Polyhalides : Structure and Bonding

- I_3^-

Bond length – 2.67 A^o

Symmetrical Triodides

Tetraphenylarsonium iodides $[(C_6H_5)_4As]I_3$ 2.9 A^o

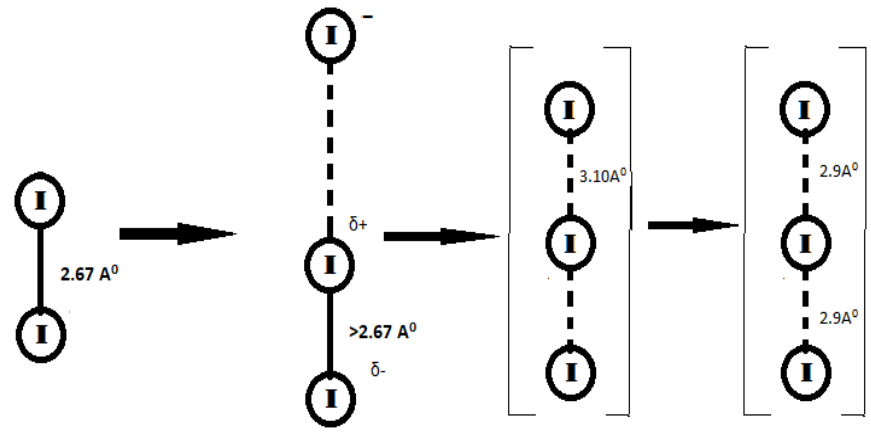
and Unsymmetrical triiodide

CsI_3 (3.03 and 2.83 A^o)

NH_4I_3 (3.10 and 2.82 A^o)

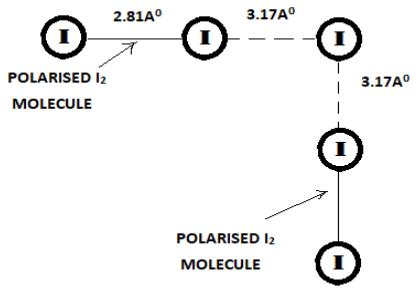
As I_2 approaches I⁻there is distortion of electron cloud in I_2

A dipole is introduced in Iodine molecule. The induced dipole attracts I⁻the magnitude of polarisation determines strength of bond in Triiodide



Pentaiodide I_5^-

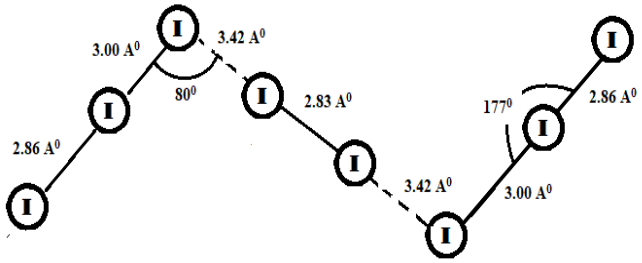
- Two iodine molecules co-ordinated by Iodide.Two unsymmetrical triiodides sharing common iodine atom. The bond lengths are 2.82 and 3.17A^o
- Bond length as in unsymmetrical triiodides



Tetraiodide I_4^-

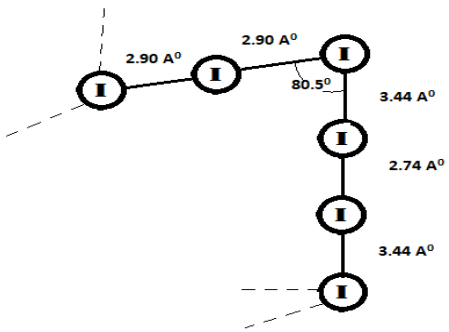
CsI_4 has a dimeric form . It has the molecular formula $(I_4^-)_2$ or I_8^- . I_3^- added to I_5^-

Tetraiodide ion has a Z – arrangement.



I_7^- Heptataiodide

- $[(C_2H_5)_4N]I_7$



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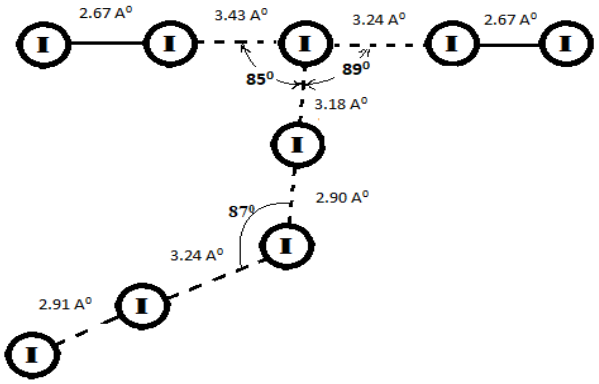
  - Infinite 3-dimensional framework of molecules ($2.74A^o$)

- Symmetrical triiodide ions (2.9A^o) are co-ordinated through long bonds (3.44 A^o) to Iodide ion.

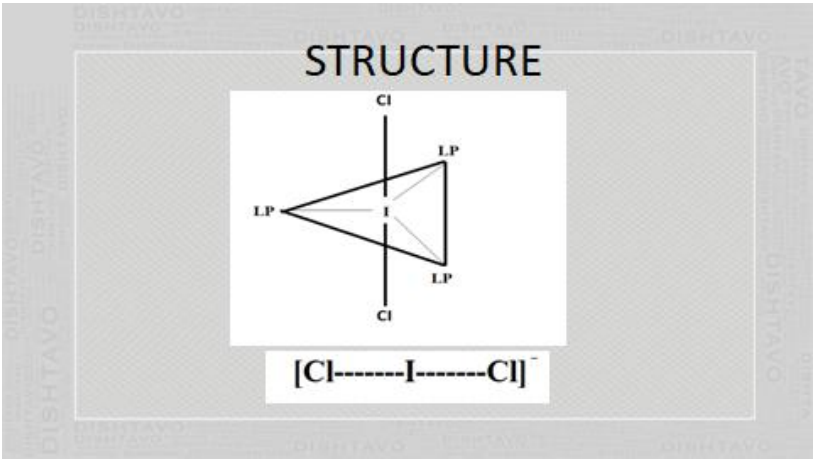
Structure of I_9^-

- Complex Structure
- $I_7^- + I_2$ or $I_5^- + 2I_2$. It has irregular structure, with bond lengths 2.67, 2.90, 3.18,3.24,3.43 and 3.49A^o



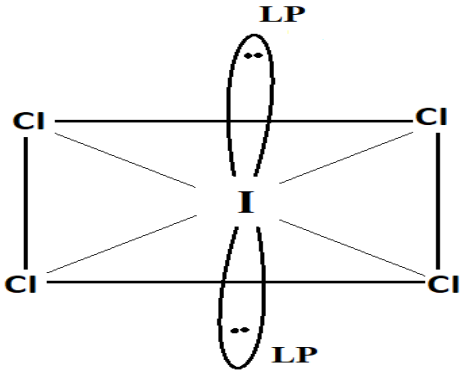
Structure of Dichloroiodate ion

ICl_2^-

- 

- Structure of ICl_2^- is distorted trigonal pyramidal. ICl_2^- has sp3 d-hybridized state, having trigonal bipyramidal shape. Distorted due to the presence of lone pair of electron on I-atom. The three lone pairs are in the equatorial positions, leaving the Cl and I in a linear molecular shape, but due to the presence of lone pair of electron on iodine atom the structure is distorted.

- Structure of Tetrachloroiodate ion ICl^-_4



- The central iodine atom has six pairs of electrons but it has just four bonding pairs of electrons.
- Its two lone pairs of electrons occupy the axial positions.These lone pairs repel each other and the four bonding pairs so that the four chlorine atoms occupy the equatorial positions.
- This produces a square planar structure, even though there is an octahedral arrangement of electron pairs.