

# Metallurgy

## Metal

Note: Metal Oxides are Basic

- a) Solids at room temp.  
exception: Mercury
- b) Metal possess a high lusture  
exception: Lead with dull appearance
- c) Metals are Hard and Strong  
exception: Sodium and potassium  
Can be cut with knife
- d) High Melting point, Boiling Point  
exception: Mercury, Sodium & Potassium
- e) High Density  
exception: Sodium and potassium
- f) Ductility: Metals are ductile  
Can be drawn into thin wires  
Gold is most ductile  
exception → Zinc, Mercury
- g) Malleable  
Can be beaten into thin sheets  
exception: Zinc and Mercury
- h) Good Conductor of heat and electricity  
exception: Tungsten
- i) have 1, 2, 3 valence e<sup>-</sup>

## Non-Metal

Non-metal Oxides are Acidic

- a) exist in all 3 states  
Liquid non-metal → Bromine
- b) Non-metals have a dull appearance, except Iodine  
and graphite  
↓  
volatile (vapourises sublimes)
- c) Soft  
exception → Diamond
- d) Low M.P & B.P  
exception: Silicon
- e) Low density  
exception: Diamond
- f) Non-Ductile  
exception → Carbon fibre
- g) Non-Malleable
- h) Bad conductor
- i) have 4, 5, 6, 7 valence e<sup>-</sup>

Differentiate between Alkalie Metals and Alkaline Earth Metals.

<u>Ans</u>	<u>Alkalie</u>	<u>Alkaline Earth</u>
i)	Group I of periodic Table Li, Na, K, Rb, Cs, Fr	i) Group II of periodic Table Be, Mg, Ca, Sr, Ba, Ra
ii)	Are good reducing agent ⇒ As they loose $e^-$ easily due to low Ionisation potential	ii) not as good as alkalie metals
iii)	Have 1 $e^-$ in valence shell	iii) 2 $e^-$ in valence shell
iv)	Basic oxides	iv) less Basic oxide

③ Name an allotrop of a non metal which is a) Hard  
b) Conductor of electricity

Ans a) Diamond b) Graphite Note: Both are allotrope of Carbon

④ Generally metals are \_\_\_\_\_ and non metals are \_\_\_\_\_ . (Oxidising/reducing agent)

Ans Metals → ~~oxidising~~ reducing Agent  
Non-metals → Oxidising Agent

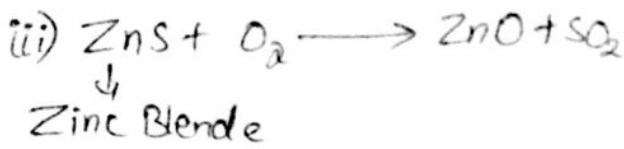
⑤ What is Galvanisation?

Ans To protect iron from rusting, it is painted with or electroplated with more electropositive metal Zinc. Zinc corrodes itself getting oxidised and forms an Oxide layer which prevents corrosion of iron.

# Differentiate between Roasting and Calcination.

## Roasting

- i) Heating of Sulphide ore
- ii) in presence of air (oxygen) to form metal oxide



## Calcination

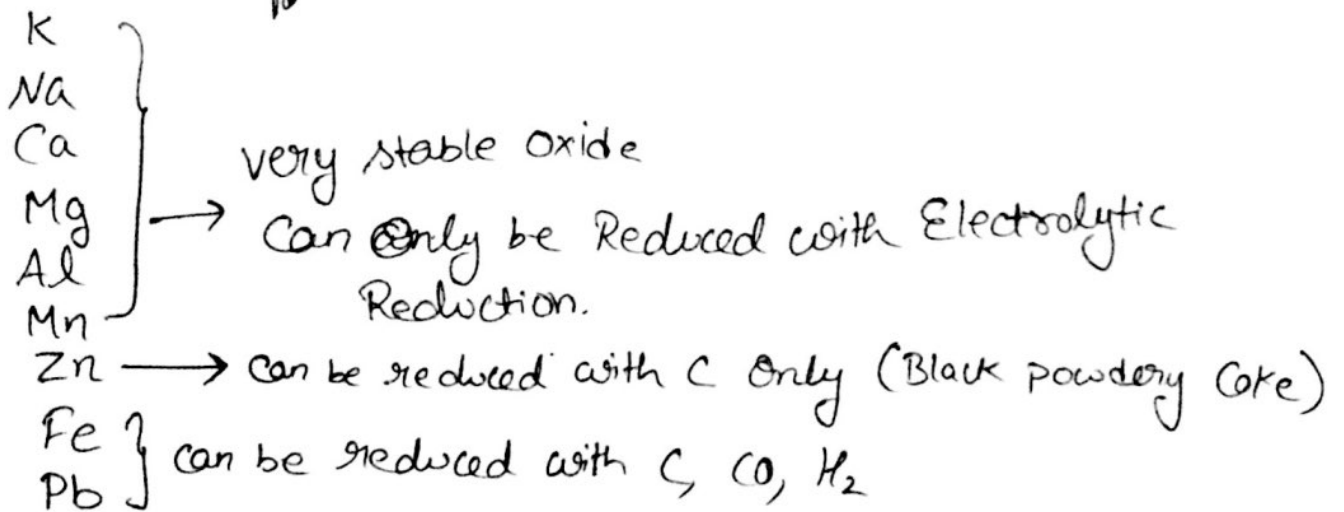
- i) Heating of Carbonate ore
- ii) in absence of air (oxygen) to form metal oxide



⑦ Name a metal oxide which can be reduced only by coke but not by  $H_2$  or  $CO$ ?

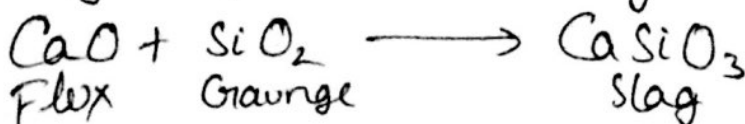
Ans Zinc oxide

⑧ Explain how different oxides are reduced.



⑨ What is Flux, Slag and Grounge (Matrix)?

Ans Grounge (Matrix) is impurity present in an ore  
Flux is the charge added to remove grounge  
slag is formed when Grounge combines with flux

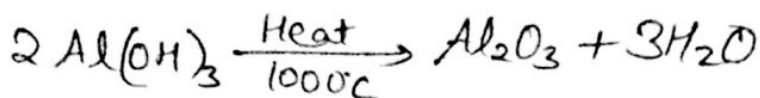
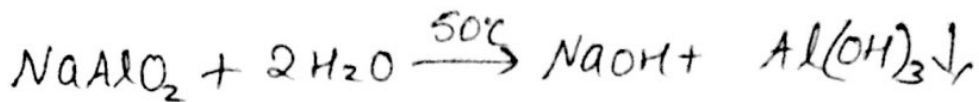
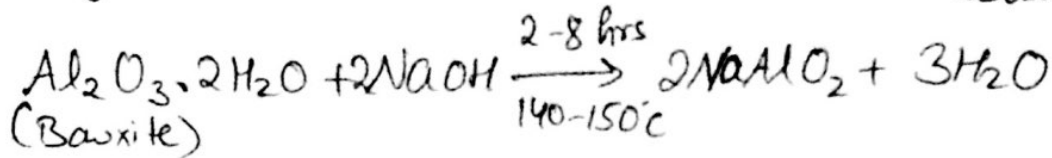


Which is the most abundant metal in Earth's Crust?

Ans: Aluminium.

⑪ What is Baeyers Process.

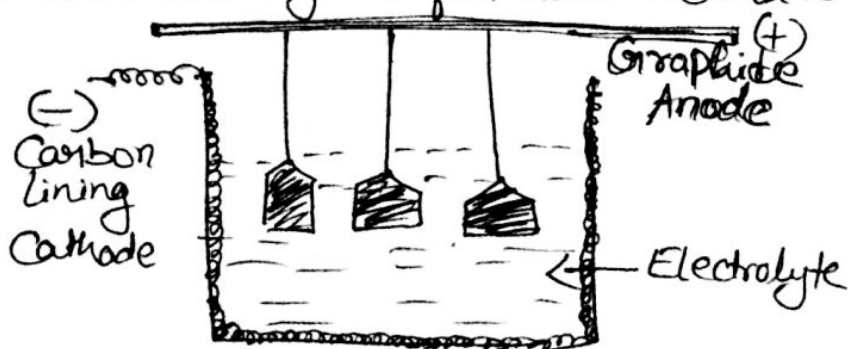
Ans Baeyers Process is used for concentration of Aluminium ore (Bauxite)



⑫ Who is Aluminium Oxide Reduced to Aluminium?

Ans Electrolytic Reduction - Hall Heroult's Process

⑬ Draw a diagram for Hall Heroult's Process.



⑭ What is the Electrolytic Mixture used in Hall Heroult's Process.

Ans i)  $\text{Na}_3\text{AlF}_6 \rightarrow$  Cryolite 60%

ii)  $\text{CaF}_2 \rightarrow$  Fluorspar 20%

iii)  $\text{Al}_2\text{O}_3 \rightarrow$  Alumina 20%

⑮ What is the purpose of cryolite in Hall Heroult's process?

Ans i) It lowers the fusion (melting) temperature of Alumina  
ii) Increases the conductivity of electrolyte

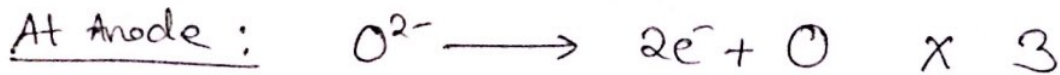
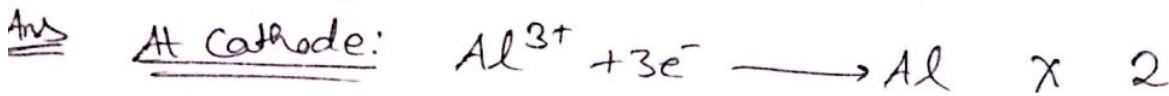
Why is Fluorspar added in Hall Heroult's Process?

Ans: i) Acts as solvent ii) Increases conductivity

16) Why is powdered ore sprinkled over surface of electrolytic mixture.

Ans i) Reduces heat loss by radiation  
ii) prevents the burning of Anode.

17) Write Reaction At cathode and Anode during Electrolytic Reduction of Alumina (Hall Heroult's Process)

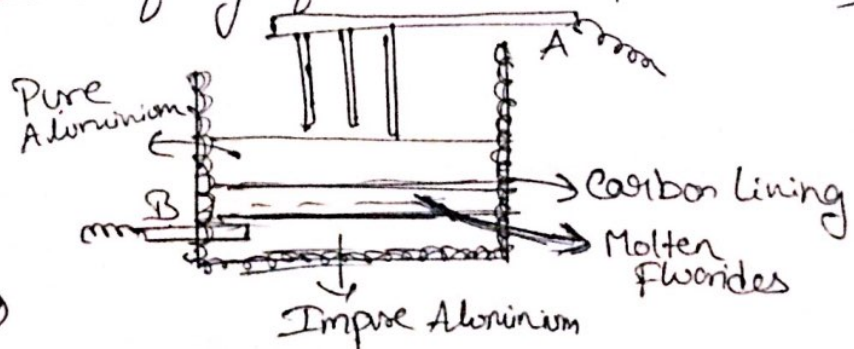


18) How is Alumina refined?

Ans Hoopes Process  $\rightarrow$  Electrorefining of Alumina

19) With respect to Electrorefining of Alumina (Hoopes Process), State:

a) Which is Cathode/Anode A or B



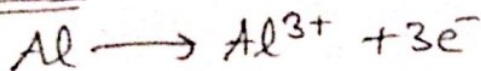
Ans B  $\rightarrow$  Anode (+)  
A  $\rightarrow$  Cathode (-)

b) Which material is used as Cathode.

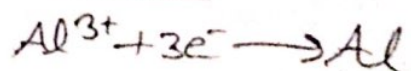
Ans Graphite rods & Aluminium (Pure) Acts as Cathode.

c) Reactions at Cathode & Anode

Anode



Cathode



Give the Components of Following Alloys. & their Uses

i) Duralumin  $\rightarrow$  Al, Cu, Mg, Mn  $\rightarrow$  Aircraft Body  
 (AlkumagMan)  $\rightarrow$  Light But Strong  
 $\rightarrow$  Resistant to Corrosion

ii) Brass  $\rightarrow$  Cu, Zn  
 (गुठत)  $\rightarrow$  Decorative hardware  
 $\rightarrow$  parts of watches  
 $\rightarrow$  Electrical goods

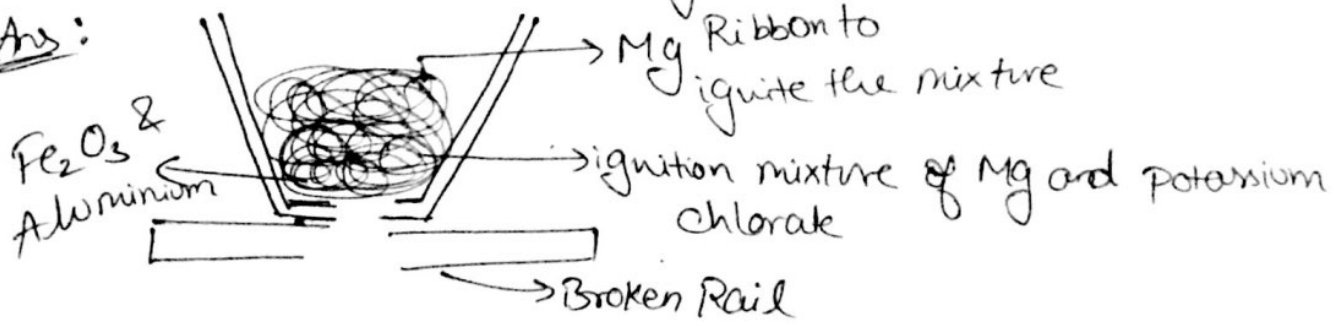
iii) Bronze  $\rightarrow$  Cu, Sn, Zn  
 $\rightarrow$  Medals  
 $\rightarrow$  Statues  
 $\rightarrow$  Coins

iv) Solder / Fuse metal  $\rightarrow$  Pb, Sn  
 $\rightarrow$  Welding  
 $\rightarrow$  Fuse

v) Stainless steel  $\rightarrow$  Fe, Cr, Ni, C  
 $\rightarrow$  Surgical Instruments  
 $\rightarrow$  Ornamental Pieces  
 $\rightarrow$  Utensils

20) What is thermite welding?

Ans:



• Iron formed from Ferric oxide is allowed to drop over gap between the broken pieces and they join together.

Thermite welding  $\rightarrow$  3 parts of Ferric Oxide + 1 part of Al powder