

The p-Block Elements

Group 18 Elements

Group 18 consists of six elements- helium (He), neon (Ne), argon (Ar), krypton (Kr), xenon (Xe) and radon (Rn). All these are gases and chemically unreactive. So they are called inert gases or noble gases.

All noble gases have general electronic configuration ns^2np^6 (except helium which has $1s^2$). Due to stable electronic configuration these gases have very high ionisation enthalpy and electron gain enthalpy.

Even though these elements are chemically inert, Kr and Xe form some compounds with oxygen and fluorine under special conditions.

In noble gases, there is only weak van der Waals force of attraction. So they have low melting and boiling point.

(a) Xenon-fluorine compounds

Xenon forms three binary fluorides, XeF_2 , XeF_4 and XeF_6 by the direct reaction of elements under suitable conditions.



(xenon in excess)

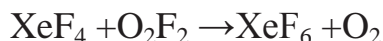


(1:5 ratio)



(1:20 ratio)

XeF_6 can also be prepared by the interaction of XeF_4 and O_2F_2 at 143K.



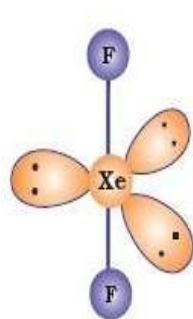
XeF_2 , XeF_4 and XeF_6 are colourless crystalline solids. They are powerful fluorinating agents.

They are readily hydrolyzed even by traces of water. For example, XeF_2 is hydrolysed to give Xe, HF and O_2 .

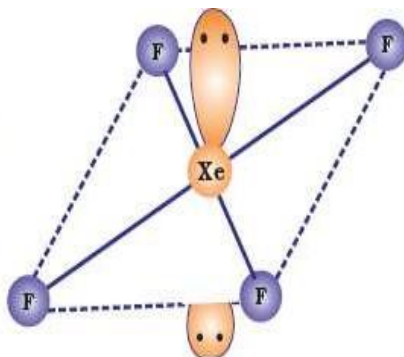


Structures

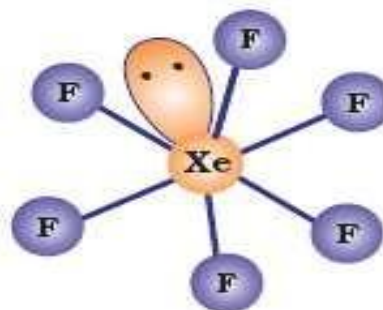
XeF_2 and XeF_4 have linear and square planar structures respectively. XeF_6 has seven electron pairs (6 bonding pairs and one lone pair) and thus, have a distorted octahedral structure



(a) Linear



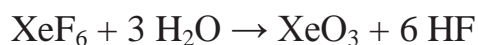
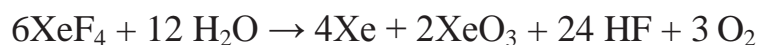
(b) Square planar



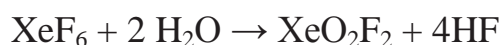
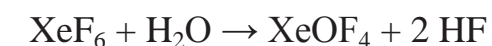
(c) Distorted octahedral

(b) Xenon-oxygen compounds

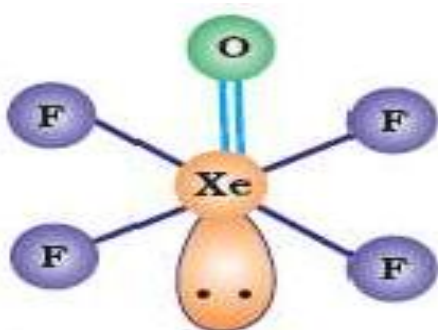
1. XeO_3 : It is obtained by the hydrolysis of XeF_4 and XeF_6 with water.



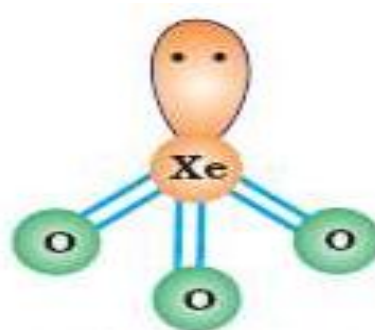
2. XeOF_4 & XeO_2F_2 : Partial hydrolysis of XeF_6 gives oxyfluorides, XeOF_4 and XeO_2F_2 .



XeO_3 is a colourless explosive solid and has a pyramidal molecular structure. XeOF_4 is a colourless volatile liquid and has a square pyramidal molecular structure.



(d) Square pyramidal



(e) Pyramidal

Uses of noble gases:

Helium is used in filling balloons for meteorological observations. It is also used in gas-cooled nuclear reactors. Liquid helium is used as cryogenic agent for carrying out various experiments at low temperatures. It is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in blood.

Neon is used in discharge tubes and fluorescent bulbs for advertisement display purposes. Neon bulbs are used in botanical gardens and in green houses.

Argon is used to provide an inert atmosphere in high temperature metallurgical processes and for filling electric bulbs. It is also used in the laboratory for handling substances that are air-sensitive.

Xenon and Krypton are used in light bulbs designed for special purposes.
