

ALUMINUM

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

Introduction

- Group IIIA is called Earth Metals, B, Al, Ga, In, and Tl.
- Isolated from alum in 1827 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

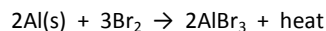
- Third most abundant element in the earth's crust.
- The most abundant metal in the earth's crust.
- The main aluminum ores are Feldspar, $\text{K}_2\text{Al}_2\text{Si}_6\text{O}_{16}$, Kaolinite, $\text{Al}_2\text{Si}_2\text{O}_7 \cdot 2\text{H}_2\text{O}$, Corundum, Al_2O_3 , Cryolite, Na_3AlF_6 , Bauxite, $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$.

Preparation

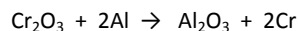
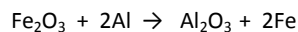
- The industrial production of aluminum, in the first step pure Al_2O_3 is obtained from the mineral bauxite, $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$. And in the second step
 $2\text{Al}_2\text{O}_3 + 3\text{C}(\text{s}) + 6\text{Cl}_2 \rightarrow 4\text{AlCl}_3 + 3\text{CO}_2(\text{g})$
The molten AlCl_3 is then electrolyzed.
 $2\text{AlCl}_3 \rightarrow 2\text{Al}(\text{s}) + 3\text{Cl}_2$
- 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.
 $2\text{Al}(\text{s}) + 6\text{HCl}(\text{dil.}) \rightarrow 2\text{AlCl}_3 + 3\text{H}_2$
 $2\text{Al}(\text{s}) + 6\text{H}_2\text{SO}_4(\text{dil.}) \rightarrow \text{Al}_2(\text{SO}_4)_3 + 3\text{H}_2$
- Reacts with strong bases.
 $2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2$
 $2\text{Al} + 6\text{NaOH} + 6\text{H}_2\text{O} \rightarrow 2\text{Na}_3[\text{Al}(\text{OH})_6] + 3\text{H}_2$
- Reacts with mercury salts
 $2\text{Al}(\text{s}) + 3\text{HgCl}_2 \rightarrow 2\text{AlCl}_3 + 3\text{Hg}(\text{s})$
- Reacts with nonmetals at high temperature.
 $4\text{Al}(\text{s}) + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3 + \text{heat}$



- Reduces metals from their compounds



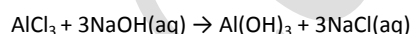
3. Compounds

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, $\text{Al}(\text{OH})_3$

- It is gray precipitate produced from the reaction of aluminum salts with bases.



Aluminum Sulfate, $\text{Al}_2(\text{SO}_4)_3$

- Aluminum sulfate forms in nature as an important series of alums.
- Alums have $\text{MAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$, 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.