

## HL Questions on Lewis acids & bases

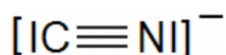
1. Boron trifluoride,  $\text{BF}_3$ , can react with potassium fluoride to form the salt potassium tetrafluoroborate,  $\text{KBF}_4$ .

Explain why this can be considered an acid-base reaction and deduce the shapes of both boron trifluoride and the tetrafluoroborate ion and the  $\text{F}-\text{B}-\text{F}$  bond angles in each case.

2. Aluminium chloride,  $\text{AlCl}_3$ , can act as a halogen carrier in organic chemistry, for example, benzene reacts with chlorine in the presence of aluminium chloride to form chlorobenzene and hydrogen chloride. It works by breaking the  $\text{Cl}-\text{Cl}$  bond to form  $\text{AlCl}_4^-$  and a positive chloride ion,  $\text{Cl}^+$ , which can then react with benzene. Explain why the reaction between aluminium chloride and chlorine can be considered to be an acid-base reaction.

3. Explain why all ligands and all nucleophiles can also be considered as Lewis bases.

4. The cyanide ion,  $\text{CN}^-$  is a good ligand.



It is poisonous as it reacts irreversibly with transition metal ions in the body.

- Use the concept of formal charge to suggest why it is the carbon atom of the cyanide ion that bonds to the transition metal ion and not the nitrogen atom.
  - Using information from the spectrochemical series suggest why drinking an aqueous solution of iron(II) sulfate is an effective antidote to cyanide poisoning provided it is taken immediately after the cyanide has been ingested.
5. Aluminium chloride,  $\text{AlCl}_3$  readily dimerises to form  $\text{Al}_2\text{Cl}_6$ . Explain this dimerisation reaction in terms of Lewis acid and base theory clearly identifying the Lewis acid and the Lewis base.