

Chapter -5

Occurrence of Extraction and Isolation of Li, Be and F₂

Q.1.(a) Give one method for the extraction of lithium from its ores. 2002

or

How does lithium occur in nature? using law sheet diagram give one method of its extraction. 2004,08,15,17

or

Write the name of important minerals of lithium. How will you extract lithium from its aluminosilicate ore?

2006

Ans. Lithium occurs in nature in the form of ores. Which have B.P.- 1340°C, M.P.- 179.1°C, Density - 0.53g/ml, Silver white metal.

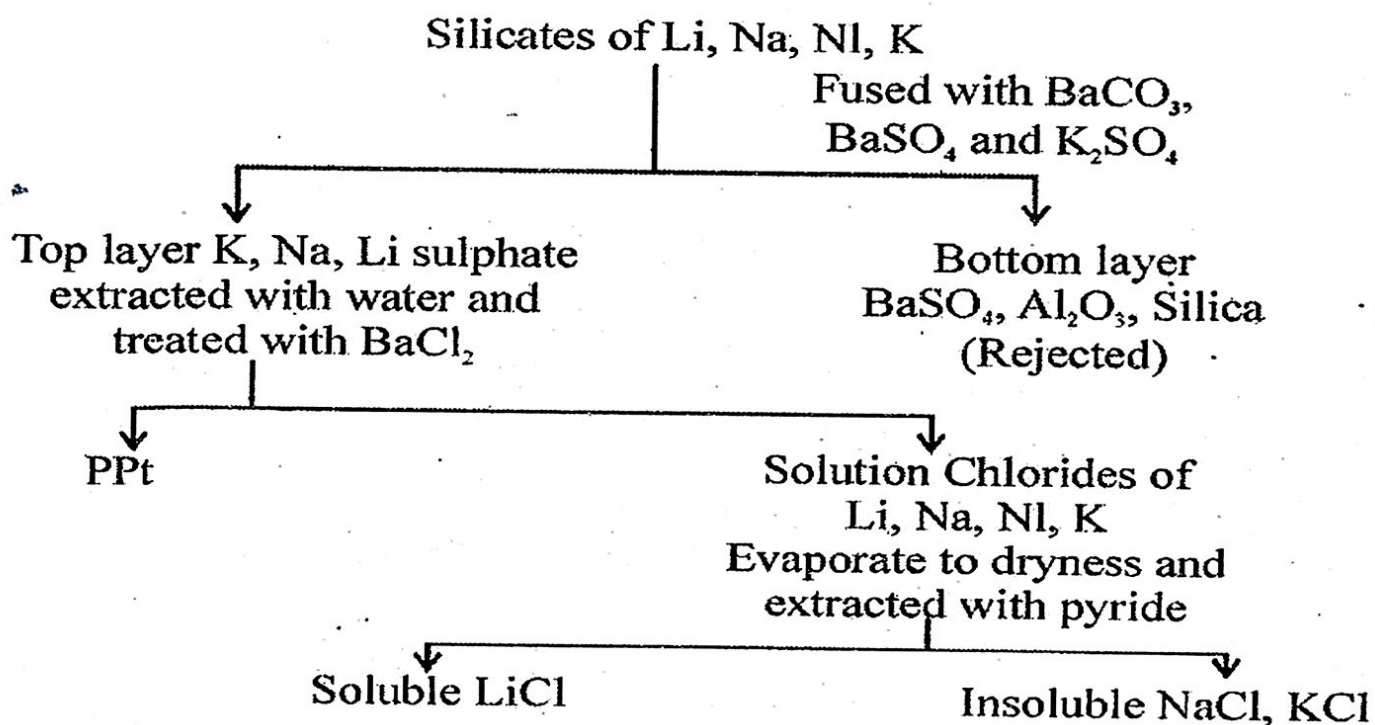
Ores:

(i) **Petalite** - $\text{LiAl}(\text{Si}_2\text{O}_5)$ 2.7-3.7% Li

(ii) **Lepidolite or Lithium Mica** $\text{KLi}_2\text{AlSi}_4\text{O}_{10}$

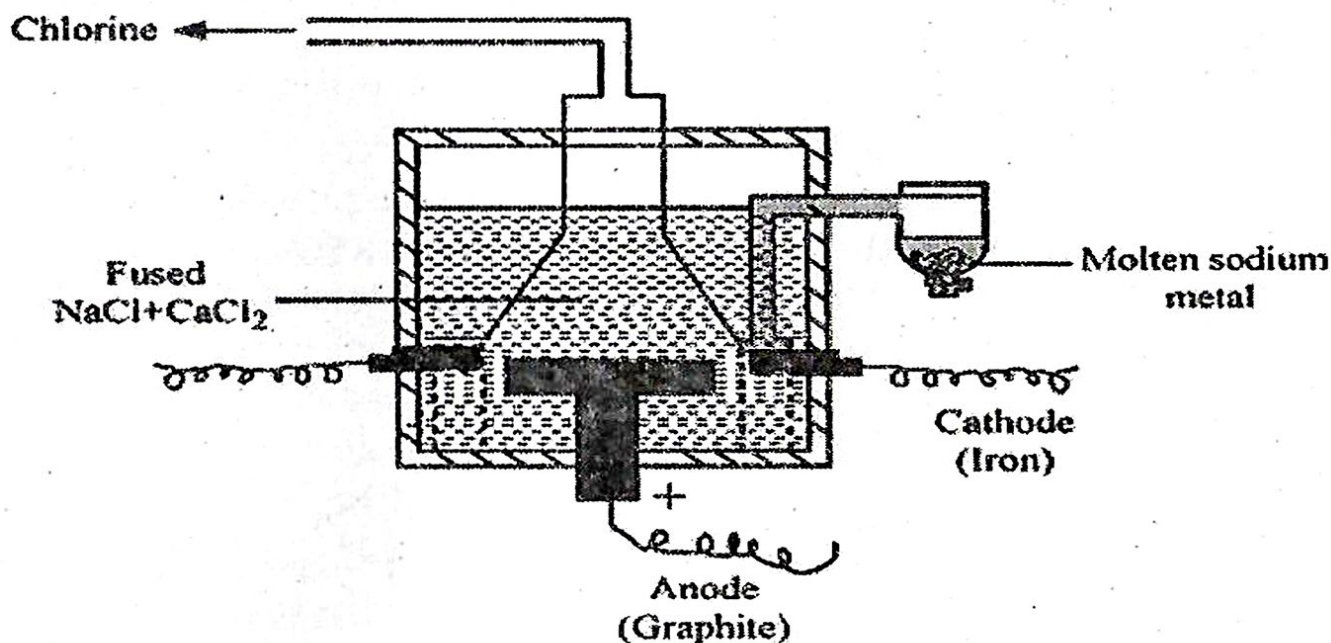
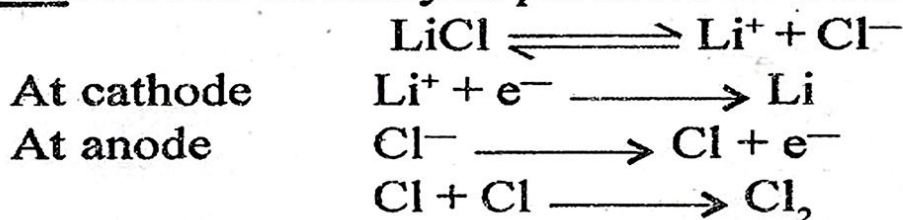
Metallurgy: Li is extracted by the electrolysis of fused LiCl.

(i) **Preparation of lithium chloride:** The LiCl is obtained by mineral Lepidolite as follows-



- (ii) **Electrolysis of fused LiCl (Down's Process):** The mixture of LiCl and KCl (increase the conductivity of LiCl and Low the fussion temp) is fused at temp 400–420°C and at the voltage 8-9 volts in an electrolytic cell. In which Carbon and steel rod used as anode and cathode. The Iron gavage diaphragm the Li and Cl₂ are taken from cathode and anode.

Reaction: LiCl on electrolysis produces Li⁺ ions and Cl⁻ ions



- Q.2.** Write the name with formulae of the two ores of beryllium. Describe the method of extraction of beryllium from one of them. Give two properties of beryllium in which it differs from its other family member but resemble with aluminium. 2005, 2007, 2014, 16

Ans. Beryllium (Be)
 B.P. — 2477°C
 M.P. — 1280°C
 Density — 1.86

Solid state
 Silvery white metal
 Oxide - Amphoteric

Ores: Beryl — $3\text{BeO} \cdot \text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2$ (Chief Source)

Phenacite — Be_2SiO_4

Extraction of Beryllium from Beryl Ore:

Extraction of Beryllium from Beryl ore by the following methods:-

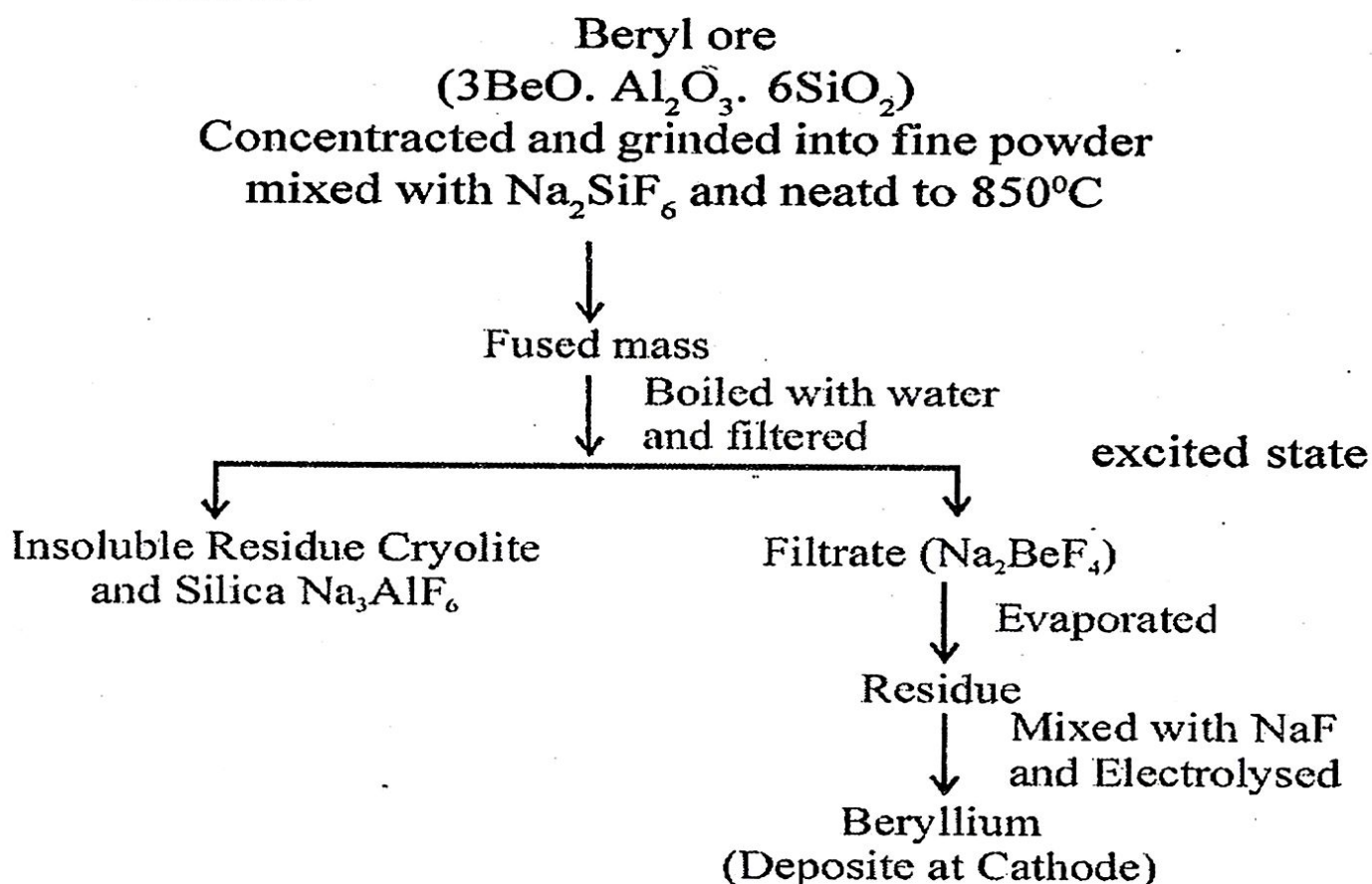
(i) Electrolysis of Beryllium fluoride.

(ii) Reduction of beryllia.

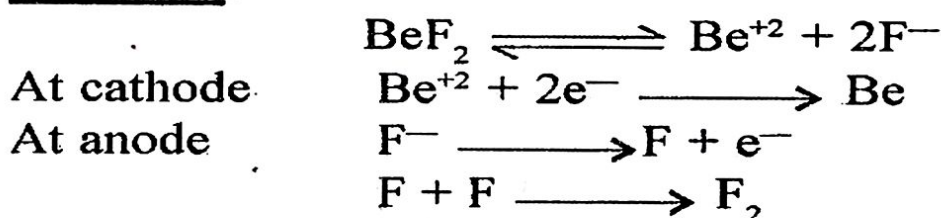
excited state

(i) Electrolysis of Beryllium Fluoride:

Beryl ore is concentrated and converted into a fine powder by grinder. It is mixed with Na_2SiF_6 (sodium silico fluoride) at 850°C . Na_3AlF_6 and SiO_2 obtained insoluble. Soluble sodium beryllium fluoride Na_2BeF_4 . It mixed with NaF and BaF_2 and electrolysed into electrolytic cell. In which graphite pot and iron rod act as anode and cathode. Be is obtained at cathode.



Reaction:



Be and Al show diagonal relationship. Be differs in most of

the properties of its group but resemble Al (diagonally placed to Be) in following respects.

Properties	Explanations
With alkali	Both dissolve giving off H_2 $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$ $Be + 2NaOH \rightarrow Na_2BeO_2 + H_2$
Amphoteric Nature	Both metals react with acid and base and thus are amphoteric
Oxides	Both BeO and Al_2O_3 are amphoteric
Chloride	$BeCl_2$ and $AlCl_3$ both are electron deficient and thus are Lewis acids.

Q.3. What were the difficulties in the isolation of fluorine? Describe the modern method for industrial production of fluorine. 2002, 2008

or

Giving the diagram of electrolytic cell. Describe the modern method for industrial production of fluorine.

2011, 2007, 2009

Ans. F_2 has the most negative ΔG° value (-730 KJ/mole), hence is strongest oxidizing agent. F_2 is extremely reactive because it has low bond energy than other halogen so this causes great difficulties in the isolation of fluorine.

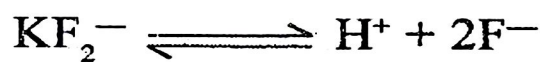
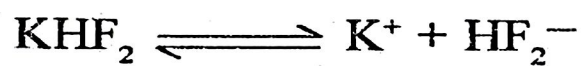
For the industrial preparation of fluorine generally used modern method.

Moern Method: For the industrial production of fluorine, the electrolytic cell is used.

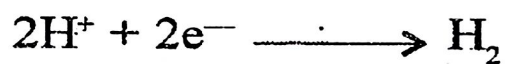
The electrolytic cell contains anhydrous hydrofluoric acid, Potassium hydrogen fluoride and lithium fluoride. The ratio of these are 14:83:3 by weight respectively. The hydrofluoric acid acts as a ionizing solvent for KHF_2 . The lithium fluoride lowers the melting point of the electrolysis and carried out at low temperature. The working temperature of the electrolyte is 100°C . The anode consists of carbon and the cathode are separated by a diaphragm made of monel metal alloy of Cu and Ni containing 70% Ni. The upper portion of the diaphragm is continuous sheet and the lower part is perforated which allows electrolysis to occur.

Reaction:

KHF₂ ionizes as



Cathode



anode

