Diborane : Preparation - Diborane is prepared by the reduction of B trihalide with a suitable reducing agent.

Industrially, B_2H_6 is prepared by reduction of BF_3 with LiH.

$$2BF_3 + 6LiH \xrightarrow{450K\,\Delta} B_2H_6 + 6LiF$$

By reduction of BCl_3 with $LiAlH_4$.

$4BCl_3 + 3LiAlH_4 \rightarrow 2B_2H_6 + 3LiCl + 3AlCl_3$

By subjecting BCl_3 and H_2 to silent electric discharge.

$2BCl_3 + 6H_2 \rightarrow B_2H_6 + 6HCl$

Physical properties : It is a colourless gas.

It is unstable and change to other boranes easily. It is stable in the absence of greases and moisture.

Reactions:

With air – It burns in air to give B_2O_3. This reaction is highly exothermic and more heat is released than that of C_2H_6.

$\therefore B_2H_6$ is used as potential rocket fuel.

$B_2H_6 + 3O_2 \rightarrow B_2O_3 + 3H_2O$

With water :

$B_2H_6 + 6HOH \rightarrow 2B(OH)_3 + 6H_2$

With base :

$B_2H_6 + 2KOH + 2H_2O \rightarrow 2KBO_2 + 6H_2$

With HCl:

$$B_2H_6 + HCl \xrightarrow{AlCl_3} B_2H_5Cl + H_2$$

With Cl_2 :

$$B_2H_6 + Cl_2 \xrightarrow{25^0} 2BCl_3 + 6HCl$$

With Br :

$$B_2H_6 + Br_2 \xrightarrow{100^0C} B_2H_5Br + HBr$$

B_2H_6 dost not react with I_2

With Na amalgam : It forms addition compund of disodium diborane

$B_2H_6 + 2Na\text{-}Hg \rightarrow Na_2B_2H_6 + 2Hg$

With CO: At 20 atm pressure and 100°C B_2H_6 combines with CO to form diborane carbonyl complex

$B_2H_6 + 2CO \rightarrow 2BH_3CO$

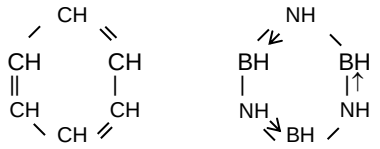
With ammonia : B_2H_6 with NH_3 at 120^0 C to form diammoniate of diborane. This on further heating above 200^0C it decomposes to give borazole or borazine i.e., $B_3N_3H_6$.

$$B_2H_6 + 2NH_3 \xrightarrow{120^0} B_2H_6\,2NH_3 \xrightarrow{200^0C} B_3N_3H_6$$

Borazole resembles C_6H_6 in structure and properties.

$\therefore$ It is called inorganic benzene.

C_6H_6 and borazole are isosters because they contain same number of atoms and electrons.



Benzene (C_6H_6) Inorganic Benzene ($B_3N_3H_6$)

STRUCTURE OF DIBORANE:

- It is electron deficient.
- It has two electrons less than that of required to have C_2H_6 like structure.
- Electron diffraction studies, NMR and Raman spectra have conform that diborane consists of two coplanar BH_2 groups and two bridge hydrogens.
- Out of the six hydrogens of diborane molecule four hydrogens are one type and the other two are of another type. It is conform by methylation of diborane.
- Diborane on methylation gives $Me_4B_2H_2$. These two hydrogens which can not be methylated are bridge hydrogens.
- Both boron atoms are sp^3 hybridised.
- Out of 4 sp^3 hybrid orbitals of each boron three contain one electron each and fourth is empty.
- Four terminal hydrogens are bonded to borons by sp^3 – s overlapping. These are normal covalent bonds.
- The B–H–B bridges involve sp^3–s–sp^3 overlapping.
- The B–H–B bridges are three centred electron pair bonds.
- The B–H–B bridges are banana bonds or tau bonds.