## P – BLOCK ELEMENTS II

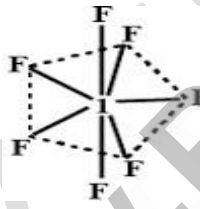
1. **Chalcogens belongs to p – block elements. Give reason.**
   - Elements belonging to group 16 are called chalcogens or ore forming elements as most of the ores are oxides or sulphides.
   - Their outer electronic configuration is $ns^2np^4$
   - In these elements the last electron enters in np orbitals
   - Hence, they belong to p – block elements

2. **Explain why fluorine always exhibit an oxidation state of –1.**
   Fluorine is the most electro negative element. By gaining an electron it attains the most stable inert gas configuration. So, fluorine always exhibit an oxidation state of –1.

3. **What are interhalogen compounds? Give examples.**
   Each halogen combines with other halogens to form a series of compounds called inter halogen compounds.
   Example: BrF, $IF_7$, IBr

4. **Give the uses of Helium.**
   - Used for filling air balloons
   - He – $O_2$ mixture is used by deep sea divers
   - Used in electric arc welding of metals

5. **What is the hybridization of iodine in $IF_7$? Give its structure.**
   - Hybridization is $sp^3d^3$
   - Structure is pentagonal bipyramidal




6. **Give the balanced equation for the reaction between chlorine with cold NaOH and Hot NaOH.**
   - With cold NaOH:
     $Cl_2 + 2NaOH \longrightarrow NaOCl + NaCl + H_2O$
   - With hot NaOH:
     $3Cl_2 + 6NaOH \longrightarrow NaClO_3 + 5NaCl + 3H_2O$

7. **How will you prepare chlorine in the laboratory.**
   $4NaCl + MnO_2 + 4H_2SO_4 \longrightarrow Cl_2 + MnCl_2 + 4NaHSO_4 + 2H_2O$

8. **Write the reason for the anomalous behaviour of Nitrogen.**
   - Small size
   - High electronegativity
   - High ionization energy
   - Non – availability of d- orbitals

**9. Give the uses of Argon.**

- It prevents the oxidation of hot filament and prolongs the life in filament bulbs
- It is used in radio valves and tubes

**10. Write the valence shell electronic configuration of group – 15 elements.**

General electronic configuration : $ns^2\ np^3$

| **Element** | **Valence shell electronic configuration** |
|---|---|
| Nitrogen | $2s^2\ 2p^3$ |
| Phosphorus | $3s^2\ 3p^3$ |
| Arsenic | $3d^{10}\ 4s^2\ 4p^3$ |
| Antimony | $4d^{10}\ 5s^2\ 5p^3$ |
| Bismuth | $4f^{14}\ 5d^{10}\ 6s^2\ 6p^3$ |

**11. Write the difference between white phosphorus and red phosphorus.**

| **S.No** | **White Phosphorus** | **Red phophorus** |
|---|---|---|
| 1 | Poisonous in nature | Not poisonous in nature |
| 2 | Shows phosphorescence | Do not show phophorescence |
| 3 | Garlic smell | No smell |
| 4 | Ignition temperature is very low | Does not ignite at low temperature |
| 5 | inflammable | No such action |
| 6 | Exist as discrete $P_4$ molecule | Exist as a chain of $P_4$ tetrahedral unit |
| 7 | Colourless but turns pale yellow on standing | Dark red colour |

**12. Give the uses of Nitrogen.**

- It is used for the manufacture of ammonia, nitric acid and calcium cyanamide.
- Liquid nitrogen is used for producing low temperature required in cryosurgery and in biological preservation.

**13. Give the preparation of Nitrogen.**

- Pure nitrogen gas can be obtained by the thermal decomposition of sodium azide about 575K.

$$2NaN_3 \longrightarrow 2Na + 3N_2$$

- It can also be obtained by oxidizing ammonia using bromine water.

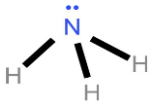
$$8NH_3 + 3Br_2 \longrightarrow 6NH_4Br + N_2$$

**14. Give the laboratory preparation of ammonia.**

- Ammonia is prepared in the laboratory by heating an ammonium salt with a base.

$$2NH_4Cl + CaO \longrightarrow CaCl_2 + 2NH_3 + H_2O$$

**15. Write notes on the structure of ammonia.**



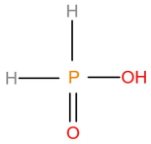
- Shape : Pyramidal
- Hybridisation: $sp^3$
- N – H bond distance: 1.016 A˚
- Bond angle: 107˚
- **Structure:** Tetrahedral with one lone pair of electrons in one tetrahedral position.

**16. Give the uses of Phosphorous.**

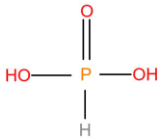
- The red phosphorous is used in the match boxes
- It is also used for the production of certain alloys such as phosphor bronze.

**17. Draw the structure of oxoacids of Phosphorous.**

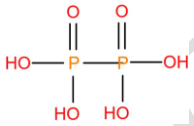
- **Hypophosphorous acid:** $H_3PO_2$



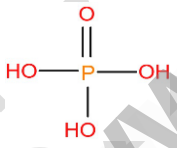
- **Orthophosphorous acid:** $H_3PO_3$



- **Hypophosphoric acid:** $H_4P_2O_6$

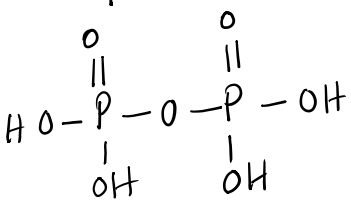


- **Orthophosphoric acid:** $H_3PO_4$



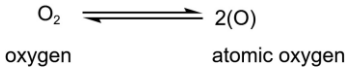
- Pyrophosphoric acid

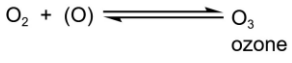
$H_4P_2O_7$



**18. Give the laboratory preparation of ozone.**

- Ozone is prepared by passing electrical discharge through oxygen.
- At a potential of 20,000 V about 10% of oxygen is converted into ozone. It gives a mixture known as ozonized oxygen.
- Pure ozone is obtained as a pale blue gas by fractional distillation of liquified ozonized oxygen.



**19. Write notes on the structure of ozone.**

- Ozone have bent shape and symmetrical with delocalized bonding between the oxygen atoms.

**20. How will you estimate ozone quantitatively?**

$$O_3 + 2KI + H_2O \longrightarrow 2KOH + O_2 + I_2$$

**21. Write the uses of oxygen.**

- It is one of the essential component for the survival of living organisms.
- It is used in welding
- Liquid oxygen is used as a fuel in rockets.

**22. Write notes on the Allotrophic forms of sulphur.**

- **Rhombic sulphur (α sulphur):**
  - It is thermodynamically stable allotropic form at ordinary temperature and pressure.
  - Crystals have yellow colour and composed of $S_8$ molecules.
  - When heated slowly above 96˚C, it converts into monoclinic sulphur.
  - Upon cooling below 96˚C the β form converts back to α form.
- **Monoclinic sulphur ( β sulphur):**
  - It also contains $S_8$ molecules in addition to small amount of $S_6$ molecules.
  - It exists as a long needle like prism and is also called as prismatic sulphur.
  - It is stable between 96˚ - 119˚C and slowly changes into rhombic sulphur.
- **Plastic sulphur:**
  - When molten sulphur is poured into cold water a yellow rubbery ribbon of plastic sulphur is produced.
  - They are very soft and can be stretched easily.
  - On standing, it slowly becomes hard and changes to stable rhombic sulphur.

**23. Write the uses of Sulphur dioxide.**

- It is used in bleaching hair, silk, wool.
- It can be used for disinfecting crops and plants in agriculture.

**24. Write notes on the structure of sulphur dioxide.**

- Sulphur atom undergoes $sp^2$ hybridisation.
- The double bond between S and O is due to pπ – dπ overlapping.

**25. Explain the manufacture of chlorine by electrolytic process.**

- **Electrolytic solution:** Brine (NaCl)
- When NaCl solution is electrolysed, $Na^+$ and $Cl^-$ are formed.

$$NaCl \longrightarrow Na^+ + Cl^-$$

$$H2O \longrightarrow H^+ + OH^-$$

$$Na^+ + OH^- \longrightarrow NaOH$$

- **At cathode:** $H^+ + e^- \longrightarrow H$

  $H + H \longrightarrow H_2$
- **At anode:** $Cl^- \longrightarrow Cl + e^-$

  $Cl + Cl \longrightarrow Cl_2$

**26. Write notes on Deacon's process.**

- Mixture of air and HCl is passed in a chamber containing number of shelves.
- Pumice stones soaked in cuprous chloride are placed.
- Hot gases at about 400˚C are passed through a jacket that surrounds the chamber.

$$4HCl + O_2 \xrightarrow[Cu_2Cl_2]{400^\circ C} 2H_2O + 2Cl_2 \uparrow$$

- The catalysed reaction is given below:

$$2Cu_2Cl_2 + O_2 \longrightarrow \underset{\text{Cuprous oxy chloride}}{2Cu_2OCl_2}$$

$$Cu_2OCl_2 + 2HCl \longrightarrow \underset{\text{Cupric chloride}}{2CuCl_2} + H_2O$$

$$2CuCl_2 \longrightarrow \underset{\text{Cuprous chloride}}{Cu_2Cl_2} + Cl_2$$

**27. Give the uses of chlorine.**

- It is used in
  - Purification of drinking water
  - Bleaching of cotton textiles, paper and rayon
  - Extraction of gold and platinum

**28. Give the uses of Radon.**

- It is used as a source of gamma rays
- Radon gas is sealed as small capsules and implanted in the body to destroy malignant cancer growth.

**29. Give the uses of Xenon.**

- It is used in fluorescent bulbs, flash bulbs and lasers
- It is used in high speed electronic flash bulbs used by photographers.

**30. Give the uses of krypton.**

- It is used in fluorescent bulbs, flash bulbs.
- Lamps filed with krypton are used in airports as approaching light.

**31. Give the oxidation state of halogen in the following.**

**a) $OF_2$ b) $O_2F_2$ c) $Cl_2O_3$ d) $I_2O_4$**

| Compound | Oxidation state of halogen |
|---|---|
| $OF_2$ | -1 |
| $O_2F_2$ | -1 |
| $Cl_2O_3$ | +3 |
| $I_2O_4$ | +4 |

**32. Why fluorine is more reactive than other halogens ?**

- This is due to the minimum value of F – F bond dissociation energy
- Fluorine is most electro negative thus it is most reactive.

**33. Give the uses of Sulphuric acid. ( any three)**

- It is used as a drying agent
- Used in the preparation of pigments, explosives
- Used in the manufacture of fertilisers, ammonium sulphates, super sulphates
- Used in the manufacture of chemicals like hydrochloric acid, nitric acid, etc.

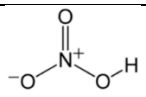
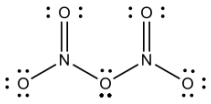
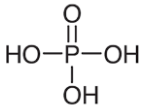
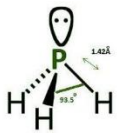
**34. Give a reason to support that sulphuric acid is a dehydrating agent.**

- It is highly soluble in water and has strong affinity towards water and hence it is used as a dehydrating agent.
- When dissolved in water it forms mono ( $H_2SO_4.H_2O$) and dihydrates ($H_2SO_4.2H_2O$) and the reaction exothermic.

$$HCOOH + H_2SO_4 \longrightarrow CO + H_2SO_4.H_2O$$

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

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

| Molecular formula | Structure |
|---|---|
| Nitric acid $HNO_3$ |  |
| Dinitrogen pentoxide $N_2O_5$ |  |
| Phosphoric acid $H_3PO_4$ |  |
| Phosphine $PH_3$ |  |

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

$$PH_3 + 4Cl_2 \longrightarrow PCl_5 + 3HCl$$

$$3AgNO_3 + PH_3 \longrightarrow Ag_3P + 3HNO_3$$

**37. Give the reaction between nitric acid and a basic oxide.**

$ZnO + 2HNO_3 \longrightarrow Zn(NO_3)_2 + H_2O$

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

$$PCl_5(g) \longrightarrow PCl_3(g) + \underset{\text{(Excess)}}{Cl_2(g)}.$$

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

- The relative acidic strength of HF, HCl, HBr and HI depends upon their bond dissociation enthalpies.
- The bond dissociation enthalpy of H – X bond decreases from H – F to H – I as the size of atom increases from F to I
- Larger the size of atom, higher is the acidity.
- H – F < H – Cl < H – Br < H – I

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

- The oxidation number of F in hypofluorous acid is +1 and Hydrogen is +1
- Hence , oxidation state of Oxygen is -2

1(H) + x +1( F) = 0
1 + x +1 = 0
2 + x = 0
X = -2

**41. What type of hybridization occur in**

a) **$BrF_5$** **b) $BrF_3$**

| Compound | Hybridisation |
|---|---|
| $BrF_5$ | $Sp^3d^2$ |
| $BrF_3$ | $Sp^3d$ |

**42. What is inert pair effect?**

In heavier post transition metals, the outer s electrons have a tendency to remain inert and do not take part in bonding. This is called inert pair effect.

**43. Discuss the structure of Phosphorus.**

- White phosphorus exists as discrete $P_4$ molecules.
- Red P have polymeric structure with chains of $P_4$ linked tetrahedrally.
- P – P single bond is stable than P ≡ P bonds

**44. What is Phosphorescence ?**

White Phosphorus undergoes spontaneous oxidation in air giving a greenish yellow glow which is visible in the dark. This is known as Phosphorescence.

**45. How will you prepare bleaching powder in the laboratory ?**

Bleaching powder is produced by passing chlorine gas through dry slaked lime ( calcium hydroxide.

$Ca(OH)_2 + Cl_2 \rightarrow CaOCl_2 + H_2O$

**46. Explain the bleaching property of chlorine.**

- Chlorine is a strong oxidizing and bleaching agent because of the nascent oxygen.

$H_2O + Cl_2 \rightarrow HCl + HOCl$

$HOCl \rightarrow HCl + (O)$

Colouring matter + Nascent oxygen → colourless oxidation product

**47. Explain the bleaching action of sulphur dioxide (SO2).**

- In presence of water, SO2 bleaches coloured wool, silk, sponges and straw into colourless due to its reducing property.

$$SO_2 + 2H_2O \longrightarrow H_2SO_4 + 2(H)$$

$$\underset{\text{Coloured}}{X} + 2(H) \longrightarrow \underset{\text{Colourless}}{XH_2}$$

**48. Give the action of HF with glass and silica.**

- Moist HF rapidly react with silica and glass.

$$SiO_2 + 4HF \longrightarrow SiF_4 + 2H_2O$$

$$Na_2SiO_3 + 6HF \longrightarrow Na_2SiF_6 + 3H_2O$$

**49. Write the properties of interhalogen compounds.**

- Central atom will be the larger one
- Formed only between two halogens
- Undergo auto oxidation
- Strong oxidizing agents
- Fluorine cannot act as a central metal atom being the smallest one.

**50. Complete the following reactions.**

1. $NaCl + MnO_2 + H_2SO_4 \longrightarrow ?$

$4NaCl + MnO_2 + 4H_2SO_4 \rightarrow Cl_2 + MnCl_2 + 4NaHSO_4 + 2H_2O$

2. $NaNO_2 + HCl \longrightarrow ?$

$NaNO_2 + HCl \rightarrow NaCl + HNO_2$

3. $P_4 + NaOH + H_2O \longrightarrow ?$

$P_4 + 3NaOH + 3H_2O \rightarrow 3NaH_2PO_2 + PH_3$

4. $AgNO_3 + PH_3 \longrightarrow ?$

$3AgNO_3 + PH_3 \rightarrow Ag_3P + 3HNO_3$

5. $Mg + HNO_3 \longrightarrow ?$

$4Mg + 10HNO_3 \rightarrow 4Mg(NO_3)_2 + NH_4NO_3 + 3H_2O$

6. $KClO_3 \xrightarrow{\Delta} ?$

$2KClO_3 \xrightarrow[MnO_2]{\Delta} 2KCl + 3O_2$

7. $Cu + \underset{H_2SO_4}{\text{hot conc.}} \longrightarrow ?$

$Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$

8. $Sb + Cl_2 \longrightarrow ?$

$2Sb + 3Cl_2 \longrightarrow 2SbCl_3$

9. $HBr + H_2SO_4 \longrightarrow ?$

$2HBr + H_2SO_4 \longrightarrow 2H_2O + Br_2 + SO_2$

10. $XeF_6 + H_2O \longrightarrow ?$

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

11. $XeO_6^{4-} + Mn^{2+} + H^+ \longrightarrow ?$

$5XeO_6^{4-} + 2Mn^{2+} + 14H^+ \longrightarrow 2MnO_4^- + 5XeO_3 + 7H_2O$

12. $XeOF_4 + SiO_2 \longrightarrow ?$

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

13. $Xe + F_2 \xrightarrow[400^\circ C]{Ni\ /\ 200\ atm} ?$

$Xe + 3F_2 \xrightarrow[400^\circ C]{Ni\ /\ 200\ atm} XeF_6$