3. P-BLOCK ELEMENTS – II

1.Define Inert pair effect.

- ✓ In P-block, the pair of S-electrons becomes chemical inert and do not take part in bonding.
- ✓ This is called as Inert pair effect.

2. Explain why Fluorine show -1 oxidation state ?

- ✓ Smaller in size
- ✓ High electro negativity and high electron affinity
- ✓ High electron charge density

3. Find the Oxidation states of the Halogen in the following

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

a) OF_2

(+2) + 2F = 0

F = - 2/2

F = -1

b) O_2F_2

(+1×2) + 2F = 0

2F = - 2

F = -2/2

= -1

c) Cl_2O_3

(-2×3) + 2Cl = 0

2Cl = 6

Cl = 6/2

= +3

d) I_2O_4

(-2×4) + 2I = 0

2I = 8

I = 8/2

= +4

4. What are inter halogens compounds. Give example.

- ✓ Each halogen reacts with another halogen to form inter halogens.
- ✓ Ex. BrF_3

5. Why Fluorine is more reactive than other halogens?

- ✓ F-F bond energy is very low
- ✓ Highly electro negativity

6. Give the uses of Helium.

- ✓ Helium – Oxygen mixture is used to prevent Bends during deep sea diving
- ✓ Helium is used in electric arc welding of metals
- ✓ Helium is used in Low temperature science
- ✓ Helium is used in filling Balloons

7. Find the Hybridisation of Iodine in IF_7 and its structure.

- ✓ Hybridization is $sp^3 d^3$
- ✓ Shape is Pentagonal bi-pyramidal.

8. Give the action of Chlorine with cold and hot NaOH.

- ✓ With Cold NaOH it give Sodium hypo chlorite

$$Cl_2 + 2NaOH \longrightarrow \underset{\text{sodium hypo chlorite}}{NaOCl} + NaCl + H_2O$$

- ✓ With Hot NaOH it give Sodium Chlorate

$$3Cl_2 + 6NaOH \longrightarrow \underset{\text{sodium chlorate}}{NaClO_3} + 5NaCl + 3H_2O$$

9. Give the Lab preparation of chlorine

- ✓ It is prepare by the action of HCl with Manganese dioxide.

$$MnO_2 + 4\ HCl \rightarrow MnCl_2 + 2\ H_2O + Cl_2$$

10. List the uses of Sulphuric acid.

- ✓ It is used to prepare Fertilizers and Nitric acid
- ✓ It is used to prepare pigments and explosives
- ✓ It is used as Drying agent

11. Show that Sulphuric acid is a good dehydrating agent

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

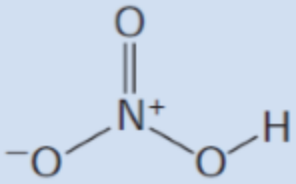
Formic acid

12. Give the structure and formula for the following

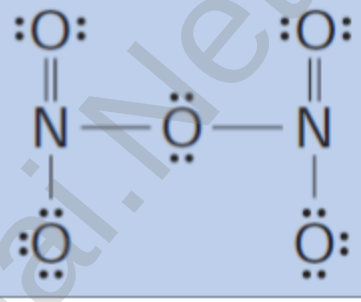
a) Nitric acid b) Dinitrogen Pentoxide c) Phosphoric acid d) Phosphine

e) Phosphours acid

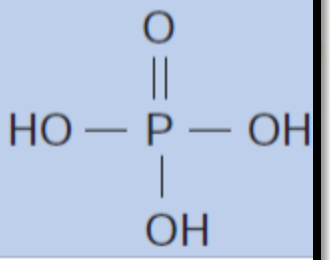
a) Nitric acid.

Nitric acid	HNO_3	

b) Dinitrogen Pentoxide

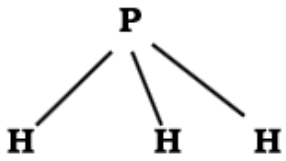
Nitrogen pentoxide	N_2O_5	

c) Phosphoric acid

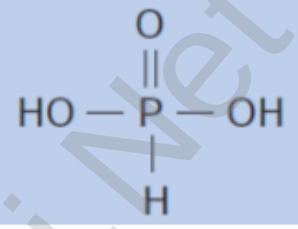
Orthophosphoric acid	H_3PO_4	

d) Phosphine

PH_3 - Pyramidal shape



e) Phosphours acid

Orthophosphrous acid	H_3PO_3	

13. List the uses of Argon.

- ✓ It prevent the oxidation of the hot filament and so it is used to increase the life of Bulbs.

14. What is the valence shell electronic configuration of the 15 th group?

- ✓ The General electronic configuration is $ns^2\ np^3$

N	P	As	Sb	Bi
$2S^2\ 2P^3$	$3S^2\ 3P^3$	$4S^2\ 4P^3$	$5S^2\ 5P^3$	$6S^2\ 6P^3$

15. Explain any 2 chemical properties of Phosphine.

a) Reducing property of Phosphine

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

b) Action of heat

$$4PH_3 \xrightarrow{317K} P_4 + 6H_2$$

16. Give the reaction between nitric and Basic oxides

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

17. Give the action of heat of PCl_5

- ✓ On heating PCl_5 gives PCl_3 and Cl_2

$$PCl_5 \rightarrow PCl_3 + Cl_2$$

18. Why HF is a weak acid but other acids are strong acids?

- ✓ Fluorine is highly electro negative and electron affinity
- ✓ H-F bond energy is very high. So difficult to break

19. Explain the oxidizing property of Sulphur Dioxide

$$2Mg + SO_2 \rightarrow 2MgO + S$$

20. Find the Hybridisation of the following

a) XeF_2 b) XeF_4 c) XeF_6 d) $XeOF_2$ e) $XeOF_4$ f) XeO_3

Compound	Hybridization	Shape/ Structure
XeF_2	sp^3d	Linear
XeF_4	sp^3d^2	Square planar
XeF_6	sp^3d^3	Distorted octahedron
$XeOF_2$	sp^3d	T Shaped
$XeOF_4$	sp^3d^2	Square pyramidal
XeO_3	sp^3d^3	Pyramidal

21. Explain the Haber's process of Ammonia

- ✓ Direct reaction with hydrogen gives ammonia.
- ✓ This reaction is favoured by high pressures and at optimum temperature in presence of iron catalyst.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

22. List the uses of Nitrogen

- ✓ It is used to prepare Ammonia and Nitric acid
- ✓ Liquid nitrogen is used in Biological preservation

23. Give the preparation of Ammonia from Urea

- ✓ Ammonia is formed by the hydrolysis of urea.

$$NH_2CONH_2 + H_2O \rightarrow 2NH_3 + CO_2$$

24. Explain the reducing property of Ammonia

$$3PbO + 2NH_3 \rightarrow 3Pb + N_2 + 3H_2O$$

25. Give the commercial preparation of Nitric acid by Ostwald's process.

Step I:

- ✓ The temperature rises to about 1275 K and the metallic gauze brings about the rapid catalytic oxidation of ammonia resulting in the formation of NO
- ✓ NO, which then oxidised to nitrogen dioxide.

$$4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O + 120\ kJ$$

$$2NO + O_2 \longrightarrow 2NO_2$$

Step II:

- ✓ The nitrogen dioxide produced is passed through a series of adsorption towers.
- ✓ It reacts with water to give nitric acid.

$$6NO_2 + 3H_2O \longrightarrow 4HNO_3 + 2NO + H_2O$$

26. Show that Nitric acid is a good Oxidizing agent

$$HNO_3 + F_2 \rightarrow HF + NO_3F$$

27. Show that Nitric acid is a good Nitrating agent

$$C_6H_6 + HNO_3 \xrightarrow{H_2SO_4} C_6H_5NO_2 + H_2O$$

28. What is Phosphorescence ?

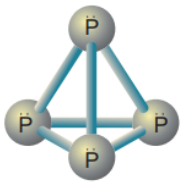
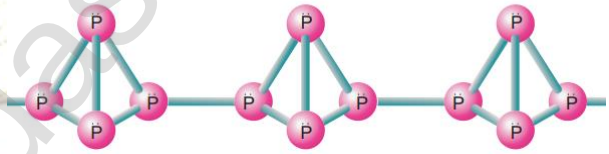
- ✓ Phosphorus glows in the dark due to oxidation.
- ✓ This is called as Phosphorescence.

29. Give the preparation of Phosphine

- ✓ When sodium hydroxide reacts with Phosphorus it gives Phosphine

$$P_4 + 3NaOH + 3H_2O \longrightarrow \underset{\text{sodium hypo phosphite}}{3NaH_2PO_2} + \underset{\text{Phosphine}}{PH_3}\uparrow$$

30. Compare the allotropic forms of Phosphorous.

S.No	**White Phosphorous**	**Red Phosphorous**
1	White phosphorous is converted to red phosphorous by heating at 420^0 C in the absence of air and light	Red phosphorous is converted to white phosphorous by boiling in a inert atmosphere and condensing the vapours in water.
2	It is poisonous	It is non poisonous
3	It has a Garlic smell	It has no smell
4	It glow in the dark due to Phosphorescence	No phosphorescence
5	Its ignition temperature is very low.	Its ignition temperature is very high
6	It spontaneously gets combusted.	No spontaneous combustion
7	It has a tetrahedral structure.	It has a linear polymeric Structure
8		

31. List the uses of Phosphorus

- ✓ It is used to prepare match boxes
- ✓ It is used to prepare alloys like Phosphorus Bronze

32. Give the action of heat of Phosphoric acid (or) Prepare Phosphine from Phosphoric acid

$$\underset{\text{Phosphorous acid}}{4H_3PO_3} \xrightarrow{\Delta} \underset{\text{Ortho phosphoric acid}}{3H_3PO_4} + \underset{\text{Phosphine}}{PH_3}\uparrow$$

33. Give the preparation of Ortho Phosphoric acid (or) action of Phosphorus with nitric acid

$$P_4 + 20HNO_3 \longrightarrow \underset{\text{Ortho phosphoric acid}}{4H_3PO_4} + 20NO_2 + 4H_2O$$

34. Explain Holmes signal

- ✓ Chemical used : calcium carbide and calcium phosphide
- ✓ Chemicals formed : Phosphine and Acetylene
- ✓ Phosphine and Acetylene catches fire.
- ✓ This will act as a signal for the approaching ships.

35. Give the action of PCl_5 with Ethanol and carboxylic acid.

$$C_2H_5OH + PCl_5 \longrightarrow C_2H_5Cl + HCl + POCl_3$$
$$C_2H_5COOH + PCl_5 \longrightarrow C_2H_5COCl + HCl + POCl_3$$

36. Give the preparation of Oxygen

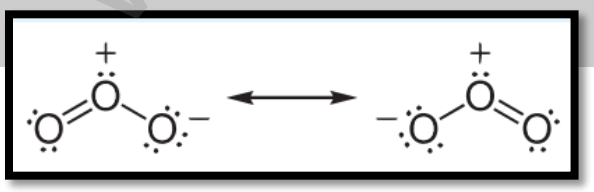
$$2HgO \xrightarrow{\Delta} 2Hg + O_2$$
$$2BaO_2 \xrightarrow{\Delta} 2BaO + O_2$$
$$2KClO_3 \xrightarrow[MnO_2]{\Delta} 2KCl + 3O_2$$
$$2KNO_3 \xrightarrow{\Delta} 2KNO_2 + O_2$$

37. Give the lab preparation of Ozone (or) What is called ozonized oxygen?

- ✓ It is prepared by passing electric discharge through Oxygen at 20,000V.
- ✓ 10% of Oxygen is converted into ozone.
- ✓ This mixture is called as Ozonised oxygen.
- ✓ Pure ozone is separated by Fractional distillation

$$O_2 \rightleftharpoons 2(O)$$
Oxygen — atomic oxygen
$$O_2 + (O) \rightleftharpoons O_3$$
Ozone

38. Explain the structure of Ozone



(Bend shape)

39. Prove Ozone is good oxidizing agent (Or) How Ozone is estimated (or) Action of Ozone with KI solution.

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

40. List the uses of Oxygen

- ✓ Oxygen gas used in welding
- ✓ Oxygen gas used for survival of living organism
- ✓ Liquid oxygen used for Rocket Fuel

41. Explain the reducing property of sulphur dioxide.

$$SO_2 + 2H_2O + Cl_2 \longrightarrow H_2SO_4 + 2HCl$$

42. Explain the Bleaching action of Sulphur Dioxide

- ✓ Due to its reducing property, it bleaches wool and silk into Colourless

$$SO_2 + 2H_2O \longrightarrow 2\,H_2SO_4 + 2(H)$$
$$\underset{\text{Coloured}}{X} + 2(H) \longrightarrow \underset{\text{Colourless}}{XH_2}$$

43. List the uses of Sulphur Dioxide.

- ✓ Used for Bleaching wool, silk and hair
- ✓ Used for Disinfecting plants in agriculture

44. Give the preparation of Bleaching powder

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

45. Give the preparation of Sulphuric acid by Contact process.

- ✓ It is prepared in 3 steps

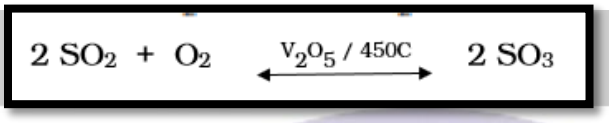
Step I:

- ✓ Initially sulphur dioxide is produced by burning sulphur in oxygen/air

$$S + O_2 \rightarrow SO_2$$

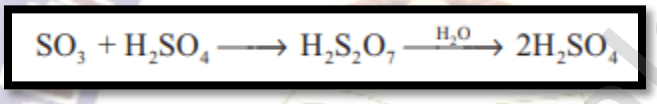
Step II:

- ✓ Sulphur dioxide formed is oxidised to sulphur trioxide by air in the presence of a catalyst such as V_2O_5



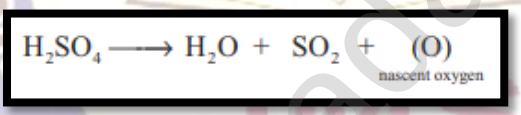
Step III:

- ✓ The sulphur trioxide is absorbed in concentrated sulphuric acid and produces oleum ($H_2S_2O_7$).
- ✓ The oleum is converted into sulphuric acid by diluting it with water.

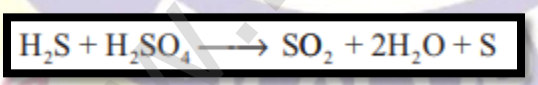


46. Explain the oxidizing property of Sulphuric acid.

- ✓ Sulphuric acid is an oxidising agent as it produces nascent oxygen

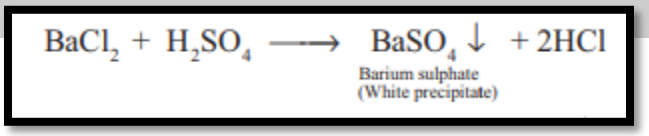


- ✓ Sulphuric acid oxidises elements



47. Give the test for Sulphates or Sulphuric acid.

- ✓ Dilute solution of sulphuric acid/aqueous solution of sulphates gives white precipitate with barium chloride solution.



- ✓ It can also be detected using lead acetate solution

$$(CH_3COO)_2Pb + H_2SO_4 \longrightarrow \underset{\text{Lead sulphate (White precipitate)}}{PbSO_4\downarrow} + 2CH3COOH$$

48. Give the action of Chlorine with Turpentine (or) Affinity for hydrogen.

$$C_{10}H_{16} + 8Cl_2 \longrightarrow 10C + 16HCl$$

49. Give the preparation of chlorine by the electrolysis of Brine solution

- ✓ When a solution of brine (NaCl) is electrolysed, Na^+ and Cl^- ions are formed.
- ✓ Na^+ ion reacts with OH^- ions of water and forms sodium hydroxide.

$$NaCl \longrightarrow Na^+ + Cl^-$$
$$H_2O \longrightarrow H^+ + OH^-$$
$$Na^+ + OH^- \longrightarrow NaOH$$

- ➢ At the Cathode,

$$H^+ + e^- \longrightarrow H$$
$$H + H \longrightarrow H_2$$

- ➢ At the Anode,

$$Cl^- \longrightarrow Cl + e^-$$
$$Cl + Cl \longrightarrow Cl_2$$

50. List the uses of chlorine

- ✓ Purification of Drinking water
- ✓ Bleaching paper and cotton
- ✓ Extraction of Gold and Platinum

51. Explain the Bleaching nature of chlorine

- ✓ Chlorine is a bleaching agent because of the nascent oxygen.

$$H_2O + Cl_2 \longrightarrow HCl + \underset{\text{Hypo chlorous acid}}{HOCl}$$

$$HOCl \longrightarrow HCl + (O)$$

Colouring matter + Nascent oxygen → Colourless oxidation product

52. Define Royal water or Aqua regia. Give its uses.

- ✓ 3:1 ratio of Conc. HCl and Conc. nitric acid is called as Royal water.
- ✓ It is used to dissolve gold

$$Au + 4H^+ + NO_3^- + 4\,Cl^- \longrightarrow AuCl_4^- + NO + 2H_2O$$

53. List the uses of Hydrochloric acid

- ✓ Prepare chlorine and ammonium chloride
- ✓ Purification of bone black
- ✓ Extraction of Glue from bones
- ✓ Used to prepare Glucose from Starch.

54. Give the action of HF with Glass and silica

- ✓ HF acid cannot be stored in glass containers.
- ✓ Because it reacts with Silica and glass

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

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

55. List the properties of Inter halogens compounds.

- ✓ The central atom must be large
- ✓ Formed between two halogens not more than two.
- ✓ Since Fluorine is smaller in size, it cannot be a central atom.
- ✓ Since Fluorine is smaller in size, it has high Coordination number
- ✓ They are strong oxidizing agents
- ✓ They undergo Auto ionizations

56. List the uses of Krypton.

- ✓ Used in Flash bulbs
- ✓ Krypton lamps pass through dense fog so used in Airports

57. List the uses of Radon.

- ✓ Used as source for Gamma rays
- ✓ Radon capsules – destroy cancer cells

58. List the uses of Xenon.

- ✓ Used in Flashbulbs and Lasers
- ✓ Used in Flash bulbs by Photographers

59. List the used of Neon.

- ✓ Used in Adds as Neon signs with brilliant red colour.

60. Why nobles gases have large Ionization energy.

- ✓ They have fully filled stable np^6 electronic configuration.
- ✓ Rare to remove electron from outer most subshell.

61. Explain the Oxidizing property of chlorine

- ✓ It oxidises ferrous salts to ferric

$$2FeSO_4 + H_2SO_4 + Cl_2 \longrightarrow Fe_2(SO_4)_3 + 2HCl$$

62. Prove HI is strong reducing agent.

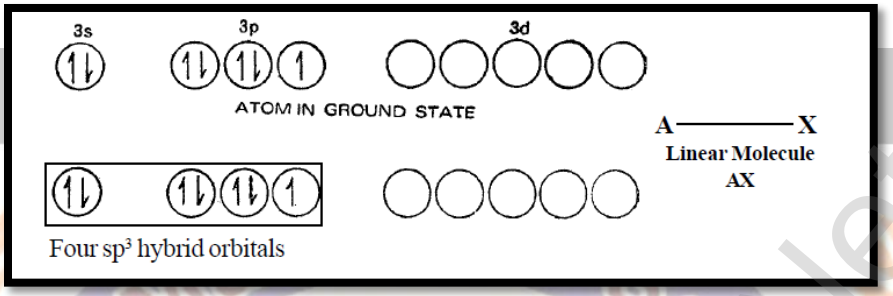
- ✓ Hydrogen iodide rapidly reduced by H_2SO_4 into H_2S and not into SO_2 .

$$8HI + H_2SO_4 \longrightarrow 4H_2O + 4I_2 + H_2S$$

63. Give a detailed account of the interhalogen compounds. Draw their structures.

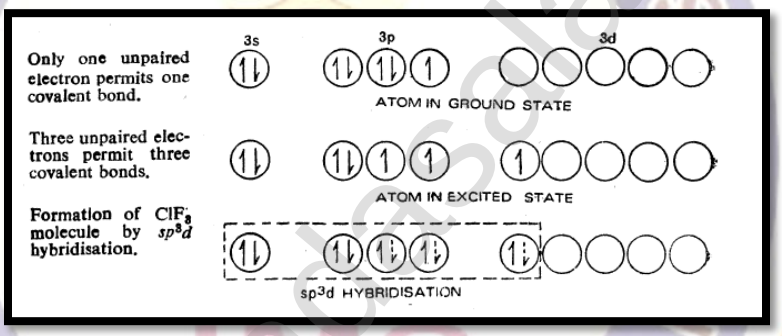
1. Type AX.

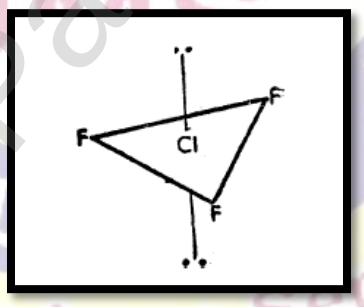
- ✓ As excepted, the compounds of the type AX are linear.
- ✓ Thus IBr and ICI are all **linear** in structure.



2. Type AX_3

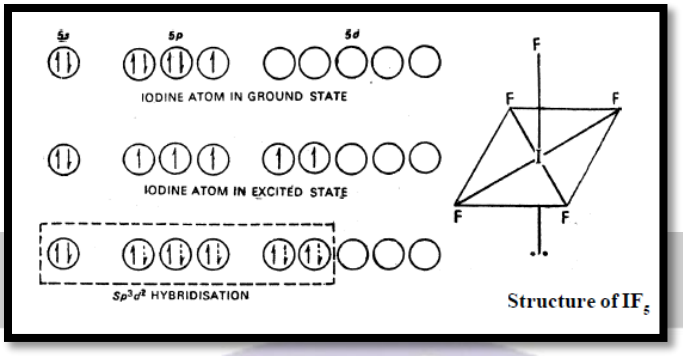
- ✓ Compounds of the type AX_3 have trigonal bipyramidal structure
- ✓ without lone pair it is T-shaped





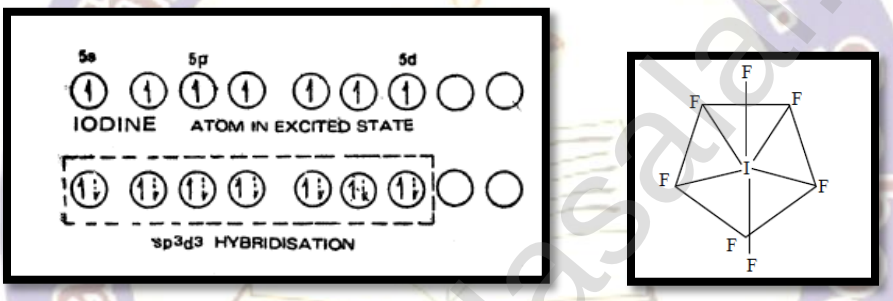
3. Type AX_5

- ✓ These compounds are formed by sp^3d^2 hybridisation and hence have an **octahedral** structure
- ✓ without lone pair it is square pyramidal



4. **Type AX_7**

✓ This compound has a pentagonalbipyramidal structure since this is formed by $sp^3 d^3$ hybridisation.



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Subject : Chemistry

Unit : 3. P-block elements – II