GENARAL INTRODUCTION TO METALLURGY

:Std: XI-CHEMISTRY

1. What is matrix?

The ore is generally associated with rock impurities like clay, sand etc. called ‘gangue or matrix

2. What is mineral?

The natural material in which the metal or their compounds occur in the earth is known as **mineral**. .

3. What is mining?

The biggest source of metal is the earth’s crust and the process of taking out the ores from the earth crust is called mining**.**

4.What are the mineral Source from sea

Four elements such as Na, Mg, Cl_2 and Br_2 can be extracted from the oceans or salt brines, where they are present as monoatomic ions (Na^+, Mg^{2+}, Cl^-, Br^-).

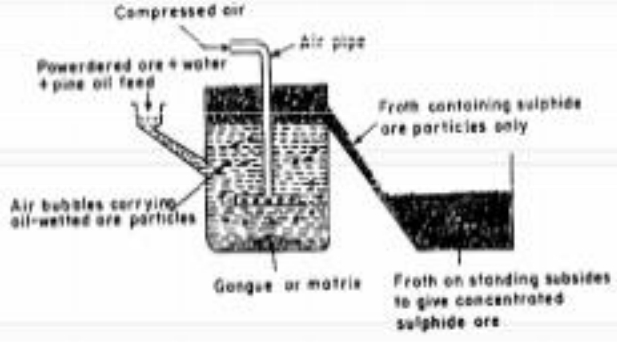
5.ExplainGravity separation process or **hydraulic washing**

This method is especially suitable for heavy ‘oxide’ ores like haematite, tinstone, etc. In this, the powdered ore is placed on a sloping floor (or platform) and washed by directing on it a strong current of water. The lighter sandy, and earthy impurities are washed away; while the heavier ore particles are left behind.

6.Explain Froth flotation process

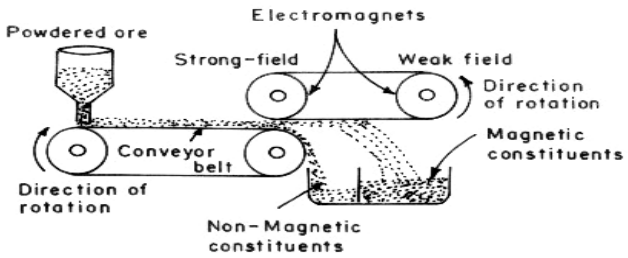
- This method is especially suitable for sulphide ores like zinc blende (ZnS), and copper pyrites ($CuFeS_2$).
- This process is based on the fact that the sulphide ore particles are only moistened by **oil;**
- oxide, and gangue particles are moistened only by **water**.
- In this process, the powdered ore is mixed with water and a little pine oil (a foaming agent) and the whole mixture is thenstirred vigorously by blowing compressed air.
-

- The oil forms a foam (or froth) with air. The ore particles stick to the froth, which rises to the surface; while the rocky, and earthy impurities (gangue) are left in water
- . The froth is skimmed off, collected, and allowed to subside to get concentrated ore.



7.How will you separate Magnetic ore from non-Magnetic ore

- This method is meant for separating **magnetic impurities from non- magnetic ore particles,** e.g., tinstone (a tin ore) in which tinstone is non- magnetic;
- Theimpurities iron, manganese and tungstates are magnetic.
- The powdered ore (containing the associated magnetic impurities) is made to fall (from a hopper) on a belt moving over electromagnetic roller.
- The magnetic impurities fall from the belt in a heap near the magnet, due to attraction;
- the non-magnetic concentrated ore falls in separate heap, away from the magnet, due to the influence of centrifugal force



A.MOORTHY.MSC,B.Ed,.CELL:8754706647 CHENNAI-37

8.ExplainChemical method

- This method is employed in case where the ore is to be in a very pureform, e.g., aluminium extraction. Bauxite (Al_2O_3), an ore of aluminium, contains SiO_2 and Fe_2O_3 as impurities.
- A bauxite ore is treated with NaOH, the Al_2O_3 goes into solution as sodium meta- aluminate leaving behind the undissolved impurities [Fe_2O_3, SiO_2, $Fe(OH)_3$,etc.], which are then filtered off.

$$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$$

- The filtrate (containing sodium meta-aluminate) on dilution, and stirring gives a precipitate of aluminium hydroxide, which is filtered, and ignited to get pure alumina.

$$NaAlO_2 + 2H_2O \rightarrow \underset{\text{Ppt}}{Al(OH)_3} + NaOH$$

$$2Al(OH)_3 \longrightarrow Al_2O_3 + 3H_2O$$

9.What are the Metallurgical processes

Metallurgy is a branch of chemistry which deals with,

(i) Extraction of metals from ores

(ii) Refining of crude metal

(iii) Producing alloys and the study of their constitution, structure and properties.

(iv) The relationship of physical and mechanical treatment of metals to alloys.

10.What are the metal are extracted from electrolysis method

The noble metals such as Au, Ag, etc are usually extracted by electrolysis of their chlorides

11.What are the ore is separated by Roasting method

oxides or hydroxides. Heavy metals, e.g. Cu, Zn, Fe, Pb, Sn,

A.MOORTHY.MSC,B.Ed,.CELL:8754706647 CHENNAI-37

etc., are extracted by making use of roasting and smelting methods.

12.**Define Roasting.**

Roasting is one of the oxidation method where ore is converted into metal oxide

13.What is Calcination

Another method of conversion of ore into metal oxide (oxidation) is called calcination

14.What is Smelting – Reduction

Smelting is one of reduction method where the metal oxide is converted into metal is called as Smelting.

15.Explain Bessemerisation process

Principle:

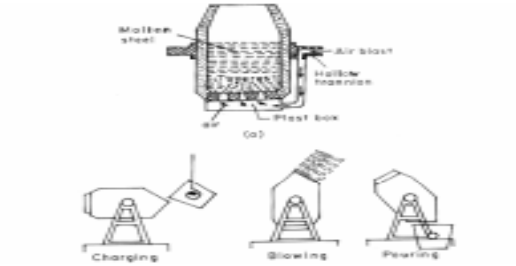
The principle involved in this process is that cold air blowed through refractory lined vessel known as converter containing molten pig iron at about 2 atmospheric pressure, oxidizing the impurities and simultaneously converting pig iron to steel.

Procedure:

The molten pig iron is mixed in mixers and then charged into converter. About 15-16 tonnes of iron can be charged at a time. The converter is first set in the horizontal position and after charging the converter is adjusted in vertical position. After charging a blast of cold air is admitted through the hole provided at the bottom at a pressure of about 2-3 kg/cm^2. The blast is continued for about 15 minutes during which the impurities are oxidized. Mn is oxidized to MnO and Si is oxidized to SiO_2. Carbon is also oxidized to CO. The resulting oxides of Mn and Si (MnO and SiO_2) combine together to form slag of manganese silicate:

Diagram:

A.MOORTHY.MSC,B.Ed,.CELL:8754706647 CHENNAI-37



16.What is matte?

A mixture containing sulphide of copper and iron, called **matte**

17.What is mean by Anode mud?

The insoluble impurities either dissolve in the electrolyte or fall at the bottom and collect as **anode mud**.

18.Explain electrolyting refining of copper?

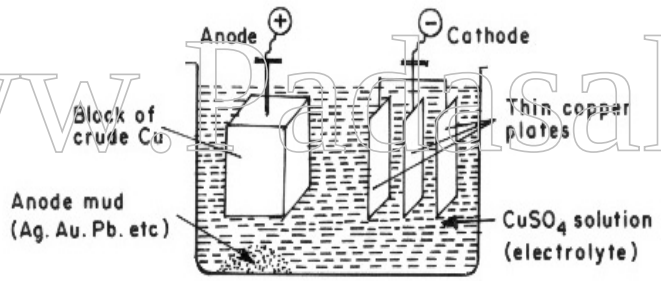
Anode: Impure copper metal

Cathode:Pure copper

Electrolyte: Copper sulphate and Sulphuric Acid

On passing electric current a pure copper is deposited on the cathode side

Diagram:



Reaction at Anode and cathode:

1) Cu^{2+} ions (from copper sulphate solution) go to the cathode (negative electrode), where they are reduced to copper, which gets deposited on the cathode.

$$Cu^{2+} + 2e^{-} \rightarrow Cu$$

2) Copper (of impure anode) forms copper ions, and these go into solution of electrolyte.

$$Cu \rightarrow Cu^{2+} + 2e^{-}$$

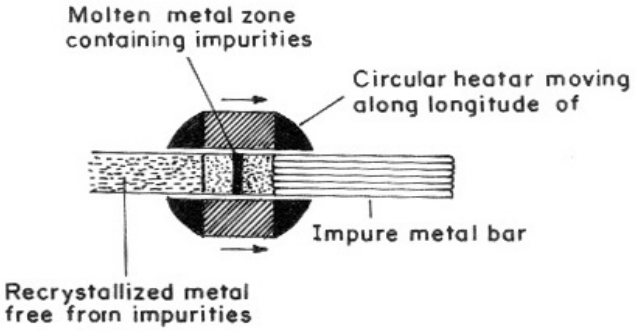
A.MOORTHY.MSC,B.Ed,.CELL:8754706647 CHENNAI-37

19.Explain Zone refining

Principle:

Melting point of a substance is lowered by the presence of impurities. Consequently, when an impure molten metal is cooled, crystals of the pure metal are solidified, and the impurities remain behind the remaining metal.

Diagram:



Procedure:

- This method is employed for preparing highly pure metal (such as silicon, tellurium, germanium), which are used as semiconductors
- The process consists in casting the impure metal in the form of a bar.
- A circular heater fitted around this bar is slowly moved longitudinally from one end to the other.
- At the heated zone, the bar melts, and as the heater moves on, pure metal crystallizes, while the impurities pass into the adjacent molten part.
- In this way, the impurities are swept from one end of the bar to the other. By repeating the process, ultra pure metal can be obtained.

20.Explain Mond's process

- Thermal methods include methods as carbonyl method, decomposition of hydrides etc.
- The carbonyl method is used for the refining of metals like Ni and Fe.

- For example, in case of nickel, the impure metal is heated with CO.
- The nickel carbonyl thus formed is then decomposed (after distilling off the impurities) to get pure nickel metal and CO. The process is known as **Mond's process.**

$$Ni + 4CO \rightarrow Ni(CO)4 \rightarrow Ni + 4CO$$

Based on the following facts:

(a) Only nickel (and not Cu, Fe, etc.) forms a volatile carbonyl, Ni(CO)4, when CO is passed over it at 50^0C.

(b) the nickel carbonyl decomposes at 180^0C to yield pure nickel.

21.What is Acid Bessemer process

The impurities present in the pig iron are basic, e.g., manganese, a lining of silica brick is used and the process is known as **acid Bessemer process.**

PREPARED

A.MOORTHY.MSC,B.Ed.,

PGT-CHEMISTRY

GREEN VALLEY MAT HR SEC SCHOOL

CHENNAI-37

CELL:8754706647

MAIL:mpchem6@gmail.com