



# CHEMISTRY

**BOOKS - BETTER CHOICE PUBLICATION**

## THE P-BLOCK ELEMENTS

### Question Bank

1. Define inert pair effect.



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2. Unlike  $\text{In}^+$ ,  $\text{Tl}^+$  is most stable with respect to disproportionation reaction.



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3. Explain inert pair effect with example.



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4. A mixed oxide of iron and chromium,  $\text{FeO} \cdot \text{Cr}_2\text{O}_3$  is fused with sodium carbonate

in the presence of air to form a yellow compound (A). On acidification, the compound (A) forms an orange coloured compound (B) which is a strong oxidising agent. Identify the compounds (A) and (B) .



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5. Bismuth is a strong oxidising agent in the pentavalent state.



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6. Explain why the first elements of a group differ from other elements of its group.



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7. Why does Nitrogen show anomalous behaviour in its group ?



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8. Nitrogen exists as diatomic molecule and phosphorous acts as tetra atomic molecule.

Explain.



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9. Why does the reactivity of nitrogen differ from phosphorus?



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10. Give reasons for the low reactivity of nitrogen molecule.



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11. Why does  $NH_3$  form hydrogen bond but  $PH_3$  does not?



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12.  $PH_3$  has lower boiling point than  $NH_3$ .

Why?



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13. Although fluorine is much more electronegative than hydrogen yet the dipole moment of  $NF_3$ (0.24D) is much lower than that of  $NH_3$ (1.46D). Explain.



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**14.**  $\text{NCl}_3$  is an endothermic compound while  $\text{NF}_3$  is an exothermic compound. explain



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**15.** Explain some important characteristics of white and yellow phosphorus.



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**16.** Why does nitrogen show catenation properties less than phosphorus ?



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**17.** Unlike Phosphorus, nitrogen shows little tendency for catenation. Why?



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**18.** Though nitrogen exhibits + 5 oxidation state, it does not form penta-halide. Given reason.



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**19.** In the structure of  $\text{HNO}_3$  molecule, N-O bond (121 pm) is shorter than N-OH bond (140 pm). why?



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20. SF<sub>6</sub> molecule is kinetically an inert substance. Explain why?



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21. SF<sub>6</sub> is used in high voltage generators and switch gears. Why?



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22. Why does ammonia act as a Lewis base?





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**23.** Explain why both N and Bi do not form pentahalides but Phosphorus does?



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**24.** Give reason to explain +5 oxidation state is less stable than the +3 state in Bismuth.



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**25.** Write balanced equation when ammonia is dissolved in water.



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**26.** Describe chemistry of manufacture of ammonia by Haber's process and discuss conditions for good yield of ammonia.



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**27.** Addition of chlorine to potassium iodide solution gives it a brown colour but excess of chlorine turns it colourless. Why?



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**28.** Draw flow chart for Haber's process for the manufacture of ammonia.



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**29.** Explain Ostwald process for manufacturing nitric acid. Draw structure of nitric acid and write its uses also.



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**30.** Illustrate how copper metal can give different products on reaction with  $HNO_3$ .



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31. Why does  $NO_2$  dimerise ?



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32. What is the covalence of nitrogen in  $N_2O_5$  ?



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33. Why does nitric oxide become brown when released in air?





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**34.** Ionic solids conduct electricity in the molten state but not in the solid state. Explain.



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**35.** Which gas is evolved when concentrated HCl is added to powdered potassium dichromate. On passing the evolved gas

through acidified KBr solution, the solution turns brown. Write the balanced equations for the reactions involved.



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**36.** Explain the difference in the structures of white and red phosphorus.



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**37.** Draw the structure of  $P_4O_{10}$ .



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**38.** What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of  $CO_2$  ?



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**39.** Explain why orthophosphorus acid,  $H_3PO_3$  is diprotic .



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40. How do you account for the reducing behaviour of  $\text{H}_3\text{PO}_2$  on the basis of its structure ?



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41. Why the basicity of all the acids of phosphorus is different?



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42. Give the structure and basicity of  $H_3PO_4$ .



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43. All the five bonds in  $PCl_5$  are not equivalent justify.



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44. Draw the structure of  $PCl_3$ .



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45. Why are pentahalides more covalent than trihalides ?



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46. Why does  $NO_2$  dimerise ?



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47. Write two reactions of  $HNO_3$  with non-metals to show the oxidising character.



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**48.** Explain the acidic character of Perchloric acid compared to sulphuric acid.



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**49.** Why white phosphorus is more reactive than red phosphorus?



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**50.** What happens when ammonium nitrate is heated ?



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**51.** What is laughing gas ?



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**52.** Account for the following: The +2 oxidation state of lead is more stable than +2 oxidation



state of Tin.



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53. Inert pair effect strongly exists in heavy p-block elements. Comment.



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54. Why does  $R_3P = O$  exist but  $R_3N = O$  does not (R-alkyl group) ?



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55. write the chemical equations when Ammonia reacts with aqueous  $FeCl_3$ .



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56. Write the chemical equations when Ammonia reacts with aqueous  $AlCl_3$ .



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57. Write the chemical equations when Ammonia reacts with aqueous  $CrCl_3$ .



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58. Write the chemical equations when Zinc reacts with dilute  $HNO_3$ .



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59. Write the chemical equations when Zinc reacts with dilute  $HNO_3$ .



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60. Write the chemical equations when: Zinc reacts with cone.  $HNO_3$



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61.  $PCl_5$  is known but  $PI_5$  is not known. Why?



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62.  $NCl_3$  is readily hydrolysed while  $NF_3$

does not. Explain.



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63.  $NH_3$  is a strong base but  $NF_3$  does not

show any basic property. Why?



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**64.** Why nitric acid acts on oxidising agent ?

How it oxidises Sulphur to sulphuric acid.



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**65.** Why nitric acid acts as an oxidising agent?

How it oxidises: Ferrous Sulphate to Ferric sulphate acid.



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**66.** Discuss abnormal behaviour of oxygen.



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**67.** Why water is a liquid and hydrogen sulphide is a gas?



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**68.** Sulphur show +4 and +6 oxidation state in their compounds but oxygen can not show

these oxidation states.



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69. Why  $SF_6$  is known but  $OF_6$  is not known



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70. Explain why  $H_2O$  is a liquid but  $H_2S$  is a gas at room temperature.



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71. How aerosols are depleting ozone layer?



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72. Why is  $H_2S$  less acidic than  $H_2Te$  ?



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73. Why  $H_2S$  is acidic while  $H_2O$  is neutral ?



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74. Why is  $H_2S$  less acidic than  $H_2Te$  ?



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75. What is the oxidation state of phosphorus in  $H_3PO_3$ ,  $Ca_3P_2$ ,  $Na_3PO_4$  and  $POF_3$



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76. Sulphur exhibits greater tendency for catenation than selenium. Explain why?



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77. Elements of Group 16 generally show lower value of first ionisation enthalpy compared to the corresponding periods of group 15. Why?



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78. Oxygen gas is inert at room temperature why?



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**79.** Give two methods of preparation of dioxygen in laboratory and give its uses ?



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**80.** Discuss the preparation of ozone by Sieman's Ozoniser.



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81. Write two uses of ozone.



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82. Why does  $O_3$  act as a powerful oxidising agent ?



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83. What is the role of  $SO_2$  in air pollution?



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**84.** How will ozone oxidise the following :  
Potassium nitrite to potassium nitrate.



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**85.** What will be the oxidation number of S in  
 $\text{SO}_2\text{Cl}_2$  and of P in  $\text{Ca}_3\text{P}_2$ ?



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**86.** How will ozone oxidise the following :  
Potassium manganate to potassium per  
manganate.



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**87.** How does fluorine and chlorine react with  
water. Only write chemical reactions.



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**88.** How does  $O_3$  oxidises the Acidified ferrous sulphate to ferric sulphate .



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**89.** What is tailing of mercury ?



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**90.** How ozone reacts with mercury.



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91. Discuss the shape of  $SF_6$



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92. Discuss the shape of  $SF_4$ ?



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93.  $SF_6$  is known but  $SCl_6$  is not known.

Explain.



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94. Sulphur hexafluoride is used as a gaseous electrical insulator. Explain.



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95.  $SF_4$  is easily hydrolysed whereas  $SF_6$  is not easily hydrolysed. Why ?



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96. Why  $SF_6$  is inert towards hydrolysis ?



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97. Why is  $SF_6$  much less reactive than  $SF_4$  ?



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98. Why  $SF_6$  is known but  $SH_6$  is not known ?



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**99.** Which form of sulphur shows paramagnetic behaviour and why ?



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**100.** Why does sulphur in vapour state exhibit paramagnetic character ?



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**101.** Explain that  $SO_2$  can act as an oxidising agent as well as a reducing agent, but  $SO_3$  can act as an oxidising agent only.



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**102.** Explain that  $SO_2$  can act as an oxidising agent as well as a reducing agent, but  $SO_3$  can act as an oxidising agent only.



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**103.**  $SO_2$  act as both oxidising and reducing agent but  $H_2S$  acts as only reducing agent.

Why ?



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**104.** Comment on nature of two S-O bond formed in  $SO_2$  molecule. Are the two S-O bonds in this molecule equal ?



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105.  $SO_2$  has acidic character. Explain.



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106. Write the reaction of  $SO_2$  with  $Cl_2$



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107. Write the reaction of  $SO_2$  with  $Cl_2$



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**108.** Give the oxidation of  $Na_2SO_3$  by acidified  $KMnO_4$ .



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**109.** Give the formula and structures of different oxo-acids of sulphur ?



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**110.** Describe the manufacture of  $H_2SO_4$  by contact process?





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**111.** Explain the manufacture of sulphuric acid by contact process.



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**112.** Write the conditions for maximum yield of  $H_2SO_4$  by contact process.



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**113.** Give an example of a reaction in which  $H_2SO_4$  behaves as a strong acid .



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**114.** Give an example of a reaction in which  $H_2SO_4$  behaves as a dehydrating agent



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**115.** Give an example of a reaction in which  $H_2SO_4$  behaves as an oxidising agent.



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**116.** Describe the commercial uses of sulphuric acid.



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**117.** Mention three areas in which  $H_2SO_4$  plays an important role.



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**118.** Why conc.  $H_2SO_4$  is viscous and has high boiling point ?



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**119.** Why is  $K_{a_2} \ll k_{a_1}$  for  $H_2SO_4$  in water?



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**120.** Why conc. sulphuric acid is always diluted by adding sulphuric acid to water with constant stirring and not water to the acid ?



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**121.** Write the chemical equation when: Oxalic acid reacts with concentrated  $H_2SO_4$ .



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**122.** Write the chemical equation when: Formic acid reacts with concentrated  $H_2SO_4$ .



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**123.** Write the chemical equations when: Sugar reacts with conc.  $H_2SO_4$ .



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124.  $SO_3$  has zero dipole moment. Why ?



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125. Why does fluorine show anomalous behaviour in its group ?



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126. Why are halogens most reactive ?



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**127.** Explain why Bond dissociation energy of  $F_2$  is less than that of  $Cl_2$  ?



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**128.** Explain why

F-F bond in fluorine is weaker than Cl-Cl bond in chlorine ?



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**129.** Explain the following :

HF is a weaker acid than HI.



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**130.** Explain the following :

Iodine is more soluble in KI solution than in water.



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**131.** Explain the following :

Fluorine does not show positive oxidation state.



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**132.** Explain the following :

Iodine forms  $I_3^-$  but  $F_2$  does not form  $F_3^-$  ion. Why?



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**133.** Explain: Electron gain enthalpy of chlorine is more negative than fluorine.



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**134.** Why electron affinity of fluorine is less than that of chlorine ?



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**135.** Boiling point of HCl is lower than HF .

Explain why?



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**136.** Why are halogens coloured ?



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**137.** Halogens have maximum negative electron gain enthalpy in the respective

periods of the periodic table. Why ?



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**138.** Electron gain enthalpy of chlorine is more negative as compared to fluorine.



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**139.** Considering the parameters such as bond dissociation enthalpy, electron gain enthalpy

and hydration enthalpy, compare the oxidising power of  $F_2$  and  $Cl_2$ .



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**140.** Why is fluorine a very reactive halogen ?



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**141.** Account for the following: Among the halogens  $F_2$  is the strongest oxidising agent.



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**142.** Fluorine exhibits only - 1 oxidation state whereas other halogens exhibit positive oxidation states such as +1, +3, +5, +7.



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**143.** Explain why

Most metal fluoride are ionic in nature than metal chloride.



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**144.** Explain why

Hydrogen fluoride is a weaker acid than hydrogen chloride in aqueous solution.



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**145.** Why are halogens strong oxidising agents?



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**146.** Explain why in spite of nearly the same electronegativity, nitrogen forms hydrogen bonding while chlorine does not.



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**147.** Write the reactions of  $F_2$  and  $Cl_2$  with water.



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**148.** Arrange the following in the order of property indicated for each set:  
 $F_2, Cl_2, Br_2, I_2$  - increasing bond dissociation enthalpy.



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**149.** Arrange the following in the order of property indicated for each set:  
 $HF, HCl, HBr, HI$  - increasing acid strength.





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**150.** Write the balanced chemical equation for the reaction of  $Cl_2$  with hot and concentrated NaOH. Is this reaction a disproportionation reaction? Justify.



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**151.** Write the balanced chemical equation for the reaction of  $Cl_2$  with hot and concentrated

NaOH. Is this reaction a disproportionation reaction? Justify.



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**152.** Write the balanced chemical equation for the reaction of  $Cl_2$  with hot and concentrated NaOH. Is this reaction a disproportionation reaction? Justify.



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**153.** Anita coloured  $\frac{3}{8}$  of the circle with yellow colour and  $\frac{4}{8}$  of the circle with green colour.

How much portion of circle did She colour?



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**154.** Name two poisonous gases which can be prepared from chlorine gas.



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**155.** Give the reason for bleaching action of  $Cl_2$ .



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**156.** Bleaching of flowers by chlorine is permanent while that by sulphur dioxide is temporary. Explain.



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**157.** How can you prepare  $Cl_2$  from HCl and HCl from  $Cl_2$ ? Write reactions only.



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**158.** Write balanced equations for the following: NaCl is heated with sulphuric acid in the presence of  $MnO_2$ .



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**159.** Write balanced equations for the following: Chlorine gas is passed into a solution of NaI in water.



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**160.** Name the different oxoacids of halogens and draw their structure.



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**161.** Explain why fluorine forms only one oxoacid, HOF.



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**162.** Explain why perchloric acid is a strong acid than sulphuric acid.



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**163.** Arrange  $HClO$ ,  $HBrO$  and  $HIO$  in order to decreasing acidic strength giving reasons.



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**164.** Compare the acidic strength of  $HClO_4$ ,  $HClO_3$ ,  $HClO_2$ ,  $HClO$ . Give reasons.



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**165.** Arrange  $\text{HClO}_4$  ,  $\text{HClO}_3$ ,  
 $\text{HClO}_2$ ,  $\text{HClO}$  in order of oxidizing power.

Give reasons.



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**166.** What are interhalogen compounds ? Give example.



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**167.** What are the interhalogen compounds ?

Why are these more reactive than halogens ?



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**168.** Why ICl is more reactive than  $I_2$  ?



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**169.** Why  $ClF_3$  exists, but  $FCl_3$  does not exist

?



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**170.** Give important properties of magnets.



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**171.** Discuss the molecular shape of  $BrF_3$  on the basis of VSEPR theory.



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**172.** Draw the structure of following interhalogen compound.



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**173.** Draw the structure of following interhalogen compound.



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**174.** Draw the structure of following interhalogen compound.



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**175.** With what neutral molecule is  $ClO^-$  isoelectronic? Is that molecule a Lewis base?



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**176.** What are pseudohalogens ? Give example.



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**177.** What are freons ?



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**178.** Why are the elements of Group 18 known as noble gases ?



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**179.** Why elements of Group 18 are less reactive or inert?



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**180.** Noble gases have low boiling points. Explain.



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**181.** Why has it been difficult to study the chemistry of radon?



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**182.** Why electron gain enthalpies of noble gases are positive ?



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**183.** Why noble gases have very high values of ionisation enthalpies?



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**184.** Why is helium placed in p-block elements although its last electron enters in the s-orbital ?



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**185.** What inspired N. Bartlett, for carrying out the reaction between Xe and  $PtF_6$ ?



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**186.** What inspired N. Bartlett, for carrying out the reaction between Xe and  $PtF_6$ ?



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**187.** Among noble gases, only Xe is known to form chemical compounds. Why ?



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**188.** Why do noble gases form compounds with fluorine and oxygen ?



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**189.** How are Xenon fluorides  $XeF_2$ ,  $XeF_4$  and  $XeF_6$  prepared ?



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**190.** Discuss the structure of the  $XeF_4$  on the basis of VSEPR theory.



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**191.** Discuss the structure of  $XeF_2$  on the basis of VSEPR theory.



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**192.** How are  $XeO_3$  and  $XeOF_4$  prepared?



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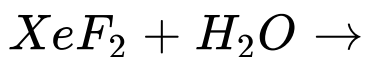
**193.** Discuss the shapes of  $XeO_3$ ,  $XeOF_4$ ,  $XeOF_2$ , and  $XeO_2F_2$

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**194.** Discuss the hydrolysis of  $XeF_3$ . Does the hydrolysis of  $XeF_6$  lead to a redox reaction ?

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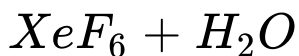
**195.** Give equation for the following:



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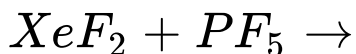


**196.** Give equation for the following:



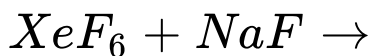
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**197.** Give equation for the following:



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**198.** Give equation for the following:



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**199.** Give the structure of  $\text{XeOF}_2$  and state of hybridization of Xe in it.



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**200.** Why is helium used in diving apparatus?



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**201.** List the uses of neon and argon gases.



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**202.** Give uses of argon, helium, neon, xenon and krypton gases.



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**203.** Give the formula and describe the structure of a noble gas species which is isostructural with:  $ICl_4^-$



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**204.** Give the formula of the noble gas species which is isostructural with  $IBr_2^-$ .



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205. Give the formula of the noble gas species which is isostructural with  $BrO_3^-$  .



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