

Question 9

Use the information and data given below to answer the questions (a) to (c):

- Stronger intermolecular forces result in a higher boiling point.
- Strength of London forces increases with the number of electrons in the molecule.

Boiling point of HF, HCl, HBr and HI is 293 K, 189 K, 206 K and 238 K respectively.

(a) Which type of intermolecular forces are present in the molecules HF, HCl, HBr and HI?

(b) Looking at the trend of boiling points of HCl, HBr and HI, explain out of dipole-dipole interaction and London interaction, which one is predominant here.

(c) Why is the boiling point of hydrogen fluoride highest while that of hydrogen chloride lowest?

Solution:

(a) Since the halides are a polar molecule, due to the presence of permanent dipoles, the dipole-dipole interactions along with the London forces are found in these halides (HF, HCl, HBr).

(b) The boiling point increases from HI to HCl (as I⁻ is a very large ion, it is bonded by Van der Waal's forces, so more energy is required to break the bonds. As the size of the ions decreases, lesser energy is required). From this trend, we can conclude that London's forces are predominant because these interactions also increase from HF to HI.

(c) In HCl, size of Cl⁻ ion is very small, due to which the bonded Van der Waal's forces are very weak, so less energy is required to break the bonds. Thus the Boiling point is the least.