

TDC Part I

Inorganic Chemistry



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TOPIC:- Interhalogens

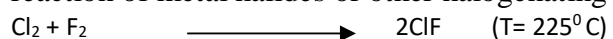
Interhalogens

Halogens react with each other to form interhalogens. These are subdivided into four types. AX, AX₃, AX₅, AX₇ (Table 28)

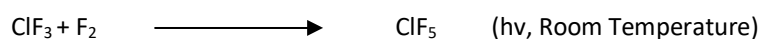
Table 28: Some interhalogen compounds

AX	AX ₃	AX ₅	AX ₇
ClF	ClF ₃	ClF ₅	IF ₇
BrF	BrF ₃	BrF ₅	
BrCl	IF ₃	IF ₅	
ICl	I ₂ Cl ₆		
IBr			
IF (unstable)			

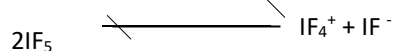
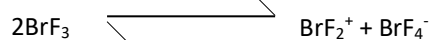
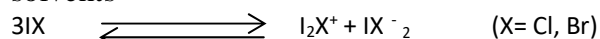
The total number of halogen atoms is even as this gives rise to diamagnetic species. They are generally more reactive than the parent halogens (except fluorine) as A-X bond is weaker than X-X bond. The interhalogens can be prepared in a variety of ways, including direct reaction of the elements (the favoured product often depends on ratio of halogens used) and reaction of metal halides or other halogenating agents. Examples include



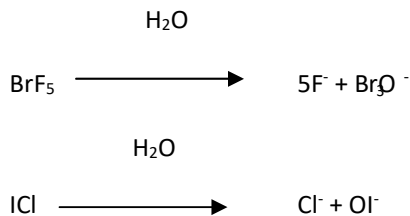
Some interhalogens may serve as intermediates in synthesis of other interhalogens



Several interhalogens undergo auto ionization in the liquid state and are used as non-aqueous solvents



The interhalogens are hydrolyzed to give halide and oxohalide; the larger halogen forms the oxohalide



The shapes of some interhalogens are given in table 29 .

Table 29: Shapes of interhalogens on basis of VSEPR Theory

Molecules	No. of electron pairs around A	No. of Bond Pairs	No. of lone pairs	Shape
AX	4	1	3	Linear
AX ₃	5	3	2	T – Shaped
SX ₅	6	5	1	Square Pyramid
AX ₇	7	7	0	Pentagonal bipyramidal

The structure can be derived by VSEPR theory. As expected interhalogens of the types AX are linear. Interhalogens of the type AX₃ (ClF₃) are T-shaped, where the central halogens 'A' (Cl) is sp³d hybridized with two lone pairs of electrons (Fig 31). ICl₃ exists as a dimer, (ICl₃)₂, in the solid state in which two T-shaped ICl₃ units are joined together.

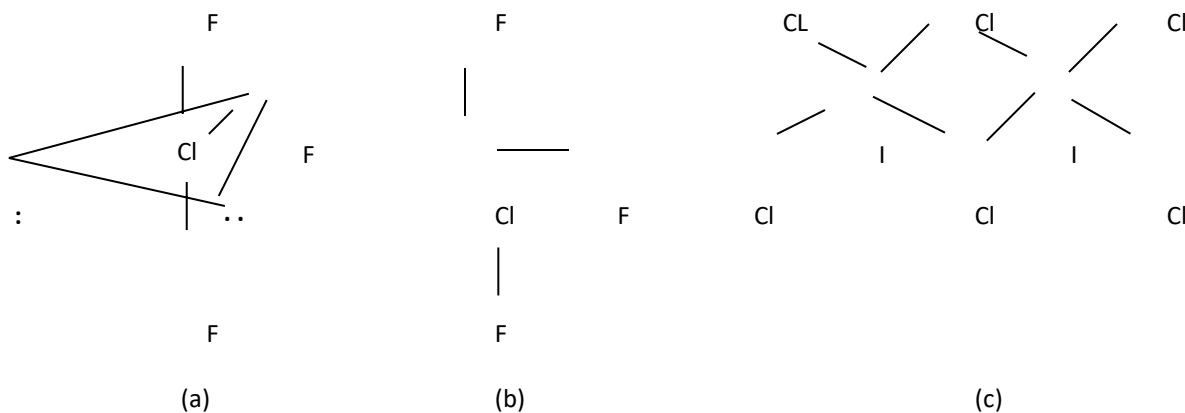


Fig. 31: The structures of ClF_3 and $(\text{ICl}_3)_2$

Interhalogens of the type AX_5 and AX_7 have square pyramidal and pentagonal bipyramidal structures respectively (Fig 32)

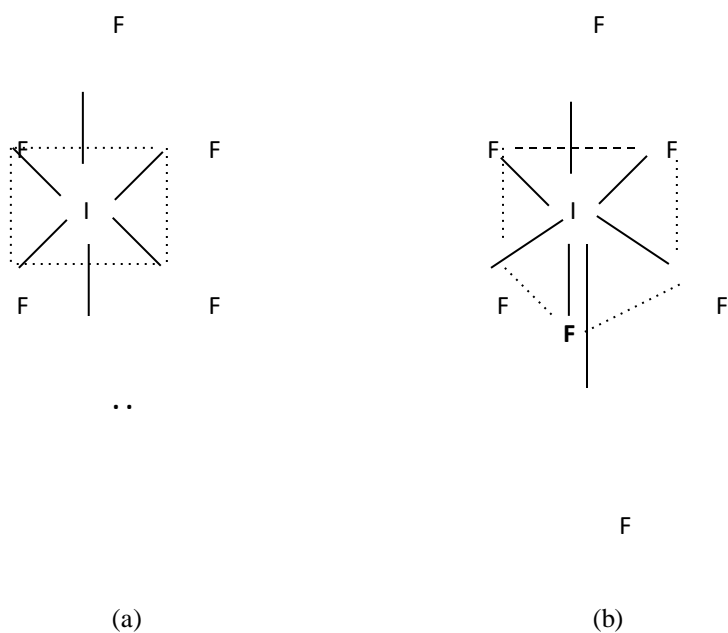


Fig. 32: The structures of (a) IF_5 and (b) IF_7

In AX_5 the central halogen is sp^3d^2 hybridized and there is one lone pair of electrons whereas in AX_7 the central halogen has sp^3d^3 hybridization.

Ternary interhalogens have recently been reported e.g. $IFCl_2$, $IFCl$.