



EXTRACTION OF ELEMENTS AND METALLURGY - I



Objectives

- **To know about origin and distribution of elements**
- **Different modes of occurrence of metals**
- **Minerals of India**
- **Metallurgy**
- **Different methods of concentration of ores**
- **Different methods to convert concentrated ore into oxides**
- **Methods to convert oxide ore into metal –
Smelting, Aluminothermy, Hydrometallurgy,
Electrolytic reduction.**

Origin Of Element

**Universe 89% H
and 11% He**

**In two
hours**

**After its formation
great decrease
in temperature**



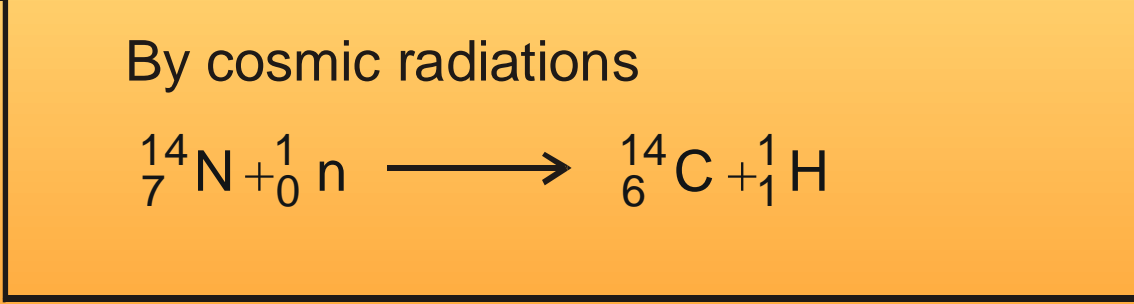
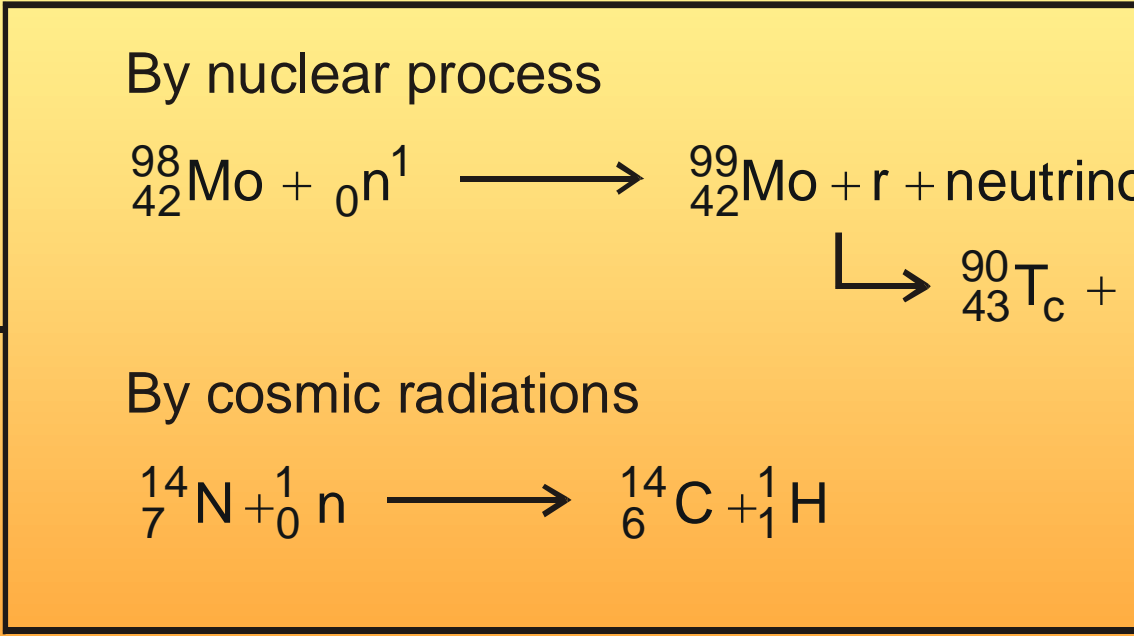
**Formation of stars
(made of clouds of
H and He)**



**Rise in temperature of
stars due to gravity**

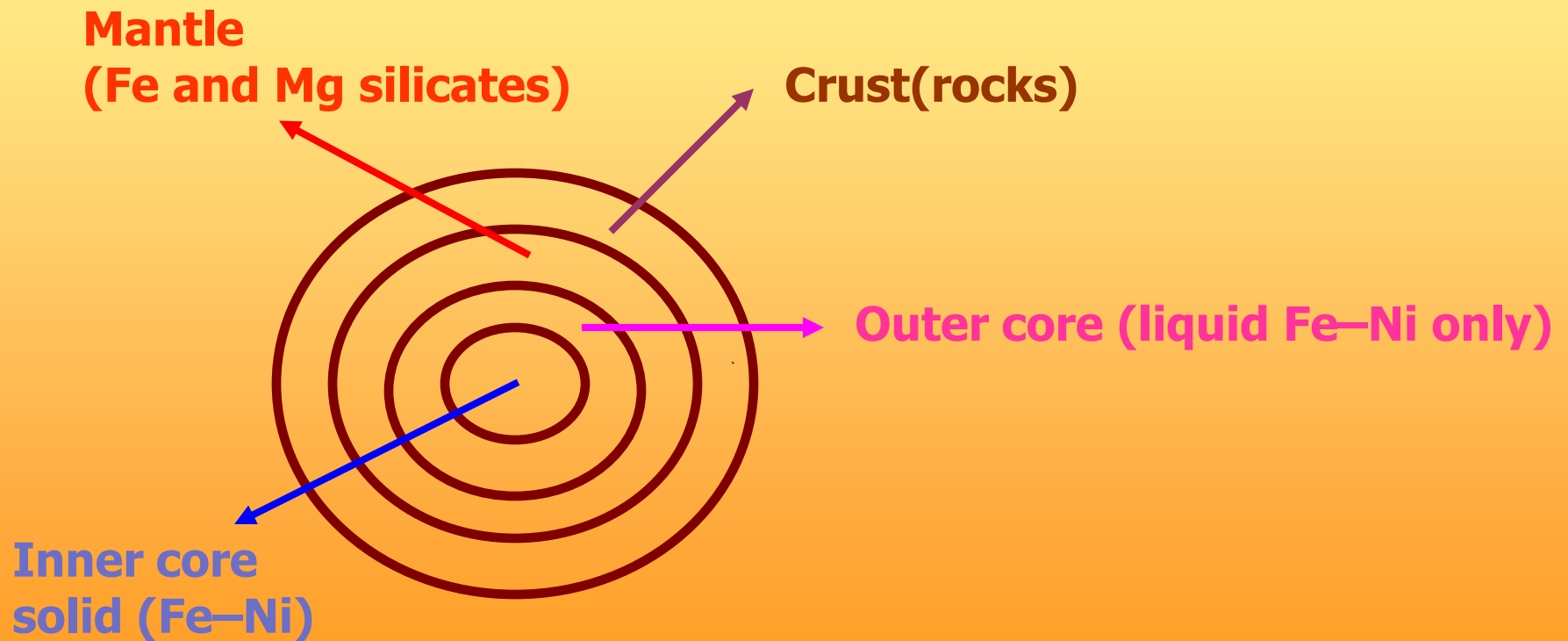


**Nuclear fusion reaction
started in formation of elements
upto iron (atomic number 26)**



The Zones in Earth's Interior

Give circles different colours



Modes of Occurrence of Elements

Native state



Copper

Combined state



Sugar



Name the element which is extracted from sea water.?

Magnesium

Name the element which is extracted from sea weeds.?

Iodine

Terms Used in Metallurgy

Ore



mineral



Ganuge or matrix



Clay $\text{Al}_2\text{O}_3 \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$ and bauxite $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ are two sources of Al.

Are they ores or minerals?

Al can be obtained profitably only from bauxite.

∴ Its ore and clay is mineral



Flux

Flux + gangue \longrightarrow Slag
(fusible mass)

e.g.
 $\text{CaO} + \text{SiO}_2 \longrightarrow \text{CaSiO}_3$
(slag)

Acidic Flux

- Removes basic impurities
- eg – P_2O_5 , SiO_2

Basic Flux

- Removes acidic impurities
- eg – CaO , MgO



Refractory materials

Furnaces

A place where metallurgical processes take place

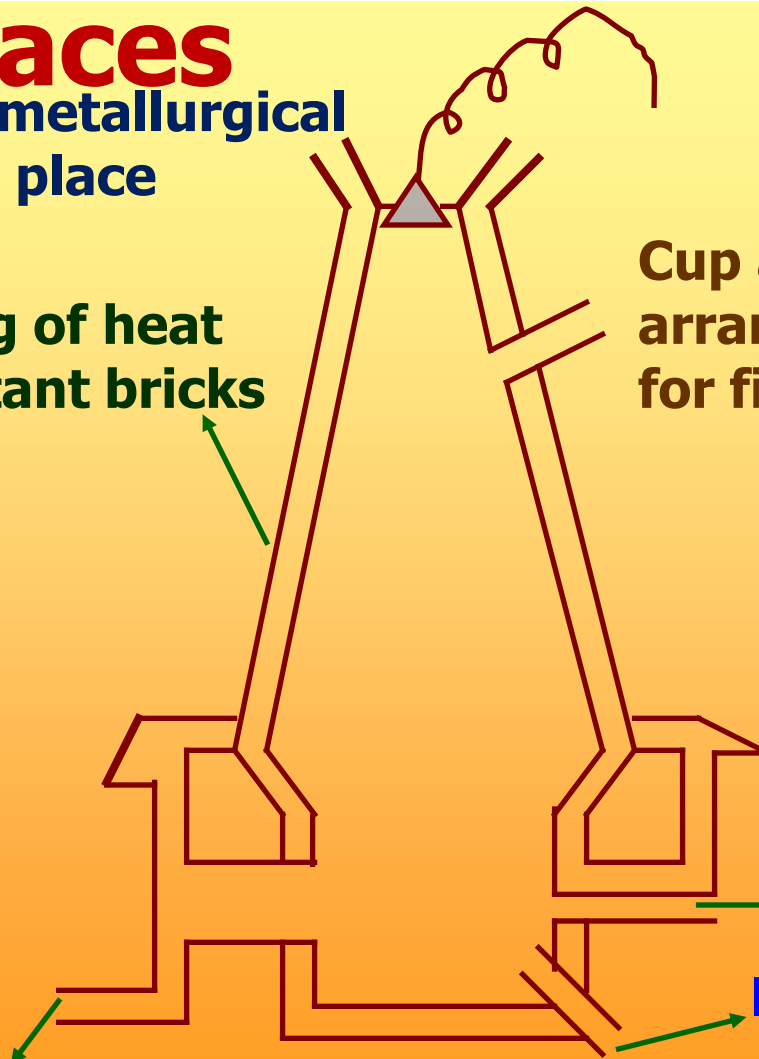
Lining of heat resistant bricks

Cup and cone arrangement for finding

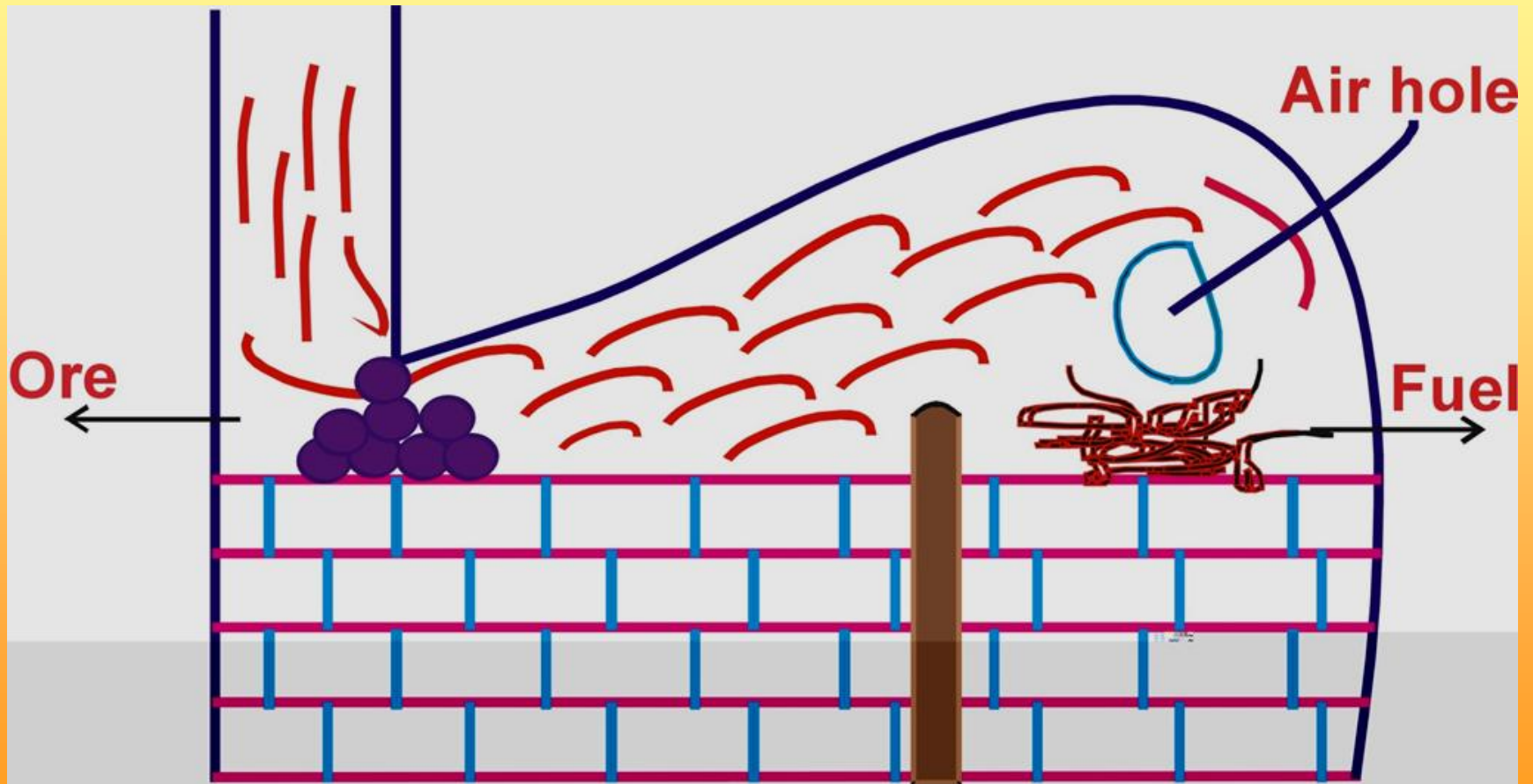
Hot air blast

Slag hole

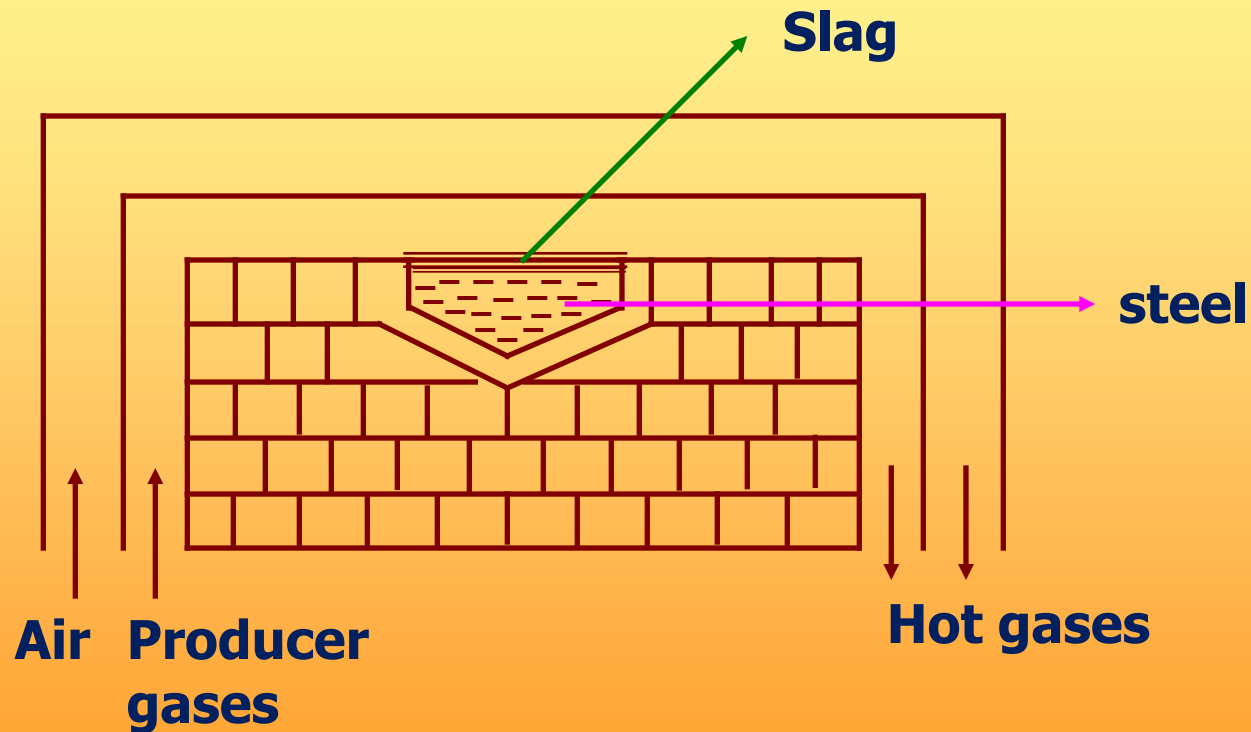
Hole for molten metal



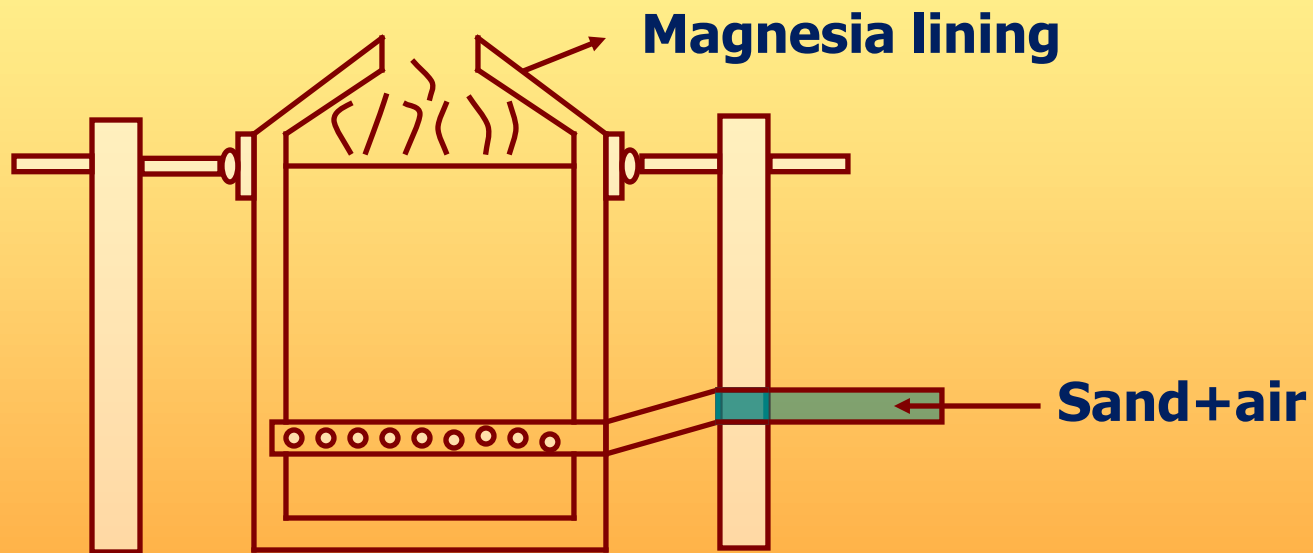
Reverberatory furnace



Open Hearth Furnace



Bessemer converter



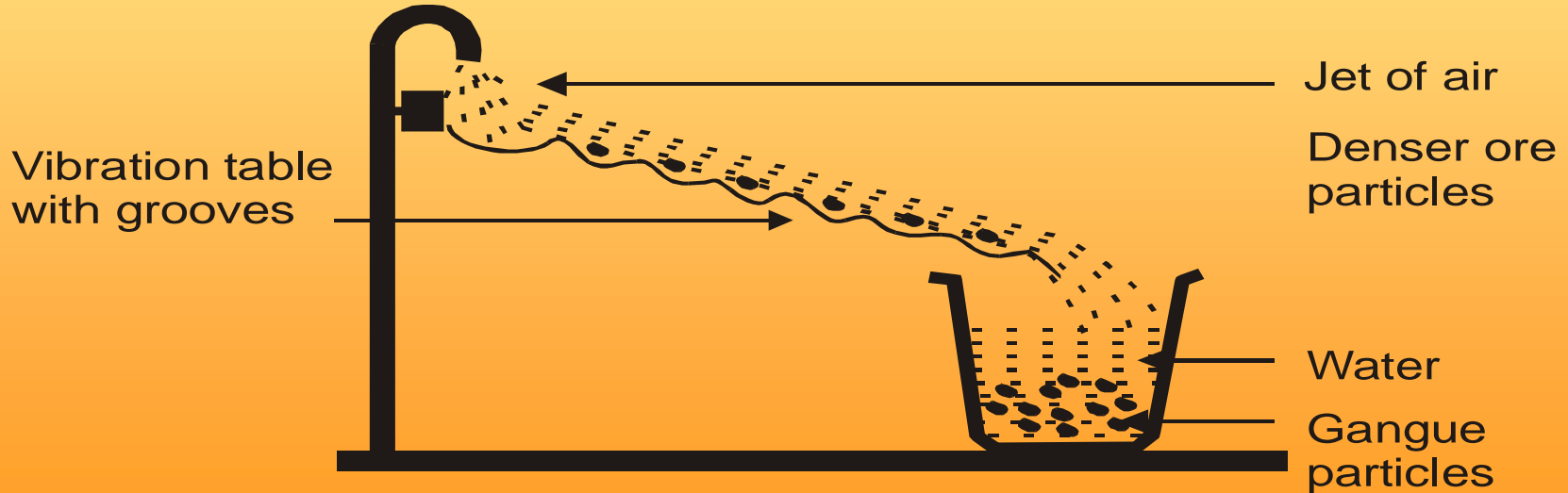


Can you name lustrous non-metals?

Iodine and graphite

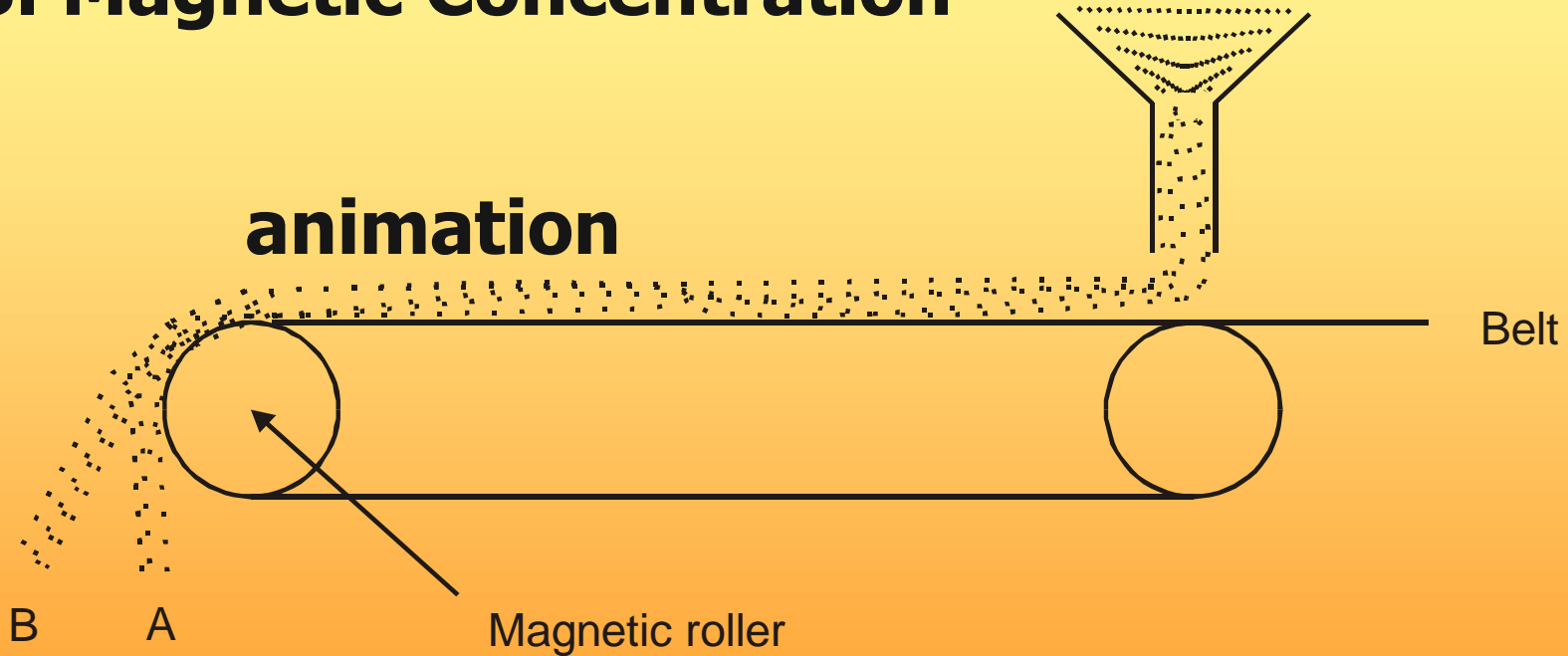
Concentration of ore

1. Hand picking : to show by picture
2. Levigation or Hydraulic washing or gravity separation.



Concentration of ore

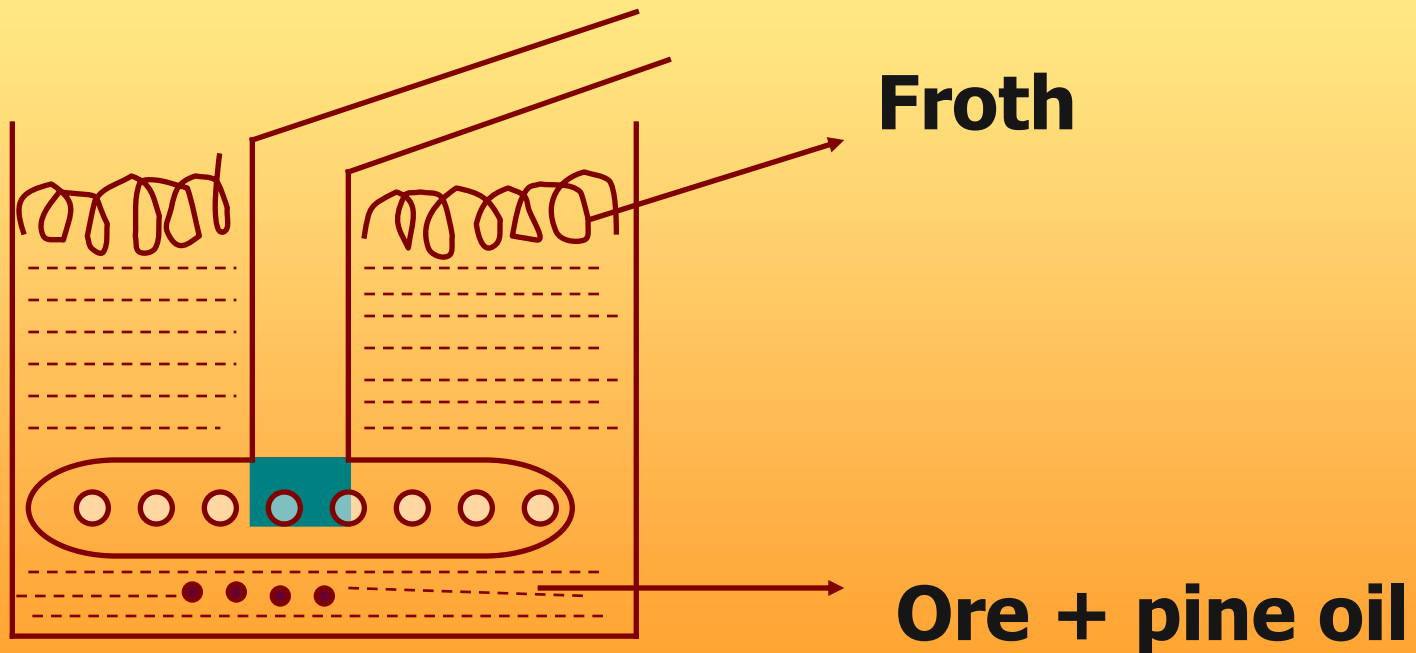
3. Magnetic Concentration



Wolfarite FeWO_4 and Cassiterite SnO_2

Concentration of ore

4. Froth Flotation Process



Concentration of ore

5. Leaching

Leaching of bauxite



Bauxite ore

Sodium
aluminate



Aluminum
hydroxide



Concentration

Leaching of Argentite





Electrostatic concentration

Principle

The good conductors of electricity become electrically charged under the influence of an electrostatic field and therefore they are repelled by electrode carrying the like charge.

Example

Lead sulphide (good conductor) is separated from zinc sulphide (poor conductor) by this method.

Oxidation of ore or conversion of ore into oxide

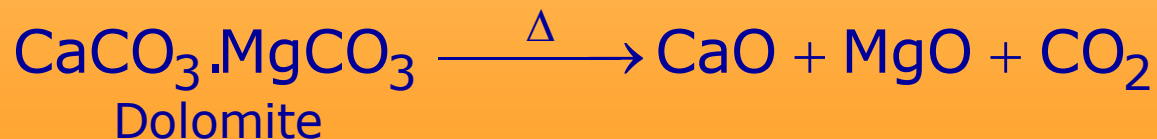
Concentrated ore

Calcination
or Roasting

Oxide of ore

Calcinations

- Ore is heated in absence of air.
- Carbonate ores are converted to oxide





Name calcinations originated from ore calcite which on thermal decomposition gives quick lime.



Oxidation of ore or conversion of ore into oxide

Roasting

Ore is heated in presence of air.

Sulphide ores converted into oxide.

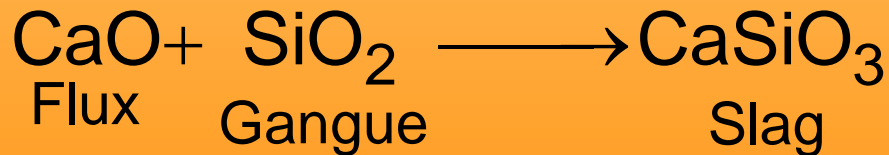
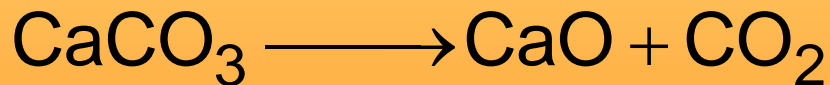




Reduction of oxide to free metal

1. Smelting(Reduction by carbon)

Oxide Ore + C + flux \longrightarrow Metal



Reduction of oxide to free metal

2. Auto Reduction or Self Reduction





Reduction of oxide to free metal

3. Goldschmidt alumino thermite Process

Thermite = 3 parts Fe_2O_3 + 1 part Al





Interesting Facts

Silver paint contains Al

Gold paint contains Cu



Reduction of oxide to free metal

4. Amalgamation Method



5. Hydrometallurgy

more reactive metal displaces the less reactive metal from its salts.





Electrolytic reduction (electrometallurgy)



At Cathode
(Made of iron)



At Anode
(Made of graphite)





Interesting Facts

Alkali and alkaline earth metals are obtained by electrolysis of their chlorides, oxides and hydroxides.



Thanks...