Chapter 7- p block elements

LEVEL-1 QUESTIONS

- 1. NH₃ has higher boiling point than phosphine. Why?
- Ans—Ammonia is a polar molecule it form in-termolecular hydrogen bonding.

2. Why BiH₃ the strongest reducing agent amongst all the hydrides of group 15 elements ?

Ans- Less B.E or longer bond length.

3. Why H₂S is acidic and H₂S is neutral ?

Ans-The S---H bond is weaker than O---H bond because the size of S atomis bigger than that of O

atom . Hence H_2S can dissociate to give H^+ lons in aqueous solution .

4. Name two poisonous gases which can be prepared from chlorine gas ? Ans- Phosgene (COCl₂), tear gas (CCl₃NO₂)

5. Name the halogen which does not exhibit positive oxidation state . Ans- Flourine being the most electronegative element does not show positive oxidation state .

6. Iodine forms I^{3⁻} but F² does not form F^{3⁻} ions .why?

Ans- Due to the presence of vacant D-orbitals , I_2 accepts electrons from I-ions to form I3ions , but because of d-orbitals F_2 does not accept electrons from F-ions to form F_3 ions.

7. Draw the structure of peroxosulphuric acid .



8. Phosphorous forms PCl5 but nitrogen cannot form NCl5. Why? Ans- Due to the availability of vacant d-orbital in p.

9. Give reasons for the following:

(i) Conc.HNO₃ turns yellow on exposure to sunlight.

(ii) PCl₅ behaves as an ionic species in solid state.

Ans- (i)Conc HNO₃ decompose to NO₂ which is brown in colour & NO₂ dissolves in HNO₃ to it yellow.

(ii)It exists as [PCl4]⁺[PCl6]⁻ in solid state.

10. How is ozone estimated quantitatively?

Ans- When ozone reacts with an excess of potassium iodide solution

Buffered with a borate buffer (Ph9.2), Iodide is liberated which can be titrated against a standard solution of sodium thiosulphate. This is a quantitative method for estimating O₃gas.

11. Are all the five bonds in PCl₅ molecule equivalent? Justify your answer.

Ans- PCl5 has a trigonal bipyramidal structure and the three equatorial P-Cl bonds are equivalent, while the two axial bonds are different and longer than equatorial bonds.

12. NO2 is coloured and readily dimerises Why ?

Ans- NO2 contains odd number of valence electrons. It behaves as a typical odd molecules On dimerization; it is converted to stable N_20_4 molecule with even number of electrons.

13. Account for the following.

(i)SF₆ is less reactive than.

(ii) Of the noble gases only xenon chemical compounds.

Ans- (i)In SF₆ there is less repulsion between F atoms than In SF₄.
(ii)Xe has low ionisation enthalpy & high polarising power due to larger atomic size.

14. With what neutral molecule is ClO⁻ Isoelectronic? Is that molecule a Lewis base?

ClF .Yes, it is Lewis base due to presence of lone pair of electron.

15.(i) why is He used in diving apparatus?

(ii)Noble gases have very low boiling points.Why? (iii)Why is ICl moe reactive than I₂?

Ans- (i)It is not soluble in blood even under high pressure.

(ii)Being monoatomic they have weak dispersion forces.

(iii)I-Cl bond is weaker than l-l bond

16. Account for the following.

(i)Noble gas form compounds with F2&O2 only.

(ii)Sulphur shows paramagnetic behavior.

(iii)HF is much less volatile than HCl.

(iv)White phosphorous is kept under water.

(v)Ammonia is a stronger base than phosphine.

Ans- (i)F₂&O₂ are best oxidizing agents.

(ii)In vapour state sulphur partly exists as S_2 molecule which has two unpaired electrons in the antibonding pi *orbitals like O_2 and, hence, exhibit paramagnetism.

(iii)HF is associated with intermolecular H bonding.

(iv) Ignition temperature of white phosphorous is very low (303 K). Therefore on explosure to air, it

spontaneously catches fire forming P₄O₁₀. Therefore to protect it from air, it is kept under water. (v)Due to the smaller size of N, lone pair of electrons is readily available.

16. Arrange the following in the increasing order of the property mentioned.

(i)HOCl, HClO₂, HClO₃, HClO₄ (Acidic strength)

(ii)As₂O₃, ClO₂, GeO₃, Ga2O₃ (Acidity)

(iii)NH3, PH3, AsH3, SbH3 (HEH bond angle)

(iv)HF, HCl, HBr, HI (Acidic strength)

(v)MF, MCl, MBr, MI (ionic character)

Ans- (i)Acidic strength: HOCl<HClO₂<HClO₃<HClO₄

(ii)Acidity: Ga₂O₃<GeO₂<AsO₃<CIO₂

(iii)Bond angle: SbH3<AsH3<PH3<NH3

(iv)Acidic strength: HF<HCl<HBr<HI

(v)Ionic character: MI<MBr<MCl<MF

LEVEL-2 QUESTIONS

1 Draw the structure of following compounds-

a) N2O, NO, N2O3 NO2 and N2O5.

b) Oxoacides of Phosphorous, Sulphur and chlorine

c) Compounds of Xenon

Ans- a)



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Fig. 7.4 Structures of some

B)

c)



2. What happens when white P is heated with conc.NaOH solution in an atmosphere of CO₂? Give equation.

Ans- Phosphorus gas will be formed. P₄+3NaOH+3H₂O→PH₃+3NaH₂PO₂

3. Give example of a molecule having geometry T- shaped. Ans- Br Cl₃ (lp=2 and bp=3)



4. Write the balanced chemical equation for the reaction of Cl2 with hot and concentrated NaOH .Is this reaction a dispropotionation reaction? Justify: 3Cl2+6NaOH→5NaCl+NaClO3+3H2O

5. Why is HF acid stored in wax coated glass bottles? Ans- This is because HF does not attack wax but reacts with glass.It dissolves SiO2 present in glass forming hydrofluorosilicic acid. SiO_{2 +}6HF→H₂SiF₆+2H₂O

6. What is laughing gas? Why is it so called? How is it prepared? Ans- Nitrous oxide (N₂O) is called laughing gas, because when inhaled it produced hysterical laughter. It is prepared by gently heating ammonium nitrate.

 $NH_4NO_3 \rightarrow N_2O+2H_2O$

LEVEL-3 QUESTIONS

1. A translucent white waxy solid (A) on heating in inert atmosphere is converted to its allotropic form (B). Allotrope (A) on reaction with very dilute aqueous KOH liberates a highly poisonous gas (C) having rotten fish smell. With excess of chlorine it forms (D) which hydrolyses to compound (E). Identify compounds (A) to (E).

Ans: A= White phosphorus B= Red phosphorous C= Phosphine

D= **Phophoruspentachloride E**= **Phosphoric acid.**

2. When conc. H₂SO₄ was added into an unknown salt present in a test tube, a brown gas (A) was evolved. This gas intensified when copper turnings were also added into this test tube. On cooling, the gas (A) changed into colorless gas (B).

a. Identify the gases A and B.

b. Write the equations for the reactions involved Ans- a) $MNO_3 + H_2SO_4 \longrightarrow MHSO_4 + HNO_3$ $4HNO_3 \longrightarrow 2H_2O + O_2$ $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$ $2NO_2 N_2O_4 \longrightarrow$

3. A colorless inorganic salt A decomposes at about 250 C to give only two produces B and C leaving no residue. The oxide C is a liquid at room temperature and is neutral to litmus paper while B is neutral oxide. White phosphorus burns in excess of B to produce Strong dehydrating agent. Give balanced equations for above processes.

Ans: $A = NH_4NO_3$ $B = N_2O$ $C = H_2O$ Reactions involved: $NH_4NO_3 \longrightarrow N_2O + 2H_2O$ $10N_2O + P_4 \longrightarrow 10 N_2 + P_4O_{10}$

4. On heating lead (II) nitrate gives a brown gas "A". The gas "A" on cooling changes to colorless solid "B". Solid "B" on heating with NO changes to a blue Solid "C". Identify "A", "B" and "C".

Ans: 2Pb $(NO_3)_2 \longrightarrow 2PbO + NO_2 + O_2$ $2NO_2 \longrightarrow N_2O_4$ (on cooling) $2NO + N_2O_4 \longrightarrow 2N_2O_3$ $A=NO_2 B=N_2O_4$ and $C=2N_2O_3$

5.An amorphous solid "A" burns in air to form a gas "B" which turns lime water milky. The gas is also produced as a by-product during roasting of sulhpide ore. This gas decolorizes acidified aqueous KMnO₄ solution and reduces Fe² and Fe³. Identify the solid "A" and the gas "B".

Ans: $A=S_8$ $B=SO_2$ $S_8 + 8O_2 \longrightarrow 8 SO_2$ $2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$

6.Why does PCl₃ fume in moisture ? Ans- In the presence of (H₂O) , PCl₃ undergoes hydrolysis giving fumes of HCl ie, PCl₃ + 3H₂O→ H₃PO₃ + 3HCl

7.What Happens when H₃PO₃ is Heated ? Ans- It disproportionate to give orthophosphoric acid and Phosphine . 4H₃PO₃ → 3H₃PO₄ + PH₃

8. When Conc. H₂SO₄ was added to an unknown salt present in a test tube, a brown gas (A) was evolved. This gas intensified when copper turnings were added in to test tube. On cooling gas (A) changed in to a colourless gas (B).
(a)Identify the gases 'A' and 'B'
(b)Write the equations for the reactions involved
Ans- The gas 'A' is NO₂ whereas 'B' is N₂O₄.
XNO₃ + H₂SO₄→XHSO₄ + HNO₃
Salt (conc.)
Cu + 4HNO₃ (Conc.) → Cu (NO₃)₂ + 2NO₂ + 2H₂O
Blue Brown (A)
2NO₂ (on cooling) → N₂O₄

9. Complete the following equations.

(i)XeF4+H2O→
(ii)Ca3P2+H2O→
(iii)AgCl_(s) +NH3 (aq)→

Ans- (i) 6XeF4+12H2O→4Xe+2XeO3+24HF+3O2

(ii)Ca2P2+6H2O→3Ca (OH) 2+2PH3
(iii)AgCl_(s) +2NH3 (aq)→[Ag(NH3)2]Cl_(aq)

10. (i)How is XeOF4 prepared ?Draw its structure.

(ii)When HCl reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride

Why?

Ans- (i)Partial hydrolysis of XeOF₄

XeF₆+H₂O→XeOF₄+2HF

Structure-square pyramidal. See Fig7.9

(ii) Its reaction with iron produces h2

Fe+2HCl→FeCl₂+H₂

Liberation of hydrogen prevents the formation of ferric chloride.