

- 7.1 Discuss the general characteristics of Group 15 elements with reference to their electronic configuration, oxidation state, atomic size, ionisation enthalpy and electronegativity.
- 7.2 Why does the reactivity of nitrogen differ from phosphorus?
- 7.3 Discuss the trends in chemical reactivity of group 15 elements.
- 7.4 Why does  $\text{NH}_3$  form hydrogen bond but  $\text{PH}_3$  does not?
- 7.5 How is nitrogen prepared in the laboratory? Write the chemical equations of the reactions involved.
- 7.6 How is ammonia manufactured industrially?
- 7.7 Illustrate how copper metal can give different products on reaction with  $\text{HNO}_3$ .
- 7.8 Give the resonating structures of  $\text{NO}_2$  and  $\text{N}_2\text{O}_5$ .
- 7.9 The HNH angle value is higher than HPH, HAsH and HSbH angles. Why? [Hint: Can be explained on the basis of  $\text{sp}^3$  hybridisation in  $\text{NH}_3$  and only s-p bonding between hydrogen and other elements of the group].
- 7.10 Why does  $\text{R}_3\text{P} = \text{O}$  exist but  $\text{R}_3\text{N} = \text{O}$  does not (R = alkyl group)?
- 7.11 Explain why  $\text{NH}_3$  is basic while  $\text{BiH}_3$  is only feebly basic.
- 7.12 Nitrogen exists as diatomic molecule and phosphorus as  $\text{P}_4$ . Why?
- 7.13 Write main differences between the properties of white phosphorus and red phosphorus.
- 7.14 Why does nitrogen show catenation properties less than phosphorus?
- 7.15 Give the disproportionation reaction of  $\text{H}_3\text{PO}_3$ .
- 7.16 Can  $\text{PCl}_5$  act as an oxidising as well as a reducing agent? Justify.
- 7.17 Justify the placement of O, S, Se, Te and Po in the same group of the periodic table in terms of electronic configuration, oxidation state and hydride formation.
- 7.18 Why is dioxygen a gas but sulphur a solid?
- 7.19 Knowing the electron gain enthalpy values for  $\text{O} \rightarrow \text{O}^-$  and  $\text{O} \rightarrow \text{O}^{2-}$  as  $-141$  and  $702 \text{ kJ mol}^{-1}$  respectively, how can you account for the formation of a large number of oxides having  $\text{O}^{2-}$  species and not  $\text{O}^-$ ? (Hint: Consider lattice energy factor in the formation of compounds).
- 7.20 Which aerosols deplete ozone?
- 7.21 Describe the manufacture of  $\text{H}_2\text{SO}_4$  by contact process?
- 7.22 How is  $\text{SO}_2$  an air pollutant?
- 7.23 Why are halogens strong oxidising agents?
- 7.24 Explain why fluorine forms only one oxoacid, HOF.
- 7.25 Explain why inspite of nearly the same electronegativity, nitrogen forms hydrogen bonding while chlorine does not.
- 7.26 Write two uses of  $\text{ClO}_2$ .
- 7.27 Why are halogens coloured?
- 7.28 Write the reactions of  $\text{F}_2$  and  $\text{Cl}_2$  with water.
- 7.29 How can you prepare  $\text{Cl}_2$  from  $\text{HCl}$  and  $\text{HCl}$  from  $\text{Cl}_2$ ? Write reactions only.
- 7.30 What inspired N. Bartlett for carrying out reaction between Xe and  $\text{PtF}_6$ ?
- 7.31 What are the oxidation states of phosphorus in the following:  
 (i)  $\text{H}_3\text{PO}_3$       (ii)  $\text{PCl}_3$       (iii)  $\text{Ca}_3\text{P}_2$       (iv)  $\text{Na}_3\text{PO}_4$       (v)  $\text{POF}_3$

- 7.32** Write balanced equations for the following:  
 (i) NaCl is heated with sulphuric acid in the presence of  $\text{MnO}_2$ .  
 (ii) Chlorine gas is passed into a solution of NaI in water.
- 7.33** How are xenon fluorides  $\text{XeF}_2$ ,  $\text{XeF}_4$  and  $\text{XeF}_6$  obtained?
- 7.34** With what neutral molecule is  $\text{ClO}$  isoelectronic? Is that molecule a Lewis base?
- 7.35** How are  $\text{XeO}_3$  and  $\text{XeOF}_4$  prepared?
- 7.36** Arrange the following in the order of property indicated for each set:  
 (i)  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{I}_2$  - increasing bond dissociation enthalpy.  
 (ii)  $\text{HF}$ ,  $\text{HCl}$ ,  $\text{HBr}$ ,  $\text{HI}$  - increasing acid strength.  
 (iii)  $\text{NH}_3$ ,  $\text{PH}_3$ ,  $\text{AsH}_3$ ,  $\text{SbH}_3$ ,  $\text{BiH}_3$  - increasing base strength.
- 7.37** Which one of the following does not exist?  
 (i)  $\text{XeOF}_4$  (ii)  $\text{NeF}_2$  (iii)  $\text{XeF}_2$  (iv)  $\text{XeF}_6$
- 7.38** Give the formula and describe the structure of a noble gas species which is isostructural with:  
 (i)  $\text{ICl}_4^-$  (ii)  $\text{IBr}_2^-$  (iii)  $\text{BrO}_3^-$
- 7.39** Why do noble gases have comparatively large atomic sizes?
- 7.40** List the uses of neon and argon gases.