ex → gold, silver	Non-Metals are non-malleable.
⑤ Ductility.	Metals can be drawn into thin wire.	Non-Metals are non-ductile.
⑥ Density	High density (Except → K, Na)	Low density.
⑦ conduction of Heat and Electricity	good conductor (Except - Lead, mercury)	Bad conductor (Except - Graphite)

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③ Melting Point

High melting point
(Except cerium and gallium)

Low melting point
(Except diamond)

④ Sonorous
(Produce Sound)

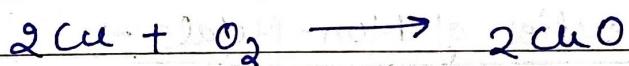
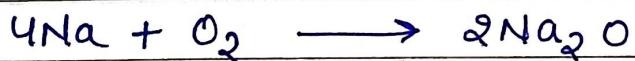
Metals produce sound on striking the hard surface.

They are non-Sonorous.

★ CHEMICAL Properties of Metals →

① Reaction of Metal with Air/oxygen.

Metal + Oxygen \rightarrow Metal oxide.



② Metal oxides can react with both acid and base to produce salt and water. These types of oxides are called Amphoteric oxides.

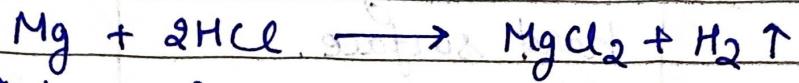
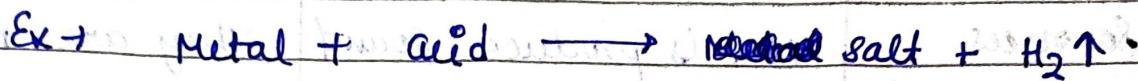


③ Metals can react with water to form metal oxide
Metal oxides reacts with water to form metal hydroxide



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- ④ Metal also react with dilute acid to form salt and hydrogen.



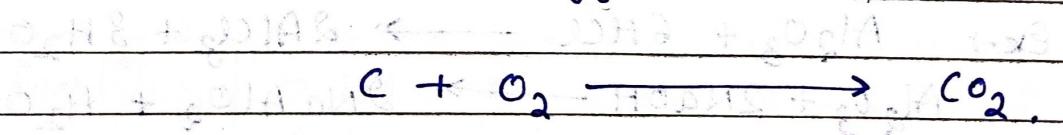
Aqua Regia \rightarrow (Concentrated HCl + Concentrated HNO_3)

are mixed in 3:1. ratio to prepare.

Gold and platinum can dissolve in it.

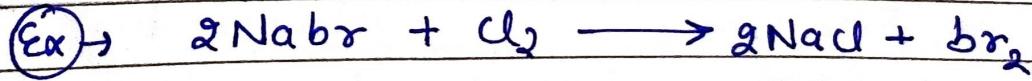
* Chemical properties of Non-Metals →

- ① Non-Metal react with oxygen to form non-metal oxides.



- ② Non-Metal do not react with water and acid.

- ③ Non-Metal can react with salt solution.



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(4) Non-Metal can react with hydrogen to form hydride.

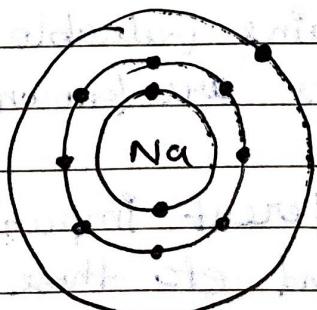


* Reactivity Series →

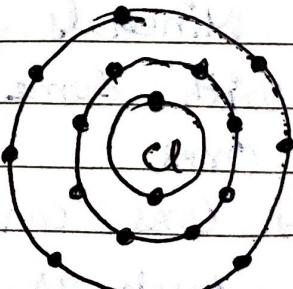
		Reactivity
K	Potassium	↑ Increase
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	
Fe	Iron	
Pb	Lead	
H	Hydrogen	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	

* Ionic compound →

Compound formed due to the transfer of electron from a metal to a non-metal are known as Ionic compound.

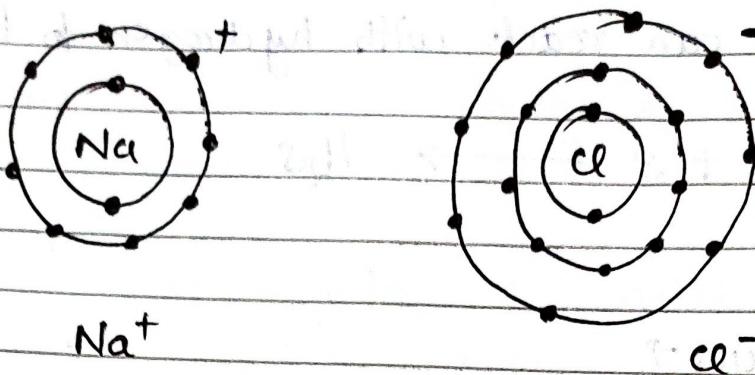


Na = 11
= 2, 8, 1



Cl = 17
= 2, 8, 7

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→ Covalent bond → A bond is formed by the sharing of two electrons b/w two atoms.

→ Properties of ionic compound →

- ① They are generally hard and solid.
- ② They have high melting and boiling point.
- ③ They are soluble in water but insoluble in inorganic solvents such as Ether.
- ④ They are conductor of electricity in molten and solution.

* Occurrence of Metals →

→ Minerals → The element or compound which occur naturally in earth crust are called minerals.

→ Ores → Minerals that contains valuable metal with some impurities are known as Ores.

→ Gangue → Ores contain different impurities in it such as soil, sand etc these impurities known as Gangue.

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★

Ore

[Concentration of ore]

Metal of high reactivity
High reactivity

Metal of medium reactivity

Metals of low reactivity

Electrolysis
of Molten Ores

Carbonate
Ore

Sulphide
ore

Pure metal

Calcination

Roasting

Metal

Oxide of Metal

Refining.

Reduction of Metal

Purification of
Metal

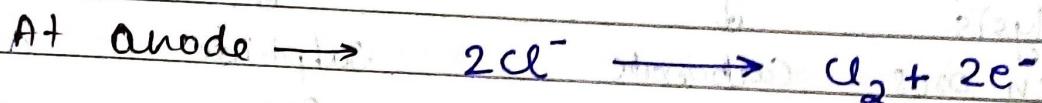
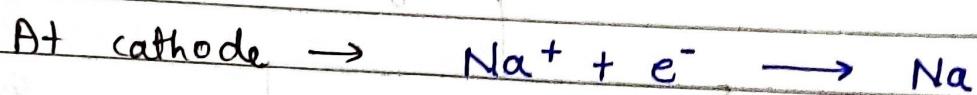
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* Obtaining Metals Top in the reactivity series \rightarrow

These metals are more reactive towards oxygen than carbon. They are obtained by electrolytic reduction.



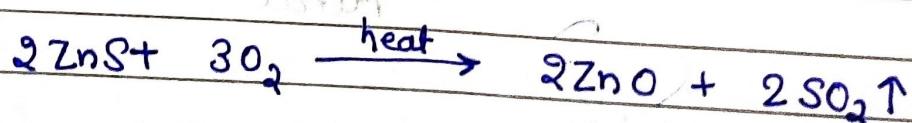
When electricity is passed through the solution metal gets deposited at cathode and non-metal at anode.



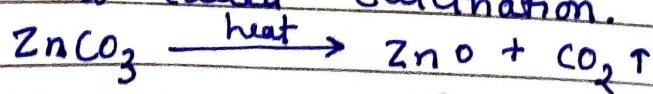
* Extracting Metals at the middle of reactivity series \rightarrow

Metals are easier to obtain from oxide ores, therefore sulphide and carbonate ores are converted into oxides.

\rightarrow Roasting \rightarrow Metal ore heated strongly in excess of air. This process is called Roasting.



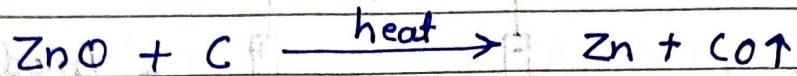
\rightarrow Calcination \rightarrow Metals ore heated strongly in limited supply of air. This process is called Calcination.



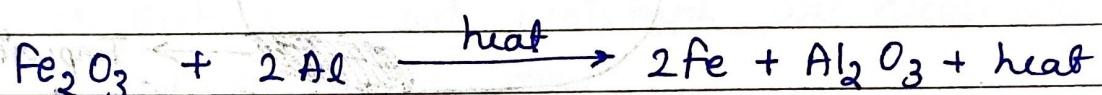
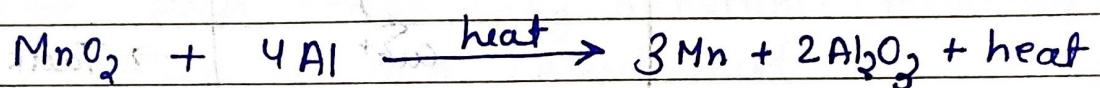
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Now Metal oxides will be Reduced. \rightarrow

i) By using Coke \rightarrow



ii) Using Displacement Reaction \rightarrow

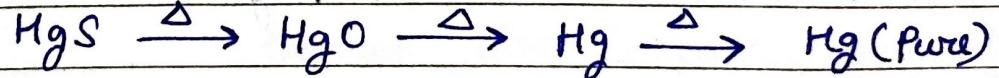


thermit reaction \rightarrow When iron oxide reacts with Aluminium, molten iron is formed and is used to join railway tracks. This is called thermit reaction.

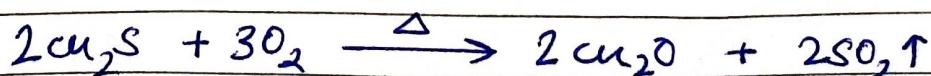
** Extraction of Metals at the top of reactivity series \rightarrow

These metals can be obtained by heating the ore in air at high temperature.

\rightarrow Mercury from cinnabar (HgS) \rightarrow

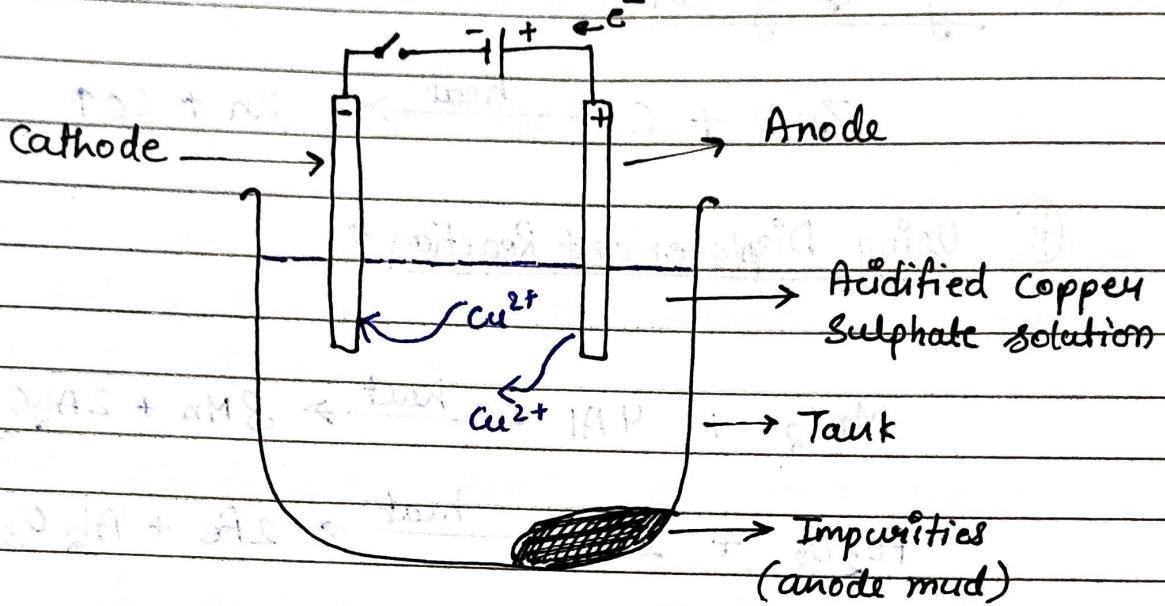


\rightarrow Copper from Copper sulphide



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* Electrolytic Refining → Many metals like copper, zinc, tin, nickel, silver, gold etc are refined electrolytically.



Anode → Slab of impure copper

Cathode → Slab of pure copper

Solution → Copper sulphate + dilute sulphuric acid

→ From anode copper ions are released in the solution and equivalent amount of copper from solution is deposited at cathode.

→ Insoluble impurities containing Ag and Au gets collected at the bottom of anode as anode mud.

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★ CORROSION → Metals are attacked by substances like moisture, acids and moist air and their surface get corroded. This process is called corrosion.

- i. Silver → Silver becomes black when exposed to air it reacts with air to form coating of Ag_2S .
- ii. Copper → Copper becomes greenish, after reacting with moist CO_2 in air.
- iii. Iron → When brown flaky substance forms on surface of iron called rust.
→ Both air and moisture are necessary for rusting of iron.

→ Prevention of Corrosion →

- ① Rusting of Iron can be prevented by
 - Painting
 - Oiling
 - greasing
 - galvanizing (Zinc coating)
 - chrome plating
 - anodising
 - making alloys.

- ② Galvanization → When iron or steel is coated with a layer of Zinc
Because zinc is called galvanization

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③ Alloys → These are the homogeneous mixture of metal with metal or metal with non-metal.

(Ex) stainless steel → Iron with nickel and chromium

Amalgam → (Mercury + Metal)

Brass → (Copper + Zinc)

Bronze → (Copper + tin)

Solder → (lead + tin)

Properties of alloys →

- ① They have high strength and hardness.
- ② They have resistance to corrosion.
- ③ They have less melting point
- ④ They have less electrical conductivity.

at lower and higher temperatures

disappears after below

melting point is said to be