

## UNIT - 3

S.SHANMUGAM

P - BLOCK ELEMENTS - II St.John's M.H.S.S porur Ch -116

## 1. What is inert pair effect?

In heavier post-transition metals, the outer s electrons (ns) have a tendency to remain inert and show reluctance to take part in the bonding, which is known as inert pair effect. This effect is also observed in groups 14, 15 and 16.

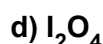
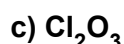
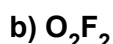
## 2. Chalcogens belongs to p-block. Give reason.

- i) The chalcogens are the first group in the p block to have no stable metallic elements.
- ii) All isotopes of polonium (Po), the only metal in group 16, are radioactive, and only one element in the group, tellurium (Te), can even be described as a semimetal.
- iii) As in groups 14 and 15, the lightest element of group 16, oxygen, is found in nature as the free element.

## 3. Explain why fluorine always exhibit an oxidation state of -1?

- 1. fluorine the most electronegative element, also behaves quite differently compared to the rest of the members of group
- 2. Absence of d orbitals in their valence shell
- 3. The fluorine is the strongest oxidising agent and the most reactive element among the halogens.

## 4. Give the oxidation state of halogen in the following.



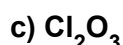
Fluorine shows only -1 oxidation state



$$2 + 2x = 0$$

$$2x = -2$$

$$x = -1$$



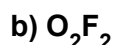
$$2x + 3(-2) = 0$$

$$2x - 6 = 0$$

$$2x = 6$$

$$x = 3$$

Oxidation state of Cl is +3



$$2(1) + 2x = 0$$

$$2 - 2x = 0$$

$$2x = -2, x = -1$$



$$2x + 4(-2) = 0$$

$$2x - 8 = 0$$

$$2x = 8$$

$$x = 4$$

Oxidation state of I is +4



## 5. What are interhalogen compounds? Give examples.

Each halogen combines with other halogens to form a series of compounds called inter halogen compounds.

A is less electronegative than B.

AB type -  $\text{ClF}$ ,  $\text{BrF}$  $\text{AB}_3$  type -  $\text{BrF}_3$  $\text{AB}_5$  type -  $\text{IF}_5$  $\text{AB}_7$  type -  $\text{IF}_7$

**6 Why fluorine is more reactive than other halogens?**

**Fluorine is more reactive.**

Due to very small size of F there is inter electronic repulsion in  $F_2$

This is due to the low value of F-F bond dissociation energy.

Fluorine wants to get to a stable 10 electrons to be like Neon.

This is because the valence/bonding electrons are closer to the nucleus in Fluorine than they are Chlorine and others and thus more strongly attracted

Fluorine is most electronegative, thus it is most reactive.

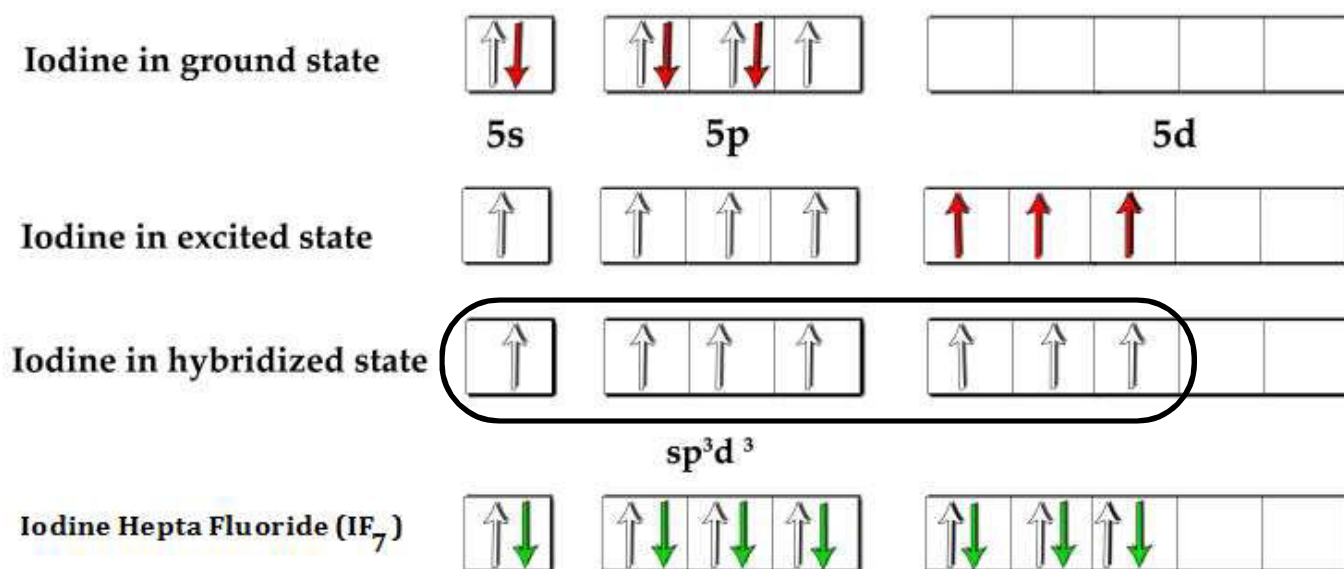
**7. Give the uses of helium.**

- i). Helium is used to provide inert atmosphere in electric arc welding of metals
- ii). Helium has lowest boiling point hence used in cryogenics (low temperature science).
- iii). It is much less denser than air and hence used for filling air balloons

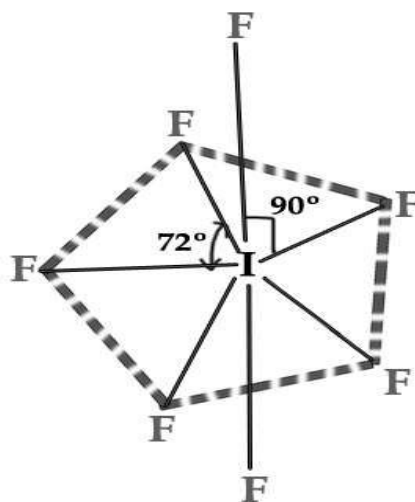
**8. What is the hybridisation of iodine in  $IF_7$ ? Give its structure.**

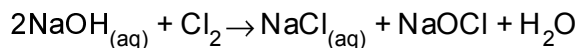
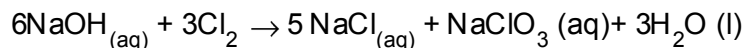
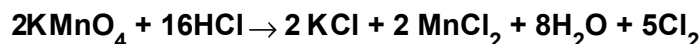
Iodine atom undergoes  $sp^3d^3$  hybridization to give 7 half filled  $sp^3d^3$  hybrid orbitals in pentagonal bipyramidal symmetry. shape of  $IF_7$  is pentagonal bipyramidal.

F - I - F bond angles in the pentagonal plane are equal to  $72^\circ$



**Geometry of  $IF_7$  is pentagonal bipyramidal.**



**9 Give the balanced equation for the reaction between chlorine with cold NaOH and hot NaOH.****i) Cold dilute alkali to give chloride and hypochlorite****ii) hot concentrated alkali to give chlorides and chlorates are formed.****10. How will you prepare chlorine in the laboratory?**Chlorine can also be prepared by dripping concentrated hydrochloric acid on  $\text{KMnO}_4$  crystals:**11. Give the uses of sulphuric acid.**

1. Sulphuric acid is used in the manufacture of fertilisers, ammonium sulphate and super phosphates and other chemicals such as hydrochloric acid, nitric acid etc...
2. It is used as a drying agent and also used in the preparation of pigments, explosives etc..

**12. Give a reason to support that sulphuric acid is a dehydrating agent.**

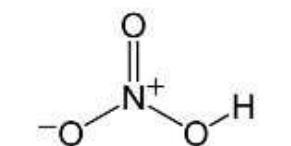
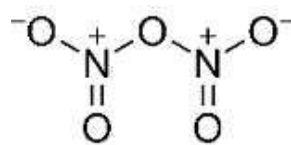
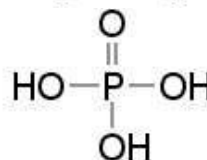
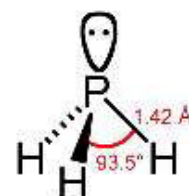
- i) It is highly soluble in water and has strong affinity towards water and hence it can be used as a dehydrating agent .
- ii) When dissolved in water, it forms mono ( $\text{H}_2\text{SO}_4 \cdot \text{H}_2\text{O}$ ) and dihydrates ( $\text{H}_2\text{SO}_4 \cdot 2\text{H}_2\text{O}$ ) and the reaction is exothermic

**13. Write the reason for the anomalous behaviour of Nitrogen.**

- i) Small size of N atom.
- ii) High value of electronegativity of N atom and high ionization energy.
- iii) Absence of d-orbitals in the valency shell.
- iv) Tendency of form multiple bonds.
- v) As a result the catenation tendency is weaker in nitrogen

**14. Write the molecular formula and structural formula for the following molecules.**

**a) Nitric acid      b) dinitrogen pentoxide      c) phosphoric acid      d) phosphine**

**Name****Molecular Formula****Structure****a) Nitric acid****b) dinitrogen pentoxide****c) phosphoric acid****d) phosphine**

**15. Give the uses of argon.**

Argon prevents the oxidation of hot filament and prolongs the life in filament bulbs

**16. Write the valence shell electronic configuration of group-15 elements.**

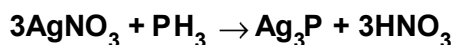
The general valence shell electronic set up of group fifteen elements is  $ns^2, np^{1-6}$

**17. Give two equations to illustrate the chemical behaviour of phosphine.**

**Basic nature:** Phosphine is weakly basic and forms phosphonium salts with halogen acids.

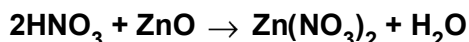


**Reducing property :** Phosphine precipitates some metal from their salt solutions.

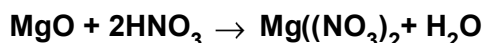


**18. Give a reaction between nitric acid and a basic oxide.**

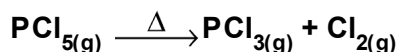
Nitric acid react with zinc oxide to produce zinc nitrate and water.



Magnesium react with nitric acid to produce nitrate magnesium and water.



**19. What happens when  $PCl_5$  is heated?**



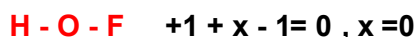
**20. Suggest a reason why HF is a weak acid, whereas binary acids of the all other halogens are strong acids.**

HF is the weakest acid because of it's strong H-F bond.

Fluorine being small in size overlaps better with 1s orbital of hydrogen leading to a strong bond.

Hence can not give proton easily. Here bond strength overweighs the electronegativity of F

**21. Deduce the oxidation number of oxygen in hypofluorous acid – HOF.**



The oxidation state of the oxygen in hypofluorites is 0.

It is also the only hypohalous acid that can be isolated as a solid.

**22. What type of hybridisation occur in a)  $BrF_5$  b)  $BrF_3$**

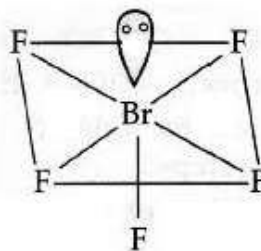
**b)  $BrF_5$**

**Valence electron 7+ bonding electron 5 = 12**

$$X = \frac{12}{2} = 6$$

**Hybridization :**  $sp^3d^2$

**Geometry:** Square Pyramidal



**b)  $BrF_3$**

**Valence electron 7+ bonding electron 3 = 10**

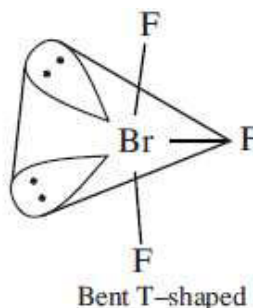
$$X = \frac{10}{2} = 5$$

**Hybridization:**  $sp^3d$

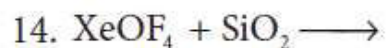
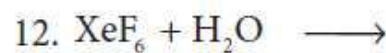
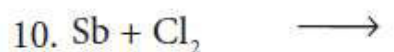
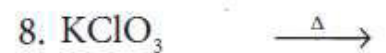
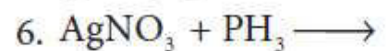
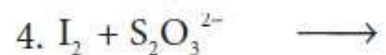
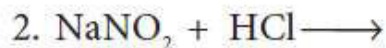
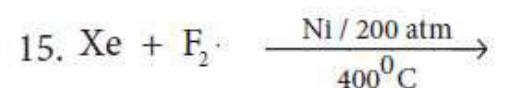
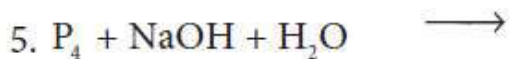
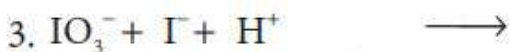
**Geometry:** Trigonal Bipyramidal

**Shape - T-shaped**

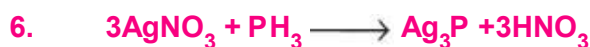
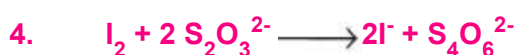
**lone pair - 2      bond pair - 3**



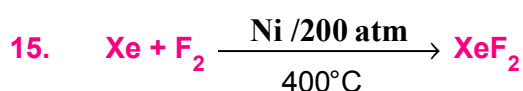
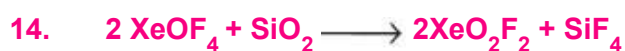
## 23. Complete the following reactions.



Ans:

If the acid is diluted we get  $\text{N}_2\text{O}$ 

(Hot Conc.)



WhatsApp