



## TEXTBOOK QUESTIONS SOLVED

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

Answer: (i) B to Tl

Common oxidation states are +1 and +3. The stability of +3 oxidation state decreases from B to Tl. +1 oxidation state increases from B to Tl.

(ii) C to Pb

The common oxidation states are +4 and +2. Stability of +4 oxidation state decreases from C to Pb.

Details can be seen from the text part.

Question 2. How can you explain higher stability of  $\text{BCl}_3$  as compared to  $\text{TlCl}_3$ ?

Answer:  $\text{BCl}_3$  is quite stable. Because there is absence of d- and f- electrons in boron three valence electrons ( $2s^2 2p_{x1}$ ) are there for bonding with chlorine atom. In Tl the valence s-electron ( $6s^2$ ) are experiencing maximum inert pair effect. Thus, only  $6p^1$  electron is available for bonding. Therefore,  $\text{BCl}_3$  is stable but  $\text{TlCl}_3$  is comparatively unstable.

Question 3. Why does borontrifluoride behave as a Lewis acid?

Answer: In  $\text{BF}_3$ , central atom has only six electrons after sharing with the electrons of the F atoms. It is an electron deficient compound and thus behaves as a Lewis acid.

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

Answer: In  $\text{BCl}_3$ , there is only six electrons in the valence shell of B atom. Thus, the octet is incomplete and it can accept a pair of electrons from water and hence  $\text{BCl}_3$  undergoes hydrolysis.

Whereas, in  $\text{CCl}_4$ , C atom has 8 electrons and its octet is complete.

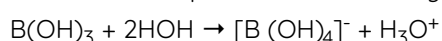
That's why it has no tendency to react with water.

$\text{CCl}_4 + \text{H}_2\text{O} \rightarrow \text{No reaction}$

Question 5. Is boric acid a protonic acid? Explain.

Answer: Boric acid is a Lewis acid, it is not a protonic acid.

Boric acid accepts electrons from hydroxyl ion of  $\text{H}_2\text{O}$  molecule.



Question 6. Explain what happens when boric acid is heated.

Answer: On heating boric acid above 370 K, it forms metaboric acid,  $\text{HBO}_2$  which on further heating yields boric oxide  $\text{B}_2\text{O}_3$ .

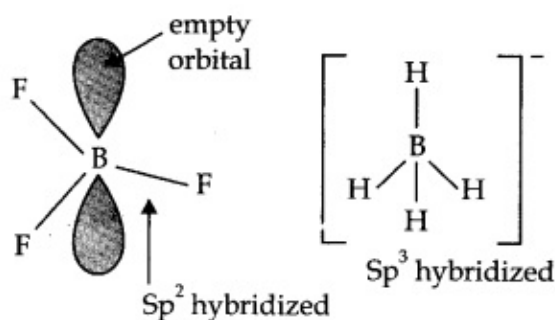


Question 7. Describe the shapes of  $\text{BF}_3$  and  $\text{BH}_4^-$ . Assign the hybridisation of boron in these species.

Answer: In  $\text{BF}_3$ , boron is  $\text{sp}^2$  hybridized.

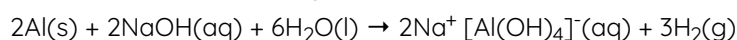
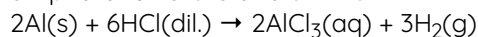
$\therefore$  shape of  $\text{BF}_3$  = planar.

In  $[\text{BH}_4]^-$ , boron is  $\text{sp}^3$  hybridized, thus the shape is tetrahedral.



Question 8. Write reactions to justify amphoteric nature of aluminium.

Answer: Aluminium reacts with acid as well as base. This shows amphoteric nature of aluminium.



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

Answer: Electron deficient species are those in which the central atom in their molecule has the tendency to accept one or more electron pairs. They are also known as Lewis acid.  $\text{BCl}_3$  and  $\text{SiCl}_4$  both are electron deficient species.

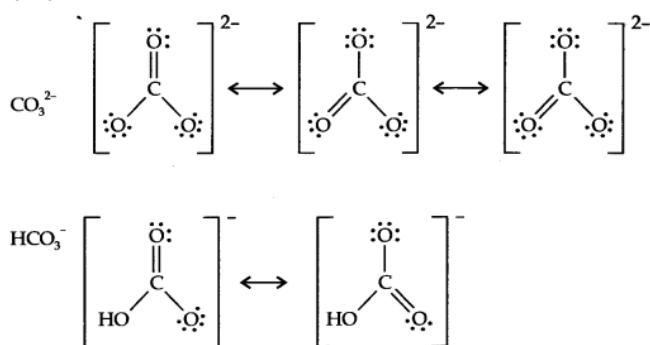
Since, in  $\text{BCl}_3$ , B atom has only six electrons. Therefore, it is an electron deficient compound.

In  $\text{SiCl}_4$  the central atom has 8 electrons but it can expand its covalency beyond 4 due to the presence of d-orbitals.

Thus,  $\text{SiCl}_4$  should also be considered as electron deficient species.

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

Answer:



Question 11. What is the state of hybridisation of carbon in

(a)  $\text{CO}_3^{2-}$  (b) diamond (c) graphite?

Answer: (a)  $\text{CO}_3^{2-}$  ( $\text{sp}^2$ ) (b) Diamond ( $\text{sp}^3$ ) (c) Graphite ( $\text{sp}^2$ )

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

Answer:

- Since diamond exists as a three dimensional network solid, it is the hardest substance known with high density and high melting point. Whereas in graphite, any two successive layers are held together by weak forces of attraction. This makes graphite soft.
- In graphite, carbon atom is  $\text{sp}^2$  hybridized whereas in

diamond, carbon atom is  $sp^3$  hybridized.

- Unlike diamond, graphite is good conductor of heat and electricity.

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