8. When hydrogen sulphide reacts with sulphur dioxide to give sulphur and water, **(2004)**
   (a) both H_2S and SO_2 are oxidised
   (b) both H_2S and SO_2 are reduced
   (c) H_2S is oxidised and SO_2 is reduced
   (d) H_2S is reduced and SO_2 is oxidised

2 Marks Questions

9. Discuss the theory involved in the manufacture of sulphuric acid by contact process. **(2017)**

10. What are the types of hybridisation of iodine in interhalogen compounds IF_3, IF_5 and IF_7, respectively? **(2017)**

11. Write the balanced chemical equations for the following reactions :
   (*i*) Ozone and lead sulphide.
   (*ii*) Sulphuric acid is treated with phosphorus : **(2014)**

12. For the molecule IF_7
   (*i*) Draw the structure of the molecule.
   (*ii*) State the hybridisation of the central atom.
   (*iii*) State the geometry of the molecule. **(2014)**

13. Give the balanced equations for the following reactions.
   (*i*) Ozone and mercury.
   (*ii*) Action of heat on a mixture of sodium chloride and concentrated sulphuric acid. **(2012)**

14. (*i*) What is the hybridisation of the chlorine atom in ClF_3 molecule ?
   (*ii*) Draw the structure of the molecule and state its geometry. **(2012)**

15. How is hydrogen peroxide prepared in the laboratory? **(2007)**

16. Give a balanced equation for a reaction in which hydrogen peroxide acts as a reducing agent and one in which it acts as an oxidising agent. **(2007)**

17. Write the balanced chemical equations for each of the following reactions :
   (*i*) Hydrogen peroxide with acidified ferrous sulphate solution.
   (*ii*) Ozone with moist iodine. **(2006)**

18. Hydrogen peroxide is used for restoring the colour of lead paintings. Give reason. **(2006)**

3 Marks Questions

19. How can ozone be manufactured by Siemen's ozoniser ? How is pure ozone recovered from the products? **(2010)**

20. What are the following converted to when hydrogen peroxide reacts with them? What type of reagent is hydrogen peroxide in each of these reactions?
   (*i*) Lead sulphide
   (*ii*) Silver oxide
   (*iii*) Sodium hydroxide **(2002)**

Solutions

1. Fluorine forms only one oxyacid, which is hypofluorous acid (HFO), while other halogens form more than one types of oxyacids.

   Hence, option (a) is correct.

2. When chlorine is passed through hot concentrated NaOH solution, the following reaction takes place :

$$\underset{\text{Chlorine}}{3Cl_2} + \underset{\text{(Hot and concentrated sodium hydroxide)}}{6NaOH} \longrightarrow \underset{\text{Sodium chlorate}}{NaClO_3} + \underset{\text{Sodium chloride}}{5\,NaCl} + \underset{\text{Water}}{3H_2O}$$

3. Fluorine due to high electronegativity, shows only one oxidation state equal to -1, so it forms only one oxide namely F_2O ($F = -1$ and $O = +2$). On the other hand, chlorine shows many oxidation states like $+1$, $+4$, $+6$ and $+7$, so it forms Cl_2O, ClO_2, Cl_2O_6 and Cl_2O_7, i.e. a series of oxides.

   Note Fluorine also forms F_2O_2 but it is unstable.

4. When fluorine is treated with dilute sodium hydroxide solution, the following reaction takes palce :

$$2F_2 + \underset{\text{Dilute}}{2NaOH} \longrightarrow 2NaF + H_2O + \underset{\text{Oxygen difluoride}}{OF_2}$$

5. *Boiling point increases with increase in molecular mass. Molecular mass increases due to association of molecules. Therefore, discuss the force due to which association of molecules takes place.*

   The high boiling point of HF is due to the presence of intermolecular hydrogen bonding between its molecules. This intermolecular hydrogen bonding leads to the association of HF molecules as shown below :

$$\cdots H—F \cdots \underset{\substack{\text{Intermolecular}\\ \text{H-bonding}}}{H—F} \cdots H—F \cdots H—F \cdots$$

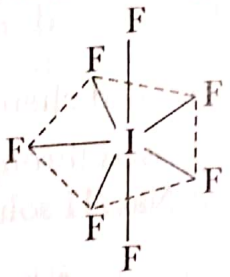
   Due to association of molecules, molecular mass increases which results in increase in boiling point.

6. When chlorine gas is passed through cold, dilute NaOH, the following reaction takes place :

$$Cl_2 + \underset{\substack{\text{(Cold and}\\ \text{dilute)}}}{2NaOH} \longrightarrow \underset{\text{Sodium chloride}}{NaCl} + \underset{\text{Sodium hypochlorite}}{NaClO} + H_2O$$

7. Halogens are strong **oxidising** agents because of their high **electronegativity.**

8. IF_7 belongs to interhalogen compounds.



Structure of IF_7

   Since, central atom I is sp^3d^3 hybridised therefore, its structure is **pentagonal bipyramidal**.

9. Reaction between bromine water and sodium sulphite is given below :

$$Br_2 + H_2O + \underset{\text{Sodium sulphite}}{Na_2SO_3} \longrightarrow \underset{\text{Sodium sulphate}}{Na_2SO_4} + 2HBr$$

10. Reaction between sodium thiosulphate and iodine solution is

$$\underset{\substack{\text{Sodium}\\ \text{thiosulphate}}}{2Na_2S_2O_3} + I_2 \longrightarrow \underset{\substack{\text{Sodium}\\ \text{tetrathionate}}}{Na_2S_4O_6} + 2NaI$$

11. $CaOCl_2$ acts as a **bleaching** agent because of its **oxidising** properties.

12. Reaction between fluorine and concentrated solution of NaOH is shown below :

$$2F_2 + \underset{\text{(Concentrated)}}{4NaOH} \longrightarrow \underset{\substack{\text{Sodium}\\ \text{fluoride}}}{4NaF} + 2H_2O + O_2$$

13. Reaction between bromine and dilute solution of NaOH.

$$Br_2 + \underset{\text{(Dilute and cold)}}{2NaOH} \longrightarrow NaBr + \underset{\substack{\text{Sodium}\\ \text{hypobromite}}}{NaBrO} + H_2O$$

14. Reaction between I_2 and hot concentrated NaOH.

$$3I_2 + \underset{\substack{\text{(Hot and}\\ \text{concentrated)}}}{6NaOH} \longrightarrow \underset{\substack{\text{Sodium}\\ \text{iodate}}}{NaIO_3} + 5NaI + 3H_2O$$

Previous Years' Examinations & Other Important Questions

1 Mark Questions

1. The geometry of XeF_6 molecule and the hybridisation of Xe atom in the molecule is **(2015)**

   (a) distorted octahedral and sp^3d^3

   (b) square planar and sp^3d^2

   (c) pyramidal and sp^3

   (d) octahedral and sp^3d^3

2 Mark Questions

2. Draw the structure of xenon hexafluoride (XeF_6) molecule and state the hybridisation of the central atom. **(2017)**

3. Draw the structure of xenon tetrafluoride molecule and state the hybridisation of the central atom and the geometry of the molecule. **(2015)**

4. For the molecule XeF_2

   (*i*) Draw the structure of the molecule indicating the lone pairs.

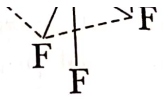
   (*ii*) State the hybridisation of the central atom.

   (*iii*) State the geometry of the molecule. **(2013)**

5. Give reactions and the conditions required for preparation of the following compounds :

   (*i*) XeF_6 (*ii*) $XeOF_4$ **(2011)**

- **XX_5' type** In these type of interhalogen compound central atom is



Previous Years' Examinations & Other Important Questions

1 Mark Questions

1. Give the balanced chemical equation: Ozone is treated with potassium iodide solution. **(2017)**

2. Give the balanced chemical equation: Phosphorus reacts with concentrated sulphuric acid. **(2016)**

3. Give the balanced chemical equation: Sulphuric acid is treated with hydrogen sulphide. **(2015)**

Or Give the balanced chemical equation for the following reaction :

Hydrogen sulphide is treated with concentrated sulphuric acid. **(2013)**

4. Explain, why interhalogen compounds are more reactive than constituent elements? **(2013)**

5. Aqua-regia is a mixture of ..... and ..... in the ratio of 3 : 1. **(2011)**

6. Give the balanced equation for the following :

Ozone and hydrogen sulphide. **(2009)**

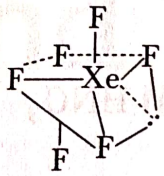
7. Give the balanced equation for the following :

Hydrogen peroxide with sodium hydroxide. **(2009)**

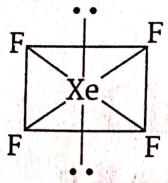
Solutions

1. (*a*) The geometry of XeF_6 molecule is distorted octahedral and hybridisation is sp^3d^3.

2. XeF_6 has sp^3d^3-hybridisation and distorted octahedral geometry due to the presence of one lone pair of electrons

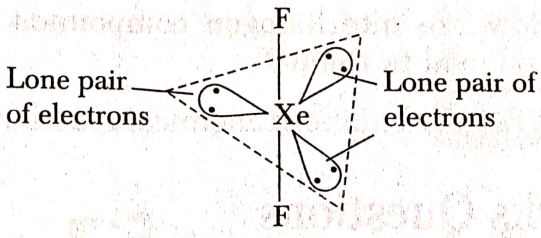


3. XeF_4



Hybridisation of XeF_4 is sp^3d^2 and geometry is square planar.

4. (*i*) **Structure of XeF_2**



(*ii*) In XeF_2, central atom Xe is sp^3d-**hybridised**.

(*iii*) XeF_2 is a linear molecule.

5. (*i*) Xenon hexafluoride (XeF_6) can be prepared by heating a mixture of xenon and fluorine in the ratio of 1:20 at 500 – 575 K under a pressure of 50 atmosphere.

Its chemical reaction is $Xe + 3F_2 \xrightarrow[50\ atm]{500-575\ K} XeF_6$

(*ii*) Xenon oxytetrafluoride ($XeOF_4$) can be prepared by the partial hydrolysis of xenon hexafluoride with water.

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

$XeOF_4$ can also be prepared by treating XeF_6 with silica (SiO_2).

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

Previous Years'
Examinations & Other Important Questions

2 Marks Questions

1. Sulphur dioxide acts as an oxidising agent as well as a reducing agent. Give one reaction each to show its oxidising nature and its reducing nature. **(2016)**

2. The molecular weight of H_2S is more than that of H_2O, but H_2S is a gas and H_2O a liquid. Explain. **(2012)**

3. SF_6 exists but OF_6 does not, though both oxygen and sulphur belong to the same group in the periodic table. **(2010)**

4. Account for the following : Sulphur has a greater tendency for catenation than oxygen.

Solutions

1. Oxidising nature of SO_2

- Sulphur dioxide oxidises H_2S to S,

$$2H_2S + SO_2 \longrightarrow 3S + 2H_2O$$

- It also oxidises Fe to FeO,

$$3Fe + SO_2 \longrightarrow 2FeO + FeS$$

Reducing nature of SO_2

In the absence of moisture, it liberates nascent hydrogen, thus acts as a reducing agent.

- Decolourisation of acidified $KMnO_4$ solution,

$$\underset{\text{Purple}}{2KMnO_4} + 5SO_2 + 2H_2O \longrightarrow K_2SO_4 + \underset{\text{Colourless}}{2MnSO_4} + 2H_2SO_4$$

- Turns acidified $K_2Cr_2O_7$ solution to green,

$$K_2Cr_2O_7 + 3SO_2 + H_2SO_4 \longrightarrow K_2SO_4 + \underset{\text{Green}}{Cr_2(SO_4)_3} + H_2O$$

2. *Discuss different intermolecular interactions between H_2O and H_2S.*

Due to small size and high electronegativity of oxygen, molecules of water are highly associated through hydrogen bonding resulting in its liquid state. Sulphur due to its larger size and low electronegativity cannot form H-bond and its molecules have weak van der Waals' intermolecular forces.

Therefore, H_2S remains as discrete gaseous molecule.

3. Sulphur and oxygen belong to the same group, but sulphur lies in the third period while oxygen lies in the second period of the periodic table.

The electronic configuration of S (16) is $1s^2, 2s^2\ 2p^6, 3s^2\ 3p^4\ 3d^0$. In its valence shell, there are 6 valence electrons. Also it has vacant *d*-orbitals, so it can show a maximum covalency of 6, due to which it can form compounds like SF_6. On the other hand, oxygen (8) has electronic configuration $1s^2, 2s^2\ 2p^4$. There is no vacant *d*-orbital, so it shows maximum covalency of 2 not six. Therefore, it cannot form compounds like OF_6.

4. Sulphur has a greater tendency for catenation than oxygen because S—S bond is stronger than O—O bond due to less inter-electronic repulsions.

Previous Years'
Examinations & Other Important Questions

1 Mark Questions

1. Among the following halogens, the one which generally does not form an oxyacid is
   (a) fluorine (b) chlorine
   (c) bromine (d) iodine **(2014)**

2. Write the balanced chemical equation.
   Chlorine is passed through hot concentrated NaOH solution. **(2014, 2010)**

3. Give reason for the following :
   Fluorine gives only one oxide but chlorine gives a series of oxides. **(2014)**

4. Give balanced chemical equation for the following reaction :
   Fluorine treated with dilute sodium hydroxide solution. **(2013, 2009)**

5. Answer the following question.
   State why the boiling point of HF is very high? **(2011)**

6. Give balanced chemical equation for the following :
   Chlorine gas is passed through cold, dilute NaOH. **(2011)**

7. Halogens are strong ..... agents because of their high ..... . **(2010)**

8. To which class of compounds does IF_7 belong ? What is the structure of the molecule ? **(2010)**

9. Write balanced equation for the following reaction :
   Bromine water and sodium sulphite. **(2008, 2004)**

10. Write balanced equation for the following reaction :
    Sodium thiosulphate and iodine solution are mixed. **(2003, 2000)**

11. $CaOCl_2$ acts as a ..... agent because of its ..... properties. **(2002)**

12. Write balanced equation for the following :
    Fluorine passed through a concentrated solution of sodium hydroxide. **(2002)**

13. Write balanced equation for the following :
    Bromine passed through a dilute solution of sodium hydroxide **(2002)**

14. Write balanced equation for the following reaction :
    Iodine with hot concentrated sodium hydroxide. **(2000)**

Previous Years' Examinations & Other Important Questions

1 Mark Questions

1. Name the inert gases used for
   (*i*) filling sodium vapour lamps.
   (*ii*) obtaining light of different colours in neon signs. **(2012)**
2. Why has it been difficult to study the chemistry of radon?
3. Account for the following.
   Noble gases have very low boiling points.
4. How does xenon atom form compounds even though the xenon atom has a closed shell electronic configuration?
5. Why is helium used in diving apparatus?
6. Which noble gas is used in filling balloons for meteorological observation?

Solutions

1. (*i*) Neon (Ne) gas is used for filling sodium vapour lamps.
   (*ii*) Argon (Ar) gas is used for obtaining light of different colours in neon signs.
2. Radon is a radioactive element with very short half-life of 3.82 days.
3. Noble gases being monoatomic have no interatomic forces except weak dispersion forces and therefore, they are liquefied at very low temperatures. Hence, they have low boiling points.
4. Xe has lowest ionisation enthalpy among noble gases due to its large size and hence, can be easily oxidised by strong oxidising agents like O_2 and F_2. Hence, it forms a number of compounds among all elements.
5. Helium is used in diving apparatus due to its very low solubility in blood.
6. Helium, as it is light as well as non-inflammable.