CHAPTER / 10

Group 18 Elements: Noble Gases

Topics Covered

- Occurrence
- Position in the Periodic Table
- Electronic Configuration
- Physical Properties
- Chemical Properties
- Fluorides of Xenon
- Oxyfluorides of Xenon
- Uses of Noble Gas

Zero group (Group 18) of the periodic table consist of elements like helium, neon, argon, krypton, xenon and radon. All these elements are monoatomic gases. They are relatively unreactive and hence are called **noble gases**. They form very few compounds that's why they are termed as noble gas.

Occurrence

Group 18 consists of six elements. All these are gases and chemically unreactive. All these gases are found in atmosphere in traces and hence they are called rare gases except radon. Radon is radioactive and is obtained from radioactive distintegration of radium. These gases are called **inert geses**.

Position in the Periodic Table

Noble gases or group 18 consists of six elements, *viz* helium, neon, argon, krypton, xenon and radon. These are *p*-block elements and are situated on the extreme right in the periodic table. These elements did not have any place in the **Mendeleev's** periodic table.

The position of these noble gases are later established by **Moseley** who built the periodic table on the basis of atomic numbers of the elements.

On the basis of the atomic number, it was very much clear that the real position of these elements is after the group VII A elements, i.e. halogens and before the first group elements, i.e. alkali metals. This group is now universally said to be group VIII of the periodic table.

Electronic Configuration

Electronic configuration of outermost shell of the group 18 elements is ns^2, np^6 except helium which has $1s^2$. Atomic number and atomic mass of group 18 elements with their electronic configuration are given in the following table.

Some atomic properties of group 18 elements

Elements	Atomic number	Atomic mass	Electronic configuration
Helium	2	4	$1s^2$
Neon	10	20	$[He]2s^2\,2p^6$
Argon	18	40	$[Ne]3s^2\,3p^6$
Krypton	36	84	$[Ar]3d^{10}\,4s^2\,4p^6$
Xenon	54	131	$[Kr]4d^{10}5s^2\,5p^6$
Radon	86	222	$[Xe]4\,f^{14}\,5\,d^{10}\,6s^2\,6p^6$

This electronic configuration suggest that these elements have saturated shells. Their valency or combining capacity is zero and hence are placed in zero group.

Physical Properties

(i) Monoatomic Nature

All noble gases are monoatomic due to the unavailability of unpaired electrons. Specific heat ratio ($C_p / C_V = 1.66$) and other physical constants such as refractive index, dielectric constant etc. confirm their monoatomic nature.

(ii) Solubility in Water

Noble gases are slightly soluble in water and solubility increases from He to Rn. Solubility in water is due to polar nature of water molecule. When it comes near a noble gas atom, it induces a dipole by polarising its symmetrical electron cloud, and hence noble gas dissolves.

(iii) Liquefaction of the Noble Gases

Noble gases have weak van der Waals' force of attraction. They can be liquefied at very low temperature. Liquefaction of these gases increases on moving down the group as the van der Waals' force increase in the same way.

(iv) Ionisation Enthalpy

All inert gases have very high ionisation enthalpy due to stable electronic configuration. However, it decreases down the group with increase in atomic size as outermost electrons are away from nucleus hence less held firmly.

(v) Electron Affinity

These elements have large positive values of electron affinity because they have stable electronic configuration and have no tendency to accept the electron.

(vi) Atomic Radii

Atomic radii of inert gases are larger than expected because electron cloud is slightly expanded due to van der Waals' radii. Atomic radii increase down the group.

(vii) Adsorption by Activated Charcoal

Adsorption by activated charcoal of all noble gases occur at low temperature. It increases with increase in atomic mass. Thus, helium has the minimum adsorption capacity.

Chemical Properties

Noble gases are least reactive elements due to the following reasons :

(i) The noble gases except He ($1s^2$) have completely filled (ns^2, np^6) electronic configuration in their valence shell.

(ii) They have high ionisation enthalpy and more positive electron gain enthalpy.

The first compound of Xe was $Xe^+PtF_6^-$ which was discovered by **Neil Bartlett**. When oxygen is treated with PtF_6, a red compound $O_2^+PtF_6^-$ was formed. In this compound, the ionisation enthalpy of molecular oxygen was identical with that of Xe.

Fluorides of Xenon

Compounds of xenon, i.e. XeF_2, XeF_4, and XeF_6 are colourless crystalline solids. A number of fluorides of xenon are as follows:

1. Xenon Difluoride (XeF_2)

Preparation of Xenon Difluoride

(i) It is prepared by the interaction of xenon with excess of O_2F_2 at – 118°C.

$$Xe + O_2F_2 \xrightarrow{-118^\circ C} XeF_2 + O_2$$

(ii) It is also prepared by exposing a mixture of xenon and fluorine to ultra-violet light in a nickel vessel.

$$Xe + F_2 \xrightarrow[\text{UV radiation}]{\text{Ni vessel}} XeF_2$$

Properties of Xenon Difluoride

(i) It is a colourless crystalline solid.

(ii) It melts at 300 K (27°C).

(iii) It oxidises water to oxygen.

$$2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$$

(iv) It oxidises hydrogen to form HF.

$$XeF_2 + H_2 \longrightarrow Xe + 2HF$$

(v) It oxidises HCl to chlorine.

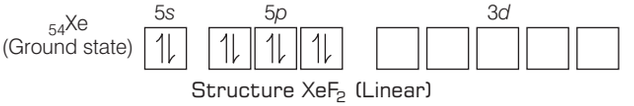
$$XeF_2 + 2HCl \longrightarrow Xe + 2HF + Cl_2$$

(vi) XeF_2 reacts like fluorine ion acceptors like PF_5, SbF_5 to form cationic species.

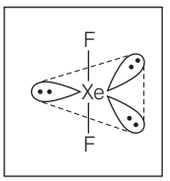
$$XeF_2 + PF_5 \longrightarrow [XeF]^+[PF_5]^-$$

Structure of Xenon Difluoride

The electronic configuration of Xe is $5s^2\,5p^6$.



Structure XeF_2 (Linear)



Structure XeF_2 (Linear)

These orbitals get hybridised to form five sp^3d -orbitals with three orbitals having lone pairs.

The structure of XeF_2 is found to be linear.

Uses

(i) It is used as fluorinating agent and mild oxidising agent.

(ii) It is used in preparation of Xe.

2. Xenon Tetrafluoride (XeF_4)

Preparation of Xenon Tetrafluoride

It can be prepared by following methods:

(i) A mixture of xenon and fluorine (ratio 1 : 10) react at high temperature (300°C) under pressure in a nickel vessel.

$$Xe + 2F_2 \xrightarrow{\text{Ni vessel } 300^\circ\text{ C, 6 atm}} XeF_4$$

(ii) When silent electric discharge is passed through a mixture of Xe and fluorine (2-15 mm pressure) at low temperature (80°C), XeF_4 is produced.

$$Xe + 2F_2 \xrightarrow[-80^\circ\text{ C, 2-15 mm}]{\text{Silent electric discharge}} XeF_4$$

Properties of Xenon Tetrafluoride

(i) It is a colourless crystalline solid.

(ii) It dissolves in liquid HF.

(iii) It melts at 100°C.

(iv) **Reaction with Water** Partial hydrolysis occur at –80° C to give $XeOF_2$.

$$XeF_4 + H_2O \xrightarrow{-80^\circ\text{C}} XeOF_2 + 2HF$$

On complete hydrolysis, XeO_3 is formed.

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

(v) **Oxidising Action** It oxidises KI to I_2 and HCl to Cl_2.

$$XeF_4 + 4KI \longrightarrow 4KF + Xe + 2I_2$$

$$XeF_4 + 4HCl \longrightarrow Xe + 4HF + 2Cl_2$$

(vi) It forms addition compound with XeF_2.

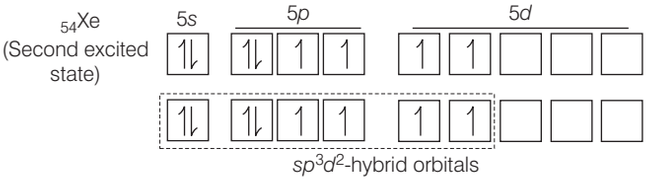
$$XeF_4 + XeF_2 \longrightarrow XeF_2 \cdot XeF_4$$

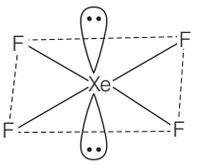
(vii) It reacts with fluoride ion acceptor like SbF_5 to form cationic species.

$$XeF_4 + SbF_5 \longrightarrow [XeF_3]^+ [SbF_6]^-$$

Structure of Xenon Tetrafluoride

These orbitals get hybridised to form six sp^3d^2-hybrid orbitals with two orbitals having lone pairs of electrons. Hence, the structure of the XeF_4 is square planar.





Square planar structure of XeF_4

Uses

(i) It reacts with water or hydrogen to form xenon.

(ii) It is used in preparation of xenon hexafluoride.

3. Xenon Hexafluoride (XeF_6)

Preparation of Xenon Hexafluoride

(i) XeF_6 is prepared when a mixture of xenon and fluorine (ratio 1 : 20) is heated to 260°C under pressure of 50 atm. A yield of 95% is obtained.

$$Xe + 3F_2 \xrightarrow[50\,\text{atm}]{260^\circ\text{C}} XeF_6$$

(ii) It is also obtained by the direct interaction of XeF_4 with O_2F_2 at 143 K.

$$XeF_4 + O_2F_2 \xrightarrow{143\text{ K}} XeF_6 + O_2$$

Properties of Xenon Hexafluoride

(i) It is a colourless crystalline solid. It turns yellow at 316 K and melts at 320.7 K to give yellow substance.

(ii) It is hydrolysed in water. The final product of hydrolysis is XeO_3.

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

$$XeF_6 + 2H_2O \longrightarrow Xe(O_2)F_2 + 4HF$$

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

(iii) It oxidises hydrogen (like other xenon fluorides), to give hydrogen fluoride.

$$XeF_6 + 3H_2 \longrightarrow Xe + 6HF$$

(iv) It dissolves in liquid HF and a chemical reaction takes place.

$$XeF_6 + HF \longrightarrow XeF_5^+ + HF_2^-$$

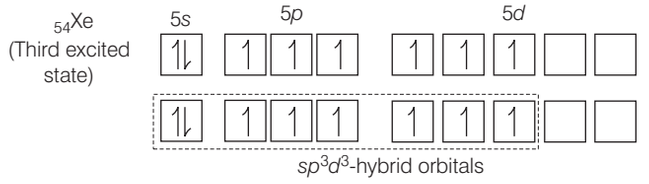
(v) It readily reacts with silica and hence cannot be stored in glass vessel.

$$2XeF_6 + SiO_2 \longrightarrow 2XeOF_4 + SiF_4$$

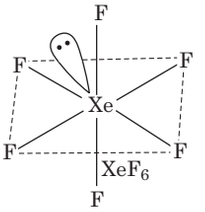
(vi) It can accept a fluoride ion when combines with alkali metal fluorides.

$$XeF_6 + CsF \longrightarrow \underset{\text{Caesium heptafluoroxenate}}{CsXeF_7}$$

Structure of Xenon Hexafluoride



These orbitals get hybridised to form sp^3d^3-hybrid orbitals with one orbital having lone pair of electron. XeF_6 has pentagonal bipyramidal geometry and involve sp^3d^3-hybridisation. Shape of XeF_6 is distorted octahedral.



Distorted octahedral shape of XeF_6

Uses

(i) It is used as oxidising agent.

(ii) It is used as fluorinating agent.

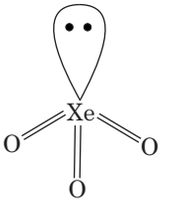
4. Xenon Trioxide (XeO_3)

It is prepared by complete hydrolysis of XeF_4 and XeF_6 as

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

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

It is a colourless solid, highly explosive and powerful oxidising agent. XeO_3 has sp^3-hybridisation, trigonal pyramidal geometry because of the presence of one lone pair of electrons over Xe. The molecule has three Xe ═ O double bonds containing $p\pi$ - $d\pi$ overlapping.



Structure of XeO_3

5. Xenon Tetraoxide (XeO_4)

It is prepared by the action of conc. H_2SO_4 on sodium or barium xenate (Na_4XeO_6; Ba_2XeO_6) at room temperature.

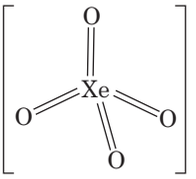
$$Na_4XeO_6 + 2H_2SO_4 \longrightarrow XeO_4 + 2Na_2SO_4 + 2H_2O$$

$$Ba_2XeO_6 + 2H_2SO_4 \longrightarrow XeO_4 + 2BaSO_4 + 2H_2O$$

XeO_4 is purified by vacuum sublimation at 195 K. It is quite unstable gas and decomposes to xenon and oxygen,

$$XeO_4 \longrightarrow Xe + 2O_2$$

XeO_4 has tetrahedral structure due to sp^3-hybridisation of Xe. There are four Xe — O double bonds containing $p\pi$ - $d\pi$ overlapping.



Structure of XeO_4

Oxyfluorides of Xenon

Preparation

Partial hydrolysis of XeF_6 give oxyfluorides, e.g. $XeOF_4$ and XeO_2F_2

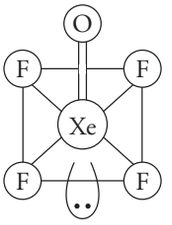
$$XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$$

$$XeF_6 + 2H_2O \longrightarrow XeO_2F_2 + 4HF$$

Properties

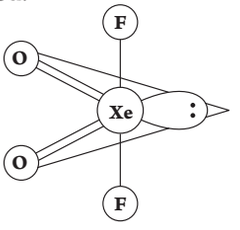
Some of their important properties are:

(i) $XeOF_4$ is a colourless volatile liquid. Here the central 'Xe' atom is sp^3d^2-hybridised and the compound has a square pramidal structure.



Structure of $XeOF_4$

(ii) XeO_2F_2 (xenon dioxydifluoride) has trigonal bipyramidal structure. Here the 'Xe' atom is sp^3d-hybridised.



Structure of XeO_2F_2

Uses of Noble Gas

(i) Helium is used in filling balloons for meteorological observations as, it is a non-inflammable and light gas.

(ii) He is also used in gas cooled nuclear reactors and as diluent for oxygen in modern diving apparatus because of its very low solubility in blood.

(iii) Liquid helium is used as a cryogenic agent for carrying out various experiments at low temperatures.

(iv) Neon is used in discharge tubes and fluorescent bulbs for display in advertisement.

(v) Neon bulbs are used in botanical gardens and in greenhouses.

(vi) Argon is used to provide an inert atmosphere in high temperature metallurgical process (arc welding of metals or alloys) and for filling electric bulbs.

PRACTICE QUESTIONS

Exams', Textbook's Other Imp. Questions

1 MARK *Questions*

Exams' Questions

Q.1 Which of the following noble gases is abundant in air? **[2019]**

(a) He (b) Ne (c) Ar (d) Kr

Sol (*c*) Argon (Ar) is the noble gas, present in abundance in air. It is about 0.9% in the air.

Q.2 Which type of hybridisation takes place in xenon during formation of XeF_2? What is its shape? **[2019, 2014, 2009]**

Sol The hybridisation of xenon is sp^3d during formation of XeF_2. It is linear in shape.

Q.3 What is the shape of XeF_4 molecule? **[2012 Instant, 2006, Textbook]**

Sol The shape of XeF_4 molecules is square planar.

Q.4 XeF_6 on complete hydrolysis gives **[2010]**

(a) Xe (b) $XeOF_2$ (c) XeO_2 (d) XeO_3

Sol (*d*) On complete hydrolysis XeF_6 gives XeO_3.

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

Q.5 Why argon is monoatomic? **[2000, Textbook]**

Sol In case of argon, there are equal number of electrons in the bonding and antibonding orbitals. Bond order for such molecules is zero and hence these are monoatomic. For the inert gases, C_p/C_V is equal to 1.66.

Important Questions

Q.6 Noble gas used in radiotherapy is **[Textbook]**

(a) Kr (b) Ar (c) Rn (d) Xe

Sol (*c*) Radon (Rn) is used in radiotheropy for cancer treatment.

Q.7 Deep sea divers respirate in a mixture of **[Textbook]**

(a) oxygen and argon (b) oxygen and helium
(c) oxygen and nitrogen (d) oxygen and hydrogen

Sol (*b*) The mixture of gases used by divers for respiration in deep sea is oxygen and helium.

Q.8 Which of the following is not correct about the rare gases? **[Textbook]**

(a) They are used to provide inert atmosphere in many chemical reactions
(b) They are sparingly soluble in water
(c) They form diatomic molecules
(d) Some of them are used for advertising signboards

Sol (*c*) The rare gases, such as helium and neon, rarely form diatomic molecules. It is because rare gases have complete octet in their valence shells. So, they do not need to form a covalent bond with another molecules to attain stability.

Q.9 The first noble gas compound obtained was **[Textbook]**

(a) XeF_2 (b) $XePtF_6$
(c) XeF_4 (d) XeO_2F_2

Sol (*b*) The first noble gas compound obtained was xenonhexafluoroplatinate ($XePtF_6$).

Q.10 The valency of noble gas is **[Textbook]**

(a) zero (b) one
(c) two (d) three

Sol (*a*) The valency of noble gases is zero because their octet is complete.

Q.11 Which of the following noble gases is the least polarisable? **[Textbook]**

(a) He (b) Ne (c) Kr (d) Xe

Sol (*a*) He with smallest electron cloud is least polarisable.

Q.12 Which of the following fluorides of xenon is impossible? **[Textbook]**

(a) XeF_2 (b) XeF_3 (c) XeF_4 (d) XeF_6

Sol (*b*) XeF_3 fluorides of xenon is impossible. Possible fluorides of xenon are :

$$Xe + F_2 \xrightarrow{673K} XeF_2$$

$$Xe + 2F_2 \xrightarrow[5\text{-}6\ atm]{673K} XeF_4$$

$$Xe + 3F_2 \xrightarrow[50\text{-}60\ atm]{573K} XeF_6$$

Q.13 The outermost shell of the elements of inert gases is characterised by **[Textbook]**

(a) ns^2np^6 (b) ns^2np^5 (c) ns^2np^4 (d) ns^2np^3

Sol (*a*) The outermost shell of the elements of inert gases is characterised by ns^2np^6.

Q.14 The coloured discharge tubes for advertisement contain **[Textbook]**

(a) xenon (b) helium (c) argon (d) neon

Sol (*d*) Neon gives bright orange colour, when electricity is passed through it. Hence, neon is used in coloured discharge takes for advertisement.

Q.15 Monazite on heating gives **[Textbook]**

(a) Ra (b) Ar (c) He (d) Ne

Sol (*c*) Monazite is heated in the presence of carbon and above 1400° C temperature, it decomposes into He.

Q.16 The maximum number of compounds are formed by **[Textbook]**

(a) He (b) Xe (c) Kr (d) Ne

Sol (*b*) Xenen has highest number of compounds because xenon is able to form sigma bonds and π-bonds.

Q.17 Which of the following is called stranger gas? **[Textbook]**

(a) Kr (b) Xe (c) He (d) Ne

Sol (*b*) Xenon is used in plasma displays, headlights and flash bulbs. Hence, it is called stranger gas.

Q.18 Which of the following rare gases shows least ionisation potential? **[Textbook]**

(a) Ar (b) Kr (c) He (d) Xe

Sol (*d*) The ionisation potential decreases down the group with increase in atomic size. Hence, xenon shows least ionisation potential.

Q.19 The noble gas which behaves abnormally in liquid state is **[Textbook]**

(a) Xe (b) Ne (c) He (d) Ar

Sol (*c*) At standard pressure, helium exists in a liquid form only at the extremely low temperature of – 270° C.

Q.20 Which of the following liquids can climb up the wall of the glass vessel in which it is placed? **[Textbook]**

(a) Alcohol (b) Liquid He
(c) Liquid N_2 (d) Water

Sol (*b*) Liquid helium can climb up the wall of the glass vessel in which it is placed.

Q.21 The compound that attacks pyrex glass is **[Textbook]**

(a) XeF_2 (b) XeF_4
(c) XeF_6 (d) None of these

Sol (*c*) XeF_6 attacks pyrex glass. The reaction steps are as follows:

$$2XeF_6 + SiO_2 \longrightarrow 2XeOF_4 + SiF_4$$
$$2XeOF_4 + SiO_2 \longrightarrow 2XeO_2F_2 + SiF_4$$
$$2XeO_2F_2 + SiO_2 \longrightarrow 2XeO_3 + SiF_4$$

Q.22 XeF_6 and XeF_4 are expected to be **[Textbook]**

(a) reducing (b) oxidising
(c) unreactive (d) strongly basic

Sol (*b*) XeF_6 and XeF_4 both are oxidising agent. The reactions in this support are as follows:

$$XeF_6 + 3H_2 \longrightarrow Xe + 6HF \quad (\text{Oxidation of } H_2)$$
$$XeF_4 + 4KI \longrightarrow 4KF + Xe + 2I_2 \quad (\text{Oxidation of } I^-)$$

Q.23 All noble gases react with oxygen and fluorine. (Correct the Sentence) **[Textbook]**

Sol Only Xe reacts with oxygen and fluorine.

Q.24 The inert gas found in sun's atmosphere is ..... (Fill in the Blank) **[Textbook]**

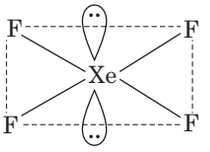
Sol helium

2 MARK *Questions*

Exams' Questions

Q.25 What type of hybridisation takes place in xenon during the formation of XeF_4? What is its shape? **[2015]**

Sol XeF_4 show sp^3d^2-hybridisation. The orbitals get hybridised to form six sp^3d^2 hybrid orbitals with two orbitals having lone pair of electrons. Thus, the structure of the XeF_4 is square planar.



(2)

Q.26 How xenon difluoride is prepared? **[2006]**

Sol **Preparation of xenon difluoride**

(i) It is prepared by the interaction of xenon with excess of O_2F_2 at –118°C.

$$Xe + O_2F_2 \xrightarrow{118°C} XeF_2 + O_2$$

(ii) It is also prepared by exposing a mixture of xenon and fluorine to ultra-violet light in a nickel vessel.

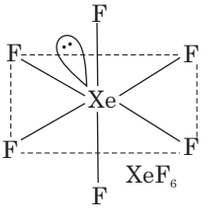
$$Xe + F_2 \xrightarrow[UV]{\text{Ni vessel}} XeF_2$$

(2)

Q.27 Give the structure of XeF_6. **[2005, Textbook]**

Sol **Structure of xenon hexafluoride**

XeF_6 has pentagonal bipyramidal geometry and involve sp^3d^3-hybridisation. Shape of XeF_6 is distorted octahedral.



Preparation of XeF_4

(2)

Important Questions

Q.28 Why do noble gases have comparatively large atomic sizes? **[Textbook]**

Sol Noble gases have comparatively large atomic sizes because they have van der Waals' radii only which are expected to have larger magnitude whereas other members of a period have either covalent or metallic radii which are less in magnitude. **(2)**

Q.29 Xenon does not form fluorides such as XeF_3 and XeF_5. Why? **[Textbook]**

Sol All the filled orbitals of Xe have paired electron. The promotion of 1, 2 or 3 electrons from the 5*p*-filled orbital to the 5*d*-vacant orbitals will give rise to 2, 4 and 6 half-filled orbitals. Therefore, Xe can combine with even number of F atom but not odd. Thus, Xe doesn't form XeF_3 and XeF_5. **(2)**

3 MARK *Questions*

Exams' Questions

Q.30 Why does Xe form fluorides and not chlorides? **[Textbook]**

Sol Xenon forms three pure fluorides (XeF_2, XeF_4 and XeF_6), two oxides (XeO_3 and XeO_4) and five oxyfluorides ($XeOF_2$, XeO_2F_2, $XeOF_4$, XeO_2F_4 and XeO_3F_2). But xenon does not form any compound with chlorine. It is because of the following reasons:

(i) Higher electronegativity
(ii) Higher reactivity
(iii) Higher oxidising power
(iv) Smaller size of fluorine atom as compared to chlorine atom. **(3)**

Q.31 Explain the following situations.

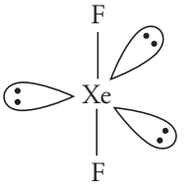
(i) XeF_2 has a straight linear structure and not a bent angular structure.

(ii) Complete the following chemical reaction equations.

$$XeF_4 + H_2O \longrightarrow$$

Sol (i) In XeF_2, Xe is sp^3d-hybridised having 2 bond pairs and 3 lone pairs of electrons. The 3 lone pairs of electrons in XeF_2 are present at equatorial positions so as to minimise repulsion.

Hence, XeF_2 has a linear structure.



Linear XeF_2 **(2)**

(ii) $6XeF_4 + 12H_2O \longrightarrow 2XeO_3 + 24HF + 4Xe + 3O_2$ **(1)**

7 MARK *Questions*

Exams' Questions

Q.32 (i) Justify the position of noble gases in the periodic table.

(ii) Discuss one method of preparation and the structure of the following compounds.

(a) XeF_2 (b) XeF_4 **[2012]**

Sol (i) Refer to the text on page 163. **(3½)**

(ii) Refer to the text on page 164 and 165. **(3½)**

Q.33 What are zero group elements? Give the electronic configuration of first four of them. Why are they called inert gases? How xenon difluoride is prepared? **[2002, 2000 Textbook]**

Sol Refer to the text on pages 163 and 164. **(7)**

Important Questions

Q.34 (i) Name the zero group elements and give their atomic numbers.

(ii) Complete the following chemical equations.

(a) $XeF_6(s) + H_2O(l) \longrightarrow$

(b) $XeF_2 + H_2O \longrightarrow$ (c) $XeF_4 + H_2O \longrightarrow$

(iii) Explain the following observations:

No distinct chemical compound of helium is known. **[Textbook]**

Sol (i) Refer to the text on page 163 and 164. **(3)**

(ii) (a) $XeF_6 + 3H_2O \longrightarrow XeO_3 + 6HF$

Or $XeF_6 + H_2O \longrightarrow XeOF_4 + 2HF$ **(1)**

(b) $2XeF_2 + 2H_2O \longrightarrow 2Xe + 4HF + O_2$ **(1)**

(c) $6XeF_4 + 12H_2O \longrightarrow 4Xe + 2XeO_3 + 24HF + 3O_2$ **(1)**

(iii) No distinct chemical compound of helium is known because of its small size and high ionisation energy. **(1)**

Chapter Test

1 MARK *Questions*

1 The correct order of solubility in water for He, Ne, Ar, Kr, Xe is
(a) Xe > Kr > Ar > Ne > He
(b) Ar > Ne > He > Kr > Xe
(c) He > Ne > Ar > Kr > Xe
(d) Ne > Ar > Kr > He > Xe

2 Which of the following is monoatomic?
(a) Sulphur
(b) Helium
(c) Phosphorus
(d) Chlorine [***Ans.*** **1.** (a), **2.** (b)]

3 Why argon is monoatomic? **[Textbook]**

4 Which gas is used in beacon lights? **[Textbook]**

5 The most abundant noble gas present in the atmosphere is ..... . **[Textbook]**
[***Ans.*** Argon]

6 Give one use of xenon tetrafluoride. **[Textbook]**

2 MARK *Questions*

7 Does the hydrolysis of XeF_6 lead to redox reaction? **[Textbook]**

8 Write the electronic configuration of krypton. Why is it inert? **[Textbook]**

9 Name the zero group elements and give their atomic numbers. **[Textbook]**

10 Xenon has complete shell configuration but forms compounds with fluorine why?

11 Which inert gas contain less than eight electrons in its outer shell? What is its atomic number? Write down its electronic configuration. **[Textbook]**

12 Give the electronic configuration of argon atom. **[Textbook]**

3 MARK *Questions*

13 How is XeO_3 prepared from xenon fluorides? Describe the structure of XeO_3 on the basis of hybridisation.

14 What is the oxidation state and bond angle of Xe in XeF_2?

15 Write the main reasons which are responsible for the inertness of group 18 elements.

16 Why does Xe form fluorides and not chlorides?

17 Write the hybridisation and also draw the molecular structure of
(i) XeO_3 (ii) $XeOF_4$ (iii) XeO_2F_2

7 MARK *Questions*

18 How will you account for the formation of xenon fluorides? Give the preparation and structures of xenon difluoride and xenon tetrafluoride. **[Textbook]**

19 On the basis of electronic configuration discuss the position of inert gases in the periodic table. **[Textbook]**

20 Write a short account of the fluorides of xenon, stating their preparation and properties. **[Textbook]**