

1. Discuss the pattern of variation in the oxidation states of (i) B to Tl (iii) C to Pb.

**Ans.** (i) B and Al have no d- or f-electrons. Therefore, they do not exhibit inert pair effect. Consequently, they show an oxidation state of +3 only due to the presence of two electrons in the s-orbital and one electron in the p-orbital of the valence shell. In contrast, all other elements from Ga to Tl contain only d- or d- and f-electrons and hence show two oxidation states of +1 and +3 due to inert pair effect. Further, as the number of d- and f-electrons increases down the group, the inert pair effect becomes more and more pronounced. In other words, as we move down the group from Ga to Tl, the stability of +1 oxidation state increases (i.e.,  $Ga < In < Tl$ ) while that of +3 oxidation state decreases (i.e.  $Ga > In > Tl$ ). Thus, +1 oxidation state of Tl is more stable than its +3 oxidation state.

(ii) Carbon and silicon have no d- or f-electrons. Therefore, they do not exhibit inert pair effect. Consequently, they show an oxidation state of +4 due to the presence of two electrons in the s- and two electrons in the p-orbital of the valence shell. In contrast, all other elements from Ge to Pb contain only d- or d- and f-electrons and hence show two oxidation states of +2 and +4 due to inert pair effect. Further, as the number of d- and f-electrons increases, the inert pair effect becomes more and more pronounced. In other words, as we move down the group from Ge to Pb, the stability of +2 oxidation state increases (i.e.,  $Ge < Sn < Pb$ ) while that of +4 oxidation state decreases (i.e.,  $Ge > Sn > Pb$ ). Thus, +2 oxidation state of Pb is more stable than its +4 oxidation state.

2. How can you explain higher stability of  $BCl_3$  compared to  $TlCl_3$ ?

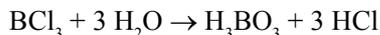
**Ans.** Inert pair effect is maximum in Tl. As a result, only  $6p^1$  electron participates in bond formation and thus the most stable state of Tl is +1 and not +3. Therefore,  $TlCl$  is stable but  $TlCl_3$  is unstable. In contrast, due to the absence of d- and f-electrons in B, all the three valence electrons (i.e., two 2s- and one 2p-) take part in bond formation and hence B shows an oxidation state of +3 and thus forms  $BCl_3$ . Thus,  $BCl_3$  is more stable than  $TlCl_3$ .

3. Why does boron trifluoride behave as a Lewis acid ?

**Ans.** The B atom in  $BF_3$  has only 6 electrons in the valence shell and thus needs two more electrons to complete its octet. Therefore, it easily accepts a pair of electrons from nucleophiles such as F,  $(C_2H_5)_2O$ ,  $RCH_2OH$ , etc. and thus behaves as a Lewis acid.

4. Consider the compounds,  $\text{BCl}_3$  and  $\text{CCl}_4$ . How will they behave with water?

**Ans.** The B atom in  $\text{BCl}_3$  has only six electrons in the valence shell and hence is an electron-deficient molecule. It easily accepts a pair of electrons donated by water and hence  $\text{BCl}_3$  undergoes hydrolysis to form boric acid ( $\text{H}_3\text{BO}_3$ ) and HCl.



In contrast, C atom in  $\text{CCl}_4$  has 8 electrons in the valence shell. Therefore, it is an electron-precise molecule and hence it does not accept a pair of electrons from  $\text{H}_2\text{O}$  molecule and hence  $\text{CCl}_4$  does not undergo hydrolysis in water.

5. Is boric acid a protic acid? Explain.

**Ans.** It is not a protic acid since it does not ionise in  $\text{H}_2\text{O}$  to give a proton:



because of the small size of boron atom and presence of only six electrons in its valence shell,  $\text{B}(\text{OH})_3$  accepts a lone pair of electrons from the oxygen atom of the  $\text{H}_2\text{O}$  molecule to form a hydrated species.



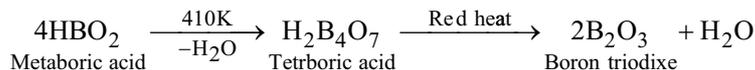
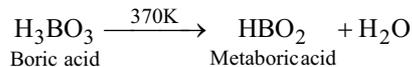
The +ve charge on the O-atom, in turn, pulls the s-electrons of the O-H bond towards itself thereby facilitating the release of a proton. As a result,  $\text{B}(\text{OH})_3$  acts as a weak monobasic Lewis acid and thus reacts with NaOH solution to form sodium metaborate.



Sodium metaborate

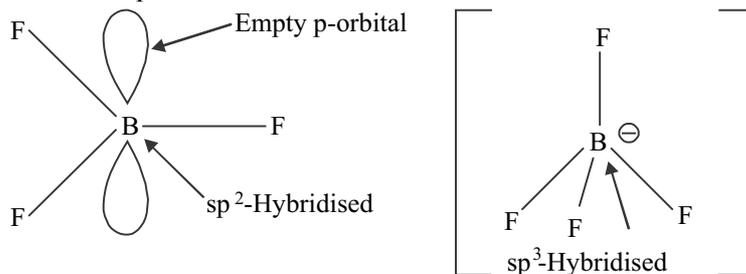
6. Explain what happens when boric acid is heated?

**Ans.** Boric acid, on heating, loses water in three different stages at different temperatures ultimately giving boron trioxide or boric anhydride.



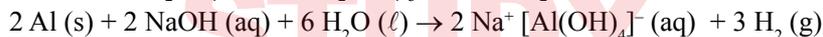
7. Describe the shapes of  $\text{BF}_3$  and  $[\text{BF}_4]^-$ . Assign the hybridisation of boron in these species.

**Ans.** In  $\text{BF}_3$ , boron is  $\text{sp}^2$ -hybridised and, therefore,  $\text{BF}_3$  is a planar molecule. On the other hand, in  $[\text{BF}_4]^-$  boron is  $\text{sp}^3$ -hybridised and hence  $[\text{BF}_4]^-$  is a tetrahedral species.



**8.** Write reactions to justify amphoteric nature of aluminum.

**Ans.** It dissolves both in acids and alkalis evolving dihydrogen.



Sodium tetrahydroxoaluminate (III)

**9.** What are electron deficient compounds? Are  $\text{BCl}_3$  and  $\text{SiCl}_4$  electron deficient species? Explain.

**Ans.** Species in which the central atom either does not have eight electrons in the valence shell or those which have 8 electrons in the valence shell but can expand their covalency beyond 4 due to the presence of d-orbital, are called electron deficient molecules. For example,

(i) In  $\text{BCl}_3$ , the central boron atom has only six electrons. Therefore, it is an electron deficient compound. As such it accepts a pair of electrons from  $\text{NH}_3$  to form an adduct

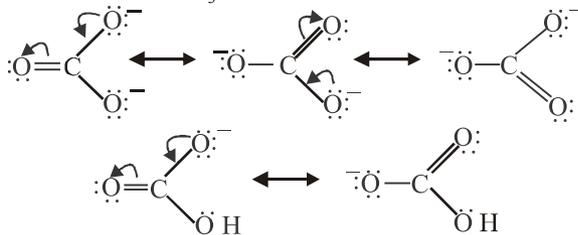


(ii) In  $\text{SiCl}_4$ , the central Si atom has 8 electrons but it can expand its covalency beyond 4 due to the presence of vacant d-orbitals. Therefore, in principle,  $\text{SiCl}_4$  should also be an electron-deficient molecule but, in fact, it does not accept two more  $\text{Cl}^-$  ions to form  $[\text{SiCl}_6]^{2-}$  because of the following two reasons:

- (a) Six large sized Cl atoms cannot be accommodated around small Si atom.
- (b) Interaction between lone pairs of chlorine atom and silicon atom is weak.

10. Write the resonance structures of  $\text{CO}_3^{2-}$  and  $\text{HCO}_3^-$ .

Ans. Resonance structures of  $\text{CO}_3^{2-}$  ion:



Resonance structures of  $\text{HCO}_3^-$  ion: given above

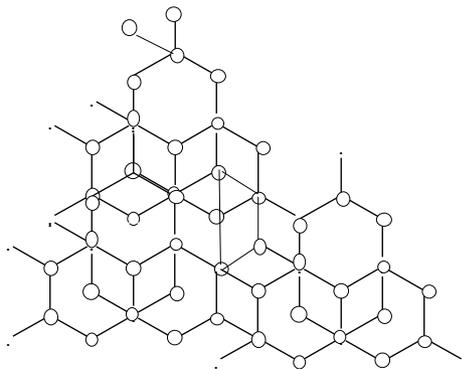
11. What is the state of hybridisation of carbon in (a)  $\text{CO}_3^{2-}$  (b) diamond (c) graphite?

Ans. (a)  $sp^2$  (b)  $sp^3$   
(c)  $sp^2$

12. Explain the difference in properties of diamond and graphite on the basis of their structures.

Ans. In diamond, carbon is  $sp^3$  hybridised. Each carbon is tetrahedrally linked to four neighboring carbon atoms through four strong  $\text{C}-\text{C}$ ,  $sp^3$   $\sigma$  bonds. This network extends in three dimensions and is very rigid. Diamond is the purest form of carbon.

Since diamond exists as a 3D network solid, it is the hardest substance known with high density and melting point. It is a bad conductor of electricity as all the electrons are firmly held in  $\text{C}-\text{C}$   $\sigma$  bonds. Because of its high refractive index, diamond can reflect and refract light. It is therefore transparent substance.



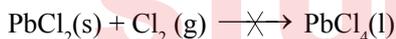
Graphite has carbon having  $sp^2$  hybridisation. Each carbon is thus linked to three other carbon atoms forming hexagonal rings. Thus graphite has a

two dimensional sheet like structure. The various sheets are held together by weak vander Waal's forces of attraction. The bond lengths in graphite are smaller than diamond. Since any two successive layers are held together by weak forces of attraction, one layer can slip over another. This makes graphite a good lubricating agent. As only three electrons of each carbon are used in making hexagonal rings in graphite, fourth valence electron is free to move. This makes graphite a good conductor of heat and electricity. Unlike diamond, graphite is black and possesses a metallic lustre.

13. Rationalise the given statements and give chemical reactions:

- Lead (II) chloride reacts with  $\text{Cl}_2$  to give  $\text{PbCl}_4$ .
- Lead (IV) chloride is highly unstable towards heat.
- Lead is known not to form an iodide,  $\text{PbI}_4$ .

**Ans.** (i) Due to inert pair effect, lead (II) chloride is more stable than lead (IV) chloride and hence lead (II) chloride does not react with  $\text{Cl}_2$  to form lead (IV) chloride.



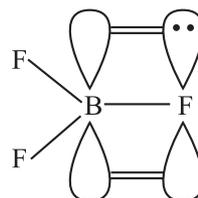
(ii) Due to greater stability of +2 over +4 oxidation state because of inert pair effect, lead (IV) chloride on heating decomposes to give lead(II) chloride and  $\text{Cl}_2$ ?



(iii) Due to oxidising power of  $\text{Pb}^{4+}$  ion and reducing power of I-ion,  $\text{PbI}_4$  does not exist.

14. Suggest a reason why the B-F bond lengths in  $\text{BF}_3$  (130 pm) and  $\text{BF}_4^-$  (143 pm) differ?

**Ans.**  $\text{BF}_3$  is a planar molecule in which B is  $\text{sp}^2$ -hybridised. It has an empty 2p-orbital. F-atom has three lone pairs of electrons in the 2p-orbitals. Because of similar sizes,  $\text{p}\pi\text{-p}\pi$  back bonding occurs in which a lone pair is transferred from F to B as shown below:

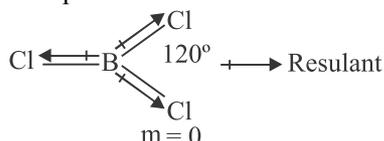


As a result of this back bonding, B-F bond acquires some double bond character. In contrast, in  $[\text{BF}_4]^-$  ion, B is  $\text{sp}^3$ -hybridised and hence does not have an empty p-orbital available to accept the electrons donated by the F atom. Consequently, in  $[\text{BF}_4]^-$ , B-F is a purely single bond. Since double bonds are shorter than single bonds.

Therefore, the B-F bond length in  $\text{BF}_3$  is shorter (130 pm) than B-F bond length (143 pm) in  $[\text{BF}_4]^-$ .

15. If B–Cl bond has a dipole moment, why does  $\text{BCl}_3$  have zero dipole moment?

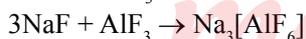
**Ans.** The overall dipole moment of a molecule, depends upon its geometry. Now  $\text{BCl}_3$  is a planar molecule in which the three B–Cl bonds are inclined at an angle of  $120^\circ$ . Therefore, the resultant of two B–Cl bonds is cancelled by equal and opposite dipole moment of the third B–Cl bond as shown below:



As a result, overall dipole moment of  $\text{BCl}_3$  is zero.

16. Aluminum trifluoride is insoluble in anhydrous HF but dissolves on addition of NaF. Aluminium tri-fluoride precipitates out of the resulting solution when gaseous  $\text{BF}_3$  is bubbled through. Give reasons.

**Ans.** (i) Anhydrous HF is a covalent compound and is strongly H-bonded. Therefore, It does give  $\text{F}^-$  ions hence  $\text{AlF}_3$  does not dissolve in HF. In contrast, NaF being an ionic compound contains  $\text{F}^-$  ions and hence combines with  $\text{AlF}_3$  to form the soluble complex.



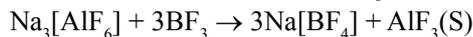
Sodium hexafluoro

aluminate (III)

(soluble complex)



(ii) Because of smaller size and higher electro negativity, B has much higher tendency to form complexes than Al, therefore, when  $\text{BF}_3$  is added to the above solution,  $\text{AlF}_3$  gets precipitated.

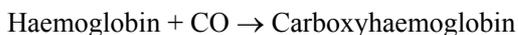


Sodium Tetra fluoro borate (III)

(soluble complex)

17. Suggest a reason as to why CO is poisonous?

**Ans.** CO combines with haemoglobin irreversibly to form carboxyhaemoglobin which is about 300 times more stable than the oxyhaemoglobin.



As a result, the oxygen carrying capacity of haemoglobin is destroyed and the man dies of suffocation. Thus, the highly poisonous nature of CO arises due to its ability to form a complex with haemoglobin.

18. How is excessive content of  $\text{CO}_2$  responsible for global warming?

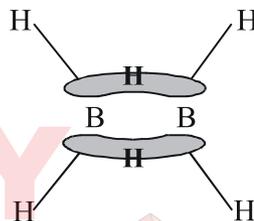
**Ans.** If the concentration of  $\text{CO}_2$  increases beyond a certain level due to excessive combustion, some of the  $\text{CO}_2$  will always remain unutilised. This excess  $\text{CO}_2$  absorbs heat radiated by the earth. Some of it is dissipated into the atmosphere while the remaining part is radiated back to the earth and other bodies present on the earth. As a result, temperature of the earth and other bodies on the earth increases. This is called greenhouse effect and  $\text{CO}_2$  is called a green house gas.

As a result of greenhouse effect, global warming occurs which has serious consequences.

**19.** Explain structures of diborane and boric acid.

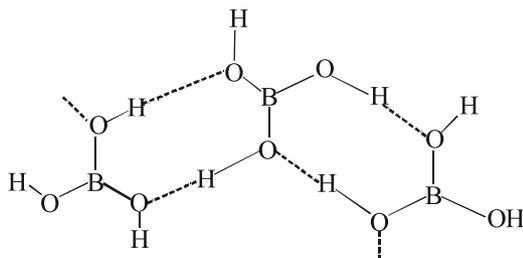
**Ans.** For structure of diborane,

Diborane has three centre two electron bonds ( $3c - 2e$ ) and hence quite weak. Because of their resemblance to banana, they are also called banana bond. The electronic configuration of excited state of boron is  $1s^2 2s^1 2p_x^1 2p_y^1 2p_z^0$ . It undergoes  $sp^3$ -hybridisation.



The two half filled hybrid orbitals of each boron atom overlap with the half filled orbitals of hydrogen atoms forming normal covalent bonds whereas the third half filled hybrid orbital of one boron atom and the vacant hybrid orbital of the second boron atom overlap simultaneously with the half filled orbitals of H-atom.

Thus the electron cloud contains two electrons but spreads over three atoms (2 B-atoms and 1 H-atom) which take the shape of banana and called banana bond.



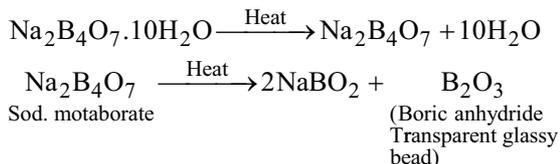
### Structure of boric acid

The electronic configuration of excited state of boron is  $1s^2 2s^1 2p_x^1 2p_y^1 2p_z^0$ . It undergoes  $sp^2$ -hybridisation to give three  $sp^2$ -hybridised orbitals. Each one of these three  $sp^2$ -orbitals overlaps with  $2p$ -orbitals of O— forming three B—O— bonds.

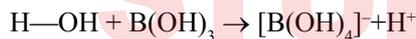
20. What happens when

- Borax is heated strongly
- Boric acid is added to water
- Aluminium is treated with dilute NaOH
- $\text{BF}_3$  is reacted with ammonia

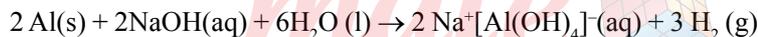
**Ans.** (a) When borax is heated strongly, a transparent glassy bead which consists of sodium metaborate ( $\text{NaBO}_2$ ) and boric anhydride is formed.



(b) Boric acid acts as a weak Lewis acid by accepting a hydroxide ion of water and releasing a proton into the solution.



(c) Dihydrogen is evolved.



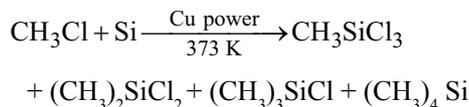
(d)  $\text{BF}_3$  being a Lewis acid accepts a pair of electrons from  $\text{NH}_3$  to form the corresponding complex.



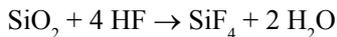
21. Explain the following reactions:

- Silicon is heated with methyl chloride at high temperature in the presence of copper.
- Silicon dioxide is treated with hydrogen fluoride.
- CO is heated with ZnO.
- Hydrated alumina is treated with aqueous NaOH solution.

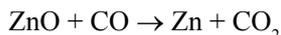
**Ans.** (a) A mixture of mono-, di- and trimethylchlorosilanes along with a small amount of tetramethylsilane is formed.



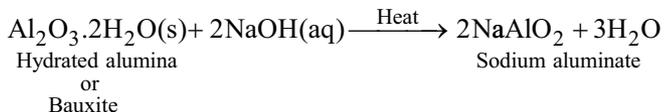
(b) The initially formed silicon tetra fluoride dissolves in HF to form hydrofluorosilicic acid



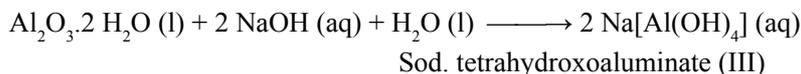
(c) ZnO is reduced to zinc metal.



(d) Alumina dissolves to form sodium meta aluminate



**OR**



22. Give reasons :

- (i) Conc.  $\text{HNO}_3$  can be transported in Aluminium container.
- (ii) A mixture of dilute  $\text{NaOH}$  and Aluminium pieces is used to open drain.
- (iii) Graphite is used as lubricant.
- (iv) while Diamond is used as an abrasive.
- (v) Aluminium alloys are used to make aircraft body.
- (vi) Aluminium utensils should not be kept in water overnight.
- (vii) Aluminium wire is used to make transmission cables.

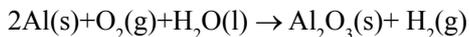
**Ans.**

- (i) Al reacts with conc.  $\text{HNO}_3$  to form a very thin film of Aluminium oxide on its surface which protects it from further action.  

$$2 \text{Al} (\text{s}) + 6 \text{HNO}_3 (\text{conc.}) \rightarrow \text{Al}_2\text{O}_3 (\text{s}) + 6 \text{NO}_2 (\text{g}) + 3 \text{H}_2\text{O} (\text{l})$$
 Alumina Thus, Al becomes passive and hence Aluminium containers can be used to transport conc.  $\text{HNO}_3$ .
- (ii)  $\text{NaOH}$  reacts with Al to evolve dihydrogen whose pressure can be used to open clogged drains.  

$$2\text{Al}(\text{s}) + 2 \text{NaOH} (\text{aq}) + 2 \text{H}_2\text{O}(\text{l}) \rightarrow 2\text{NaAlO}_2 (\text{aq}) + 3 \text{H}_2(\text{g})$$
- (iii) Graphite has  $\pi$ -bonded layered structure in which the different layers are held together by weak van der Waal's forces and hence can be made to slip over one another. Therefore, graphite acts as a lubricant
- (iv) Diamond is very hard and hence can be used as an abrasive.
- (v) Aluminium alloys such as duralumin is light, tough and resistant to corrosion and hence is used to make aircraft body.

(vi) Al reacts with  $\text{H}_2\text{O}$  and dissolved  $\text{O}_2$  to form a thin film of Aluminium oxide.



A very small amount of  $\text{Al}_2\text{O}_3$  may dissolve to give a few ppm of  $\text{Al}^{3+}$  ions in the solution. Since  $\text{Al}^{3+}$  ions are injurious to health, therefore, drinking water should not be kept in Aluminium utensils overnight.

(vii) On weight to weight basis, Aluminium conducts twice as Cu. Therefore, it is used in transmission cables.

23. Explain why is there a phenomenal decrease in ionisation enthalpy from carbon to silicon?

**Ans.** Due to increase in atomic size and screening effect, the force of attraction of the nucleus for the valence electron decreases considerably in Si as compared to C. As a result, there is a phenomenal decrease in ionisation enthalpy from carbon to silicon.

24. How would you explain the lower atomic radius of Ga as compared to Al ?

**Ans.** Due to poor shielding of the valence electrons of Ga by the inner 3d-electrons, the effective nuclear charge of Ga is greater in magnitude than that of Al. As a result, the electrons in gallium experience greater force of attraction by the nucleus than in Al and hence atomic size of Ga (135 pm) is slightly less than that of Al (143 pm).

25. What are allotropes? Sketch the structure of two allotropes of carbon namely diamond and graphite. What is the impact of structure on physical properties of two allotropes?

**Ans.** The phenomenon of existence of an element in two or more forms having different physical properties but identical chemical properties are called allotropy and the different forms are called allotropes. (For rest answers see Ans. 12 above).

26. Classify following oxides as neutral, acidic, basic or amphoteric  $\text{CO}$ ,  $\text{B}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{CO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{PbO}_2$ ,  $\text{Ti}_2\text{O}_3$ .

**Ans.** Neutral oxides:  $\text{CO}$ ; Acidic oxides:  $\text{B}_2\text{O}_3$ ,  $\text{SiO}_2$ ,  $\text{CO}_2$  Amphoteric oxides :  $\text{Al}_2\text{O}_3$ ,  $\text{PbO}_2$  Basic oxide:  $\text{Ti}_2\text{O}_3$ .

27. In some of the reactions, thallium resembles aluminium, whereas in others it resembles with group I metals. Support this statement by giving some evidences.

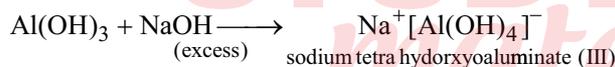
**Ans.** Aluminium shows a uniform oxidation of +3. Like Aluminium, Tl also shows +3 oxidation state in some of its compounds like  $TlCl_3$ ,  $Tl_2O_3$ , etc. Like Al, Tl also forms octahedral complexes:  $[AlF_6]^{3-}$  and  $[TlF_6]^{3-}$ . Group 1 metals shows +1 oxidation state. Tl also shows +1 oxidation state due to inert pair effect. Thus it resembles with group 1 metals. Example,  $TlCl$ ,  $Tl_2O$ ,  $TlClO_4$ ,  $Tl_2O$  is a base.

**28.** When metal X is treated with sodium hydroxide, a white precipitate (A) is obtained, which is soluble in excess of NaOH to give soluble complex (B). Compound (A) is soluble in dilute HCl to form compound (C). The compound (A) when heated strongly gives (D), which is used to extract metal. Identify (X), (A), (B), (C) and (D). Write suitable equations to support their identities.

**Ans.** As the metal given in question on treatment with NaOH gives a white ppt (A) which dissolves in excess of NaOH to give metal complex (B), therefore the given metal must be Al. the reactions may given as



(A)



(A)

(B)

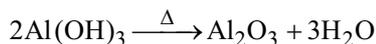
As  $Al(OH)_3$  is amphoteric in nature, it reacts with dil HCl to form  $AlCl_3$  (C).



(A)

(C)

(A) when heated strongly give alumina which is used to extract metal.



(A)

(D)

**29.** What do you understand by (a) inert pair effect (b) allotropy and (c) catenation?

**Ans.** (a) **Inert pair effect**—As we move down the group, the tendency of s-electrons of the valence shell to participate in bond formation decreases. This reluctance of the s-electrons to participate in bond formation is called inert pair effect.

(b) **The phenomenon** of existence of an element in various physical forms but with similar chemical properties is known as allotropy. Carbon exists in various allotropic forms.

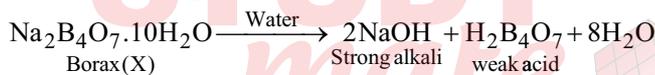
- (i) Diamond — a hard, beautiful crystalline substance.
  - (ii) Graphite — a soft, greyish black crystalline substance .
  - (iii) Amorphous carbon — black residue left when carbon compounds are heated.
- (c) **Catenation** may be defined as the ability of like atoms to link with one another through covalent bonds. This is due to smaller size, higher electronegativity and unique strength of C – C bonds.

30. A certain salt X, gives the following results.

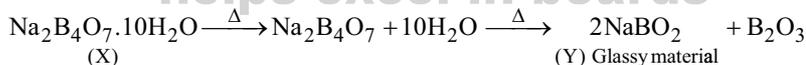
- (i) Its aqueous solution is alkaline to litmus.
- (ii) It swells up to a glassy material Y on strong heating.
- (iii) When conc.  $\text{H}_2\text{SO}_4$  is added to a hot solution of X, white crystal of an acid Z separates out.

Write equations for all the above reactions and identify X, Y and Z.

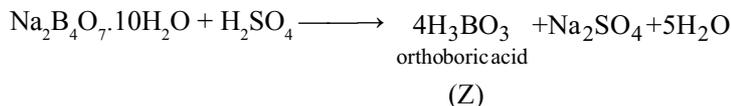
Ans. (i) Since the aqueous solution of X is alkaline to litmus, here it must be a salt of strong base and weak acid.



- (ii) Since (X) on strong heating swells up to a glassy material, i.e., giving Borax Bead test thus it is now confirmed that the compound X is Borax.



- (iii) When conc.  $\text{H}_2\text{SO}_4$  is added to a hot solution of X white crystal of an acid separate out, thus Z must be ortho boric acid.



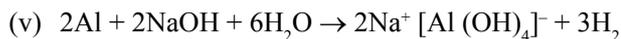
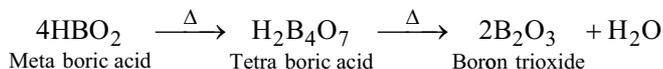
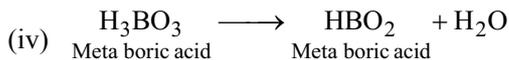
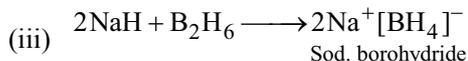
31. Write balanced equations for:

- (i)  $\text{BF}_3 + \text{LiH} \rightarrow$
- (ii)  $\text{B}_2\text{H}_6 + \text{H}_2\text{O} \rightarrow$
- (iii)  $\text{NaH} + \text{B}_2\text{H}_6 \rightarrow$
- (iv)  $\text{H}_3\text{BO}_3 \xrightarrow{\Delta} \rightarrow$
- (v)  $\text{Al} + \text{NaOH} \rightarrow$
- (vi)  $\text{B}_2\text{H}_6 + \text{NH}_3 \rightarrow$

Ans. (i)  $2\text{BF}_3 + 6\text{LiH} \longrightarrow \text{B}_2\text{H}_6 + 6\text{LiF}$

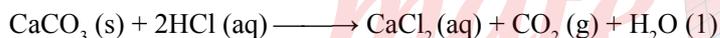
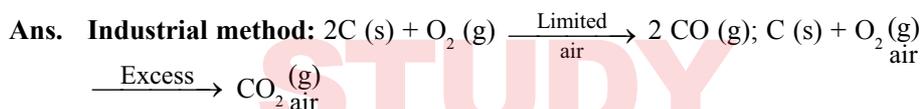
Diborane





Borane-ammonia complex

32. Give one method for industrial preparation and one for laboratory preparation of CO and CO<sub>2</sub> each.



33. An aqueous solution of borax is

- (a) neutral                      (b) amphoteric  
(c) basic                        (d) acidic

- Ans.** Borax is a salt of a strong base (NaOH) and a weak acid (H<sub>3</sub>BO<sub>3</sub>), therefore, it is basic in nature, i.e., option (c) is correct.

34. Boric acid is polymeric due to

- (a) its acidic nature                      (b) the presence of hydrogen bonds  
(c) its monobasic nature                      (d) its geometry

- Ans.** Boric acid is polymeric due to the presence of H-bonds. Therefore, option (b) is correct.

35. The type of hybridisation of boron in diborane is

- (a) sp                                      (b) sp<sup>2</sup>  
(c) sp<sup>3</sup>                                      (d) dsp<sup>2</sup>

- Ans.** In B<sub>2</sub>H<sub>6</sub>, B is sp<sup>3</sup>-hybridised. Therefore, option (c) is correct.

36. Thermodynamically the most stable form of carbon is

- (a) diamond (b) graphite  
(c) fullerenes (d) coal

**Ans.** Thermodynamically the most stable form of carbon is graphite, i.e., option (b) is correct.

37. Elements of group 14.

- (a) exhibit oxidation state of +4 only  
(b) exhibit oxidation state of +2 and +4  
(c) form  $M^{2-}$  and  $M^{4+}$  ion  
(d) form  $M^{2+}$  and  $M^{4+}$  ions.

**Ans.** Due to inert pair effect, elements of group 14 exhibit oxidation states of +2 and +4. Thus, option (b) is correct.

38. If the starting material for the manufacture of silicones is  $RSiCl_3$ , write the structure of the product formed.

**Ans.** Hydrolysis of trichlorosilanes gives cross-linked silicones.

