

# P-BLOCK ELEMENTS

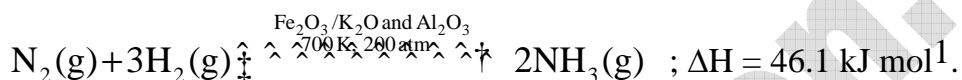
## (Group 15 Elements)

### Long Answer Questions:

\*1. How is ammonia manufactured industrially by Haber's process? Explain the reactions of ammonia with

- a.)  $ZnSO_4(aq)$                       b)  $CuSO_4(aq)$                       c)  $AgCl(s)$

**Ans.** Ammonia is manufactured industrially by Haber's process from nitrogen and hydrogen.



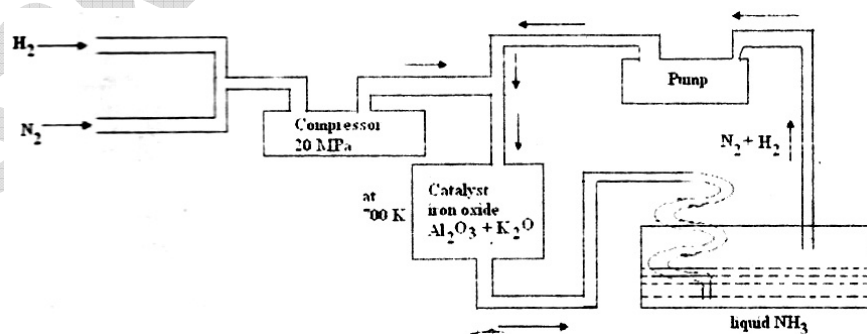
It is a homogeneous equilibrium. In this forward reaction is an exothermic and involve decrease in number of moles. According to Le-Chatelier's principle, high pressure and low temperature would favour the forward reaction i.e. the production of ammonia.

Optimum conditions for production of  $NH_3$  are

1. Temperature: 725-775K
2. Pressure:  $200 \times 10^5$  Pa (or 200 atm)
3. Catalyst: finely divided Fe powder with molybdenum
4. Promoter : a mixture of  $K_2O$  and  $Al_2O_3$ .

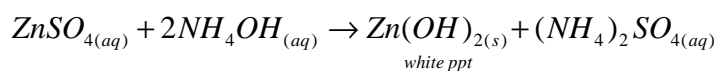
Moist ammonia can be dried by passing over quick lime ( $CaO$ ) but not by conc.

$H_2SO_4$ , anhydrous  $CaCl_2$  and  $P_4O_{10}$  as it reacts with these reagents.

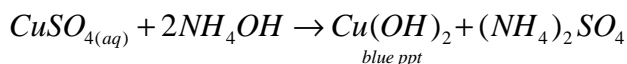


### Chemical Reactions:

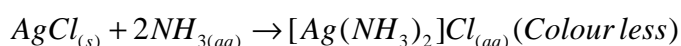
a) Zinc sulphate reacts with ammonium solution to form zinc hydroxide and ammonium sulphate



b) Copper sulphate reacts with ammonium solution, to form cupric hydroxide and ammonium sulphate



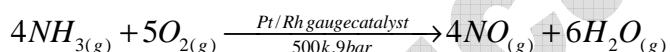
c) Silver chloride reacts with ammonia solution to form Di ammine silver chloride



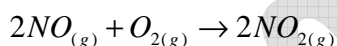
### Short Answer Questions

**1. How is nitric acid manufactured by Ostwald's process?**

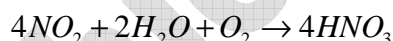
**A: On large scale Nitric acid is prepared by Ostwald's process.** This method is based on catalytic oxidation of ammonia by atmospheric air ( $NH_3$  and air in 1:7 (or) 1:8 ratio).



Nitric oxide thus obtained is oxidised to  $NO_2$  by air



$NO_2$  is dissolved in water in the presence of oxygen to get  $HNO_3$



**\*2. Discuss the trends in chemical reactivity of group 15 elements.**

**Sol. Trends in chemical reactivity of group 15 elements.**

**1. Reactivity towards hydrogen:** These elements form covalent hydrides with the formula  $EH_3$ , [where, E = N, P, As, Sb].

(a) Thermal stability of hydrides decreases down the group.

(b) Reducing character of hydrides increases down the group.

(c) Basic character of hydrides decreases down the group.

(d) Boiling point of  $NH_3$  is greater than  $PH_3$  due to H-bonding. Boiling points of other hydrides increase from  $PH_3$  onwards.

Lighter elements like nitrogen also form hydrides of the formula  $M_2H_4$ . e.g.,  $N_2H_4$ .

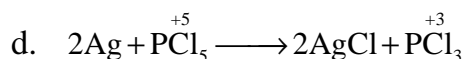
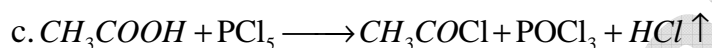
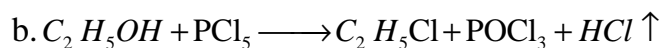
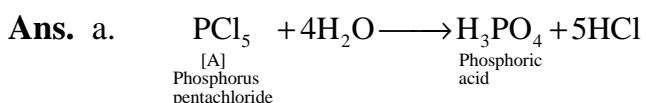
**2. Reactivity towards halogens:** All group 15 elements i.e., N, P, As, Sb, Bi form

(a) Halides of general formula  $MX_3$ . Except  $NBr_3$  and  $NI_3$ , all are stable with pyramidal shape with  $sp^3$  hybridization. These get hydrolyzed by water.

(b) Halides of general formula  $MX_5$ . These are formed by P, As, and Sb but not by N. These halides are trigonal bipyramidal with  $sp^3d$  hybridization.

**\*3. How does  $PCl_5$  reacts with the following?**

- a) Water    b)  $C_2H_5OH$     c)  $CH_3COOH$     d) Ag

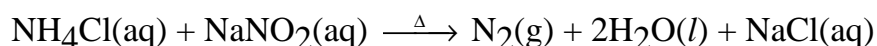


### Very Short Answer Questions

**\*1. How is nitrogen prepared in the laboratory? Write the chemical equations of the reactions involved.**

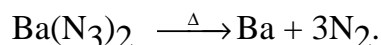
**Ans. Laboratory preparation of nitrogen gas.**

i. Di nitrogen is prepared by treating an aqueous solution of ammonium chloride with sodium nitrite.



Small amounts of NO and HNO<sub>3</sub> are also formed as impurities which can be removed by passing the gas through aqueous sulphuric acid containing potassium dichromate.

ii. Pure nitrogen is obtained by thermal decomposition of sodium or barium azide.

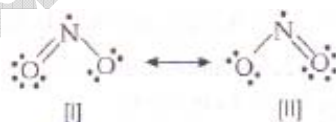


**\*2. N<sub>2</sub> molecule is highly stable. Why?**

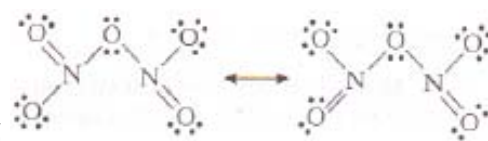
**Ans.** Di nitrogen is highly stable as the triple bond (N≡N) dissociation energy is very high.

**\*3. Give the resonating structures of NO<sub>2</sub> and N<sub>2</sub>O<sub>5</sub>**

**Ans. Resonating structures of NO<sub>2</sub>.**



**Resonating structures of N<sub>2</sub>O<sub>5</sub>**



**4. Why does nitrogen show catenation property less than phosphorus?**

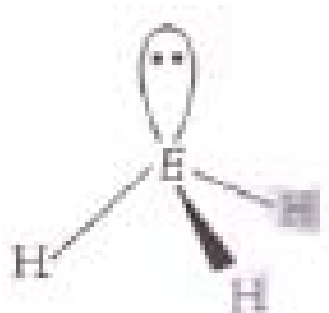
**Ans.** The single N-N bond is weaker than the single P-P bond due to high inter electronic repulsion of the non-bonding electrons in N<sub>2</sub> owing to small bond length. Therefore, the catenation property is weaker in nitrogen as compared to phosphorus.

**5. Explain why NH<sub>3</sub> is basic while BiH<sub>3</sub> is only feebly basic?**

**Ans.** As atomic radius increases from Nitrogen to bismuth, electron density on the nitrogen atom is greater than that on bismuth atom and electron releasing tendency of ammonia is more than BiH<sub>3</sub>. Therefore, NH<sub>3</sub> is basic while BiH<sub>3</sub> is only feebly basic.

**\*6. The HNH angle value is higher than HPH, HAsH and HSbH angles. Why?**

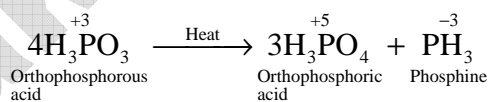
**Ans.** The central atom M (where, M = N, P, As, Sb, Bi) in all the given hydrides is sp<sup>3</sup> hybridized. However, its electro negativity decreases and atomic size increases on moving down the group. Therefore, there is a gradual decrease in the force of repulsion between the bonding electron pairs around the central atom. Thus, bond angle decreases as we move down the group.



<b>Molecule</b>	NH <sub>3</sub>	PH <sub>3</sub>	AsH <sub>3</sub>	SbH <sub>3</sub>	BiH <sub>3</sub>
<b>Bond angle</b>	107.8°	93.6°	91.8°	91.3°	90°

**7. Give the disproportionation reaction of H<sub>3</sub>PO<sub>3</sub>**

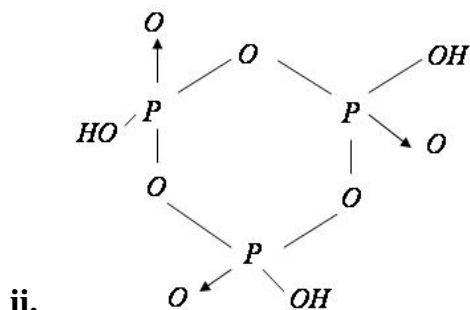
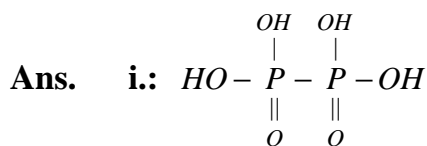
**Ans.** On heating it disproportionates to give orthophosphoric acid and phosphine gas.



\*8. Draw the structures of

i. Hypo phosphoric acid

ii. Cyclic Meta phosphoric acid.



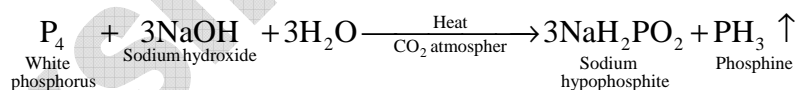
9. Nitric oxide is paramagnetic in gaseous state but diamagnetic in liquid and the solid states.

Why?

Ans. In gaseous state, NO exists as a monomer which has one unpaired electron but in **liquid or solid state** it dimerises to  $\text{N}_2\text{O}_2$  and no unpaired electron left. Therefore, NO is paramagnetic in gaseous state but diamagnetic in solid state.

10 What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of  $\text{CO}_2$ ?

Ans. White phosphorus dissolves in boiling NaOH in an inert atmosphere of  $\text{CO}_2$  producing phosphine ( $\text{PH}_3$ ) gas and sodium hypophosphite ( $\text{NaH}_2\text{PO}_2$ ).



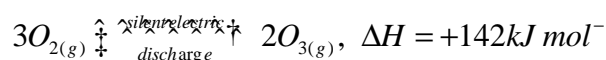
## Group 16 Elements

### Long Answer Questions:

**\*\*1. How is ozone prepared? How does it react with the following?**

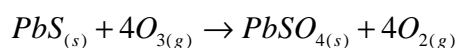
- 1). PbS                      2) KI                      3) Hg                      4) Ag                      5)  $C_2H_4$

A: Preparation of ozone: Ozone is prepared by subjecting pure, cold and dry oxygen gas to a silent electric discharge in an apparatus called ozoniser. 10% ozone is formed. This product is known as ozonised oxygen. Silent discharge is used to prevent the decomposition of ozone

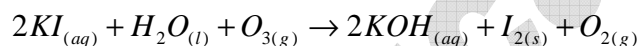


#### Chemical properties:

1) **Reaction with PbS:** Ozone oxidizes lead sulphide to lead sulphate



2) **Reaction with KI:** Ozone oxidizes potassium iodide to iodine

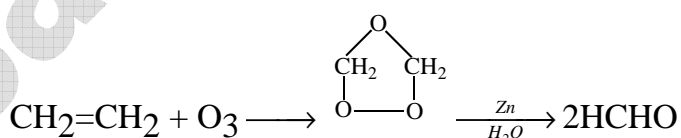


3) **Reaction with Hg:** On passing  $O_3$ , mercury loses its metallic luster and meniscus and it sticks on the glass walls due to formation of mercurous oxide ( $Hg_2O$ ). This is known as tailing of mercury  $2Hg + O_3 \rightarrow Hg_2O + O_2$

4) **Reaction with Ag:** Ozone oxidizes silver metal to silver oxide



5) Ethylene adds on ozone to form unstable ozonide which on hydrolysis in presence of zinc gives formaldehyde.



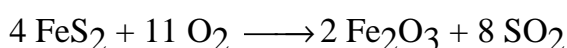
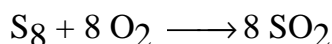
## Short Answer Questions

\*1. Describe the manufacture of  $\text{H}_2\text{SO}_4$  by contact process.

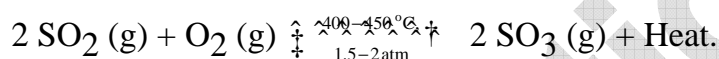
Ans. Manufacture of sulphuric acid (contact process)

It involves following steps:

(i) **Production of sulphur dioxide:** It is carried out by burning powdered sulphur or roasting of sulphur rich ores.



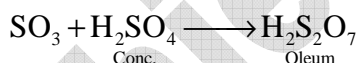
(ii) **Oxidation of sulphur dioxide to sulphur trioxide.**



This is the major step to the contact process.

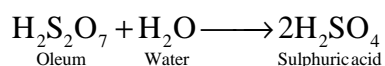
For better yield of  $\text{SO}_3$ , conditions required are: Temperature =  $400-450^\circ \text{C}$ ; Pressure = 1.5 to 2 atm. Catalyst = Pt asbestos or vanadium pentoxide  $\text{V}_2\text{O}_5$ .

(iii) **Conversion of  $\text{SO}_3$  into  $\text{H}_2\text{SO}_4$ :**  $\text{SO}_3$  is absorbed in conc.  $\text{H}_2\text{SO}_4$  to produce oleum or pyro sulphuric acid.



$\text{SO}_3$  is not absorbed in water as the reaction is highly exothermic and a mist of acid particles is formed. Sometimes it becomes difficult to handle the operation.

(iv.) **Dilution of oleum and formation of  $\text{H}_2\text{SO}_4$ :** Oleum is diluted with calculated quantity of water to obtain  $\text{H}_2\text{SO}_4$  in required concentration.

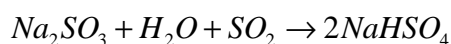




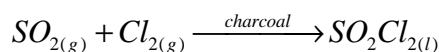
2). How does SO<sub>2</sub> reacts with the following

- a). Na<sub>2</sub>SO<sub>3</sub>(aq)      b. Cl<sub>2</sub>      c) Fe<sup>+3</sup> ions      d. KMnO<sub>4</sub>

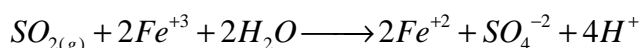
**Ans.** a. Sulphur dioxide reacts with Sodium sulphite solution to give Sodium hydrogen sulphate.



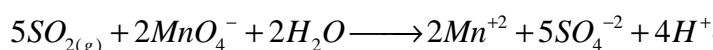
b. sulphur dioxide reacts with chlorine in presence of charcoal catalyst to form sulphuryl chloride.



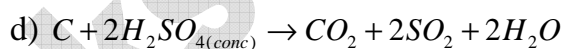
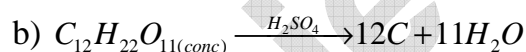
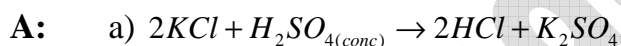
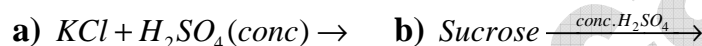
c. Moist sulphur dioxide reduces ferric ions to ferrous ions.



d. It decolourises acidified KMnO<sub>4</sub> solution. It is a test for SO<sub>2</sub>



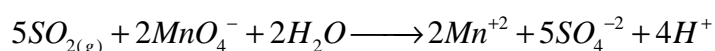
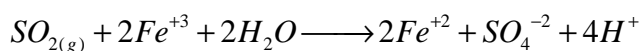
## 3. Complete the following



**\*4. Which oxide of sulphur can acts as both oxidising and reducing agent? Give one example each.**

**Ans.** Sulphur dioxide can acts as both oxidising and reducing agent.

- i. Moist sulphur dioxide reduces ferric ions to ferrous ions and decolourises acidified KMnO<sub>4</sub> solution.

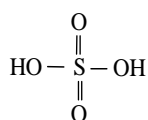


ii. It oxidises  $H_2S$  to sulphur.  $2H_2S + SO_2 \rightarrow 3S + 2H_2O$

### Very Short Answer Questions

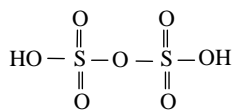
1. Write the names of any two oxy acids of sulphur. Indicate the oxidation state of sulphur in them.

Ans. 1. Sulphuric acid



Oxidation state of 'S' is +6

2. Pyro sulphuric acid,

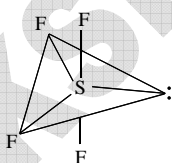


Oxidation state of 'S' is +6, +6

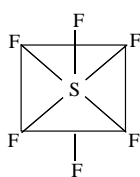
2). Why is  $H_2O$  is a liquid while  $H_2S$  is a gas?

Ans. Because of small size and high electro negativity of oxygen, molecules of water are highly associated through hydrogen bonding resulting in liquid state but hydrogen bonding absent in  $H_2S$ .

3. Give the structures of  $SF_4$  and  $SF_6$ .



Distorted tetrahedral

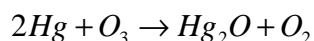


Octahedral

Ans.

#### 4. What is tailing of mercury? How is it removed?

**Ans.** On passing  $O_3$ , mercury loses its metallic lustre and meniscus and it sticks on the glass walls due to formation of mercurous oxide ( $Hg_2O$ ). This is known as tailing of mercury. **It is removed by washing with water.**



#### 5. Out of $O_3$ and $O_2$ , which is paramagnetic. Why?

**Ans.**  $O_2$  is paramagnetic as it contains two unpaired electrons in its anti bonding molecular orbital's.

#### 6) Why is di oxygen a gas but sulphur a solid?

**Ans.** Oxygen being smaller and highly electronegative forms  $p\pi-p\pi$  multiple bonds. So, it exists as  $O_2$  molecules which are held together by weak Vander Waals' force. Thus oxygen exists as a gas at room temperature.

Sulphur has less tendency to form  $p\pi-p\pi$  multiple bonds, moreover it has large atomic size, less electro negativity and forms strong S-S single bonds, that's why it shows more catenation property and exists as  $S_8$  molecules having puckered ring structure. Hence, sulphur is a solid at room temperature.

## Group 17 Elements

### Short Answer Questions

**\*\*1. Write balanced equations for the following?**

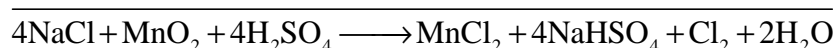
a) NaCl is heated with conc.  $H_2SO_4$  in the presence of  $MnO_2$

b) Chlorine is passed into a solution of NaI in water

**A:** a)  $NaCl + H_2SO_4 \longrightarrow NaHSO_4 + HCl$  4 ..... (i)

$4HCl + MnO_2 \longrightarrow MnCl_2 + Cl_2 + 2H_2O$  ..... (ii)

**Overall reaction:**



b)  $2NaI + Cl_2 \xrightarrow{H_2O} 2NaCl + I_2$

**2. How is chlorine prepared in the laboratory? How does it react with the following?**

a) Acidified  $FeSO_4$    b) Iodine   c)  $H_2S$    d)  $Na_2S_2O_3$

**A: preparation of chlorine in laboratory:**

i) By heating manganese dioxide with conc. HCl



However, a mixture of common salt and conc.  $H_2SO_4$  is used in the place of HCl

ii) By the action of HCl on potassium permanganate

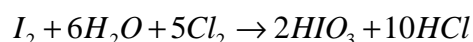


**Chemical Reactions:**

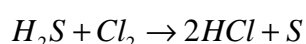
a) Reaction with acidified  $FeSO_4$ : Chlorine oxidises acidified  $FeSO_4$  to  $Fe_2(SO_4)_3$

(Ferric sulphate)  $2FeSO_4 + H_2SO_4 + Cl_2 \rightarrow Fe_2(SO_4)_3 + 2HCl$

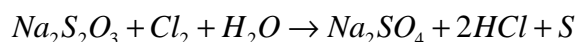
b) Reaction with iodine: In the presence of water chlorine reacts with iodine to form iodic acid and HCl



c) Reaction with  $H_2S$ : When chlorine reacts with  $H_2S$  produces HCl and sulphur



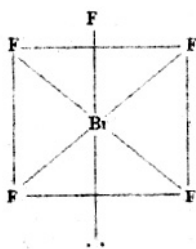
d) Reaction with  $Na_2S_2O_3$ : When chlorine reacts with  $Na_2S_2O_3$  produces  $Na_2SO_4$ , HCl and sulphur



3. Explain the structures of (a)  $BrF_5$       b)  $IF_7$  ?

A: a)  $BrF_5$  :

i) It is colourless liquid

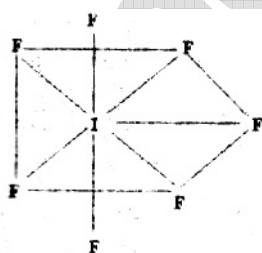


ii) The central bromine atom undergoes  $sp^3d^2$  hybridization

iii) Shape of the molecule is square pyramidal

b)  $IF_7$  :

i) It is colourless gas



ii) The central iodine atom undergoes  $sp^3d^3$  hybridization

iii) Shape of the molecule is pentagonal bi pyramidal

**4. What are inter halogen compounds? Give some examples to illustrate definition how are they classified?**

- A:
- i) Halogens mutually combine together to form a set of compounds having general formula  $AX_n$ . Where A & X are halogen atoms and  $n = 1, 3, 5$  (or)  $7$  these compounds are called inter halogen compounds
  - ii) 'A' is always a larger halogen atom where as 'X' is always smaller halogen atom
  - iii) The oxidation states of halogen atom 'A' could be  $+1, +3, +5$  (or)  $+7$ , but the oxidation state of halogen atom 'X' is always  $-1$
  - iv) depending upon the value of  $n$ , inter halogen compounds can be classified into the following four categories

<b>Type</b>	AX	$AX_3$	$AX_5$	$AX_7$
	ClF, BrF	$ClF_3$	$ClF_5$	$IF_7$
<b>Example</b>	BrCl, ICl	$BrF_3$	$BrF_5$	

## Long Answer Questions

1. How is chlorine prepared by electrolytic method? Explain its reaction with  
a) NaOH    b)  $NH_3$  under different conditions

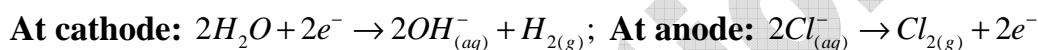
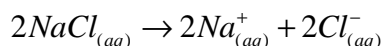
**A: Principle:**  $Cl_2$  is manufactured by electrolysis of brine solution

### Manufacture:

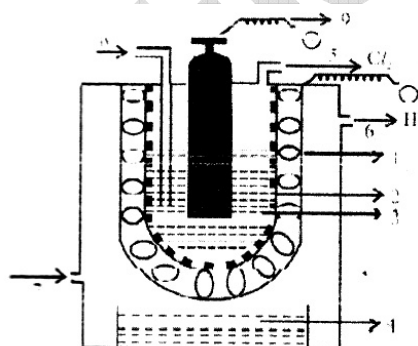
Nelson cell consists of a U-shaped porous steel vessel lined inside with asbestos.

It serves as cathode. This vessel is suspended in a rectangular iron tank. Brine solution (10% NaCl) is taken as electrolyte and carbon rod is dipped in the brine solution, which acts as anode. Steam is passed into the cell.

On electrolysis the following reactions take place



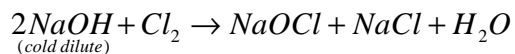
$Cl_2$  gas is liberated at anode. Sodium ions ( $Na^+$ ) Penetrate through the asbestos paper lining and reach the cathode. Here sodium ions ( $Na^+$ ) combine with  $OH^-$  to form NaOH. In this process,  $H_2$  and NaOH are important by products.  $2Na^+ + 2OH^- \rightarrow 2NaOH$



- |                                      |                    |
|--------------------------------------|--------------------|
| 1. Perforated steel U-tube & cathode | 2. Asbestos lining |
| 3. Brine solution                    | 4. NaOH solution   |
| 5. Chlorine outlet                   | 6. Hydrogen outlet |
| 7. Steam inlet                       | 8. Brine inlet     |
| 9. Graphite anode                    |                    |

**Chemical Reaction:**

a) **Reaction with NaOH:** i) with cold and dilute NaOH chlorine produces a mixture of NaCl and NaOCl

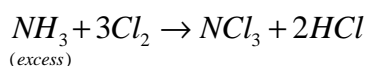
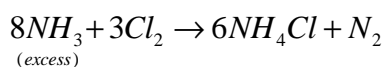


ii) With hot and conc. NaOH gives NaCl and  $NaClO_3$



b) **Reaction with  $NH_3$ :** With excess ammonia, chlorine gives nitrogen and ammonium chloride.

But with excess chlorine ammonia gives nitrogen tri chloride is formed



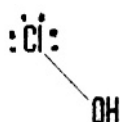
\*2. Write the names and formulae of the oxy acids of chlorine give their structures and relative acidic nature

A: Chlorine forms four types of oxy acids. They are

Name	Formula	Hybridisation	Oxidation state	Basicity
Hypochlorous acid	HClO	$SP^3$	+1	1
Chlorous acid	$HClO_2$	$SP^3$	+3	1
Chloric acid	$HClO_3$	$SP^3$	+5	1
Perchloric acid	$HClO_4$	$SP^3$	+7	1

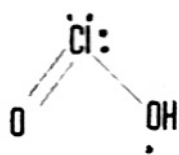
**Structure of oxyacids of chlorine:**

1) Hypochlorous acid: HClO:

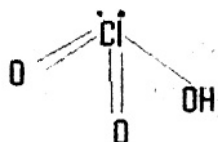




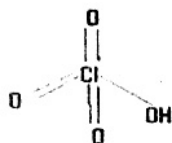
2) Chlorous acid:  $HClO_2$



3) Chloric acid:  $HClO_3$



4) Per chloric acid:  $HClO_4$



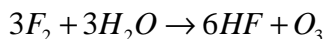
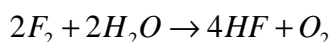
The acid strength of different oxy acids of chlorine increases with an increase in the oxidation state of the chlorine



### Very Short Answer Questions

1. Which halogen produces  $O_2$  and  $O_3$  on passing through water?

A. Fluorine produces ozonised oxygen on reaction with water



2. Electron gain enthalpy of fluorine ( $F_2$ ) is less than of  $Cl_2$  explain?

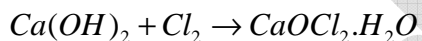
A: It is due to small size of fluorine atom and strong inter electronic repulsions in fluorine atom

3. Bond dissociation enthalpy of ' $F_2$ ' is less than that of ' $Cl_2$ ' explain?

A: Fluorine atoms are small and hence bond distance (F-F) is also small ( $1.48 \text{ \AA}$ ). Due to this large lone pair lone pair electronic repulsions in the fluorine molecule are possible that means bond energy is less

4. What happens when  $Cl_2$  react with dry slaked lime?

A: When chlorine reacts with dry slaked lime gives bleaching powder



5. Compare the bleaching action of  $Cl_2$  and  $SO_2$ ?

A: The bleaching action of ' $Cl_2$ ' is due to oxidation  $Cl_2 + H_2O \rightarrow 2HCl + (O)$  coloured substance  
 $(O) \rightarrow$  colourless substance. In the presence of moisture  $SO_2$  liberate nascent hydrogen

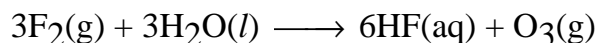
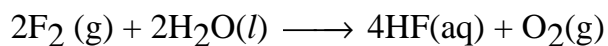


Colouring matter  $+2[H] \rightarrow$  colourless matter

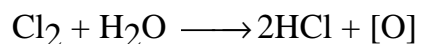
$SO_2$  has bleaching property due to reduction

**6. Write the reactions of F<sub>2</sub> and Cl<sub>2</sub> with water?**

**Ans.** (i) Fluorine reacts with water to produce oxygen and ozone.



(ii) Chlorine reacts with water in presence of sunlight to produce nascent oxygen.



**7. Why are halogens coloured?**

**Ans.** Halogens are coloured due to absorption of radiations in visible region. It results in excitation of valence electrons to higher energy level. As different halogens absorb different quanta of radiation, they display different colours. Different colours of halogens are

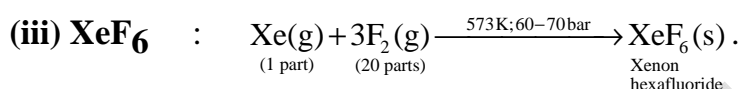
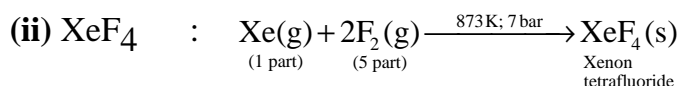
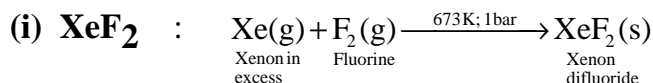
<b>Fluorine</b>	<b>Yellow</b>
<b>Chlorine</b>	<b>Greenish yellow</b>
<b>Bromine</b>	<b>Red</b>
<b>Iodine</b>	<b>Violet</b>

## Group 18 Elements

## Short Answer Questions:

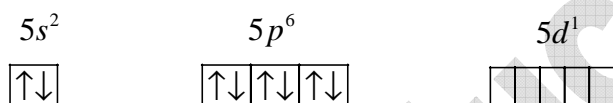
\*1. How are xenon fluorides  $\text{XeF}_2$ ,  $\text{XeF}_4$  and  $\text{XeF}_6$  obtained?

**Sol.** Xenon fluorides are prepared by direct reaction of xenon and fluorine under different reaction conditions.

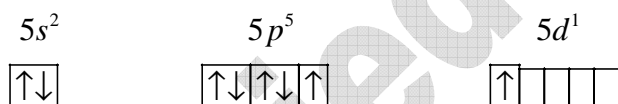


\*\*2. Explain the structure of a)  $\text{XeF}_2$  and b)  $\text{XeF}_4$

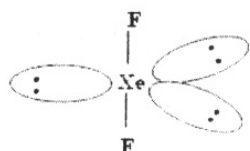
A).  $\text{XeF}_2$ : The valence electronic configuration of Xe in the ground state is  $5s^2 5p^6$



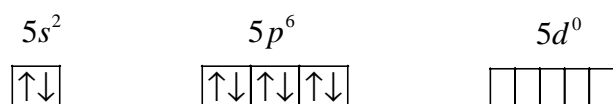
The valence electronic configuration of Xe in 1<sup>st</sup> excited state is  $5s^2 5p^5 5d^1$



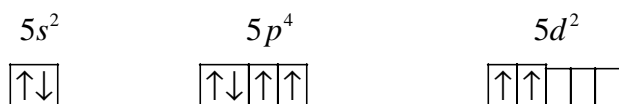
In  $\text{XeF}_2$  the central Xe atom undergoes  $sp^3d$  hybridisation. It contains three lone pairs and 2 unpaired hybrid orbitals. These two unpaired hybrid orbitals overlaps with two 'p' orbitals of two fluorine atoms forms two sigma bonds. The shape of  $\text{XeF}_2$  is linear



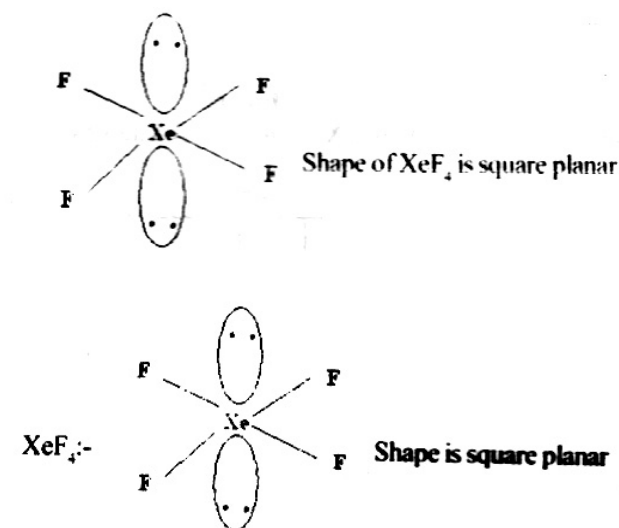
Structure of  $\text{XeF}_4$ : The valence electronic configuration of Xe in the ground state is  $5s^2 5p^6$



The valence electronic configuration of Xe in II excited state is  $5s^2 5p^4 5d^2$

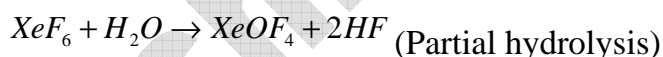


In  $XeF_4$  molecule, the central Xe atom undergoes  $sp^3d^2$  hybridization it contains two lone pairs. 4 unpaired hybrid orbitals these 4 unpaired hybrid orbitals overlap with 4p-orbitals of 4 fluorine and forms 4 sigma bonds



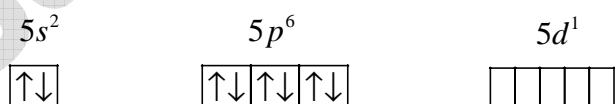
**3. How are  $XeO_3$  and  $XeOF_4$  prepared?**

A.  $XeO_3$  and  $XeOF_4$  are prepared by the complete and partial hydrolysis of  $XeF_6$  .

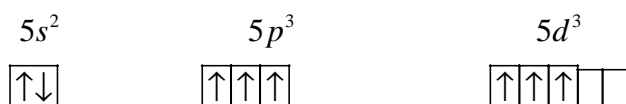


**4. Explain the structures of a)  $XeF_6$  and b)  $XeOF_4$**

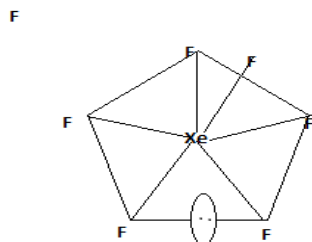
Ans. a)  $XeF_6$ : The valence electronic configuration of Xe in the ground state is  $5s^2 5p^6$



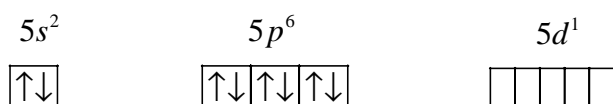
The valence electronic configuration of Xe in 3rd excited state is  $5s^2 5p^3 5d^3$



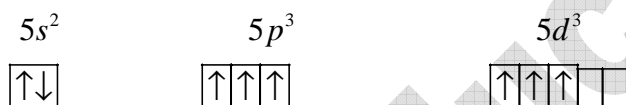
In  $XeF_6$  the central Xe atom undergoes  $sp^3d^3$  hybridization. It contains one lone pair and 6 unpaired hybrid orbitals. These six unpaired hybrid orbitals overlaps with six 'p' orbitals of six fluorine atoms forms six sigma bonds. The shape of  $XeF_6$  is distorted octahedral.



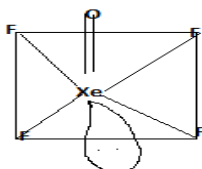
b)  $XeOF_4$ : The valence electronic configuration of Xe in the ground state is  $5s^25p^6$



The valence electronic configuration of Xe in 3rd excited state is  $5s^25p^35d^3$



In  $XeOF_4$  the central Xe atom undergoes  $sp^3d^2$  hybridisation. It contains one lone pair and 5 unpaired hybrid orbitals. These four unpaired hybrid orbitals overlaps with four 'p' orbitals of four fluorine atoms forms four sigma bonds. One half filled hybrids orbital is used to form a bond with oxygen. The unhybridised half filled d-orbital is used to form  $\pi$  bond with oxygen. The shape of  $XeOF_4$  is square pyramidal.



### Very Short Answer Questions

**1. List out the uses of Neon?**

A. Uses of Neon

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

**2. Write any two uses of argon?**

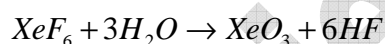
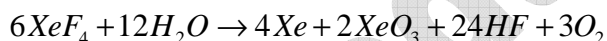
- A:
- 1) Argon is mainly used to provide an inert atmosphere in high temperature metallurgical process
  - 2) Argon is used in the laboratory for handling substances that are air-sensitive
  - 3) It is also used for filling electric bulbs

**3. In modern diving apparatus, a mixture of He & O<sub>2</sub> is used-why?**

A: He is used as a diluent for oxygen in modern diving apparatus because of its very low solubility in the blood

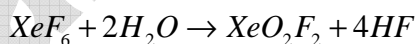
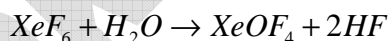
**4. How is XeO<sub>3</sub> prepared?**

A: XeO<sub>3</sub> is prepared by the hydrolysis of XeF<sub>4</sub> or XeF<sub>6</sub>



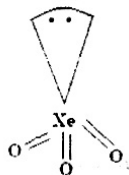
**5. Give the preparation of a) XeOF<sub>4</sub>      b) XeO<sub>2</sub>F<sub>2</sub>**

A): XeOF<sub>4</sub>, XeO<sub>2</sub>F<sub>2</sub> are obtained by partial hydrolysis of XeF<sub>6</sub>



**6. Explain the structure of XeO<sub>3</sub> ?**

A: In XeO<sub>3</sub>, Xe atom undergoes sp<sup>3</sup> hybridisation. But the shape of XeO<sub>3</sub> is pyramidal and bond angle is 103°, due to the presence of a lone pair of electrons on Xe.



**7. Noble gases are inert. Explain?**

A: Due to stable  $ns^2np^6$  (Except He =  $1S^2$ ) electronic configuration in their outermost shell they are chemically inert and hence known as inert gases

**8. Write the name & formula of the first noble gas compound prepared by Bartlett?**

A: The first noble gas compound prepared by Bartlett is Xenon hexa fluoro platinate (IV),  
 $Xe[PtF_6]$ .