

CONCEPT MAP

GROUP 13 : BORON FAMILY

(B, Al, Ga, In, Tl)

Electronic configuration : $ns^2 np^1$

Properties

Physical properties

- $\Delta_f H_1$ is lower but $\Delta_f H_2$ and $\Delta_f H_3$ are quite higher.
- Quite electro-negative.
- Sum of first 3 $\Delta_f H$ is very high.

Chemical properties

- Ba and Al \rightarrow +3 oxidation state.
- Ga, In, Tl \rightarrow +1 and +3 due to inert pair effect.
- Form trioxides (M_2O_3) with O_2 .
- B and Al form nitrides (MN).
- Ga, In and Tl do not react with N_2 .
- All react with both non-oxidising (HCl) and oxidising acids (H_2SO_4). (except B \rightarrow does not react with non-oxidising).
- Form trihalides (MX_3) (except TlI_3).

Anomalous behaviour of boron

- Harder
- Higher melting point and boiling point.
- Form only covalent compounds.
- Oxides and hydroxides are weakly acidic.
- Trihalides of B are monomeric and on hydrolysis form tetrahedral species $[B(OH)_4]^-$.

Boron

Borax : $Na_2B_4O_7 \cdot 10H_2O$
or $Na_2[B_4O_5(OH)_4] \cdot 8H_2O$

- Naturally occurring borax is tincal.
- **Borax bead test**
A transparent glass like bead ($NaBO_2 + B_2O_3$) is formed on heating borax.

Coloured salt $\xrightarrow{\Delta}$ Metal oxide

combines with glass beads
 B_2O_3

Coloured metaborates

Important compounds

Boric acid : H_3BO_3 or $B(OH)_3$

- Layered structure
- Monobasic acid
- Lewis acid
- Its aq. solution is used as mild antiseptic (in eye wash) \rightarrow boric lotion

Boron hydrides (Boranes)

Nidoboranes
 $B_n H_{n+4}$

Arachnboranes
 $B_n H_{n+6}$

Aluminium

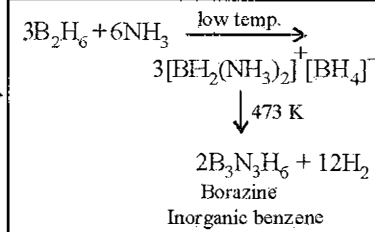
Reactions with

Acids

It becomes passive with conc. HNO_3 due to formation of thin protective Al_2O_3 layer on surface.

Alkalies

Al (amphoteric) evolves H_2 gas.



Reactions

Structure of diborane

- B_2H_6 : There are
(a) four 2 centre-2-electron bond
(b) two 3 centre-2-electron bond (banana bonds)
(c) is sp^3 hybridised.
- B_2H_6 is electron deficient molecule.