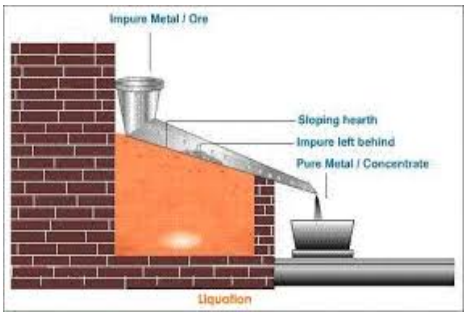
a) Liquation

This technique is for separating constituents of an ore, a metal, or an alloy by partial melting. When the material is heated to a temperature where one of the constituents melts and the other remains solid, the liquid constituent can be drained off.



b) Leaching:

Leaching is used when the ore is soluble in a solvent. The powdered ore is dissolved in a chemical, usually a strong solution of NaOH. The chemical solution dissolves the metal in the ore and it can be extracted and separated from the gangue by extracting the chemical solution. Extraction of the Aluminium metal from Bauxite ore is done using this process.

The principal ore of aluminium, bauxite, usually contains SiO_2, iron oxides and titanium oxide (TiO_2) as impurities. Concentration is carried out by digesting the powdered ore with a concentrated solution of NaOH at 473 – 523 K and 35 – 36 bar pressure. This way, Al_2O_3 is leached out as sodium aluminate (and SiO2 too as sodium silicate) leaving the impurities behind:

$$Al_2O_3\ (s) + 2NaOH(aq) + 3H_2O(l) \rightarrow 2Na[Al(OH)_4](aq)$$

The aluminate in solution is neutralised by passing CO_2 gas and hydrated Al_2O_3 is precipitated. At this stage, the solution is seeded with freshly prepared samples of hydrated Al2O3 which induces the precipitation:

$$2Na[Al(OH)_4](aq) + CO_2(g) \rightarrow Al_2O_3.xH_2O(s) + 2NaHCO_3\ (aq)$$

The sodium silicate remains in the solution and hydrated alumina is filtered, dried and heated to give back pure Al_2O_3:

$$Al_2O_3.xH2O(s) + 1470\ K \rightarrow Al_2O_3\ (s) + xH2O(g)$$

1. Conversion of the concentrated ores to their oxides

The concentrated ore must be converted into a form which is suitable for reduction. Usually the sulphide ore is converted to oxide before reduction.

For chemical reduction the concentrated ore is converted into oxide by ***calcination and roasting***.

Calcination : It is the process of heating the ore at low temperature in the absence of any blast of air. The moisture, CO2, etc. are removed and the ore

becomes porous i. e. when limestone is heated, CO2 is given off and it is said to be calcinated. When bauxite is calcinated at high temperature, water is removed and anhydrous aluminum is left.

$$CaCO_3 \rightarrow CaO + CO_2$$

$$Al_2O_3.2H_2O \rightarrow Al_2O_3 + 2H_2O$$

Roasting: It is a process of heating the ore strongly in excess of air .applied for sulphide ore

$$2ZnS\ (s) + 3O_2\ (g) \rightarrow 2ZnO\ (s) + 2SO_2\ (g)$$

$$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$$

$$2Cu_2S + 3O_2 \rightarrow 2Cu_2O + 2SO_2$$

Q1: Write down the differences between roasting and calcinations

Q2. Write down the principles of froth floatation process, magnetic separation method, leaching and liquation

Q3. Explain *all ores are minerals, but all minerals are not ores*