**METALLURGY**

* Metallurgy : The branch of science which deals with the extraction of metals from their ores is Called metallurgy.

**CHARACTERISTICS OF METALS:**

1. They are Solids at room temperature except "Hg".
2. They are hard and strong.
3. They have high density.
4. They hove high M.P & B.P .
5. They are good conductors of heat and electricity.
6. They have “1” to “3” valency electrons.
7. They form Cations .
8. They have electro positive nature.
9. They are good reducing agents.
10. They have malleable & ductile properties.
11. They form basic oxides.

**Distinguish between metals & non-metals:**

|  |  |
| --- | --- |
| **Metals** | **Non-metals** |
| 1. They are Solids at room temperature except "Hg". | 1.They are solids (or) liquids (or) gaseous at room temperature. |
| 2.They are hard and strong. | 2.They are soft and weak. |
| 1. They have high density | 3.They have low density |
| 4.They have high M.P & B.P | 4.They have low M.P & B.P |
| 5.They are good conductors of heat and electricity. | 5.They are bad conductors of heat and electricity. |
| 6.They have “1” to “3” valency electrons. | 6.They have “4” to “7” valency electrons. |
| 7.They form Cations . | 7.They form anions. |
| 8.They have electro positive nature. | 8.They have electro negative nature. |
| 9.They are good reducing agents. | 9.They are good oxidising agents. |
| 10.They have malleable & ductile properties. | 10.They don’t have such properties. |
| 11.They form basic oxides. | 11.They form acidic oxides. |

Mineral: The natural compound of metal which is associated with earth impurities like as soil, sand, mud, etc.. is called mineral.

Ex: MgCO3 (Magnesite)

Cu2O (Cuprite)

Al2O3 . 2H2O (Bauxite)

* Ore: A metal which is extracted from the mineral is Called ore
* Ex:-NaCl , CaCO3 , MgSO4 , etc…

Gangue: The earth impurities present in the ore is called gangue.

* Ex: Soil , Sand, mud , etc….

Flux:- A Chemical substance which is added to remove the gangue is called flux.

* They are two types:
* Acidic flux:- It removes the basic impurities.

Ex: P4O10

* Basic flux :-It removes the acidic impurities

Ex-CaO.

* Slag: Flux reacts with the gangue to form a fusible product is called slag.

Ex: CaO + SiO2 🡪 CaSiO3

(FLUX) (GANGUE) (SLAG)

* Concentration of ore: The process of removal of gangue from the ore is called Concentration of ore
* They are 3 types:
* Handpicking: This method is used when the ore and gangue are having difference in size, shape and colour

Ex: Hematite( Fe2O3)

**WASHING (OR) LEVIGATION:**

* PRINCIPLE : This method is used when the ore and gangue are having difference in density.
* In this method we can take a finely powdered ore into a tank .To this we can add water then the heavier ore particles are settle down at the bottom of tank . The light weight gangue are raised to top of tank and carried away with water.
* Ex: galena (PbS)

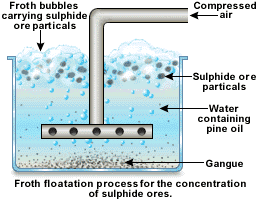
**Froth flotation:**

Principle:

1. This method it based on the difference in the wetting properties of ore and gangue.
2. This method is used for purification of sulphide ore.
3. This method we can take a finely powder ore into a tank . To this add water and small amount of Pine oil , lime and Pottasium ethyl xanthate.
4. Whole mixture is stirred vigorously by Passing compressed air to form forth.
5. Ore particle are wetted by the oil and rise to the top tank
6. The gangue are wetted by the water and will settle down at bottom of tank
7. The ore particles are separated from the froth & washed with water to get Pure sulphide ore.
8. Collector : potassium ethyl xanthate

activator : CuSO4

depresents : NaCN , KCN , etc….



* Roasting:The Process of heating the ore, in the Presence of air below it’s melting point is called roasting.
* It can be used to remove volatile impurities.
* Ex-1: 2ZnS + 3O2 -- **Δ**🡪 2ZnO + 2SO2 ↑
* Ex-2: 2FeS + 3O2 -- **Δ**🡪 2FeO + 2SO2 ↑

CALCINATION: The Process of heating the ore, in the absence of air below it’s melting point is called calcination.

* It can be used to remove volatile impurities , moisture , organic impurities.
* Ex-1: CaCO3 -- **Δ**🡪 CaO + CO2 ↑
* Ex-2: ZnCO3 -- **Δ**🡪 ZnO + CO2 ↑

Smelting: The process of heating the ore in the presence of reducing agent (C**coke**) to form molten metal is called smelting.

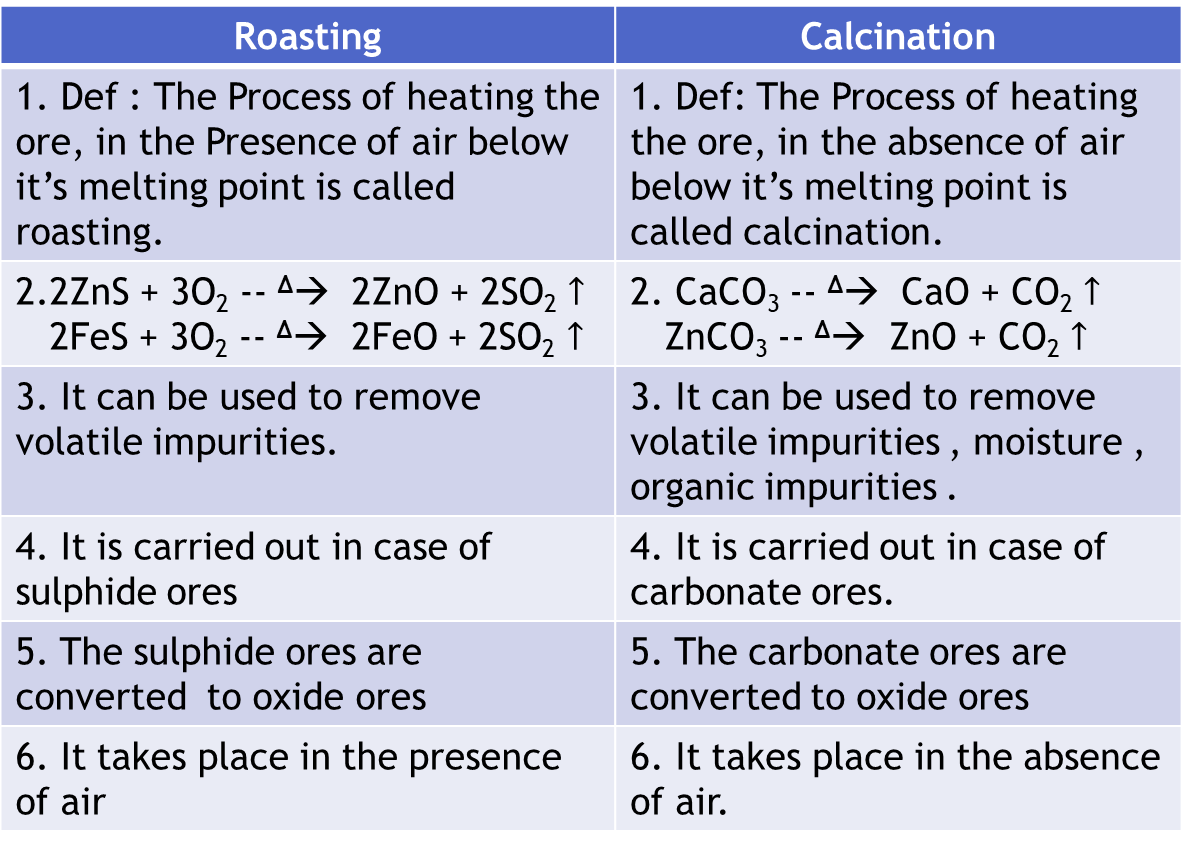
* Ex-1: ZnO + C**coke** -- **Δ**🡪 Zn + CO↑

(MOLTEN METAL)

* Ex-2: PbO + C**coke** -- **Δ**🡪 Pb + CO↑

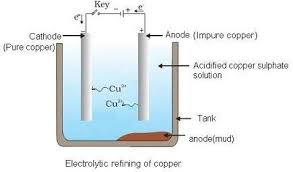
(MOLTEN METAL)

**Difference between roasting and calcination:**



**Electrolytic refining process:**

* Def: The process of removal of impurities from impure metal to get pure metal by electrolysis is called electrolytic refining process.



1. Anode: impure copper metal
2. Cathode: pure copper metal
3. Electrolyte: acidified CuSO4.
4. REACTIONS:
5. Ionisation: CuSO4 ⇌ Cu2+ + SO42-
6. At anode: Cu 🡪 Cu2+ + 2e- (oxidation)
7. At cathode: Cu2+ + 2e- 🡪 Cu (reduction)

Alloys: The homogenous mixture of two or more elements with metalic properties is called alloys.

* Properties:

1. They are harder than metals.
2. They are less reactive.
3. They are more corrosive in resistance.
4. They have low M.P.

**Compositions and uses of alloys:**

**BRASS:**

* Composition: Cu(60% - 70% )

Zn(30% - 40%)

* Uses:

1. It is used for making of decorative articles, screws. handles , etc..
2. It is used for making of parts of watches , machinery parts , etc…

**German silver:**

* Composition: Cu ( 50% )

Zn (30% )

Ni ( 20% )

* Uses:

1. It is used for making of decorative articles , electric heaters , etc.
2. It is used for making of resistors , rheostats , etc….

**Nichrome:**

* Composition: Ni ( 60% )

Cr ( 15% )

Fe ( 25% )

* Uses:

1. It is used for making of resistors , heating coils , etc…
2. It is used for making of resistance wires , etc…