ALUMINUM

Isotopes	**1st Ionization energy**
^{27}Al , and ^{26}Al	577.5 kj/mol
Earth`s crust abundance	**Common oxidation num.**
8.20%	3
Electron configuration	**Physical state**
$[Ne]3s^2 3p^1$	solid
Melting point	**Color**
660.3^0C	Silvery white
Boiling point	**Density**
2519^0C	2.7 g/mL

Introduction

- Group IIIA is called Earth Metals, B, Al, Ga, In, and Tl.
- Isolated from alum in1827 by the German chemist F. Woehler.
- Aluminum comes from the word alumen means bitter taste in Latin.
- Silvery white, and soft metal, ductile and malleable,
- Hammered easily into wire, sheet and plate,
- Conductor of electricity.

1. Occurrence

- Third most abundant element in the earth's crust.
- The most abundant metal in the earth's crust.
- The main aluminum ores are Feldspar, $K_2Al_2Si_6O_{16}$, Kaolinite, $Al_2Si_2O_7.2H_2O$, Corundum , $A1_2O_3$, Cryolite, Na_3AlF_6, Bauxite, $Al_2O_3.2H_2O$.

Preparation

- The industrial production of aluminum, in the first step pure Al_2O_3 is obtained from the mineral bauxite, $Al_2O_3.2H_2O$. And in the second step
  `$2Al_2O_3 + 3C(s) + 6Cl_2 \rightarrow 4AlCl_3 + 3CO_2(g)$
  The molten $AlCl_3$ is then electrolyzed.
  $2AlCl_3 \rightarrow 2Al(s) + 3Cl_2$
- This method is known as Charles Martin Hall.

2. Chemical Properties

- It is an amphoteric metal, reacts with acids, bases and some non metals.
- It reduces some metal oxides
- Reacts with dil. HCl and H_2SO_4 solutions.
  $2Al(s) + 6HCl(dil.) \rightarrow 2AlCl_3 + 3H_2$
  $2Al(s) + 6H_2SO_4(dil.) \rightarrow Al_2(SO_4)_3 + 3H_2$
- Reacts with strong bases.
  $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$
  $2Al + 6NaOH + 6H_2O \rightarrow 2Na_3[Al(OH)_6] + 3H_2$
- Reacts with mercury salts
  $2Al(s) + 3HgCl_2 \rightarrow 2AlCl_3 + 3Hg(s)$
- Reacts with nonmetals at high temperature.
  $4Al(s) + 3O_2 \rightarrow 2Al_2O_3 + heat$
  $2Al(s) + 3Br_2 \rightarrow 2AlBr_3 + heat$
- Reduces metals from their compounds
  $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$
  $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

3. Compounds

Aluminum Oxide, Al_2O_3

- It is called as alumina, white substance.
- Hard substance
- Melting point of 2045°C.
- Almost insoluble in water.
- Shows amphoteric properties

Aluminum Hydroxide, $Al(OH)_3$

- It is gray precipitate produced from the reaction of aluminum salts with bases.
  $AlCl_3 + 3NaOH(aq) \rightarrow Al(OH)_3 + 3NaCl(aq)$

Aluminum Sulfate, $Al_2(SO_4)_3$

- Aluminum sulfate forms in nature as an important series of alums.
- Alums have $MAl(SO_4)_2.12H_2O$, Where M may be Na^+, K, NH_4^+, and Ag^+

Uses

- Aluminum has a wide variety of uses because of its low cost, nice appearance, lightness, good conductivity of heat and electricity as well as a good material for packaging foods. It is used in buildings, ships, submarines, planes and space technology, and high voltage electrical lines.
- Aluminum powder is used in camera flashes, dyes, alumina thermo processes, and napalm bombs.