(b) Xenon Oxy Tetra Fluoride ($XeOF_4$) ⟶

(1) The xenon oxy tetra fluoride is formed to, small extent by Partial hydrolysis of Xenon hexa Fluoride.

$$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$$

(2) It is prepared in appreciable quantities by heating a mixture of xenon in the molecular ratio 1:4 in the presence of a large excess of oxygen at about 230°. It can be purified by Vaccum distillation.

Properties ⟶

(1) It is a Colourless Compound with M.P., -4

(2) On treatment with hydrogen it is reduced to Xenon.

$$XeOF_4 + 3H_2 \longrightarrow Xe + H_2O + 4HF$$

(3) It reacts with Water to form another oxyfluoride, XeO_2F_2 in which xenon rema in the same oxidation state equal to 6. This Compound is named as Oxiai fluoride.

$$XeOF_4 + H_2O \longrightarrow XeO_2F_2 + 2HF$$

(4) It reacts with Silica to yield Xeno Oxiarfluoride.

$$2XeOF_4 + SiO_2 \longrightarrow 2XeO_2F_2 + SiF_4$$

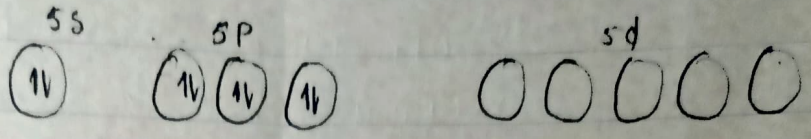
Structure and Shape of $XeOF_4$ molecule

In Considering the Structure of $XeOF_4$, three of the 5p- electrons are Supposed to move to 5d-orbitals When excited as Shown in the figure.

The formation of the compound involves the hybridisation of 6 orbitals:

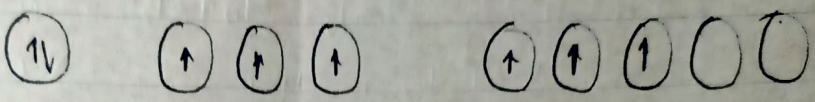
These are 5s, all the three 5p-and two of the 5d-orbitals. This is thus a case of sp^3d^2 hybridisation.

(a)



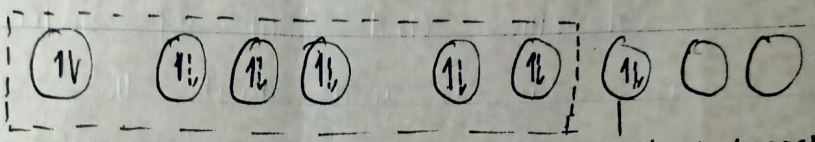
Ground state.

(b)



Excited state.

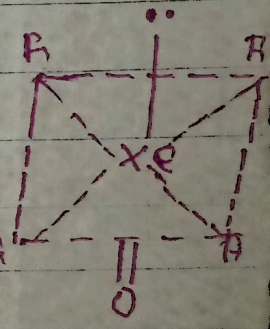
(c)



sp^3d^2 hybridisation.

π bond formation with one-O-atom.

Formation of $XeOF_4$



Five of singly occupied hybrid orbitals are involved in 6-bond formation with four fluorine atoms and one O-atom. One unhybridised 5d-orbital forms a π bond with O-atom.

Thus Oxygen is combined to Xenon by double bond one of which is a 6-bond and the other is π bond. It may be noted that one hybrid orbital contains a lone pair. The molecule has a Square Pyramidal shape as shown above. All the F-atom lie in one plane. The lone pair of-electron lies opposite to the O-atom. which is bonded to Xenon by a double bond.

Some others suggest the structure of $XeOF_4$ to be octahedral.

Xenon dioxy difluoride (XeO_2F_2) →

(i) It is obtained by mixing XeO_4 and $XeOF_4$ at a low temperature close to $-78°C$

It is also formed with XeO_3

It is hydrolysed or reacted with silica.

$$XeOF_4 + H_2O \longrightarrow XeO_2F_2 + 2HF$$

$$2\,XeOF_4 + SiO_2 \longrightarrow 2\,XeO_2F_2 + SiF_4$$

Properties → XeO_2F_2 is a colourless sol. and it is easily hydrolyses to give XeO_3

$$XeO_2F_2 + H_2O \longrightarrow XeO_3 + 2HF$$

Structure and Shape of molecules →

In order to understand the structure of the compound three of the 5-p. electrons are suppo. to move vaccant 5-d orbital in excited sta. The formation of the compound involves hybridisation 5- orbitals. These are 5s, 9 the three 5-p- orbitals and one of the 5d as shown. This is evidently a case of sp^3d hybridisation. One hybrid orbital is occupied by a lone pair and 4 hybrid orb. are singly occupied. As can be seen from the figure, these are six half-fi orbitals, including the four hybrid orbi. The four hybrid orbitals are involved for the σ-bond formation.

(a) 1V | 1V 1V 1V | 5-d | gro

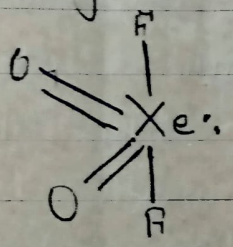
(b) 1V 1 1 1 1 1 1 | O O

(c) 1V | 1V 1V 1V 1V 1V 1V | O O

sp^3d

The six σ-bond is formed due to combination (overlapping) with two fluorine atoms and two oxygen atoms the remaining two single filled orbitals which do not take part in hybridisation form π-bonds with the same two oxygen atoms. Thus, each oxygen atom is bounded to Xe-atom by double bond. One of which is a σ bond and other is a π bond. Since it is a case of sp^3d hybridisation so molecule should be trigonal bipyramidal.

But some distortion occurs in geometry due to presence of a lone pair on one the equatorial position. The actual Geometry is given below.



(d) XeO_3 (Xenon trioxide) ⟶

(i) Xenon trioxide is formed in small amounts when xenon tetrafluoride undergoes disproportionation on hydrolysis with water.

$$2XeF_4 + 3H_2O \rightarrow Xe + XeO_3 + 6HF + F_2$$

Or when Xenon hexafluoride reacts slowly with atmospheric moisture.

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