



WEIRD CHEMIST

P-Block Elements

Back Bonding

DPP – 01

Topic: Back Bonding

Questions: 15 Questions

Exam: JEE / NEET

▶ TYPE 1 : Back Bonding in BF_3 — Bond Properties & Structure

Q1. In BF_3 :

- (1) B–F bond has some double bond character and this bond is delocalised
- (2) All the B–F bonds are single covalent in nature
- (3) Bond energy and bond length of B–F bond indicate its single bond character
- (4) All the bonds are ionic

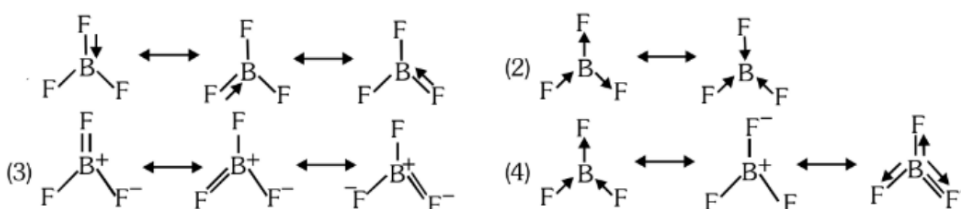
Q2. Which of the following statements is incorrect in the context of the B–F bond in BF_3 ?

- (1) All the three B–F bond lengths are equal and each of them is shorter than the sum of the covalent radii of boron and fluorine
- (2) The bond energy of the B–F bond is very high, higher than for any other single bond
- (3) The unusual shortness and strength of the B–F bond may be explained by a $p\pi-p\pi$ interaction between boron and fluorine atoms
- (4) The unusual shortness and strength of the bonds may be explained by a $p\pi-d\pi$ interaction between the atoms of boron and fluorine

Q3. In BF_3 , the B–F bond length is 1.30 \AA . When BF_3 is allowed to react with Me_3N , it forms an adduct $[\text{Me}_3\text{N} \rightarrow \text{BF}_3]$. The bond length of B–F in the adduct is:

- (1) Greater than 1.30 \AA
- (2) Smaller than 1.30 \AA
- (3) Equal to 1.30 \AA
- (4) None of these

Q4. Which of the following structures correctly represents the boron trifluoride molecule?



- (1) Structure 1 (2) Structure 2 (3) Structure 3 (4) Structure 4

▶ **TYPE 2 : Back Bonding — Effects, Geometry & Comparison**

Q5. Trisilylamine $[\text{N}(\text{SiH}_3)_3]$ has a

- (1) Planar geometry (3) Pyramidal geometry
(2) Tetrahedral geometry (4) None of these

Q6. Which of the following is not possible due to back bonding?

- (1) State of hybridisation may change (3) Bond angle always increases
(2) Bond order increases (4) Lewis acidic strength decreases

Q7. In which of the following compounds is the B–F bond length shortest?

- (1) BF_4^- (2) $\text{BF}_3 \leftarrow \text{NH}_3$ (3) BF_3 (4) $\text{BF}_3 \leftarrow \text{N}(\text{CH}_3)_3$

Q8. “Hybridisation of central atom does not always change due to back bonding.” This statement is valid for which of the following compounds?

- (i) CCl_3^- (ii) CCl_2 (iii) CF_2 (iv) $\text{N}(\text{SiH}_3)_3$

- (1) (i), (ii) (2) (i), (iii) (3) (ii), (iii) (4) All

Q9. The geometry with respect to the central atom of the following molecules are $\text{N}(\text{SiH}_3)_3$, Me_3N , $(\text{SiH}_3)_3\text{P}$:

- (1) planar, pyramidal, planar (3) pyramidal, pyramidal, pyramidal
(2) planar, pyramidal, pyramidal (4) pyramidal, planar, pyramidal

Q10. In which of the following compounds, the observed bond angle is found to be greater than expected, but not due to back bonding?

- (1) $\text{N}(\text{SiH}_3)_3$ (2) $\text{O}(\text{CH}_3)_2$ (3) $\text{O}(\text{SiH}_3)_2$ (4) All of these

▶ **TYPE 3 : NCERT BASED**

Q11. BF_3 is sp^2 -hybridised. When it accepts a fluoride ion to form BF_4^- , which single combination of changes correctly describes the process and confirms its Lewis-acid behaviour?

- (1) Hybridisation changes $sp^2 \rightarrow sp^3$, and the electron count around B rises from 6 to 8 — confirming Lewis-acid behaviour
- (2) Hybridisation changes $sp^3 \rightarrow sp^2$, and B donates a pair — confirming Lewis-base behaviour
- (3) Hybridisation stays sp^2 , electron count rises $6 \rightarrow 8$ — confirming Lewis-acid behaviour
- (4) Hybridisation changes $sp^2 \rightarrow sp^3$, but electron count stays at 6 — confirming the deficiency persists

Q12. Why do trivalent boron compounds such as BF_3 behave as Lewis acids?

- (1) Boron has an incomplete octet ($6 e^-$) and accepts an electron pair to complete it
- (2) Boron donates a proton from the B–F bond
- (3) Boron has a lone pair that it readily donates to electron-deficient species
- (4) The high electronegativity of fluorine forces boron to release electrons

Q13. A graph is plotted with the size of the central Group-13 atom on the x -axis (increasing to the right) and its tendency to accept an electron pair on the y -axis. Four points P, Q, R, S lie on one smooth curve: P sits top-left (smallest atom, highest y) and S sits bottom-right (largest atom, lowest y). Which point represents the trichloride of the heaviest element shown, and what does the curve's slope indicate?

- (1) S; Lewis-acid strength **decreases** as atomic size increases
- (2) P; Lewis-acid strength increases as atomic size increases
- (3) S; Lewis-acid strength increases down the group
- (4) P; Lewis-acid strength is independent of size

Q14. AlCl_3 is used as a catalyst in the Friedel–Crafts reaction because it can accept an electron pair. Extending this logic, which trivalent Group-13 chloride would make the weakest such catalyst?

- (1) TlCl_3 (2) AlCl_3 (3) GaCl_3 (4) InCl_3

Q15. Arrange the boron trihalides in increasing order of Lewis-acid strength:

- (1) $\text{BI}_3 < \text{BBr}_3 < \text{BCl}_3 < \text{BF}_3$ (3) $\text{BCl}_3 < \text{BF}_3 < \text{BBr}_3 < \text{BI}_3$
(2) $\text{BF}_3 < \text{BCl}_3 < \text{BBr}_3 < \text{BI}_3$ (4) $\text{BF}_3 < \text{BBr}_3 < \text{BCl}_3 < \text{BI}_3$