CHEMISTRY STUDY MATERIALS FOR CLASS 12

(NCERT Based Reasoning of Chapter -07)

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P – block elements

Question 59: Explain the following giving an appropriate reason in each case.

(i) O_2 and F_2 both stabilize higher oxidation states of metals but O_2 exceeds F_2 in doing so.

(ii) Structures of Xenon fluorides cannot be explained by Valence Bond approach.

Answer:

(i) This is due to the ability of oxygen to form multiple bonds to metals.

(ii) This is because the energy required for the promotion of electrons in Xenon is very high. Energy factor does not favour VB approach.

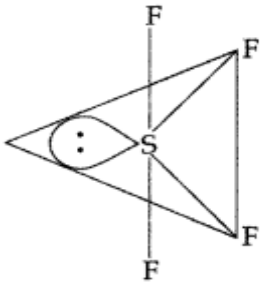
Question 60: Explain the following facts giving appropriate reason in each case :

(i) NF_3 is an exothermic compound whereas NCl_3 is not.

(ii) All the bonds in SF_4 are not equivalent.

Answer:

(i) The bond energy of F – F bond is lower than that of N-F bond so NF_3 is an exothermic. On the other hand bond energy of Cl – Cl bond is higher than that of N – Cl bond so NCl_3 is an endothermic as well as unstable compound.



(ii) SF_4 has trigonal bipyramidal structure in which one position of equatorial is occupied by a lone pair of electrons. Sulphur undergoes sp^3d hybridisation and has sea-saw geometry.

Question 61: Explain the following:

(a) Xenon does not form such fluorides as XeF_3 and XeF_5.

(b) Out of noble gases, only Xenon is known to form real chemical compounds.

Answer:

(a) By impairing of one paired orbital, two singly occupied orbitals come into existence. Thus, either two or four or six singly occupied orbitals can be formed instead of one, three or five singly occupied orbitals. Hence XeF, XeF_3 or XeF_5 are not formed.

(b) Xe atom has a large size and lower ionisation potential and hence the force of nucleus over the electrons is weak and hence very small energy can excite the electrons and hence it is easier for Xenon to form compounds than other noble gases.

Question 62: (a) Which form of sulphur shows paramagnetic behaviour and why?

(b) Fluorine exhibits only -1 oxidation state whereas other halogens exhibit +1, +3, +5 or +7 oxidation states also. Explain as to why.

Answer:

(a) In vapour state sulphur partly exists as S_2 molecule which has two unpaired electrons in the antibonding π* orbitals like O_2 and hence exhibits paramagnetism.

(b) It is because fluorine is the most electronegative element and it does not have d-orbitals.

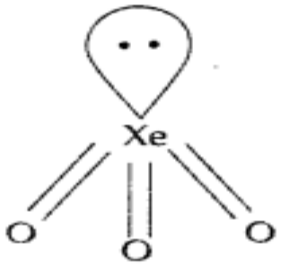
Question 63: How is XeO_3 obtained? Write the related chemical equations.

Draw the structure of XeO_3

Answer: Hydrolysis of XeF_4 and XeF_6 with water gives XeO_3

$$6XeF_4 + 12H_2O \rightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$$

$$XeF_6 + 3H_2O \rightarrow XeO_3 + 6HF$$



Shape : XeO_3 is pyramidal structure

Question 64: What happens when

(i) PCl_5 is heated? (ii) H_3PO_3 is heated? Write the reactions involved.

Answer:

(i) On heating PCl_5 decomposes into $PCl_3 + Cl_2$

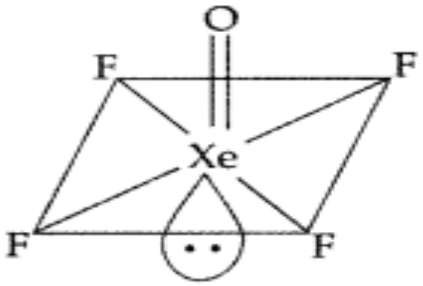
$$PCl_5 + CO \overset{\Delta}{\rightleftharpoons} PCl_3 + Cl_2$$

(ii) Orthophosphorous acid on heating disproportionate to give orthophosphoric acid and phosphine.

$$\underset{\text{Orthophosphorous acid}}{4H_3PO_3} \longrightarrow \underset{\text{Orthophosphoric acid}}{3H_3PO_4} + \underset{\text{Phosphine}}{PH_3}$$

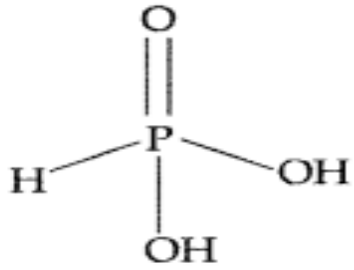
Question 65: Draw the structures of the following molecules: (i) $XeOF_4$ (ii) H_3PO_3

Answer: (i) $XeOF_4$



Shape : Square pyramidal

(ii) H_3PO_3 (phosphorus acid)



Shape : Tetrahedral

Question 66: How are interhalogen compounds formed? What general compositions can be assigned to them?

Answer: Interhalogen compounds: Halogens react with each other to form a number of compounds called interhalogen compounds, whose general formula is XX'n.

Where X = less electronegative atom (have larger size)

X' = more electronegative atom (have smaller size)

n = no. of more electronegative atoms/high

They are of four types :

$XX' = ClF, BrF, IF, BrCl, ICl, IBr$

$XX'_3 = ClF_3\ BrF_3, IF_3, ICl_3$

$XX'_5 = ClF_5, BrF_5, IF_5$

$XX'_7 = IF_7$

Naming: The halogen with positive oxidation state named first and with negative oxidation state named after first with suffix 'ide'.

Example : $BrCl_3$ → Bromine trichloride, IF_7 → Iodine heptafluoride

Preparation of Interhalogen Compounds :

By direct combination ;

Example:

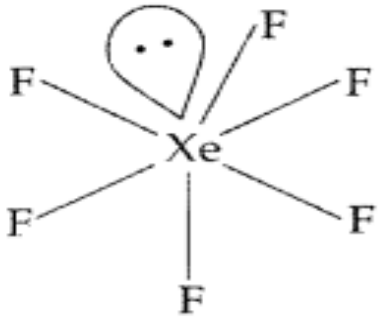
$$Cl_2 + F_2 \xrightarrow{473\,K} 2ClF$$
(equal volumes) — Chlorine monofluoride

$$Cl_2 + 3F_2 \xrightarrow{573\,K} 2ClF_3$$
(excess) — Chlorine trifluoride

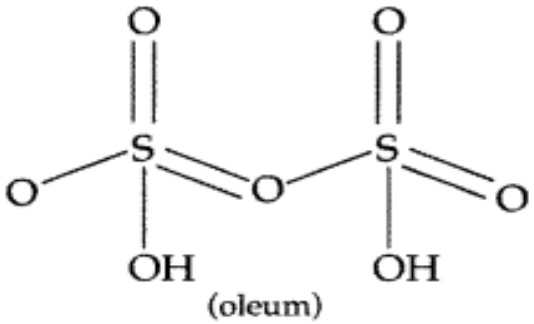
$$I_2 + 7F_2 \xrightarrow{523\,K-573\,K} 2IF_7$$
Iodine heptafluoride

Question 67: Draw the structures of the following molecules :(i) XeF_6 (ii) $H_2S_2O_7$

Answer:(i) XeF_6 :



(ii) $H_2S_2O_7$:



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