P-BLOCK ELEMENTS - I

1. **Write a short note on anamolous properties of the first element of p-block.**

The following factors are responsible for this anomalous behaviour.

1. Small size of the first member
2. High ionisation enthalpy and high electronegativity
3. Absence of d orbitals in their valance shell

2. Describe briefly allotropism in p- block elements with specific reference to carbon.

Allotropism (or) allotropy is the property of some chemical elements to exist in two or more different forms, in the same physical state, known as allotropes of the elements.

Allotropic forms of Carbon are

i) Graphite ii) Diamond iii) fullerenes

iv) carbon nanotubes v) graphene,

3. **Boron does not react directly with hydrogen. Suggest one method to prepare diborane from BF_3.**

Boron does not react directly with hydrogen. However, it forms a variety of hydrides called boranes. The simplest borane is diborane - B_2H_6.

$$2BF_3 + 6NaH \xrightarrow{450\ K} B_2H_6 + 6NaF$$

To prevent subsequent pyrolysis, the product diborane is trapped immediately.

4. **Give the uses of Borax.**

1. Borax is used for the identification of coloured metal ions
2. In the manufacture optical and borosilicate glass, enamels and glazes for pottery
3. It is also used as a flux in metallurgy and also acts as a preservative

5. **What is catenation ? describe briefly the catenation property of carbon.**

Catenation is an ability of an element to form chain of atoms.

Catenation property of carbon.

(i) the valency of element is greater than or equal to two,

(ii) element should have an ability to bond with itself

(iii) the self bond must be as strong as its bond with other elements

(iv) kinetic inertness of catenated compound towards other molecules. Carbon possesses all the above properties and forms a wide range of compounds with itself and with other elements such as H, O, N, S and halogens.

6. **Write a note on Fisher tropsch synthesis.**

The reaction of carbon monoxide with hydrogen at a pressure of less than 50 atm using metal catalysts at 500 - 700 K yields saturated and unsaturated hydrocarbons.

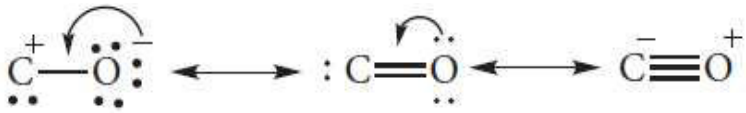
$$nCO + (2n+1)H_2 \longrightarrow C_nH_{(2n+2)} + nH_2O$$

$$nCO + 2nH_2 \longrightarrow C_nH_{2n} + nH_2O$$

Eg. Nickel tetracarbonyl $[Ni(CO)_4]$, Iron pentacarbonyl $[Fe(CO)_5]$, Chromium hexacarbonyl $Cr(CO)_6]$.

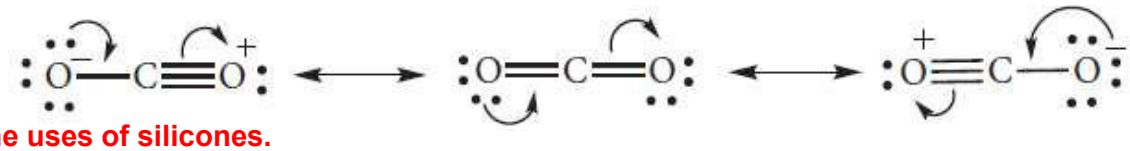
7. Give the structure of CO and CO_2.

i) **CO - linear structure.** ii) The C-O bond distance is 1.128Å. iii) Two canonical forms.



i) **CO2 liner structure** ii) equalbond distance for the both C-O bonds

iii) Addition there is 3c-4e bond covering all the three atoms.

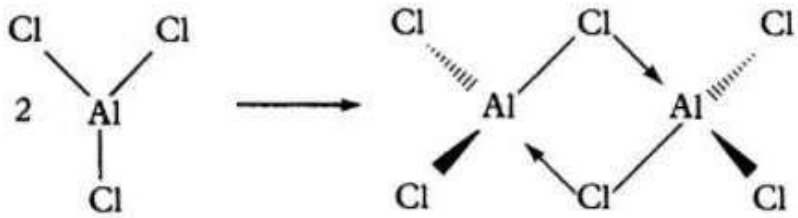


8. Give the uses of silicones.

1. Silicones are used for low temperature lubrication and in vacuum pumps, high temperature oil baths etc...
2. They are used for making water proofing clothes
3. They are used as insulting material in electrical motor and other appliances
4. They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

9. $AlCl_3$ behaves like a lewis acid. Substantiate this statement.

In $AlCl_3$, it forms three bonds and hence outer shell has 6 electrons. In $AlCl_3$, Al needs two electron to complete its octet so it needs electron from outside and it exist in **dimer form** and form bond with Cl atom and complete its octet so its accept non bonding electron pair from Cl so we called it lewis acid.



10. Describe the structure of diborane.

i) In diborane two BH_2 units are linked by two bridged hydrogens.

ii) It has eight B-H bonds.

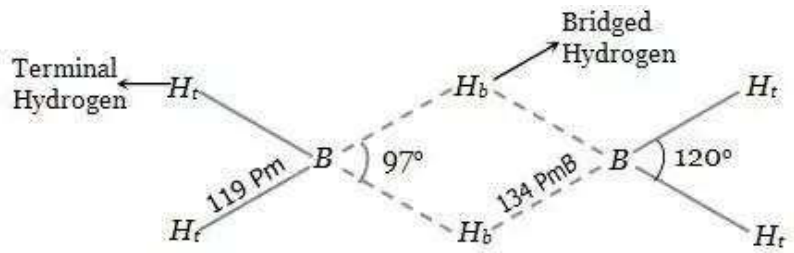
iii) Diborane has only 12 valance electrons

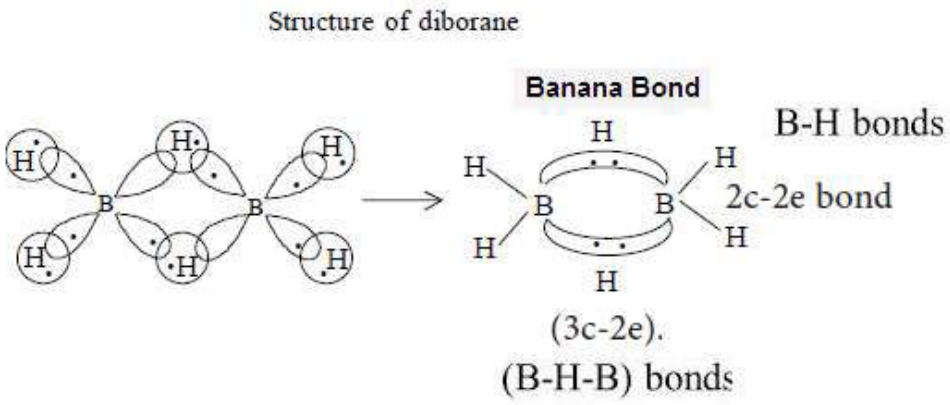
iv) The four terminal B-H bonds is 2c-2e bond (two centre - two electron bond.)

v) Two three centred B-H-B bonds utilise two electrons each. (3c-2e).

vi) In diborne, the boron is sp^3 hybridised

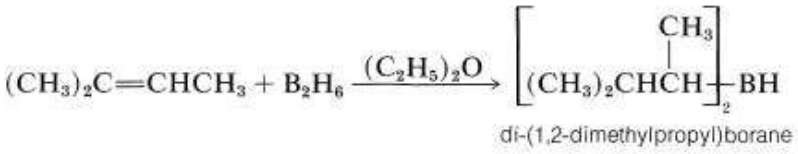
vii) Three of the four sp3 hybridised orbitals contains single electron and the fourth orbital is empty.





11. Write a short note on hydroboration.

Diborane adds on to **alkenes and alkynes in ether solvent at room temperature.** This reaction is called hydroboration and is highly used in synthetic organic chemistry, especially for anti Markovnikov addition



12. Give one example for each of the following

(i) icosogens (ii) tetragen (iii) pnictogens (iv) chalcogen

i) Icosogens -- **Group No.13** - Boron family

(ii) Tetragen -- **Group No.14** - Carbon family

(iii) Pnictogens -- **Group No.15 -** Nitrogen family

(iv) Chalcogen -- **Group No.16** - Oxygen family

13. Write a note on metallic nature of p-block elements.

The tendency of an element to form a cation by loosing electrons is known as electropositive or metallic character. This character depends on the ionisation energy. Generally on descending a group the ionisation energy decreases and hence the metallic character increases.

14. Complete the following reactions

a) $B(OH)_3 + NH_3 \rightarrow BN + 3H_2O$

b) $Na_2B_4O_7 + 5\,H_2SO_4 + H_2O \rightarrow 4H_3BO_3 + Na_2SO_4$

c) $B_2H_6 + 2NaOH + 2H_2O \rightarrow 2NaBO_2 + 6H_2$

d) $B_2H_6 + CH_3OH \rightarrow 2B(OCH_3)_3 + 6H_2$

e) **BF_3+ 9 H_2O $\rightarrow$ H_3BO_3 + HBF_4 + 2HF (book back questions answer)**

$3BF_3 + 3H_2O \rightarrow H_3BO_3 + 3H^+ + 3[BF_4]^-$ (book inside questions answer)

f) $HCOOH + H_2SO_4 \rightarrow CO + H_2O + H_2SO_4$

g) $2SiCl_4 + NH_3 \xrightarrow{330K/ether} Cl_3Si\text{-}NH\text{-}SiCl_3 + 2HCl$

h) $SiCl_4 + 4C_2H_5OH \rightarrow Si(C_2H_5O)_4 + 4HCl$

i) $2B + NaOH \rightarrow 2Na_3BO_3 + 3H_2$

j) $H_2B_4O_7 \xrightarrow{\text{red hot}} 2B_2O_3 + H_2O$

15. How will you identify borate radical?

When boric acid or borate salt is heated with ethyl alcohol in presence of conc. sulphuric acid, an ester, trialkylborate is formed. The vapour of this ester burns with a **green edged flame** and this reaction is used to identify the presence of borate.

$H_3BO_3 + 3C_2H_5OH \xrightarrow{\text{Conc } H_2SO_4} B(OC_2H_5)_3 + 3H_2O$

16. Write a note on zeolites.

Zeolites are three-dimensional crystalline solids containing aluminium, silicon, and oxygen in their regular three dimensional framework. They are hydrated sodium alumino silicates with general formula

$NaO.(Al_2O_3).x(SiO_2).y\ H_2O$ (x=2 to 10; y=2 to 6).

The Si and Al atoms are **tetrahedrally** coordinated with each other through shared oxygen atoms. Zeolites are **similar to clay** minerals but they **differ in their crystalline structure.**

17. How will you convert boric acid to boron nitride?

Fusion of urea with $B(OH)_3$, in an atmosphere of ammonia at 800 - 1200 K gives boron nitride

$B(OH)_3 + NH_3 \xrightarrow{\Delta} BN + 3H_2O$

18. A hydride of 2nd period alkali metal (A) on reaction with compound of Boron (B) to give a reducing agent (C). identify A , B and C.

$4LiH + BF_3 \rightarrow LiBH_4 + 3LiF$

A is lithium hydride (LiH) **B** is boron trifluoride (BF_3) **C** is lithium borohydride ($LiBH_4$)

Lithium borohydride is used in organic synthesis as a reducing agent for esters.

19. A double salt which contains fourth period alkali metal (A) on heating at 500K gives (B). aqueous solution of (B) gives white precipitate with $BaCl_2$ and gives a red colour compound with alizarin. Identify A and B.

i) Compound A is potash alum

$K_2SO_4.Al_2(SO_4)_3.24H_2O \xrightarrow{500\ K} K_2SO_4.Al_2(SO_4)_3$ **(burnt alum)** $+ 24H_2O$

ii) Compound B is (burnt alum)

ii) Aqueous solution of (B) gives white precipitate with $BaCl_2$ and gives a red colour compound with alizarin

$4\ BaCl_2 + K_2SO_4.Al_2(SO_4)_3.24H_2O \rightarrow 4\ BaSO_4$ (White ppt) $+ 2\ AlCl_3 + 24\ H_2O + 2KCl$

But $AlCl_3$ + alizarin to gives red colour

20. CO is a reducing agent . justify with an example.

Carbon monoxide also useful as a metallurgical reducing agentbecause at high temperatures it reduces many metal oxides to the elemental metal.

For example, copper(II) oxide, CuO, and iron(III) oxide, Fe_2O_3, are both reduced to the metal by carbon monoxide.