Chapter_07

p-Block Elements

Practice Questions

1. Chile saltpetre is the common name of
(a) $AgNO_3$ *(b)* $NaNO_3$
(c) $NaSO_4$ *(d)* AgCl

2. The common oxidation states of group 15 elements are
(a) + 3 and + 5 *(b)* − 3 and − 5
(c) − 5 and + 5 *(d)* − 3, + 3 and + 5

3. Nitrogen lacks *d*-orbital in its valence shell and hence, it cannot
(a) exhibit orbital hybridisation
(b) exhibit the oxidation state of + 5
(c) forms oxides with oxidation state greater than +3
(d) have covalency greater than three

4. Which of the following hydrides has the lowest boiling point?
(a) PH_3 *(b)* AsH_3
(c) SbH_3 *(d)* NH_3

5. Extra pure N_2 can be obtained by thermal decomposition of
(a) NH_3 with CuO *(b)* NH_4NO_3
(c) $(NH_4)_2Cr_2O_7$ *(d)* $Ba(N_3)_2$

6. Which of the following are the applications of dinitrogen gas?
(a) Preservation of biological materials and food items
(b) Production of inert atmosphere in copper and steel industry
(c) In the preparation of explosives
(d) Etching of metals

7. On heating HNO_3 with P_4O_{10}, the oxide of nitrogen produced is
(a) NO_2 *(b)* N_2O_5 *(c)* N_2O_4 *(d)* N_2O_3

8. Red phosphorus is less reactive, less volatile and less soluble in non-polar solvent than white/yellow phosphorus because
(a) it has high molecular energy
(b) it has low molecular energy
(c) it forms condensation products
(d) it possesses highly polymerised structures

9. PH_3 produces smoky rings when it comes in contact with air because
(a) PH_3 reacts with water vapours
(b) PH_3 reacts with N_2
(c) PH_3 burns in air
(d) PH_3 contains impurities of P_2H_4

10. Among the following, the number of compounds that can react with PCl_5 to give $POCl_3$ is
I. O_2 II. CO_2 III. CH_3COOH IV. H_2O
V. C_2H_5OH VI. P_4O_{10}
(a) 1 *(b)* 2 *(c)* 3 *(d)* 4

11. The compound that cannot act both as oxidising and reducing agent is
(a) H_2SO_3 *(b)* H_3PO_4
(c) HNO_2 *(d)* H_2O_2

12. Sulphur exhibits valencies of 2, 4 and 6, whereas oxygen has a valency of 2 due to
(a) being less electronegative than S
(b) presence of *d*-orbitals in S
(c) S is bigger atom
(d) S has higher ionisation potential

13. All the hydrides (of group 16 elements) except one possess reducing property. Identity the hydride
(a) H_2Se *(b)* H_2O
(c) H_2S *(d)* H_2Te

14. Tetrafluorides of elements of group-16 have hybridisation and structure respectively are
(a) sp^3 and trigonal pyramidal
(b) sp^3d and tetrahedral
(c) sp^3d and trigonal bipyramidal
(d) sp^3d and tetrahedral

15. Water is much less volatile than H_2S because
(a) H_2O has a bond angle of nearly 150°
(b) hydrogen is loosely bonded with the sulphur
(c) S-atom is less electronegative than O-atom
(d) S-atom is more electronegative than O-atom

16. Which of the following oxides is amphoteric in nature?
(a) Cl_2O_7 *(b)* Na_2O
(c) N_2O *(d)* Al_2O_3

17. Angular shape of ozone molecule consists of
(a) 1σ-bond and 1π-bond *(b)* 2σ-bond and 2π-bonds
(c) 1σ-bond and 2π-bonds *(d)* 2σ-bond and 1π-bond

18. The industrial preparation of SO_2 is
(a) $S(s) + O_2(g) \longrightarrow SO_2(g)$
(b) $SO_3^{2-}(aq) + 2H^+(aq) \longrightarrow H_2O(l) + SO_2(g)$
(c) $4FeS_2(s) + 11O_2(g) \longrightarrow 2Fe_2O_3(s) + 8SO_2(g)$
(d) All of the above

19. Peroxoacids of sulphur are
(a) $H_2S_2O_8$ and H_2SO_5
(b) $H_2S_2O_8$ and $H_2S_2O_7$
(c) $H_2S_2O_7$ and $H_2S_2O_6$
(d) H_2SO_5 and $H_2S_2O_7$

20. H_2SO_4 is used in
(a) petroleum refining
(b) manufacture of paints, pigments and dyestuff intermediates
(c) detergent industry
(d) All of the above

21. The anomalous behaviour of fluorine is due to
(a) its small size
(b) its highest electronegativity
(c) low F—F bond dissociation enthalpy and non-availability of *d*-orbitals in valence shell
(d) All of the above

22. Correct order of bond dissociation energy is
(a) $Br_2 > Cl_2$ *(b)* $F_2 > Cl_2$ *(c)* $I_2 > F_2$ *(d)* $F_2 > I_2$

23. HCl gas can be dried by passing through
(a) conc. H_2SO_4 *(b)* dil. H_2SO_4
(c) conc. HNO_3 *(d)* dil. HNO_3

24. The first noble gas compound obtained was
(a) $Xe^+PtF_6^-$ *(b)* XeF_4
(c) XeF_2 *(d)* $XeOF_4$

25. Among XeO_3, XeO_4 and XeF_6, the molecules having same number of lone pairs on Xe are
(a) XeO_3 and XeO_4
(b) XeO_3 and XeF_6
(c) XeO_4 and XeF_6
(d) XeO_3, $XeOF_4$ and XeF_6

ANSWERS

1. (b)	**2.** (d)	**3.** (b)	**4.** (a)	**5.** (d)	**6.** (a)	**7.** (b)	**8.** (d)	**9.** (d)	**10.** (d)
11. (b)	**12.** (b)	**13.** (b)	**14.** (c)	**15.** (c)	**16.** (d)	**17.** (d)	**18.** (c)	**19.** (a)	**20.** (d)
21. (d)	**22.** (d)	**23.** (a)	**24.** (a)	**25.** (d)					

Hints & Solutions

4. (*a*) PH_3 has the lowest boiling point because boiling point increases with increase in size of central atom and NH_3 has more boiling point than that of PH_3 due to hydrogen bonding.

5. (*d*) Extra pure N_2 can be obtained by thermal decomposition of barium azide as follows :

$$Ba(N_3)_2 \xrightarrow{\text{Heat}} Ba(s) + 3N_2(g)$$

As the decomposed product of $Ba(N_3)_2$ contain solid Ba as by-product alongwith gaseous nitrogen, hence no additional step of separation is required.

6. (*a*) Liquid N_2 is used as refrigerant to preserve biological materials, food items and in cryosurgery.

It also finds use where an inert atmosphere is required (e.g. in iron and steel industry, inert diluent for reactive chemicals).

7 (*b*) On heating HNO_3 with P_4O_{10}, the oxide of nitrogen produced is N_2O_5.

The reaction is given below :

$$2HNO_3 + P_2O_5 \longrightarrow \underset{\text{(Dinitrogen pentaoxide)}}{N_2O_5} + \underset{\text{(Metaphosphoric acid)}}{2HPO_3}$$

9. (*d*) PH_3 produces smoky rings when it comes in contact with air because PH_3 contains impurities of P_2H_4 which undergoes spontaneous combustion.

10. (*d*) Among the given compounds, the four compounds, i.e. CH_3COOH, H_2O, C_2H_5OH and P_4O_{10} can react with PCl_5 to give $POCl_3$. The reactions are given as below :

$$PCl_5 + CH_3COOH \longrightarrow CH_3COCl + POCl_3 + HCl$$
$$PCl_5 + H_2O \longrightarrow POCl_3 + 2HCl$$
$$PCl_5 + C_2H_5OH \longrightarrow POCl_3 + C_2H_5Cl + HCl$$
$$6PCl_5 + P_4O_{10} \longrightarrow 10POCl_3$$

11. (*b*) In H_3PO_4, P is in its highest oxidation state (+5), it can only act as oxidising agent but not as reducing agents, because it can be reduced but not oxidised.

H_2SO_3: S = + 4 can get oxidised or reduced.

HNO_2 : N = + 3 can get oxidised or reduced.

H_2O_2 : O = – 1 can get oxidised or reduced.

12. (*b*) Due to presence of *d*-orbitals, sulphur can expand its valencies from 2 to 6, while oxygen has only one valency (2) due to the absence of *d*-orbital.

13. (*b*) All the hydrides of group 16 elements except H_2O possess reducing property and this character increases from H_2S to H_2Te.

15. (*c*) Water (H_2O) is much less volatile than H_2S because sulphur atom is less electronegative than O-atom and, hence does not form H-bonding like water.

16. (*d*) Some metallic oxides exhibit a dual behaviour. They show characteristics of both acidic as well as basic oxides. Such oxides are known as amphoteric oxides. Al_2O_3 is such an example.

17. (*d*) Angular shape of ozone molecule consists of 2σ and 1 π-bond.

18. (*c*) Industrially, SO_2 is produced as a by-product of the roasting of sulphide ores.

$$4FeS_2(s) + 11O_2(g) \longrightarrow 2Fe_2O_3(s) + 8SO_2(g)$$

19. (*a*) $H_2S_2O_8$ (peroxodisulphuric acid) and H_2SO_5 (peroxomonosulphuric acid) are peroxoacids of sulphur.

20. (*d*) H_2SO_4 is used in petroleum refining, manufacture of pigments, paints and dyestuff intermediates, detergent industry, etc.

21. (*d*) The anomalous behaviour of fluorine is due to its small size, highest electronegativity, low F — F bond dissociation enthalpy and non-availability of *d*-orbitals in its valence shell.

22. (*d*) In general, bond enthalpy or bond dissociation energy of halogen molecules (X_2) decreases down the group from Cl_2 to I_2.

$$Cl_2 > Br_2 > F_2 > I_2$$

The decrease in bond enthalpy from Cl_2 to I_2 is due to increase in atomic size that increases the distance between two atoms. Hence, it becomes easier to break them apart. The exceptionally low bond dissociation energy of fluorine molecule is due to very small size of fluorine atom. This brings the non-bonding electrons of fluorine nearer to each other, resulting in a much greater lone pair-lone pair repulsion, which weakens the covalent bond and lowers its dissociation energy.

Hence, option (d) is the only correct option.

23. (*a*) HCl gas can be dried by passing through concentrated sulphuric acid (H_2SO_4).

24. (*a*) The first noble gas compound obtained by mixing PtF_6 and xenon, $Xe^+PtF_6^-$.

25. (*d*) Among XeO_3, $XeOF_4$ and XeF_6, all the molecules have one lone pair of electrons on Xe.