

ATOMIC ENERGY CENTRAL SCHOOL-3, TARAPUR

HAND-OUT

MODULE-4

UNIT-p-BLOCK ELEMENTS

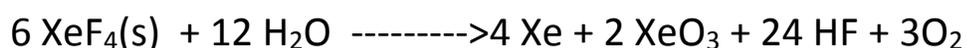
CHAPTER : 18-GROUP ELEMENTS

The elements present in Group 18 have their valence shell orbitals completely filled and, therefore, react with a few elements only under certain conditions. Therefore, they are now known as **noble gases**.

In March 1962, Neil Bartlett, then at the University of British Columbia, observed the reaction of a noble gas. First, he prepared a red compound which is formulated as $\text{O}_2^+\text{PtF}_6^-$. He, then realised that the first ionization enthalpy of molecular oxygen (1175 kJ mol^{-1}) was almost identical with that of xenon (1170 kJ mol^{-1}). He made efforts to prepare same type of compound with Xe and was successful in preparing another red colour compound $\text{Xe}^+\text{PtF}_6^-$ by mixing PtF_6 and xenon. After this discovery, a number of xenon compounds mainly with most electronegative elements like fluorine and oxygen, have been synthesised.

The structures of the three xenon fluorides can be deduced from VSEPR theory. 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 would, thus, have a distorted octahedral structure as found experimentally in the gas phase.

The fluorides of Xe get easily hydrolysed even by the traces of water. For example,



Since in this reaction, oxidation state of Xe converts from +4 to 0(zero) and +6 . its means both reduction and oxidation taking place simultaneously therefore this is a redox reaction but more precisely it is a disproportionation reaction.

Xe has the lowest ionization potential among noble gases hence can be easily oxidized by strong oxidizing agents and most electronegative elements like fluorine and oxygen. That is why majority of noble gas compounds are those of xenon.

Xe does not form XeF_3 and XeF_5 because in the first, second and third exciting state of Xe, there is promotion of one, two or three electrons from the 5p-filled orbitals to the 5d –vacant orbitals will give rise to two, four and six half-filled orbitals respectively. So xenon can combine with even but not odd number of F atoms.

Neon is generally used for warning signals because neon lights are visible from long distances even in fog and mist.

Helium does not form any chemical compound because it is smallest in size having stable electronic configuration therefore its ionization enthalpy is much higher than those of fluorine and oxygen as well as it does not have vacant d-orbitals in the valency shell.

