H_3BO_3 — Acid , but it accept OH^- from water releasing proton.

Imp. reacⁿ of Boron :

① $B + O_2 \longrightarrow B_2O_3$

② $B + S \longrightarrow B_2S_3$

③ $B + N_2 \longrightarrow BN$

④ $B + X_2 \longrightarrow BX_3$ (BCl_3, BBr_3, BI_3)

⑤ $B + NaOH \longrightarrow Na_3BO_3 + H_2$

⑥ $B + NH_3 \longrightarrow BN + H_2$

⑦ $B + M \longrightarrow M_xB_y$

Acidity;

$BF_3 < BCl_3 < BBr_3 < BI_3$

↓ only Al,

$Al + HCl \rightarrow AlCl_3 + H_2$

B_2O_3 — Acidic

Al_2O_3, Ga_2O_3 — Amphoteric

In_2O_3, Tl_2O_3 — Basic

$Al + HCl\,(aq) \longrightarrow [Al(H_2O)_6]^{3+} + 6Cl^- + H_2$

$Al + NaOH \longrightarrow Na[Al(OH)_4] + H_2$

conc HNO_3 renders Al passive by forming oxide layer on its surface.

Extracⁿ of Boron

① $Na_2B_4O_7 + HCl + H_2O \longrightarrow H_3BO_3 + 2NaCl$

$\downarrow \Delta$

B_2O_3

$B_2O_3 \xleftarrow[\text{e.g. Mg}]{\text{Red. agent}} B + MgO$

② $KBF_4 + K \xrightarrow{\Delta} KF + B$

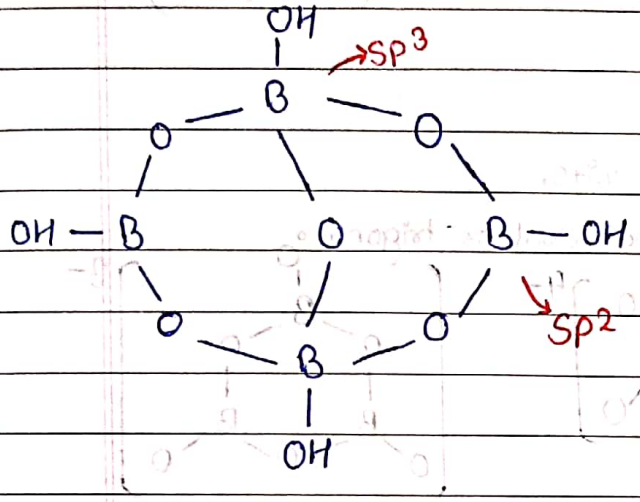
③ $BI_3 \xrightarrow{\text{Red hot tungsten}} B + I_2$ (Van arkel method)

④ $B_2H_6 \xrightarrow{\Delta} B + H_2$

⑤ $BCl_3 + Zn \longrightarrow ZnCl_2 + B$

Borax : $Na_2B_4O_7 \cdot 10H_2O$

↳ $Na_2[B_4O_5(OH)_4] \cdot 8H_2O$ - Struct. formula.



Tetraborate ion $[B_4O_5(OH)_4]^{2-}$

$Na_2B_4O_7 + H_2O \longrightarrow H_3BO_3 + NaOH$

on Heating, Borax first loses water and swells up. on further heating it turns into transparent liquid which solidifies into a glassy like material 'Borax Bead'

$Na_2B_4O_7 \cdot H_2O \xrightarrow{\Delta} Na_2B_4O_7 + 10H_2O$

$Na_2B_4O_7 \xrightarrow{\Delta} \underbrace{NaBO_2 + B_2O_3}_{\text{Borax Bead}}$

Borax Bead test :-

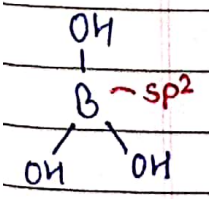
when Borax mixed with certain metal salt is heated, coloured metaborates are formed.

Salt + Borax powder $\xrightarrow[\text{on (Pt wire loop)}]{\Delta}$ Coloured beads.

e.g. $CuO + B_2O_3 \longrightarrow Cu(BO_2)_2$ (Blue)

$CoO + B_2O_3 \longrightarrow Co(BO_2)_2$ (Blue)

Ortho-boasic Acid : H_3BO_3 or $B(OH)_3$



↳ White crystalline solid with soapy touch.

→ very weak monobasic lewis acid.

$B(OH)_3 + H_2O \rightleftharpoons [B(OH)_4]^- + H_3O^+$

Prep^n :

① $B_2H_6 + H_2O \longrightarrow B(OH)_3 + H_2$

② $BX_3 + H_2O \longrightarrow B(OH)_3 + HX$

→ Used as mild antiseptic, insecticide neutron absorber.

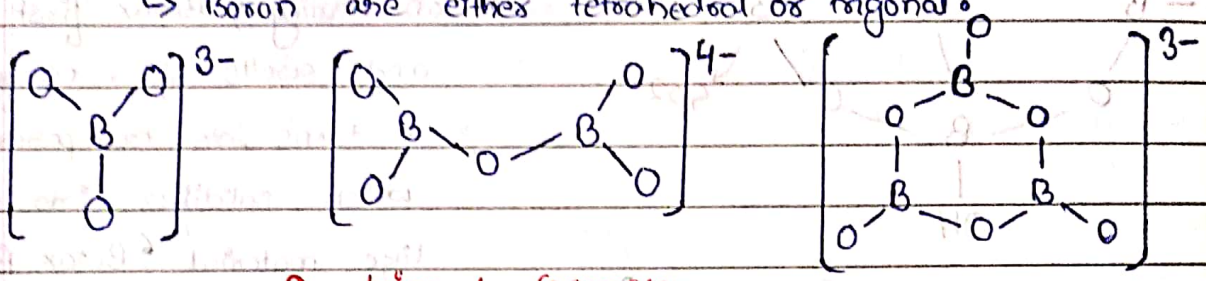
H_3BO_3 + Heat $\xrightarrow{\Delta}$ HBO_2 $\xrightarrow{\Delta}$ B_2O_3

orthoboric acid — Metaboric acid — Boric anhydride (Boric oxide)

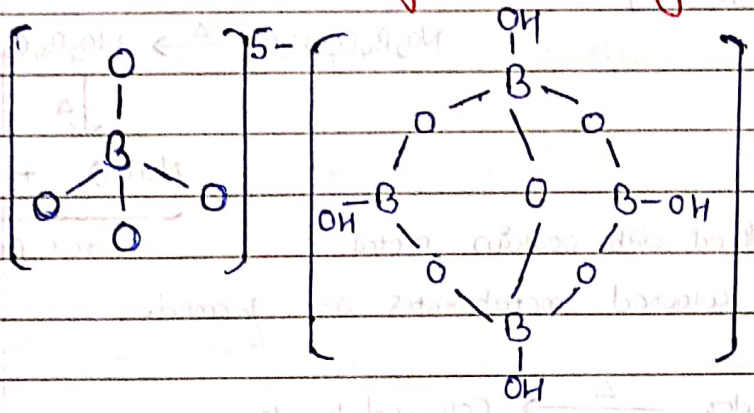
Crystalline Borates :

↳ skeletal boron - oxygen units.

↳ Boron are either tetrahedral or trigonal.



B - trigonal Geometry

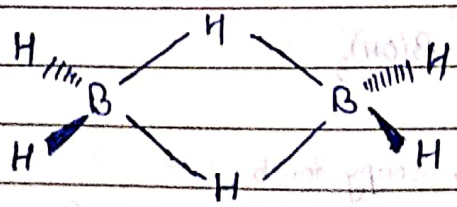


B - tetrahedral geometry.

Diborane : B_2H_6

↳ Binary comp. of B & H are called Boranes

↳ B_2H_6 is simples Borane.



3-centre 2e⁻ bond — (weak Bond)

① $BF_3 + LiAlH_4 \xrightarrow{\text{ether}} B_2H_6 + LiAlF_4$

② $BCl_3 + H_2$ (excess) $\xrightarrow[\text{discharge}]{\text{silent electric}} B_2H_6 + HCl$

③ $NaBH_4 + BF_3 \xrightarrow[\Delta]{\text{ether}} B_2H_6 + NaBF_4$

④ $B_2O_3 + H_2 + Al \longrightarrow B_2H_6 + Al_2O_3$

⑤ $BF_3 + NaH \longrightarrow B_2H_6 + NaF$ (Industrial)

Properties of B_2H_6 :

① colourless gas & highly toxic

② catch fire spontaneously in air,

$$B_2H_6 + O_2 \longrightarrow B_2O_3 + H_2O$$

③ used as rocket fuel.

④ Hydrolyzed by water,

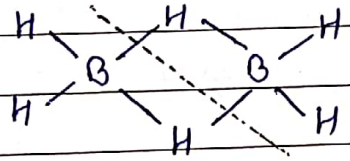
$$B_2H_6 + H_2O \longrightarrow H_3BO_3 + H_2$$

⑤ $B_2H_6 + Cl_2 \rightarrow BCl_3 + HCl$

Breaking of Banana Bond

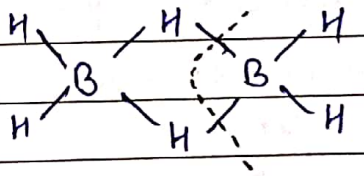
Symmetrical

- large amines, $(CH_3)_3\ddot{N}$ & Pyridine (or large $N\ddot{u}$)



Unsymmetrical.

- small amines CH_3NH_2, NH_3, $(CH_3)_2NH$

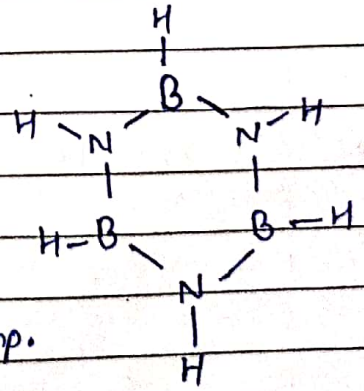


$\downarrow 2\,NH_3$

$[BH_2(NH_3)_2]^{\oplus}[BH_4]^{-}$

$\downarrow \Delta$

$B_3N_3H_6$ (Borazine)



Borazine

↳ Isostructural & isoelectronic with benzene

↳ easily undergoes add^n reac^n.

↳ easily Hydrolysed to give NH_3 & H_3BO_3 at (↑) temp.