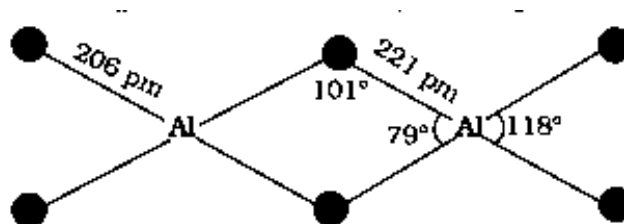


Q. Arrange BF_3 , BCl_3 & BBr_3 according to their decreasing strength of Lewis acid.

Note: AlCl_3 form dimer.



The Elements:

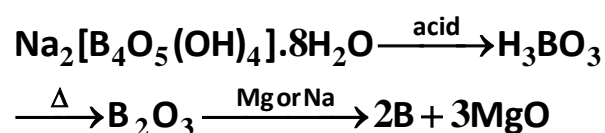
- Boron naturally occurs as Borax ($\text{Na}_2\text{B}_4\text{O}_5(\text{OH})_4 \cdot 8\text{H}_2\text{O}$) & Kernite ($\text{Na}_2\text{B}_4(\text{OH})_4 \cdot 2\text{H}_2\text{O}$), from which the impure element is obtained.
 - Aluminum most important mineral is Bauxite (complex mixture of Hydrated aluminum hydroxide & aluminum oxide)
 - Gallium oxide occurs as impurity in bauxite.
 - In & Tl occur in trace amounts in many minerals.
- p-block elements ranges from metal to non-metal, through metalloids. (B is nonmetal, Al is amphoteric character & Ga, In, Tl are metals)

Anomalous Property of Boron:

Boron show diagonal relationship with Si.

- B and Si form acidic oxides, B_2O_3 & SiO_2 . (Al form amphoteric oxide)
- B & Si form flammable gaseous hydrides (aluminum hydride is solid)

Amorphous Boron is brown powder. Amorphous boron of low purity called Moissan boron, obtained by reducing B_2O_3 with Mg or Na at high temperature.

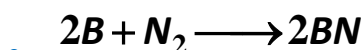


Crystalline Boron forms shiny black crystals. Difficult to obtain pure crystalline boron due to its high M.P.

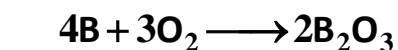


Reaction of Boron:

- Pure crystalline boron is very unreactive.
- Boron does not react with acid and base at low temperature. At high temp^r attacked by Na_2O_2 & mixture of hot conc. HNO_3 & H_2SO_4
- Finely divided amorphous boron is more reactive (containing some impurity)



BN is similar to graphite, slippery white solid with layer structure similar too graphite.

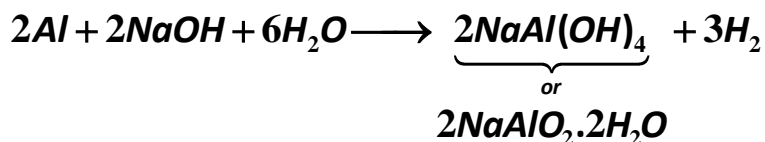


Reaction of Aluminum:

- Aluminum dissolve in dil. Mineral acids producing H₂ gas



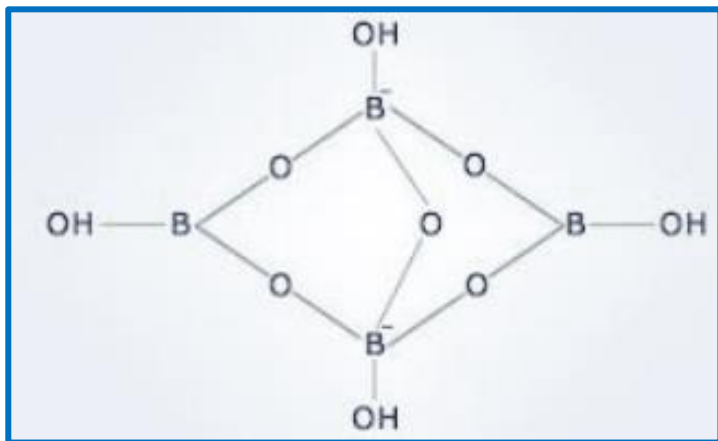
- Conc. HNO₃ renders metal passive (produce protective layer of oxides on the surface)
- Al also dissolves in NaOH



Important compounds of Boron:

Borax: Na₂B₄O₇·10H₂O or Na₂B₄O₅(OH)₄·8H₂O

Structure:



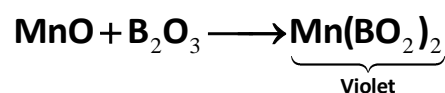
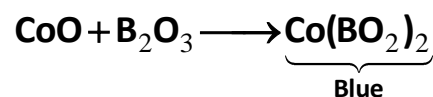
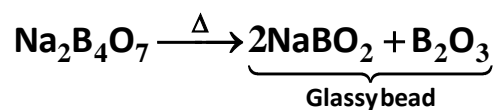
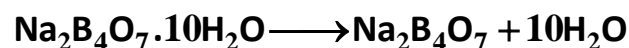
Property of Borax:

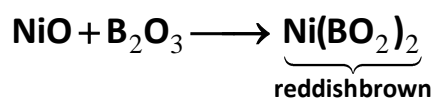
- $Na_2B_4O_7 + 7H_2O \longrightarrow 2NaOH + 4H_3BO_3$
- Borax is a white crystalline solid

Q. Find incorrect statement-

- Two B-atoms are SP² hybridisation
- Two B-atoms are SP³ hybridisation
- Five B-O-B bond are present
- All B-atoms are SP³ hybridisation

Borax Bead Test:





Use:

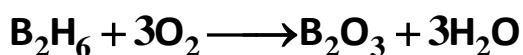
1. in making of hard borosilicate glass
2. to make sodium peroxoborate (used as used as brightner in washing powder)
3. used as antiseptic
4. used in softening of water

Boron Hydride:

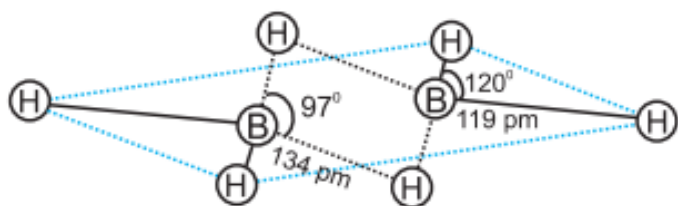
Simplest boron hydride – diborane (B_2H_6)

Diborane (B_2H_6):

- Colorless toxic gas,
- Highly flammable, catches fire spontaneously in air



Structure of diborane:



Preparation:

Lab method:

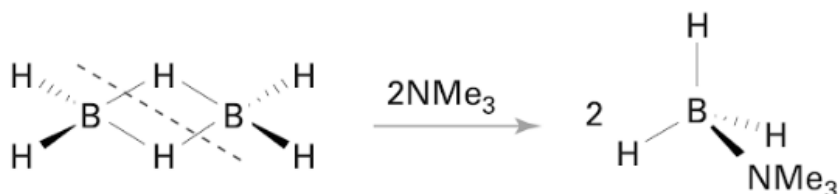
- $4\text{BF}_3 + 3\text{LiAlH}_4 \longrightarrow 2\text{B}_2\text{H}_6 + 3\text{LiF} + 3\text{AlF}_3$
(Synthesis is carried out in vacuum because in air catches fire)
- $2\text{NaBH}_4 + \text{I}_2 \longrightarrow \text{B}_2\text{H}_6 + 3\text{NaI} + \text{H}_2$

Large scale:

- $2\text{BF}_3 + 6\text{NaH} \xrightarrow{450\text{K}} \text{B}_2\text{H}_6 + 6\text{NaF}$

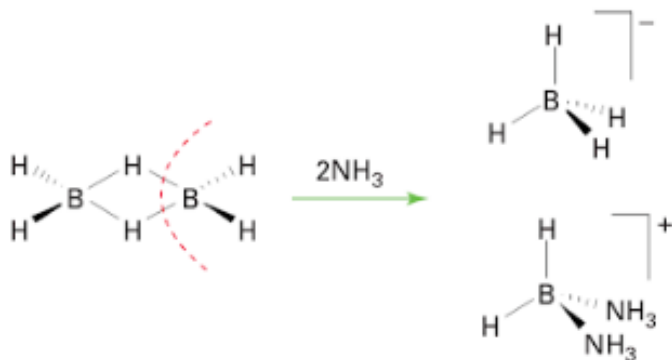
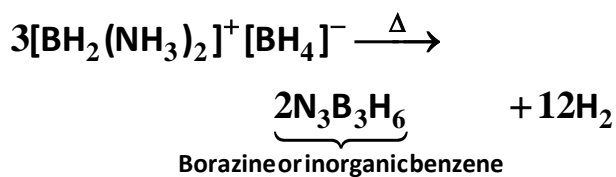
Reactions of diborane:

1. **Hydrolysis by water:** $\text{B}_2\text{H}_6 + 6\text{H}_2\text{O} \longrightarrow 2\text{H}_3\text{BO}_3 + 6\text{H}_2$
2. $\text{B}_2\text{H}_6 + 2\text{NMe}_3 \longrightarrow 2\text{BH}_3 \cdot \text{NMe}_3$



(Symmetrical cleavage)

3. $3\text{B}_2\text{H}_6 + 6\text{NH}_3 \longrightarrow 3[\text{BH}_2(\text{NH}_3)_2]^+ [\text{BH}_4]^-$



(unsymmetrical Cleavage)

- Q.** In the following reaction,
 $2\text{X} + \text{B}_2\text{H}_6 \rightarrow [\text{BH}_2(\text{X})_2]^+ [\text{BH}_4]^-$
 The amine(s) X is/are

- A. NH_3
- B. CH_3NH_2
- C. $(\text{CH}_3)_2\text{NH}$
- D. $(\text{CH}_3)_3\text{N}$

Ans. A, B, C

- Q.** The two types of bonds present in B_2H_6 are covalent and _____.

[IIT-JEE, 1994]

- Q.** Compound X on reduction with 21.72% gives a hydride Y containing 21.72% hydrogen along with other products. Compound Y reacts with air explosively resulting in boron trioxide. Identify X and Y. Give balanced reactions involved in the formation of Y and its reaction with air. Draw the structure of Y.

[IIT-JEE, 2001]