



## CHEMISTRY

### BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

#### THE P-BLOCK ELEMENTS

##### Problem 1

1. Calculate the volume of 0.1 M NaOH solution required to neutralise the solution produced dissolving 1.1 g of  $P_4O_6$  in water.

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##### Problem 2

1. Calculate the weight of HI obtained by the reaction of 62 g of red phosphorus with iodine in presence of water.



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### Problem 3

1. How many grams of CaO are required to neutralise 852 g of  $P_4O_{10}$  ?

Draw structure of  $P_4O_{10}$  molecule.



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### Concept Based Questions

1.  $PF_5$  is known but  $NF_5$  is not known. Discuss.



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2. Molecular nitrogen is very inert chemically. Why ?



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3. The experimentally determined  $N - F$  bond length in  $NF_3$  is greater than the sum of the covalent radii of  $N$  and  $F$ . Assign reason.



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4.  $NF_3$  is not hydrolysed while  $NCl_3$  can be readily hydrolysed. Explain.



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5. Nitrogen and chlorine have same electronegativity (3.0). Molecular nitrogen is inert at room temperature while chlorine is highly reactive. How will you account for it ?



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6.  $H_3PO_3$  is a diprotic acid. Justify.



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7.  $NF_3$  and  $NH_3$  are both pyramidal but differ widely in dipole moment values. Assign the reason.



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8. All bonds in the molecule of  $PCl_5$  are not equivalent. Explain.



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9.  $PCl_5$  acts as a chlorinating agent in organic reactions. Why?



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10. Boiling point of phosphine is less than that of ammonia though its molecule size is more. Assign reason.



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11. On heating,  $(\text{NH}_3)_2\text{Cr}_2\text{O}_7$  gives rise to a gas which on treatment with  $\text{Mg}$  ribbon gives a white solid. On dissolving white solid in water another gas ( $X$ ) is evolved. It gives white fumes when a rod dipped in conc.  $\text{HCl}$  is brought in its contact. Identify the gas  $X$ .



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12. Phosphorus acid can act both as oxidising agent as well as reducing agent while phosphoric acid is only an oxidising agent. Explain.

Or

Phosphorus acid undergoes disproportionation reaction but phosphoric acid does not. Explain.



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13. Ammonia has a higher proton affinity than phosphine. Discuss.



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14. Oxides of phosphorus have cage like and not open structures. Explain.



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15. Ammonia acts as a ligand. Discuss.



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



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17. There is a small increase in atomic radius in moving from P to As in group 15 elements as compared to large increase in atomic radius in moving from N to P in the same group. Explain.



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18.  $H_3PO_2$  and  $H_3PO_3$  act as good reducing agents while  $H_3PO_4$  does not. Discuss.



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19. Give reasons for the following :

(a)  $CN^-$  ion is known but  $CP^-$  ion is not known

(b)  $NO_2$  dimerises to form  $N_2O_4$



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20. Explain why both N and Bi do not form pentahalides while phosphorus does.



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21.  $MgN_2$  when reacted with water gives  $NH_3$  and HCl. However,  $MgCl_2$  does not give HCl when treated with water at room temperature. Assign reason.



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22. A water soluble compound of a poisonous element M when heated with  $Zn/H_2SO_4$  gives a colourless and extremely poisonous gaseous compound N which when passed through a heated tube gives a silvery mirror of element M. Identify M and N.



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23. ( $\text{SiH}_3$ ) is a weaker base than  $(\text{CH}_3)_3\text{N}$ . Explain.



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24. When conc.  $\text{H}_2\text{SO}_4$  was added to an unknown salt present in a test which was heated, a brown gas (A) was evolved. The gas intensified when copper turnings were also added into the test tube. On cooling, the gas (A) changed into a colourless liquid (B).

(a) Identify the gases A and B

(b) Write equations for the reactions involved.



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25. A colourless gas 'A' with a pungent odour is highly soluble in water and its aqueous solution is weakly basic. As a weak base, it precipitates the hydroxides of many metals from their salt solution. Gas 'A' finds application in detection of metal ions. It gives a deep blue colouration with copper ions. Identify the gas 'A' and write the chemical equations

involved in the following :

- (i) Gas 'A' with copper ions
- (ii) Solution of gas 'A' with  $ZnSO_4$  solution.



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26. Zinc reacts with dilute  $H_2SO_4$  to give  $H_2$ . It also reacts with conc.  $H_2SO_4$  to give  $SO_2$ . How will you account for this difference ?



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27.  $H_2S$  acts only as reducing agent while  $SO_2$  can act both as a reducing agent and as an oxidising agent. How will you account for it ?



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28. Sulphur dioxide acts as bleaching agent in the presence of moisture. Discuss.



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29. Sulphur is a solid while oxygen is a gas at room temperature. Why ?



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30.  $SF_6$  is a well known compound while  $SH_6$  does not exist. Explain.



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31. Oxygen does not show oxidation states of +4 and +6 like sulphur. Explain.



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32.  $H_2O$  is liquid while  $H_2S$  is a gas at room temperature. Explain.



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33. Sulphur dioxide is a more powerful reducing agent in the alkaline medium than in the acidic medium. Assign reason.



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34. Bond angle in  $H_2S$  is lower than in  $H_2O$ . Justify.



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35. Hydrogen sulphide cannot be dried by passing through conc.  $H_2SO_4$ . Why ?



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36.  $H_2S$  is a stronger acid than  $H_2O$ . Explain



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37. Sulphur vapours exhibit some paramagnetic behaviour. Explain.



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38.  $SF_6$  is not easily hydrolysed whereas  $SF_4$  can be. Assign reason.



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39. Bond dissociation enthalpy of F-F bond is less than that of Cl-Cl bond. Explain.



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40. Sulphur disappears when boiled with aqueous solution of sodium sulphite. Assign reason.



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41. Chlorine water has both oxidising as well as bleaching properties ?  
Explain.



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42. Oxygen molecule has the formula  $O_2$  while sulphur is  $S_8$ . Why ?



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



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44. Why does burning Mg continue to burn in a jar containing NO but burning S gets extinguished ?



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45. Reducing character decreases from  $SO_2$  to  $TeO_2$ . Explain.



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46. Why is iodine more soluble in  $KI$  solution than in water ?



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47. Iodine is liberated in the reaction between  $KI$  and  $Cu^{2+}$  ions but chlorine is not liberated when  $KCl$  is added to  $Cu^{2+}$  ions. Explain.



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48. Lithium fluoroide ( $LiF$ ) is mainly ionic but lithium iodide ( $LiI$ ) is covalent in nature. Assign reason.



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49. Interhalogen compounds are more reactive than halogens. Why ?



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50.  $ClF_3$  exists but  $FCl_3$  does not. Why ?



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51. Ferric iodide is very unstable but ferric chloride is stable. Explain.



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52. HF is not stored in glass bottles but is kept in wax bottles. Assign reason.



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53.  $KHF_2$  is a well known compound whereas  $KHCl_2$  does not exist. Why?



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54. Fluorine does not show variable oxidation states while other members of the halogen family exhibit variable oxidation states. Why?



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55. Chlorine water has both oxidising as well as bleaching properties properties ? Explain.



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56. On addition of ozone gas to KI solution, violet vapours are obtained. Why?



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57. Despite having greater polarity, hydrogen fluoride boils at a lower temperature than water. Elaborate.



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58. The conjugate base of  $HClO_4$  is a weaker base than  $H_2O$ . Explain.



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59. The group of noble gas elements is called zero group. Why ?



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60. Noble gas elements form compounds only with fluorine and oxygen. Explain.



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61. Helium and neon do not form compounds with fluorine. Assign reason.



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62. Why is neon used in illuminating warning signal. Why ?



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63. Xenon does not form fluorides such as  $XeF_3$  and  $XeF_5$ . Explain.



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64. Structure of xenon fluorides cannot be explained by valence bond theory. Explain.



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1. Why are pentahalides more covalent than trihalides in the members of the nitrogen family ?



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2. Why is  $BiH_3$  the strongest reducing agent amongst all the hydrides of group 15 elements ?



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3. Why is  $N_2$  less reactive at room temperature ?



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4. Mention the conditions required for the maximum yield of ammonia.



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5. How does ammonia react with blue solution having  $Cu^{2+}$  ions ?

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6. Valency and oxidation number of nitrogen in  $N_2O_5$

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7. Why is bond angle in  $PH_4^+$  ion higher than in  $PH_3$  ?

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

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9. What happens when  $PCl_5$  is heated ?



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10. Write the balanced equation for the hydrolytic reaction of  $PCl_5$  in heavy water.



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11. What is the basicity of  $H_3PO_4$  ?



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12. What happens when phosphorus acids ( $H_3PO_3$ ) is heated ?



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13. List the important sources of sulphur.



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14. Write the order of the thermal stability of the hydrides of group 16 elements.



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15. Why is  $H_2O$  a liquid and  $H_2S$  a gas ?



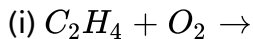
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16. Which of the following does not react with oxygen directly?  
 $Zn, Ti, Pt, Fe$ .



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17. Complete the following reactions :



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



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19. How is  $O_3$  estimated quantitatively ?



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20. What happens when sulphur dioxide gas is passed through an aqueous solution of Fe(III) salt ?



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21. Comment on the nature of two S-O bonds formed in  $SO_2$  molecule.

Are the two bonds in the molecule equal ?



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22. How is the presence of  $SO_2$  detected?



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



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24. Write the conditions to maximise the yield of  $H_2SO_4$  by contact process.



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25. If osmotic pressure of  $1M$  aqueous solution of  $H_2SO_4$  at  $500K$  is  $90.2 \text{ atm}$ . Calculate  $K_{a2}$  of  $H_2SO_4$ . Give your answer after multiplying  $1000$  with  $K_{a2}$ . (Assuming ideal solution).

(Given:  $K_{a1}$  of  $H_2SO_4$  is  $\infty$ ,  $R = 0.082 \text{ lt} - \text{atm} / \text{mol} - K$ ).



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26. 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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27. Give two examples to show the anomalous behaviour of fluorine.



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28. Sea is the greatest source of some halogens. Comment.



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29. Give reason for the bleaching action of  $Cl_2$ .



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



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31. Why is  $ICl$  more reactive than  $I_2$  ?



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32. Why is helium used in diving apparatus ?



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33. Balance the equation :  $XeF_6 + H_2O \rightarrow XeO_2F_2 + HF$



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



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### N.C.E.R.T. Exercise

1. Discuss the general characteristics of Group 15 elements with reference to their electronic configuration, oxidation state, atomic size, ionisation enthalpy and electronegativity.



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2. Why is the reactivity of nitrogen different from that of phosphorus ?



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3. Discuss the trends in chemical reactivity of group 15 elements.



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4. Why does  $NH_3$  form hydrogen bonding while  $PH_3$  does not ?



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5. How is nitrogen prepared in the laboratory? Write the chemical equations of the reactions involved.



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6. How is ammonia manufactured industrially?



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7. Illustrate, how copper gives different products on reaction with  $HNO_3$ .



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8. Give the resonating structures of  $NO_2$  and  $N_2O_5$ .



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9. The HNH angle value is higher than those of HPH, HAsH and HSbH angles, why?



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10. Why does  $R_3P = O$  exist but  $R_3N = O$  does not (R is an alkyl group)?



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11. Explain why is  $NH_3$  basic while  $PH_3$  is feebly basic in nature.



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12. Nitrogen exists as diatomic molecule ( $N_2$ ) while phosphorus as tetra-atomic molecule ( $P_4$ ). Why?



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13. Write main differences between the properties of white phosphorus and red phosphorus.



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14. Why does nitrogen show catenation properties less than phosphorus.



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15. Give one disproportionation reaction of phosphorus acid ( $H_3PO_3$ ).



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16. Can  $PCl_5$  act as oxidising as well as reducing agent ? Justify.



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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 states and hydride formation.



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18. Why is dioxygen a gas but sulphur a solid?



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19. Knowing the electron gain enthalpy values for  $O \rightarrow O^-$  and  $O \rightarrow O^{2-}$  as  $-141 \text{ kJ mol}^{-1}$  and  $702 \text{ kJ mol}^{-1}$  respectively, how can you account for the formation of a large number of oxides having  $O^{2-}$  species and not  $O^-$ ?



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20. Which aerosols deplete ozone?



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21. The catalyst used in the manufacture of  $H_2SO_4$  by contact process is



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22. How is  $SO_2$  an air pollutant ?



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23. Why are halogens strong oxidising agents ?



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24. Explain why does fluorine form only one oxoacid (HOF).



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25. Explain why inspite of nearly the same electronegativity, nitrogen forms hydrogen bonding while chlorine does not.



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26. Write two uses of  $ClO_2$ .



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27. Why are halogens coloured?



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28. Write redox reactions between fluorine and water.



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



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



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**31.** What are the oxidation states of phosphorus in the following:

(i)  $H_3PO_3$  , (ii)  $PCl_3$  , (iii)  $Ca_3P_2$

(iv)  $Na_3PO_4$  , (v)  $POF_3$



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**32.** Write balanced equation for the following:

(i).  $NaCl$  is heated with sulphuric acid in the presence of  $MnO_2$ .

(ii). Chlorine gas is passed into a solution of  $NaI$  in water.



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33. Xenon does not form fluorides such as  $XeF_3$  and  $XeF_5$ . Explain.



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34. With which neutral molecule is  $ClO^-$  isoelectronic ? Is this molecule Lewis acid or base ?



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35. How are  $XeO_3$  and  $XeOF_4$  prepared ?



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36. Arrange the following in the order of property indicated for each set:

(i).  $F_2$ ,  $Cl_2$ ,  $Br_2$ ,  $I_2$  – increasing bond dissociation enthalpy.

(ii).  $HF$ ,  $HCl$ ,  $HBr$ ,  $HI$  – increasing acid strength.

(iii).  $NH_3$ ,  $PH_3$ ,  $AsH_3$ ,  $SbH_3$ ,  $BiH_3$  – increasing base strength.



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37. Which one of the following does not exist ?

(i)  $XeOF_4$  (ii)  $NeF_2$  (iii)  $XeF_2$  (iv)  $XeF_6$ .



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38. Give the formula and describe the structure of a noble gas species which is isostructural with :

(i)  $ICl_4^-$  (ii)  $Ibr_2^-$  (iii)  $BrO_3^-$



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39. Why do noble gases have comparatively large atomic sizes?



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40. List the uses of neon and argon gases.



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### Short Answer Type Questions

1. In the preparation of  $H_2SO_4$  by Contact process, why is  $SO_3$  not absorbed directly in water to form  $H_2SO_4$  ?



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2. Write a balanced chemical equation for the reaction showing catalytic oxidation of  $NH_3$  by atmospheric oxygen.



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3. Write the structure of pyrophosphoric acid.



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4.  $PH_3$  forms bubbles when passed slowly in water but  $NH_3$  dissolves.

Explain why ?



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5. In  $PCl_5$ , phosphorus is in  $sp^3 d$  hybridised state but all its five bonds are not equivalent. Justify your answer with reason.



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6. Why is nitric oxide paramagnetic in gaseous state but the solid obtained on cooling it is diamagnetic ?



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7. Give reason to explain why  $ClF_3$  exists but  $FCl_3$  does not exist.



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8. Out of  $H_2O$  and  $H_2S$ , which one has higher bond angle and why?



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9.  $SF_6$  is known but  $SC_6$  is not. Why?



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10. On reaction with  $Cl_2$  phosphorus forms two types of halides 'A' and 'B'. Halide 'A' is yellowish- white powder but halide 'B' is colourless oily liquid. Identify A and B and write the formulae of their hydrolysis products.



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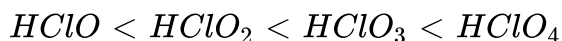
11. In the ring test of  $\text{NO}_3^-$  ion,  $\text{Fe}^{2+}$  ion reduces nitrate ion to nitric oxide, which combines with  $\text{Fe}^{2+}$  (aq) ion to form brown complex .

Write the reactions involved in the formation of brown ring.



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12. Explain why the stability of oxoacids of chlorine increases in the order given below.



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13. Explain why ozone is thermodynamically less stable than oxygen ?



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14.  $P_4O_6$  reacts with water according to equation  $P_4O_6 \rightarrow 4H_3PO_3$ .

Calculate the volume of  $0.1M NaOH$  solution required to neutralise the acid formed by dissolving  $1.1g$  of  $P_4O_6$  in  $H_2O$ .



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15. White phosphorus reacts with chlorine and the product hydrolyses in the presence of water. Calculate the mass of  $HCl$  obtained by the hydrolysis of the product formed by the reaction of  $62 g$  of white phosphorus with chlorine in the presence of water.



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16. Name three oxoacids of nitrogen. Write the disproportionation reaction of that oxoacid of nitrogen is in  $+3$  oxidation state.



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17. Nitric acid forms an oxide of nitrogen on reaction with  $P_4O_{10}$ . Write the reaction involved . Also write the resonating structures of the oxide of nitrogen formed.



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18. Phosphorus has three allotropic forms \_\_

(i) white phosphorus (ii) red phosphorus and (iii) black phosphorus. Write the difference between white red and black phosphorus on the basis of their structure and reactivity.



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19. Given an example to show the effect of concentration of nitric acid on the formation of oxidation product.



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20.  $PCl_5$  reacts with finely divided silver on heating and a white silver salt is obtained, which dissolves on adding excess aqueous  $NH_3$  solution. Write the reactions involved to explain what happens.



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21. Phosphorus forms a number of oxoacids. Out of these oxoacids, phosphinic acid has strong reducing property. Write its structure and also write a reaction its reducing behaviour.



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### Long Answer Type Questions

1. 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 sulphide ore. This gas decolourises acidified aqueous  $KMnO_4$  solution

and reduces  $Fe^{3+}$  to  $Fe^{2+}$ . Identify the solid A and the gas B and write the reactions involved.



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2. On heating lead (II) nitrate gives a brown gas "A". The gas "A" on cooling changes to colourless solid "B". Solid B on heating with NO changes to a blue solid 'C'. Identify 'A', 'B' and 'C' and also write reactions involved and draw the structures of 'B' and 'C'.



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3. On heating compound (A) gives a gas (B) which is a constituent of air. This gas when treated with 3 moles of hydrogen ( $H_2$ ) in the presence of a catalyst gives another gas (C) which is basic in nature. Gas C on further oxidation in moist condition gives a compound (D) which is a part of acid rain. Identify compounds (A) to (D) and also give necessary equations of all the steps involved.





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## Questions From Board Examinations

1. In solid state,  $PCl_5$  is a.....



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2. Why does ethyne (acetylene) burn with a sooty flame?



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3. Why is  $ICl$  more reactive than  $I_2$  ?



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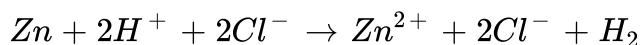
4. Reaction of phosphoric acid with  $Ca_5(PO_4)_3F$  yields a fertiliser 'triple superphosphate'. Represent the same through balanced chemical

equations.



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5. Which of the following ion is spectator ion in the reaction given below:



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6.  $\text{SF}_6$  is a well known compound while  $\text{SH}_6$  does not exist. Explain.



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7. The correct decreasing order of the acidic strength of  $\text{HClO}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$ ,  $\text{HClO}_4$  is



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8. Why is nitric oxide paramagnetic in gaseous state but the solid obtained on cooling it is diamagnetic ?



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9.  $NF_3$  is not hydrolysed while  $NCl_3$  can be readily hydrolysed. Explain.



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10. All bonds in the molecule of  $PCl_5$  are not equivalent. Explain.



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11. Assertion:  $HClO_4$  is a stronger acid than  $HClO_3$ .

Reason: Oxidation state of  $Cl$  in  $HClO_4$  is  $+VII$  and in  $HClO_3$  is  $+V$ .



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12. Bleaching powder is prepared by passing chlorine into



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13. Addition of  $Cl_2 \rightarrow KI$  solution gives it a brown colour but excess of  $Cl_2$  turns it colourless. Why?



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14. Why does  $H_3PO_3$  act as a reducing agent but  $H_3PO_4$  does not ?



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15. The compound which could not act both as oxidising and reducing agent is



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16. Phosphorus acid can act both as oxidising agent as well as reducing agent while phosphoric acid is only an oxidising agent. Explain.

" " Or

Phosphorus acid undergoes disproportionation reaction but phosphoric acid does not. Explain.



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17. Assertion : Fluorine is the strongest oxidising agent in halogens.

Reason : It displaces other halogens from its aqueous solution.



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18. What happen when  $Cl_2$  is passed through a hot concentrated solution of a base like  $Ba(OH)_2$ ?



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19.  $XeF_4$  on partial hydrolysis produces



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20.  $PH_3$  has lower boiling point than  $NH_3$ . Why?



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21. Why does  $PCl_3$  fumes in air?



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22. Which set of elements have strongest tendency to form anions?



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23. Molecular shape of  $SF_4$ ,  $CF_4$  and  $XeF_4$  are





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**24.** Write the balanced equation for the following chemical reaction:

Hydrogen + Chlorine  $\rightarrow$  Hydrogen chloride



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**25.** Write the balanced chemical equations for the following.

(i) Hypophosphorous acid is heated.

(ii) Sodium chlorate reacts with sulphur dioxide in dilute sulphuric acid medium.



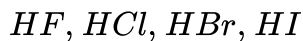
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**26.** The oxidation states exhibited by hydrogen in its various compounds are :



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27. Arrange the following acids in the decreasing order of their acid strength:



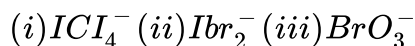
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28. When the first electron gain enthalpy ( $\Delta_{eg} H$ ) of oxygen is  $-141 \text{ kJ/mol}$ , its second electron gain enthalpy is :



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29. Give the formula and describe the structure of a noble gas species which is isostructural with :



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30. Bond angle in  $NH_3$  is more than in  $PH_3$ . Explain.



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31.  $NaOH$  gives disproportionation reaction with



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32. Give one use of lichen



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33.  $Bi(V)$  and  $Sb(V)$  which may be a stronger oxidizing agent and why ?



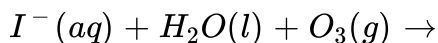
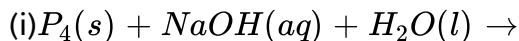
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34. Sulphur vapours exhibit some paramagnetic behaviour. Explain.



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35. Complete the following chemical equations :



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36. In the structure of  $HNO_3$ , why is N-O bond (121 pm) shorter than N-OH bond (140 pm) ?



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37.  $XeF_2$  has linear structure and not a bent structure , Given reason .



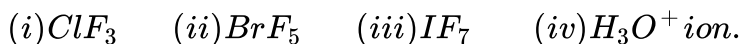
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**38.** Red phosphorus is less reactive than yellow phosphorus because



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**39.** On the basis of VSEPR theory, predict the shapes of the following molecules ions :



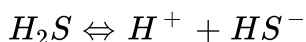
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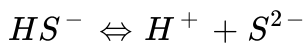
**40.** Why helium and neon do not form compounds with fluorine?



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**41.**  $K_{a1}$ ,  $K_{a2}$  and  $K_{a3}$  are the respective constants for the following reactions





The correct relationship between  $Ka_1$ ,  $Ka_2$  and  $Ka_3$  is



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42. Give the decreasing order of dipole moments of  $HF$ ,  $HCl$ ,  $HBr$ , and  $HI$ .



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43. (a) Why does  $NO_2$  dimerise ?

(b) In what way can it be proved that  $PH_3$  is basic in nature ?



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44. Red phosphorus is .....reactive than white phosphorus as red phosphorus is polymeric and consists of ..... the of  $P_4$  units.

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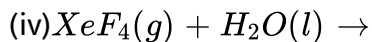
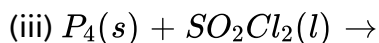
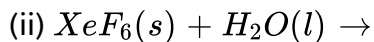
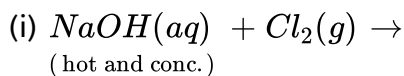
45.  $NF_3$  is not hydrolysed while  $NCl_3$  can be readily hydrolysed. Explain.

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46. Among  $ClF_3$ ,  $BF_3$  and  $NH_3$  molecules the one with non-planar geometry is

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47. Complete the following equations :

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48. The stability of +5 oxidation state decreases down the group 15 of the periodic table. Explain this observation giving appropriate reasons.



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49. The negative value of electron gain enthalpy is less for fluorine than for chlorine . Why?



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50. Which of the following correct about  $[Icl_4]^-$  and  $iCl_4$  compound



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51. Why does  $H_3PO_3$  act as a reducing agent but  $H_3PO_4$  does not ?



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52. (a) Write the balanced chemical equation for the reaction of  $Cl_2$  with hot and concentrated  $NaOH$ . Is this reaction a disproportionation reaction?

(b) when  $HCl$  reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride. why?

Deduce the molecular shape of  $BrF_3$  on the basis of  $VSEPR$  theory.



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53. find the total numbers of compounds which contain S-S linkage.

$H_2S_2O_3$ ,  $H_2S_2O_5$ ,  $H_2S_4O_6$ ,  $H_2S_2O_7$ ,  $H_2S_2O_8$ ,  $H_2S_2O_6$



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54. Arrange the following in order of decreasing N - O bond length

$NO_2^-$ ,  $NO_2^-$ ,  $NO_3^-$



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55. Give reasons for the following observations :

Why  $SF_4$  undergoes hydrolysis but not  $SF_6$ ?

Or  $SF_6$  is inert towards hydrolysis.

$SF_6$  is much less reactive than  $SF_4$ .

Or (i)  $SF_4$  is easily hydrolysed whereas  $SF_6$  is not easily hydrolysed.

(ii) Sulphur exhibits greater tendency for catenation than selenium.

(iii) Sulphur has a higher tendency for catenation than oxygen.



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56. Although fluorine is more electronegative than oxygen, but the ability of oxygen to stabilize higher oxidation states exceeds that of fluorine . Why ?



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57. Which element of chalcogens has maximum tendency to show catenation ?



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58. Group 16 element (except polonium ) are called chalcogens because



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59. Structure of xenon fluorides cannot be explained by valence bond theory. Explain.



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60. Predict the shape and the asked angle ( $90^\circ$  or more or less ) in each of the following cases :

(i)  $SO_3^{2-}$  and the angle O-S-O

(ii)  $ClF_3$  and the angle F-Cl-F

(iii)  $XeF_2$  and the angle F-Xe-F.



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61. Draw the structure of the following molecules

(i)  $H_3PO_2$  (ii)  $H_2S_2O_7$  (iii)  $XeOF_4$ .



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62. what happens if conc  $H_2SO_4$  is used in preparing hydrogen by its reaction with a metal?



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63. Why phosphorus is more reactive than nitrogen?



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64. The stability of +5 oxidation state decreases down the group 15 of the periodic table. Explain this observation giving appropriate reasons.



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65. Arrange the following in order of decreasing N - O bond length



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66. Which is a stronger reducing agent,  $SbH_3$  or  $BiH_3$  and why?



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67. Explain why all bonds in  $SF_4$  molecule are not equivalent.



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68. Despite lower value of its electron gain enthalpy with negative sign, fluorine ( $F_2$ ) is a stronger oxidising agent than chlorine ( $Cl_2$ ). Explain.



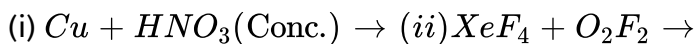
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69. Why are halogens coloured?



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70. Complete the reactions



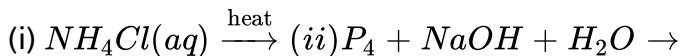
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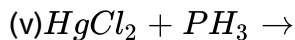
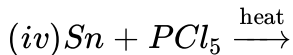
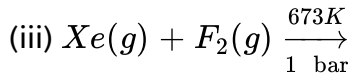
71. Although hydrogen bonding in HF is stronger than in water, yet water has much higher boiling point than HF. Explain.



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72. Complete the following reactions :





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**73.** Write balanced chemical equations for the following reactions :

(a) Hypophosphorus acid is added to  $AgNO_3$  solution

(b) Chlorine gas is passed through hot and concentrated solution of sodium hydroxide.

(c)  $XeF_2$  undergoes hydrolysis.



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**74.** Write balanced chemical equation for the following :

(a) NaCl is heated with sulphuric acid in the presence of  $MnO_2$

(b) Iodine is treated with Conc.  $HNO_3$ .



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75. Give two allotropes of oxygen. Give one method of preparation and two uses of each.



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76. Which xenon compound has distorted octahedral shape ?



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77. How will you account for the following :

(i) HI is a stronger acid than HF.

(ii) The electron affinity of fluorine is less than that of chlorine.



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78. How are interhalogen compounds formed ? Write general compositions that can be assigned to them.



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79. What happens when :

(i)  $PCl_5$ , is heated (ii)  $H_3PO_3$  is heated



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80. Bleaching of flowers by  $Cl_2$  is permanent while bleaching by  $SO_2$  is temporary, why ?



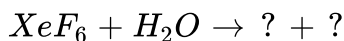
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81. Arrange  $HClO$ ,  $HBrO$ ,  $HIO$  decreasing order of acidic strength.



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82. Complete the equation





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**83.** Draw the shapes of the following molecules :

(i)  $XeOF_4$  (ii)  $H_2SO_4$



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**84.** Write main differences between the properties of white phosphorus and red phosphorus.



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**85.** The two O-O bond lengths in ozone molecule are equal. Assign reason.



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**86.** Why is  $PCl_5$  more covalent than  $PCl_3$  ?



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87. How will you prepare  $PH_3$  from

(i) Metal phosphides (ii)  $H_3PO_2$  (iii)  $H_3PO_3$  ?

Draw the structure of  $PH_3$ .



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88. Explain why nitrogen exists as a diatomic molecule and phosphorus as  $P_4$  molecule.



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89. Why are halogens strong oxidising agents ?



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**90.** How will you prepare the following ? Give chemical equations also.

(i) Chlorine from HCl (ii) Phosphoric acid from  $PCl_5$

(iii) Bleaching powder from  $Cl_2$



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**91.** Why phosphorus is more reactive than nitrogen?



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**92.** Why are the elements of group 17 generally coloured ?



**Watch Video Solution**

**93.** How does nitric acid react with (i) Copper (ii) Iron ? Give chemical equations.



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94. What is the basicity of  $H_3PO_3$  ?



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95. What happens when barium azide is heated ?



Watch Video Solution

96. How are interhalogen compounds formed ? Write general compositions that can be assigned to them.



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97. Find the total number of diprotic acids among the following:

$H_3PO_4$ ,  $H_2SO_4$ ,  $H_3PO_3$ ,  $H_2CO_3$ ,  $H_2S_2O_7$ ,  $H_3BO_3$ ,  $H_3PO_2$ ,  $H_2CrO_4$ ,  $H_2S$



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98. Why does  $NH_3$  act as a good complexing agent ?



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99. Which allotropic form of sulphur is most stable ?



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100. Why is bond angle in  $NH_4^+$  ion higher than in  $NH_3$  ?



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101. Why is the  $BiH_3$  strongest reducing agent amongst all the hydrides of group 15 ?



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**102.** Which poisonous gas is evolved when white phosphorus is heated with conc. NaOH solution ? Write the chemical equations involved.



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**103.** (i) Which allotrope of phosphorus is more reactive and why ?

(ii) How are the supersonic jet aeroplanes responsible for the depletion of ozone layers ?

(iii)  $F_2$  has lower bond dissociation enthalpy than  $Cl_2$ . Why ?

(iv) While noble gas is used in filling balloons for meteorological observations ?



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**104.** Give reason for the following :

(i) Chlorine water loses its colour on standing.

(ii) The is more acidic than  $H_2S$ .



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105. Draw the structures of (i)  $H_2S_2O_8$  (ii)  $XeO_4$ .



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106. On heating copper turnings with conc.  $HNO_3$ , a brown coloured gas is evolved which upon cooling dimerises. Identify the gas.



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107. Give reasons :

- (i)  $PCl_5$  is more volatile than  $PCl_3$ .
- (ii) O-O bond has lower bond dissociation enthalpy than S-S bond.
- (iii)  $F_2$  is stronger oxidising than  $Cl_2$ .



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**108.** Assign reason for the following :

- (i)  $H_3PO_2$  is a stronger reducing agent than  $H_3PO_4$ .
- (ii) Sulphur shows more tendency for catenation than oxygen.
- (iii) Reducing character increases from HF to HI.



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**109.** ON adding NaOH to ammonium sulphate, a colourless gas with pungent odour is evolved which forms a blue coloured complex with  $Cu^{2+}$  ions. Identify the gas.



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**110.** 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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111. Write the conditions to maximize the yield of  $H_2SO_4$  by contact process.



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112. Arrange the following in increasing order of the property indicated :

(a)  $H_3PO_3$ ,  $H_3PO_4$ ,  $H_3PO_2$  (Reducing Character)

(b)  $NH_3$ ,  $PH_3$ ,  $AsH_3$ ,  $SbH_3$ ,  $BiH_3$  (Basic Strength)



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113. (a) Write the laboratory method for the preparation of  $HNO_3$ .

(b) Write the structure of three oxoacids of phosphorus.



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**114.** Describe the manufacture of sulphuric acid by contact process on the basis of the following points :

(i) Theory and chemical reaction (ii) Labelled diagram (iii) Any two uses.



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**115.** (i) Why is concentrated  $H_2SO_4$  always diluted by adding  $H_2SO_4$  to water with constant stirring and not water to acid ?

(ii) Arrange  $HClO_4$ ,  $HClO_3$ ,  $HClO_2$ ,  $HClO$  in order of decreasing acidic strength.



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**116.** What happens when

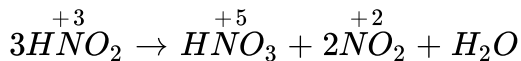
(i) Orthophosphorus acid is heated ?

(ii)  $XeF_6$  undergoes complete hydrolysis ?



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117. Write the disproportionation reaction of that oxoacid of nitrogen in which nitrogen is in +3 oxidation state.



Give reasons for the following :

- (i) Fluoride ion has higher hydration enthalpy than chloride ion.
- (ii) Thermal stability, decreases from  $\text{H}_2\text{O}$  to  $\text{H}_2\text{Te}$ .



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118. Electron gain enthalpies of halogens are largely negative. Explain.



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119. Why is  $\text{N}_2\text{O}_5$  more acidic than  $\text{N}_2\text{O}_3$  ?



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120.  $H_3PO_2$  acts as a monobasic acid. Explain.



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121. Give reasons :

(a)  $H_3PO_3$  undergoes disproportionation reaction but  $H_3PO_4$  does not

(b) Dioxygen is a gas while sulphur is a solid

(c ) When  $Cl_2$  reacts with excess of  $F_2$  compound formed is  $ClF_3$  and not  $FCl_3$ .



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122. (i) white phosphorus (ii) red phosphorus and (iii) black phosphorus.

Write the difference between white red and black phosphorus on the basis of their structure and reactivity.

Phosphorus has three allotropic forms \_\_



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1. Some farmers feel that lightening helps in producing a better crop.

What is the scientific reason behind this ?



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2. You are given an inorganic mixture with the information that the cations of group II are absent. However, on passing  $H_2S$  gas through the mixture solution acidified with dilute HCl, yellowish turbidity appears. Explain.



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3. A greenish yellow gas 'X' is passed through water to form a saturated solution. The aqueous solution on treatment with silver nitrate solution gives a white precipitate. The saturated aqueous solution also dissolves

magnesium ribbon with the evolution of a colourless gas 'Y'. Identify gases 'X' and 'Y'.



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4. Concentrated sulphuric acid is added followed by heating in each of the following test tubes labelled (i) to (v) :



Identify in which of the above test tubes, the following changes will be observed. Support your answer with the help of a chemical equation.

(a) formation of black substance

(b) evolution of brown gas

(c ) evolution of colourless gas

(d) formation of brown substance which on dilution becomes blue.

(e ) disappearance of yellow powder along with the evolution of a colourless gas.



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5. An aqueous solution of gas 'A' gave the following reactions :

(i) It decolourised an acidified  $KMnO_4$  solution.

(ii) On boiling with  $H_2O_2$  followed by cooling and then adding an aqueous solution of  $BaCl_2$ , a white precipitate insoluble in dilute HCl was obtained.

(iii) On passing  $H_2S$  through the solution of the gas, white turbidity was obtained. Identify the gas and give equations for steps (i), (ii) and (iii).



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6. An inorganic compound 'A' gives a brick red flame on performing flame test. The compound gives the following tests also.

(a) It smells of chlorine when placed in moist air.

(b) If  $KI$  and  $CH_3COOH$  are added to the suspension of the compound in water, a violet colour is noticed. Identify the compound 'A' and write the equations for the tests (a) and (b).



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



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8. An element 'A' exists as a yellow solid in standard state. It forms a volatile hydride 'B' which is a foul smelling gas and is extensively used in qualitative analysis of salts. When treated with oxygen, 'B' forms an oxide 'C' which is a colourless and pungent smelling gas. The gas when passed through acidified  $KMnO_4$  solution, decolourises it. 'C' gets oxidised to another oxide 'D' in the presence of heterogeneous catalyst. Identify A, B, C, D and also give the chemical equations of reaction of 'C' with acidified  $KMnO_4$  solution and for conversion of 'C' into 'D'.



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9. Element 'A' burns in nitrogen to give an ionic compound 'B' which reacts with water to give 'C' and 'D'. The solution of 'C' becomes milky on bubbling carbon dioxide gas. Identify the compounds A, B, C and D.



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10. A colourless inorganic salt (A) decomposes completely at about  $25^{\circ}\text{C}$  to give only two products, (B) and (C), leaving no residue. The product (C) is a liquid at room temperature and neutral to moist litmus paper while the gas (B) is a neutral oxide. White phosphorus burns in excess of (B) to produce a strong white dehydrating agent. Write balanced equations for the reactions involved in the above process.



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11. An aqueous solution of a gas ( $X$ ) shows the following reactions :

(a) It turns red litmus blue.

(b) When added in excess to a copper sulphate solution, a deep blue coloured solution is obtained.

( c ) On addition to  $FeCl_3$  solution, a brownish precipitate is formed, which is solution in  $HNO_3$ .

Identify (  $X$  ) and give an explanation for step (  $a$  ), (  $b$  ) and (  $c$  ).



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## Problems For Practice

1. Name the gas evolved when ammonium dichromate  $(NH_4)_2Cr_2O_7$  is heated.



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2. Why is ammonia highly soluble in water ?



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3. Is nitrogen gas poisonous in nature ?



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4. Name a compound of N, H and O which upon heating evolves nitrogen gas.



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5. What is the formula of nitrolim ?



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6. What happens when mixture of  $NH_3$  and air is passed over heated platinum gauze ?



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7. Why does  $NH_3$  act as a good complexing agent ?



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8. Nessler's reagent is



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9. Which oxide of nitrogen is coloured ?



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10. Which of the following is a nitric acid anhydride?



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11. The composition of aqua-regia is



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12. Name one metal which becomes passive in conc.  $HNO_3$ .



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13. Which oxide of nitrogen is paramagnetic and coloured ?



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14. What are the neutral oxides of nitrogen?



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15. Name the product when zinc is reacted with very dilute  $HNO_3$  acid.



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16. Name the product when iodine is heated with concentrated  $HNO_3$ .



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17. Name the compound of N with oxidation state  $-3$  and  $+2$ .



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18. Identify the group 15 elements (s) which correspond to the following description.

(a) exists mainly in  $+3$  oxidation state.

(b) is a gas at room temperature

(c) forms a basic oxide

(d) is the most abundant element in the atmosphere.



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19. In the ring test for  $\text{NO}_3^-$  ion, what is the chemical formula of the brown coloured ring ?



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20. Which oxide of nitrogen becomes brown when released in air ?



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21. What are the shapes of  $PH_3$  molecule and  $PH_4^+$  ion ?



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22. What is the maximum oxidation state shown by nitrogen in its compounds ?



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23. What is the nature of  $N^{3-}$  ion ?



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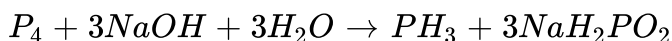


24. Apart from  $N_2O$  which other colourless gas supports combustion ?



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25. What is the nature of the following reaction ?



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26. How many (P-O) bonds are present in (i)  $P_4O_6$  (ii)  $P_4O_{10}$  ?



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27. Out of  $O_2$  and  $O_3$  which is a better oxidising agent ?



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28. What is the shape of ozone molecule ?



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29. Select the acidic and basic anhydrides from the following :

(i)  $Na_2O$  (ii)  $P_4O_6$  (iii)  $SO_2$  (iv)  $Al_2O_3$



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30. Give two examples of mixed oxides.



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31. What is the nature of the following oxides :

(i)  $CO$  (ii)  $Al_2O_3$  (iii)  $CO_2$  (iv)  $CaO$  (v)  $SO_3$  ?



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32. What happens when water is dropped over  $\text{Na}_2\text{O}_2$  ?



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33. Why is  $\text{O}_3$  more reactive than  $\text{O}_2$  ?



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34. Name two compounds in which oxygen has oxidation states different from  $-2$ .



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35. How does sulphur normally exist ?



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36. What is the hybridisation of sulphur in  $H_2SO_4$  ?



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37. What is oil of vitriol ?



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38. What is the IUPAC name of  $H_2S_4$  gas ?



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39. What is the oxidation state of sulphur in

(i)  $PbS$  (ii)  $SO_2$  (iii)  $SO_4^{2-}$  (iv)  $SCl_2$  ?



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**40.** What happens to sugar when conc.  $H_2SO_4$  is dropped on it ?



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**41.** Which allotropic form of sulphur is not sharp melting ?



**Watch Video Solution**

**42.** Which chemical is used to remove a fresh iodine stain ?



**Watch Video Solution**

**43.** What are the colours of the following sulphides ?

(i) CoS (ii) CuS (iii) MnS (iv) CdS.



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44. Out of 1 M  $H_2SO_4$  and 1 N  $H_2SO_4$ , which is more concentrated and why?



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45. Which substance removes  $As_2O_3$  in contact process?



View Text Solution

46. Name the halogens that can form true chemical bonds with noble gases?



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47. Give two compounds in which iodine behaves as a cation.



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48. Hybridisation and shape of  $BrF_5$  is :

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49. Why does fluorine fail to exhibit variable oxidation states ?

 [View Text Solution](#)

50. Give the structure of noble gas species isostructural with  $Icl_4^-$

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51. What is the shape  $ClF_3$  molecule ?

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52. Give one example each in which halogens display positive oxidation states from +1 to +7.



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53. Name a neutral molecule isoelectronic with  $ClO^-$  ion.



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54. What is the state of hybridisation of halogen atom in the Oxoacids of halogens ?



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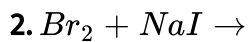
Complete the following equations



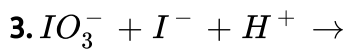




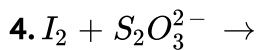
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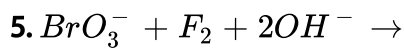
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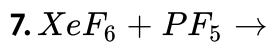
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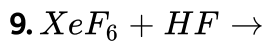
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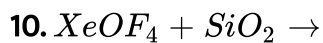
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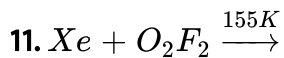
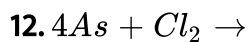
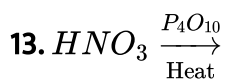
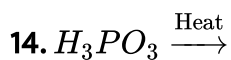


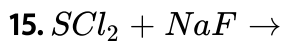
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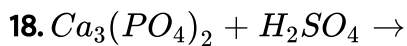
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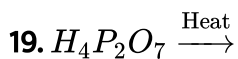
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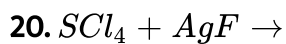
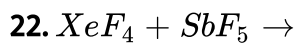
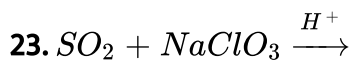


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24.  $SO_2 + H_2S \rightarrow$  Product. The final product is

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25.  $CaP_2 + H_2O \rightarrow$

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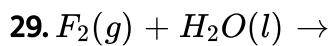
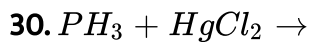
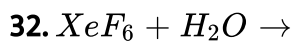
26.  $XeF_4 + H_2O \rightarrow$

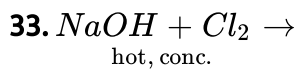
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27.  $Cu^{+} + NH_3 \rightarrow$

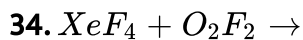
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28.  $O_3(g) + I^{-}(aq) + H_2O(l) \rightarrow$

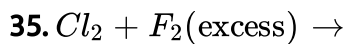
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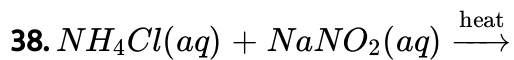
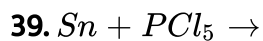
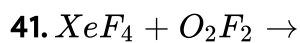
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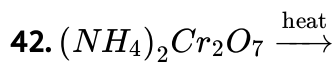


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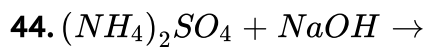
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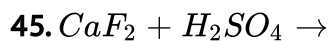
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1. On addition of con.  $H_2SO_4$  to a chloride salt, colourless fumes come out. This is because

A.  $H_2SO_4$  reduces HI to  $I_2$

B. HI is of violet colour

C. HI gets oxidised to  $I_2$

D. HI changes to  $HIO_3$

**Answer: C**



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2. In qualitative analysis when  $H_2S$  is passed through an aqueous solution of salt acidified with dil. HCl, a black precipitate is obtained. On boiling the precipitate with dil.  $HNO_3$ , it forms a solution of blue colour. Addition of excess of aqueous solution of ammonia to this solution gives

A. deep blue precipitate of  $Cu(OH)_2$

B. deep blue solution of  $[Cu(NH_3)_4]^{2+}$

C. deep blue solution of  $Cu(NO_3)_2$

D. deep blue solution of  $Cu(OH)_2 \cdot Cu(NO_3)_2$

**Answer: B**



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3. In a cyclotrimetaphosphoric acid molecule, how many single and double bonds are present ?

A. 3 double bonds, 9 single bonds

B. 6 double bonds, 6 single bonds

C. 3 double bonds, 12 single bonds

D. Zero double bonds, 12 single bonds

**Answer: A**



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4. Which of the following elements can be involved in  $p\pi - d\pi$  bonding ?

A. Carbon

B. Nitrogen

C. Phosphorus

D. Boron

**Answer: C**



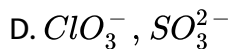
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5. Which of the following pairs of ions are isoelectronic and also isostructural ?

A.  $CO_3^{2-}$ ,  $NO_3^-$

B.  $ClO_3^-$ ,  $CO_3^{2-}$

C.  $SO_3^{2-}$ ,  $NO_3^-$



**Answer: A**



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6. Affinity for hydrogen decreases in the group from fluorine to iodine. Which of the halogen acids should have highest bond dissociation enthalpy ?

A. HF

B. HCl

C. HBr

D. HI

**Answer: A**



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7. Bond dissociation enthalpy of E- H (E = element) bonds is given below .

Compound	$NH_3$	$PH_3$	$AsH_3$	$SbH_3$
----------	--------	--------	---------	---------

$\Delta_{\text{diss}}(E - H) /$				
---------------------------------	--	--	--	--

$kJmol^{-1}$	389	322	297	255
--------------	-----	-----	-----	-----

Which of the following compounds will act as strongest reducing agent ?

A.  $NH_3$

B.  $PH_3$

C.  $AsH_3$

D.  $SbH_3$

**Answer: D**



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8. On heating with concentrated NaOH solution in an inert atmosphere of  $CO_2$ , white phosphorus gives a gas. Which of the following statements is incorrect about the gas ?

- A. It is highly poisonous and has smell like rotten fish.
- B. Its solution in water decomposes in the presence of light.
- C. It is more basic than  $NH_3$ .
- D. It is less basic than  $NH_3$

**Answer: C**



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**9. Which of the following acids forms three series of salts?**

- A.  $H_3PO_2$
- B.  $H_3BO_3$
- C.  $H_3PO_4$
- D.  $H_3PO_3$

**Answer: C**



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10. Strong reducing behaviour of  $H_3PO_2$  is due to

- A. Low oxidation state of phosphorus
- B. Presence of two  $-OH$  groups and one P-H bond
- C. Presence of one  $-OH$  group and two P-H bonds
- D. High electron gain enthalpy of phosphorus

**Answer: C**



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11. On heating lead nitrate forms oxides of nitrogen and lead. The oxides formed are :

- A.  $N_2O$ ,  $PbO$
- B.  $NO_2$ ,  $PbO$
- C.  $NO$ ,  $PbO$

D.  $NO$ ,  $PbO_2$

**Answer: B**



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**12.** Which of the following elements does not show allotropy ?

A. Nitrogen

B. Bismuth

C. Antimony

D. Arsenic

**Answer: A**



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**13.** The maximum covalency of nitrogen is

A. 3

B. 5

C. 4

D. 6

**Answer: C**



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**14.** Which of the following statements is wrong ?

A. Single N-N bond is stronger than the single P-P bond.

B.  $PH_3$  can act as a ligand in the formation of coordination compound with transition elements.

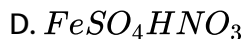
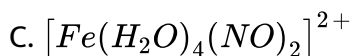
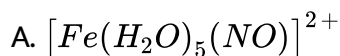
C.  $NO_2$  is paramagnetic in nature.

D. Covalency of nitrogen in  $N_2O_5$  is four.

**Answer: A**

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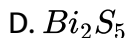
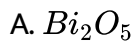
15. A brown ring is formed in the ring test for  $\text{NO}_3^-$  ion. It is due to the formation of



**Answer: A**

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16. Elements of group 15 form compounds in +5 oxidation state. However, bismuth forms only one well characterised compound in +5 oxidation state. The compound is



**Answer: B**



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17. On heating ammonium dichromate and barium azide separately we get

A.  $N_2$  in both cases

B.  $N_2$  with ammonium dichromate and NO with barium azide

C.  $N_2O$  with ammonium dichromate and  $N_2$  with barium azide

D.  $N_2O$  with ammonium dichromate and  $NO_2$  with barium azide

**Answer: A**

18. In the preparation of  $HNO_3$ , we get NO gas by catalytic oxidation of ammonia. The moles of NO produced by the oxidation of two moles of  $NH_3$  will be.

A. 2

B. 3

C. 4

D. 6

**Answer: A**

19. The oxidation state of central atom in the anion of compound  $NaH_2PO_2$  will be.

A.  $+3$

B.  $+5$

C.  $+1$

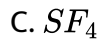
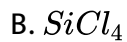
D.  $-3$

**Answer: C**



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**20. Which of the following is not tetrahedral in shape ?**

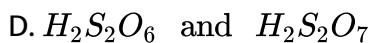
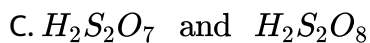
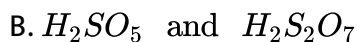
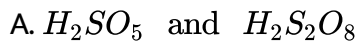


**Answer: C**



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21. Which of the following are peroxyacids of sulphur ?



**Answer: A**



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22. Hot conc.  $H_2SO_4$  acts as moderately strong oxidising agent. It oxidises both metals and non-metals. Which of the following elements is oxidised by conc.  $H_2SO_4$  into two gaseous products ?

A. Cu

B. S



C. C

D. Zn

**Answer: C**



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**23.** A black compound of manganese reacts with a halogen acid to give greenish yellow gas . When excess of this gas reacts with  $NH_3$  an unstable trihalide is formed. In this process, the oxidation state of nitrogen changes from

A.  $-3$  to  $+3$

B.  $-3$  to  $0$

C.  $-3$  to  $+5$

D.  $0$  to  $-3$

**Answer: A**



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24. In the preparation of compounds of Xe, Bartlett had taken  $O_2^+ PtF_6^-$  as a base compound. This is because

- A. both  $O_2$  and Xe have same size.
- B. both  $O_2$  and Xe have same electron gain enthalpy.
- C. both  $O_2$  and Xe have almost same ionisation enthalpy.
- D. both Xe and  $O_2$  are gases.

**Answer: C**



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25. In solid state  $PCl_5$  is a

- A. covalent solid
- B. octahedral structure

C. ionic solid with  $[PCl_6]^+$  octahedral and  $[PCl_4]^-$  tetrahedra

D. ionic solid with  $[PCl_4]^+$

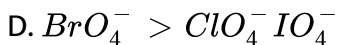
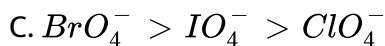
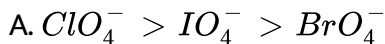
**Answer: D**



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**26.** Reduction potentials of some ions are given below. Arrange them in decreasing order of oxidising power.

Ion	$ClO_4^-$	$IO_4^-$	$BrO_4^-$
Reduction potential $E^\ominus / V$	$E^\ominus = 1.19V$	$E^\ominus = 1.65V$	$E^\ominus = 1.74$

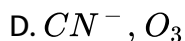
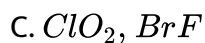
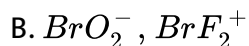
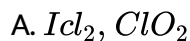


**Answer: C**



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27. Which of the following is isoelectronic pair ?



Answer: B



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## Multiple Choice Questions

1. If chlorine gas is passed through hot NaOH solution, two changes are observed in the oxidation number of chlorine during the reaction. These are \_\_\_\_ and \_\_\_\_

A. 0 to +5

B. 0 to +3

C. 0 to -1

D. 0 to +1

**Answer: A::C**



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**2. Which of the following options are not in accordance with the property mentioned against them ?**

A.  $F_2 > Cl_2 > Br_2 > I_2$  Oxidising power.

B.  $MI > MBr > MCl > MF$  Ionic character of metal halide.

C.  $F_2 > Cl_2 > Br_2 > I_2$  Bond dissociation enthalpy.

D.  $HI < HBr < HCl < HF$  Hydrogen-halogen bond strength.

**Answer: B::C**

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3. Which of the following is correct for  $P_4$  molecule of white phosphorus ?

- A. It has 6 lone pairs of electrons.
- B. It has six P-P single bonds.
- C. It has three P-P single bonds.
- D. It has four lone pairs of electrons.

**Answer: B::D**

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4. Which of the following statements are correct ?

- A. Among halogens, radius ratio between between iodine and fluorine is maximum.

B. Leaving F-F bond, all halogens have weaker X-X bond than X-X in interhalogens.

C. Among interhalogen compounds maximum number of atoms are present in iodine fluoride.

D. Interhalogen compounds are more reactive than halogen compounds.

**Answer: A::C::D**



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5. Which of the following statements are correct for  $SO_2$  gas ?

A. It acts as bleaching agent in moist conditions.

B. Its molecule has linear geometry.

C. Its dilute solution is used as disinfectant.

D. It can be prepared by the reaction of dilute  $H_2SO_4$  with metal sulphide.

**Answer: A::C**



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**6. Which of the following statements are correct ?**

A. All the three N-O bond length in  $HNO_3$  are equal.

B. All P-Cl bond lengths in  $PCl_5$  molecule in gaseous state are equal.

C.  $P_4$  molecules in white phosphorus have angular strain therefore white phosphorus is very reactive.

D.  $PCl_5$  is ionic in solid state in which cation is tetrahedral and anion is octahedral.

**Answer: C::D**



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7. Which of the following order are correct as per the properties mentioned against each ?

A.  $As_2O_3 < SiO_2 < P_2O_3 < SO_2$  Acid strength.

B.  $AsH_3 < PH_3 < NH_3$  Enthalpy of vapourisation

C.  $S < O < Cl < F$  More negative electron gain enthalpy.

D.  $H_2O > H_2S > H_2Se > H_2Te$  Thermal stability.

Answer: A::D



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8. Which of the following statements are correct ?

A. S-S bond is present in  $H_2S_2O_6$ .

B. In peroxosulphuric acid ( $H_2SO_6$ ) sulphur is in +6 oxidation state.

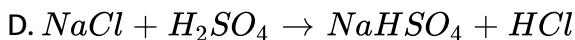
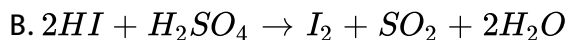
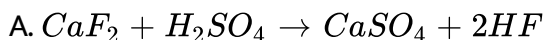
- C. Iron powder along with  $Al_2O_3$  and  $K_2O$  is used as a catalyst in the preparation of  $NH_3$  by Haber's process.
- D. Change in enthalpy is positive for the preparation of  $SO_3$  by catalytic oxidation of  $SO_2$ .

**Answer: A::B**



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9. In which of the following reactions conc.  $H_2SO_2$  is used as an oxidising reagent ?



**Answer: B::C**

10. Which of the following statements are true ?

- A. Only type of interactions between particles of noble gases are due to weak dispersion forces.
- B. Ionisation enthalpy of molecular oxygen is very close to that of xenon.
- C. Hydrolysis of  $XeF_6$  is a redox reaction.
- D. Xenon fluorides are not reactive.

**Answer: A::B**

1. Match the compounds give in Column I with the hybridisation and shape given in Column II and mark the correct option.



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2. Match the formulas of oxides given in Column I with the type of oxides given in Column II and mark the correct option.



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3. Match the items of Column I and II and mark the correct option.



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4. Match the species given in Column I with the shape given in Column II and mark the correct option.



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5. Match the items of Column I and II and mark the correct option.



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### Assertion-Reason Type Questions

1. Assertion :  $N_2$  is less reactive than  $P_4$ .

Reason : Nitrogen has more electron gain enthalpy than phosphorus.



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2. Assertion :  $HNO_3$  makes iron passive.

Reason :  $HNO_3$  forms a protective layer of ferric nitrate on the surface of iron.



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3. Assertion : HI cannot be prepared by the reaction of KI with concentrated  $H_2SO_4$

Reason : HI has lowest H-X bond strength among halogen acids.



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4. Assertion : Both rhombic and monoclinic sulphur exist as  $S_8$  but oxygen exists as  $O_2$ .

Reason : Oxygen forms  $p\pi - p\pi$  multiple bond due to small size and small length but  $p\pi - p\pi$  bonding is not possible in sulphur.



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5. Assertion :  $\text{NaCl}$  reacts with concentrated  $\text{H}_2\text{SO}_4$  to give colourless fumes with pungent smell. But on adding  $\text{MnO}_2$  the fumes become greenish yellow.

Reason :  $\text{MnO}_2$  oxidises  $\text{HCl}$  to chlorine gas which is greenish yellow.



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6. Assertion:-  $\text{SF}_6$  cannot be hydrolysed but  $\text{SF}_4$  can be.

Reason:- Six F atoms in  $\text{SF}_6$  prevent the attack of  $\text{H}_2\text{O}$  on sulphur atom of  $\text{SF}_6$



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## Assignment

1. Why does phosphorus exist as  $\text{PCl}_5$  but nitrogen cannot exist as  $\text{NCl}_5$  ?



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2. Draw the structure of  $N_2O_5$ .



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3. Why is ammonia a stronger base than phosphine ?



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4. Why is  $Bi(V)$  a stronger oxidant than  $Sb(V)$  ?



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5. Phosphorus shows greater tendency for catenation than nitrogen. Why ?



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6. Why is the bond angle in  $PH_3$  molecule lesser than that in  $NH_3$  molecule?



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7. All bonds in the molecule of  $PCl_5$  are not equivalent. Explain.



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8. Why is  $NH_3$  a stronger base than  $PH_3$  ?



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9. In the structure of  $HNO_3$ , why is N-O bond (121 pm) shorter than N-OH bond (140 pm) ?



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10.  $H_3PO_2$  and  $H_3PO_3$  act as good reducing agents while  $H_3PO_4$  does not. Discuss.



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11. Why is bond angle in  $PH_4^+$  ion higher than in  $PH_3$  ?



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12. Why phosphorus is more reactive than nitrogen?



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13.  $H_3PO_3$  is diprotic (or dibasic). Why ?



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14. Which is a stronger reducing agent,  $SbH_3$  or  $BiH_3$  and why ?



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15. Why is nitrogen ( $N_2$ ) much less reactive than phosphorus ( $P_4$ )



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16. What happens when the following are heated ?

(i)  $PCl_5$  (ii)  $H_3PO_3$ .



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17. Why does  $PH_3$  have lower boiling point than  $NH_3$  ?



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18. Write main differences between the properties of white phosphorus and red phosphorus.

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19. Why is  $PCl_5$  molecule more covalent than  $PCl_3$  molecule ?

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20. The basicity of phosphorus acid ( $H_3PO_3$ ) is ..... .

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21. Why is  $H_3PO_2$  a stronger reducing agent than  $H_3PO_3$  ?

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**22.** The formation of ammonia by Haber's process is favoured by ..... pressure.



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**23.** How does nitric acid react with (i) Copper (ii) Iron ? Give chemical equations.



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**24.** Describe the manufacture of sulphuric acid by contact process on the basis of the following points :

(i) Theory and chemical reaction (ii) Labelled diagram (iii) Any two uses.



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**25.** What happens when barium azide is heated ?



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26. Why is  $NH_3$  a good complexing agent ?



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27. Copper turnings upon heating with conc.  $HNO_3$  evolve a brown gas which dimerises upon cooling. Identify the gas.



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28. (a) Write the laboratory method for the preparation of  $HNO_3$ .

(b) Write the structure of three oxoacids of phosphorus.



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29. Why is red phosphorus less reactive than white phosphorus ?





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30. What is the basicity of  $H_3PO_4$  ?



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## Oxygen Family (Group 16)

1. Oxygen exhibits an oxidation state of - 2 while the other members of the family show oxidation states of + 2, + 4 and + 6. Explain.



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2. Amongst  $H_2O$ ,  $H_2S$ ,  $H_2Se$  and  $H_2Te$  the one with highest boiling point is :



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3. Account for the fact that  $SO_2$  can act as an oxidising and reducing agent while  $SO_3$  is only oxidising agent.



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4. Sulphur is a solid while oxygen is a gas at room temperature. Why ?



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5. Among the hydrides of oxygen family, water is anomalous. Explain.



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6. Draw the structure formula of the following :

(i) Thiosulphuric acid.

(ii) Peroxodisulphuric acid.

(iii) Sulphurous acid.

(iv) Linear chain form of solid  $SO_3$ .





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7. Sulphur vapours exhibit some paramagnetic behaviour. Explain.



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8. Sulphur disappears when boiled with an aqueous solution of sodium sulphite. Why ?



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9. Give two examples of chalcogens.



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10. Draw the shape of  $XeF_4$ .



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11. Why does sulphur have greater tendency for catenation than oxygen ?



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12. Why is  $SF_4$  easily hydrolysed while the hydrolysis while the hydrolysis of  $SF_6$  is difficult ?



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13. Why is  $H_2S$  more acidic than water ?



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14. The elements oxygen and sulphur are called chalcogens because



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15. Why is  $SF_6$  kinetically inert ?



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16. Describe contact process (equations only) for the manufacture of sulphuric acid.



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17. Draw the shape of sulphuric acid.



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18. The two O-O bond lengths in ozone molecule are equal. Assign reason.



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19. Which allotropic form of sulphur is most stable ?



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20. Draw the structure of the following molecules

(i)  $H_3PO_2$  (ii)  $H_2S_2O_7$  (iii)  $XeOF_4$ .



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21. In the estimation of sulphur organic compound on treating with conc.

$HNO_3$  is converted to



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## Halogens Family (Group 17)

1. Interhalogen compounds are



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2. Bond dissociation enthalpy of F-F bond is less than that of Cl-Cl bond. Explain.



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3. Out of  $HClO_3$  and  $HClO_4$  which has lower  $pK_a$  value and why ?



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4. Draw the structure of  $BrF_3$ .



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5. Assertion : Fluorine is the strongest oxidising agent in halogens.

Reason : It displaces other halogens from its aqueous solution.



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6. Which halogen has tendency to form cation ?



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7. Why do halogens have low melting points ?



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8. Out of HI and HCl, which is a stronger acid in aqueous solution ?



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9. Arrange  $\text{HOCl}$ ,  $\text{HClO}_2$ ,  $\text{HClO}_3$  and  $\text{HClO}_4$  in order of (i) acidic strength and (ii) oxidising power. Give reason.



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**10.** Explain the following:

- (a) More metal fluorides are ionic in nature than metal chlorides.
- (b) Perchloric acid is a stronger acid than sulphuric acid.
- (c ) Fluorine does not undergo disproportionation reactions but other halogens do.



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**11.** Chlorine acts as a bleaching agent only in the presence of



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**12.** Give the decreasing order of dipole moments of  $HF$ ,  $HCl$ ,  $HBr$ , and  $HI$ .



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13. How is chlorine prepared from HCl ? What happens when chlorine is treated with (i) Sulphur (ii) Slaked lime (iii) HCl (iv) Turpentine oil.



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14. Oxidation states of O in  $OF_2$  and  $O_2F_2$  respectively are



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15. Despite lower value of its electron gain enthalpy with negative sign, fluorine ( $F_2$ ) is a stronger oxidising agent than chlorine ( $Cl_2$ ). Explain.



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16. How will you account for the following :

(i) HI is a stronger acid than HF.

(ii) The electron affinity of fluorine is less than that of chlorine.





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17. Bond dissociation enthalpy of F-F bond is less than that of Cl-Cl bond. Explain.



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18. Bleaching of flowers by  $Cl_2$  is permanent while bleaching by  $SO_2$  is temporary, why ?



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19. Why are halogens strong oxidising agents ?



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20. Why are the elements of group 17 generally coloured ?



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21. Interhalogen compounds are

- A. covalent molecules
- B. Diamagnetic in nature
- C. Volatile solids/liquids at 298K except Cl<sub>2</sub>, F<sub>2</sub>
- D. All of the above



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22. Write the formulae of any two oxyacids of phosphorus.



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23. Why does chlorine act as a bleaching agent ?



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## Noble Gases (Group 18)

1. What are noble gases ? Why are they so named ?



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2. What was the reason applied by Bartlett for carrying out the reaction of xenon with  $PtF_6$  ?



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3. Account for the fact that noble gases exhibit low chemical reactivity.



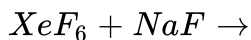
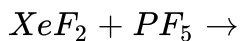
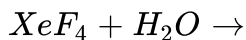
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4. How is  $XeO_3$  prepared ? Draw its structure.



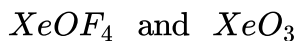
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5. Complete the following equations :



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6. Give the molecular structures of :



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7. How are  $\text{XeF}_2$  and  $\text{XeF}_4$  prepared ? Give their structures and also mention the state of hybridisation involved.





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8. Give two reactions to show that xenon hexafluoride acts as fluoride ion donor.



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9. Xenon has closed shell configuration but gives compounds with fluorine. Explain.



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10. How is  $XeF_2$  prepared ?



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11. Explain hybridisation in  $XeF_2$ . Also draw its molecular structure.



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12. Draw the structure of  $XeF_2$  molecule.



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13. Draw the structure of  $XeOF_4$ .



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14. Draw the shape of  $XeF_4$ .



[Watch Video Solution](#)

15. Among noble gases, only xenon reacts with fluorine to form stable xenon fluorides, because xenon



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16. How are xenon fluorides,  $XeF_2$ ,  $XeF_4$  and  $XeF_6$  prepared ?

Describe their molecular shapes.



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17.  $XeF_2$  has linear structure and not a bent structure , Given reason .



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18. Why are zero group elements chemically inert ?



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19. Structure of xenon fluorides cannot be explained by valence bond theory. Explain.



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20. Which xenon compound has distorted octahedral shape ?



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21. Xenon is a noble gas element but it forms compounds ? Draw the structures of any two compounds of it.



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22. Why do noble gases have low boiling points ?



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23. What inspired N. Bartlett for carrying out reaction between Xe and  $PtF_6$ ?



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1. Account for the following :

(i) Ammonia is a stronger base than phosphine.

(ii)  $H_3PO_3$  is a diprotic acid.



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2. (a) Draw the molecular structure of peroxomono sulphuric acid.

(b) Name the compounds in which iodine shows positive oxidation states.



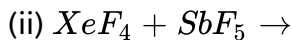
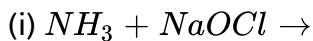
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3. (a) Draw the molecular structures of :

(i) Peroxodisulphuric acid

(ii) Iodine pentafluoride

(b) Complete and balance the following equations :



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4. Draw the molecular structures of  $XeF_2$ ,  $XeF_4$  and  $XeO_2F_2$ , indicating the location of lone pair(s) of electrons.



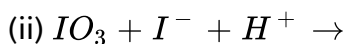
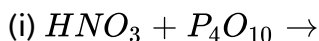
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5. Oxides of nitrogen have open chain structures while those of phosphorous have closed chain or cage structures. Why?



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6. Complete the following equations :





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7. (a) Give reasons for the following :

- (i)  $SF_6$  is a well known compound but  $SCl_6$  is not known
- (ii) In aqueous solution, HF is a weaker acid than HCl
- (iii) Addition of  $Cl_2$  to KF solution gives it a brown colour but excess of  $Cl_2$  turns it colourless

(b) Draw the structures of

- (i) Peroxodisulphuric acid
- (ii) bromine trifluoride.



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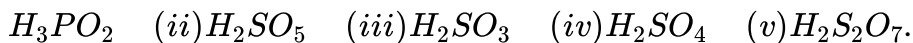
8. Write the structures of :

- (i)  $H_4P_2O_6$     (ii)  $H_2SO_5$     (iii)  $XeF_4$



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9. Draw the structures of (i)



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10. Write chemical equations for the following processes :

(i) Chlorine reacts with hot concentrated solution of NaOH

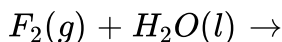
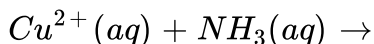
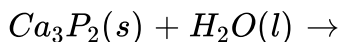
(ii) Orthophosphoric acid is heated.

(iii)  $PtF_6$  and Xenon are mixed together.



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11. Complete the following equations :



Draw the structures of (i)  $H_2S_2O_7$  (ii)  $BrF_3$  (iii)  $XeF_2$ .



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**12.** Predict the shape and the asked angle ( $90^\circ$  or more or less ) in each of the following cases :

(i)  $SO_3^{2-}$  and the angle O-S-O

(ii)  $CIF_3$  and the angle F-Cl-F

(iii)  $XeF_2$  and the angle F-Xe-F.



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**13.** Complete the following reactions :

(i)  $NH_4Cl(aq) \xrightarrow{\text{heat}} (ii) P_4 + NaOH + H_2O \rightarrow$

(iii)  $Xe(g) + F_2(g) \xrightarrow[1 \text{ bar}]{673K}$  (iv)  $Sn + PCl_5 \xrightarrow{\text{heat}}$

(v)  $HgCl_2 + PH_3 \rightarrow$



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14. (i) Which family of compounds is known as chalcogens and why ?
- (ii) Except fluorine, other members of the halogen family show variable oxidation states. Why ?
- (iii) Give the shape of  $S_8$  molecule in rhombic sulphur.



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15. Give reasons for the following:

- (i) Oxygen is a gas but sulphur is a solid.
- (ii)  $O_3$  acts as a powerful oxidising agent.
- (iii)  $BiH_3$  is the strongest reducing agent amongst all the hydrides of Groups 15 elements.



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16. Account for the following :

- (i)  $NH_3$  has a higher boiling point than  $PH_3$
- (ii) HF is a weaker acid than HI

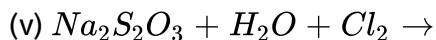
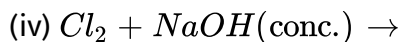
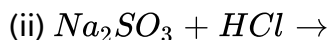
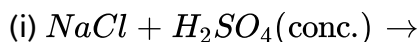
(iii) Of noble gases, only xenon forms real compounds

(iv)  $H_3PO_3$  is a diprotic acid.



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**17.** Complete the following :



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**18.** Give reasons :

(i)  $PCl_5$  is more volatile than  $PCl_3$ .

(ii) O-O bond has lower bond dissociation enthalpy than S-S bond.

(iii)  $F_2$  is stronger oxidising than  $Cl_2$ .



19. Assign reason for the following :

- (i)  $H_3PO_2$  is a stronger reducing agent than  $H_3PO_4$ .
- (ii) Sulphur shows more tendency for catenation than oxygen.
- (iii) Reducing character increases from HF to HI.



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20. (i) Name the scientist who prepared the first compound of noble gases

(ii) Give chemical reactions of  $HNO_3$  with iodine

(iii) Why are halogens coloured ?



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## Multiple Choice Questions Bank MCQ

1. The hybridisation of nitrogen in  $R_2NH$  is :



A.  $sp^3$

B.  $sp^2$

C.  $sp$

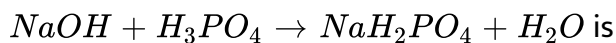
D.  $dsp^2$

**Answer: A**



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2. The equivalent weight of phosphoric acid ( $H_3PO_4$ ) in the reaction



A. 25

B. 49

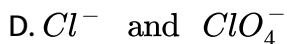
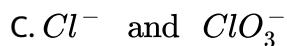
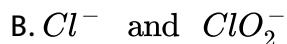
C. 59

D. 98

**Answer: D**

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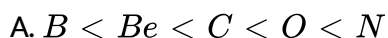
3. When chlorine reacts with cold and dilute solution of sodium hydroxide, the products obtained are



**Answer: A**

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4. Correct order of 1st ionisation potential (IP) among following elements Be, B, C, N, O is



B.  $B < Be < C < N < O$

C.  $Be < B < C < N < O$

D.  $Be < B < C < O < N$

**Answer: A**



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5. Nitrogen forms  $N_2$  but phosphorous when forms  $P_2$  gets readily converted into  $P_4$  because

A. triple bond is present in phosphorus atoms

B.  $p\pi - p\pi$  bonding in phosphorus is weak

C.  $P\pi - p\pi$  bonding in phosphorus is strong

D. Multiple bonds are formed easily in phosphorus.

**Answer: B**



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6. The oxidation number of oxygen in  $H_2O_2$  is

A.  $-1$

B.  $+1$

C.  $-2$

D.  $+2$

**Answer: A**



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7. When chlorine water is exposed to sun light, the colour change which occurs is from :

A. colourless to brown

B. brown to colourless

C. light blue to colourless

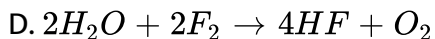
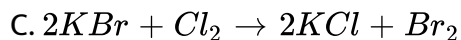
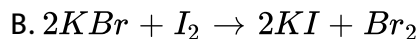
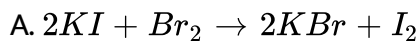
D. greenish yellow to colourless

**Answer: D**



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**8. Which of the following reaction is not feasible?**



**Answer: B**



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**9.  $SO_2$  reacts with  $Cl_2$  in the presence of sun light to form.**

A. Sulphuryl chloride

B. Sulphonyl chloride

C. Sulphur dioxide

D. None of these.

**Answer: A**



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**10. Argon was discovered by**

A. Rayleigh

B. Ramsay

C. Lockerey

D. None of these.

**Answer: A**



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11. In a regular octahedral molecule  $MX_6$  the number of  $X - M - X$  bonds at  $180^\circ$  is

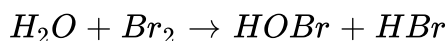
- A. three
- B. two
- C. six
- D. four

**Answer: A**



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12. Which is the best description of the behaviour of bromine in the reaction given below



- A. proton acceptor only

B. both oxidised and reduced

C. oxidised only

D. reduced only.

**Answer: B**



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**13.** Among the following molecules, (i)  $XeO_3$  (ii)  $XeOF_4$  (iii)  $XeF_6$  those having same number of lone pairs on  $Xe$  are:

A. (i) and (ii) only

B. (i) and (iii) only

C. (ii) and (iii) only

D. (i), (ii) and (iii) only

**Answer: D**



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14. The electronegativity difference between  $N$  and  $F$  is greater than that between  $N$  and  $H$  yet the dipole moment of  $NH_3$  (1.5 D) is larger than that of  $NF_3$  (0.2 D). This is because :

- A. In  $NH_3$ , the atomic dipoles and bond dipoles are in the opposite directions while in  $NF_3$  these are in the same direction
- B. in  $NH_3$  and in  $NF_3$ , the atomic dipole and bond dipoles are in the same direction
- C. in  $NH_3$ , the atomic dipoles and bond dipole are in the same direction whereas in  $NF_3$  these are in opposite direction
- D. in  $NH_3$  as well as in  $NF_3$ , the atomic dipoles and bond dipoles are in opposite direction.

**Answer: C**



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15. Which of the following is not according to the priority stated against it ?

- A.  $F_2 > Cl_2 > Br_2 > I_2$  : bond dissociation enthalpy
- B.  $F_2 > Cl_2 > Br_2 > I_2$  : Oxidising power
- C.  $HI > HBr > HCl > HF$  : acidic property in water
- D.  $F_2 > Cl_2 > Br_2 > I_2$  : electronegativity.

Answer: A



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16. Which type of bond is present in Xe molecule ?

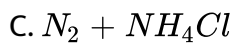
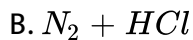
- A. Covalent
- B. Ion-dipole
- C. van der Waals
- D. dipole-dipole

**Answer: C**



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**17.** Chlorine reacts with excess of ammonia to form.



**Answer: C**



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**18.** Which of the following hydrogen halide is most volatile?



B.  $\text{HCl}$

C.  $\text{HI}$

D.  $\text{HBr}$ .

**Answer: A**



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**19.** Bromine water reacts with  $\text{SO}_2$  to form

A.  $\text{HBr}$  and  $\text{S}$

B.  $\text{H}_2\text{O}$  and  $\text{HBr}$

C.  $\text{S}$  and  $\text{H}_2\text{O}$

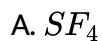
D.  $\text{H}_2\text{SO}_4$  and  $\text{HBr}$

**Answer: D**



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20. In which one of the following species, the central atom has the type of hybridization which is not the same as that present in other three?

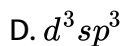
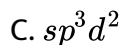
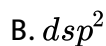


**Answer: B**



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21. Hybridisation of the central atom in  $BrF_5$  molecule is :

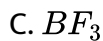
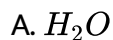


**Answer: C**



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**22.** Which of the following is least likely to behave as Lewis acid?



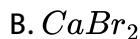
**Answer: C**



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**23.** Which of the following compounds has the lowest boiling point ?





**Answer: B**



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**24.** Among the listed molecules :  $\text{SO}_2$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{BrF}_5$  and  $\text{XeF}_4$  which of the following of the following shapes does not describe of any the molecules mentioned ?

A. Bent

B. Trigonal bipyramidal

C. Sea-saw

D. T-shape

**Answer: B**

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25. Which one is the correct observation when  $Br_2$  is treated with NaF, NaCl and NaI taken in three test tubes labelled as (I), (II) and (III) ?

- A. Only  $I_2$  is liberated.
- B. Only  $Cl_2$  is liberated
- C. Only  $F_2$  and  $Cl_2$  are liberated
- D. Only  $Cl_2$  and  $I_2$  are liberated

**Answer: A**

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26. The oxidation state of phosphorus in cyclometaphosphoric acid is :

- A. +3
- B. +5



C.  $-3$

D.  $+2$

**Answer: B**



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27. Which of the following statement is not valid for oxoacids of phosphorus?

A. Orthophosphoric acid is used in the manufacture of triple super phosphate

B. Hypophosphoric acid is diprotic acid

C. All oxoacids contain a tetrahedral four co-ordinated phosphorus

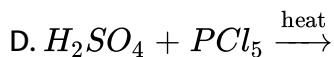
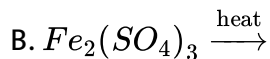
D. All oxoacids contain atleast one  $\text{P}=\text{O}$  unit and one  $\text{P}-\text{OH}$  group.

**Answer: B**



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28.  $SO_3$  can be prepared by which of the following reactions ?

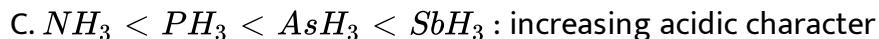


Answer: B



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29. In which of the following arrangements the given sequence is not strict according to the property indicated against it?



D.  $CO_2 < SiO_2 < SnO_2 < PbO_2$  : increasing oxidising power.

**Answer: B**



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**30.**  $XeF_2$  is isostructural with :

A.  $BaCl_2$

B.  $Icl_2^-$

C.  $TeF_2$

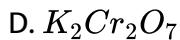
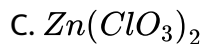
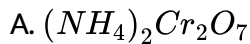
D.  $SbCl_3$

**Answer: B**



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**31.** Which of the following does not give oxygen on heating?



**Answer: A**



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**32.** The oxyacid of sulphur that contains a lone pair of electrons in sulphur is

A. Sulphurous acid

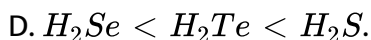
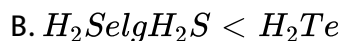
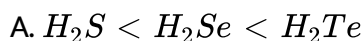
B. Sulphuric acid

C. Peroxy disulphuric acid

D. Pyro sulphuric acid

**Answer: A**

33. Acidity of diprotic acids in aqueous solutions increases in the order



Answer: A

34. The variation of the boiling points of the hydrogen halides is in the order  $HF > HI > HBr > HCl$ .

What explains the higher boiling point of hydrogen fluoride?

A. There is strong hydrogen bonding between HF molecules.

- B. The bond energy of HF molecules is greater than in other hydrogen halides.
- C. The effect of nuclear shielding is much reduced in fluorine which polarises the HF molecules
- D. The electronegativity of fluorine is much higher than that of the other elements in the group.

**Answer: A**



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**35.** Strong reducing behaviour of  $H_3PO_2$  is due to

- A. high electron gain enthalpy of phosphorus
- B. high oxidation state of phosphorus
- C. presence of two  $-OH$  groups and one P-H bond
- D. presence of one  $-OH$  group and two P-H bonds.

**Answer: D**



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**36.** Which of the following statements is incorrect ?

- A.  $O_3$  molecule is bent
- B. ONF is isoelectronic with  $O_2N^-$
- C.  $OF_2$  is an oxide of fluorine
- D.  $Cl_2O_7$  is an anhydride of perchloric acid.

**Answer: C**



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**37.** Which of the following sets of molecules contains the same number of lone pairs of electrons in the central atom ?

A.  $SO_2$ ,  $ClF_3$ ,  $BrF_3$

B.  $SF_4$ ,  $NH_3$ ,  $O_3$

C.  $ClF_3$ ,  $XeF_2$ ,  $H_2O$

D.  $NH_3$ ,  $XeF_2$ ,  $O_3$

**Answer: D**



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**38.** Which one of the following does not match with respect to the shape of the molecule ?

A.  $NH_3$  - Trigonal pyramidal

B.  $SF_4$  - Tetrahedral

C.  $H_2S$  - Bent

D.  $ClF_3$  - T-shape

**Answer: B**



39. Which of the following oxides of nitrogen contains  $N - O - N$  bond ?

- A. Dinitrogen oxide
- B. Nitrogen monoxide
- C. Dinitrogen pentoxide
- D. Dinitrogen trioxide

**Answer: C**

40. The brown ring test for nitrates depends upon :

- A. reduction of nitrate to nitric acid
- B. Oxidation of nitric oxide to nitrogen dioxide

C. reduction of ferrous sulphate ion

D. oxidising action of sulphuric acid

**Answer: D**



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**41.** Which of the following statement is correct for the given acids?

A. Phosphinic acid is a monoprotic acids while phosphonic acid is a diprotic acid.

B. Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid

C. Both are diprotic acids.

D. Both are triprotic acids.

**Answer: A**



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42. When copper is heated with conc.  $HNO_3$  it produces?

A.  $Cu(NO_3)_2$ ,  $NO$  and  $NO_2$

B.  $Cu(NO_3)_2$  and  $N_2O$

C.  $Cu(NO_3)_2$  and  $NO_2$

D.  $Cu(NO_3)_2$  and  $NO$ .

Answer: C



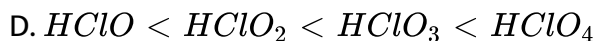
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43. Among the following, the correct order of acidity is:

A.  $HClO_2 < HClO < HClO_3 < HClO_4$

B.  $HClO_4 < HClO_2 < HClO < HClO_3$

C.  $HClO_3 < HClO_4 < HClO_2 < HClO$



**Answer: A**



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**44.** The hybridisation of atomic orbitals of nitrogen in  $NO_2^+$ ,  $NO_3^-$  and  $NH_4^+$  respectively are

A.  $sp$ ,  $sp^3$  and  $sp^2$

B.  $sp^2$ ,  $sp^3$  and  $sp$

C.  $sp$ ,  $sp^2$  and  $sp^3$

D.  $sp^2$ ,  $sp$  and  $sp^3$

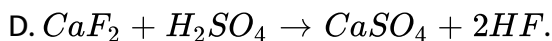
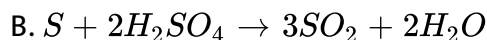
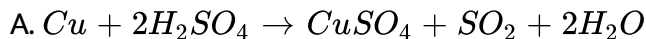
**Answer: C**



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45. Hot concentrated sulphuric acid is a moderately strong oxidizing agent.

Which of the following reaction does not show oxidizing behaviour?

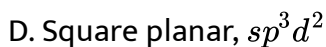
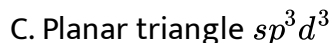


Answer: D



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46. The correct geometry and hybridization for  $XeF_4$  are



Answer: D



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47. Among the following ,which one is the wrong statement

- A.  $PH_5$  and  $BiCl_5$  do not exist.
- B.  $p\pi - d\pi$  bonds are present in  $SO_2$
- C.  $SeF_4$  and  $CH_4$  have same shape.
- D.  $I_3^+$  has bent geometry.

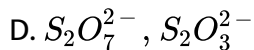
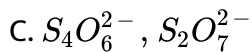
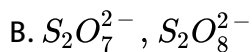
Answer: C



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48. In which pair of ions both the species contains  $S - S$  bond?

- A.  $S_4O_6^{2-}$ ,  $S_2O_3^{2-}$



**Answer: A**



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**49.** Which of the following is not true for halogens ?

A. All form monobasic acids

B. All are oxidising agents

C. All but fluorine show positive oxidation states

D. Chlorine has highest negative electron gain enthalpy.

**Answer: C**



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50. Which one is the correct observation when  $Br_2$  is treated with NaF, NaCl and NaI taken in three test tubes labelled as (I), (II) and (III) ?

- A.  $F_2$  is liberated in (I) and  $Cl_2$  in (II)
- B. Only  $I_2$  is liberated in (III)
- C. Only  $Cl_2$  is liberated in (II)
- D. Only  $F_2$  is liberated in (I)

**Answer: B**



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51. Which of the following is true for  $N_2O_5$  ?

- A. It is paramagnetic
- B. It is an anhydride of  $HNO_2$
- C. It is a brown gas
- D. It exists in solid state in the form  $[NO_2^+][NO_3^-]$



**Answer: D**



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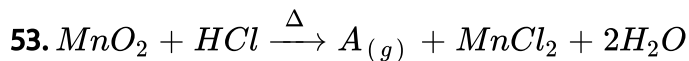
**52.** Which of the following statements is incorrect ?

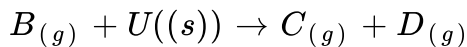
- A.  $\alpha$  - Black phosphorus is formed by heating red phosphorus.
- B.  $\beta$ - Black phosphorus does not burn in air upto 875 K.
- C. White phosphorus readily catches fire in air to give dense fumes of  $P_4O_{10}$
- D. Red phosphorus does not react with caustic alkalies.

**Answer: B**

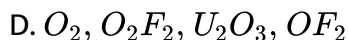
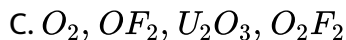
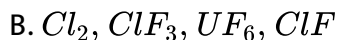
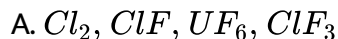


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The gases A, B, C and D are respectively



**Answer: B**



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**54.** Among the following observations, the correct one that differentiates between  $SO_3^{2-}$  and  $SO_4^{2-}$  is

A. Both form precipitate with  $BaCl_2$ ,  $SO_3^{2-}$  dissolves in HCl but  $SO_4^{2-}$  does not

B.  $SO_3^{2-}$  forms precipitate with  $BaCl_2$ ,  $SO_4^{2-}$  does not

C.  $SO_4^{2-}$  forms precipitate with  $BaCl_2$ ,  $SO_3^{2-}$  does not

D. Both form precipitate with  $BaCl_2$ ,  $SO_4^{2-}$  dissolves in HCl but

$SO_3^{2-}$  does not.

**Answer: A**



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55. 1 mol of  $N_2H_2$  loses 14 moles of electrons to form a new compound X.

Assuming that the entire nitrogen appears in the new compound, what is the oxidation state of nitrogen in X?

A.  $-1$

B.  $+3$

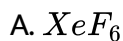
C.  $-3$

D.  $+1$

**Answer: B**

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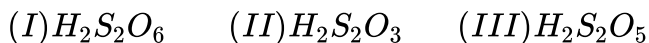
56. In the following compounds of xenon, highest number of lone pairs of electrons is present in :



**Answer: D**

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57. Identify the correct sequence of increasing of  $\pi$  — bonds in the structure of the following molecules :



A. I,II,III

B. II,III,I

C. II,I,III

D. I,III,II

**Answer: B**



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**58.** Among the following statements which one is incorrect ?

A. Nitrogen has the ability to form  $p\pi - p\pi$  bonds with itself.

B. Bismuth forms metallic bonds in elemental state.

C. Catenation tendency is higher in nitrogen when compared with other elements of the same group.

D. Nitrogen has higher first ionization enthalpy when compared with other elements of the same group.

Answer: C



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59. A dark violet solid X reacts with  $NH_3$  to form a mild explosive which decomposes to give a violet coloured gas. X also reacts with  $H_2$  to give an acid Y. Y can also be prepared by heating its salt with  $H_3PO_4$ . X and Y are

A.  $Cl_2, HCl$

B.  $SO_2, H_2SO_4$

C.  $Br_2, HBr$

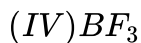
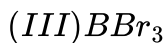
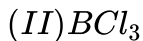
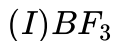
D.  $I_2, HI$

Answer: D

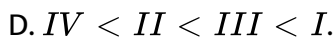
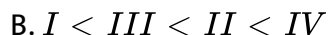
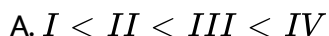


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60. Consider the following halides :



The Lewis acid strength of these halides follows the order :



Answer: A



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1. In  $XeF_2$ ,  $XeF_4$  and  $XeF_6$ , the number of the lone pairs of Xe respectively are

A. 2,3,1

B. 1,2,3

C. 4,1,2

D. 3,2,1

**Answer: D**



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**2. Orthophosphoric acid on heating gives :**

A. Metaphosphoric acid

B. Phosphine

C. Phosphorus pentoxide

D. Phosphorus acid.

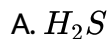
**Answer: A**



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3. Which one of the following substances has the highest proton affinity ?



**Answer: B**



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4. In case of nitrogen,  $NCl_3$  is possible but not  $NCl_5$  while in case of phosphorous,  $PCl_5$  are possible. It is due to

A. availability of vacant d-orbitals in P but not in N

B. lower electronegativity of P than N

C. lower tendency of H-bond formation in P than N

D. occurrence of P in solid while N in gaseous state at room temperature.

**Answer: A**



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5. Number of sigma bonds in  $P_4O_{10}$  is :

A. 6

B. 7

C. 17

D. 16

**Answer: D**



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6. What may be expected to happen when phosphine gas is mixed with chlorine gas ?

- A.  $PCl_3$  and HCl are formed and the mixture warms up
- B.  $PCl_5$  and HCl are formed and the mixture cools down
- C.  $PH_3$ .  $Cl_2$  is formed with warming up
- D. The mixture only cools down.

**Answer: B**



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7. When rain is accompanied by a thunderstorm, the collected rain water will have a pH value

- A. slightly higher than that when the thunderstorm is not there
- B. uninfluenced by occurrence of thunderstorm
- C. which depends on the amount of dust in air

D. slightly lower than that of rain water without thunderstrom.

**Answer: D**



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**8.** Concentrated hydrochloric acid when kept in open air sometimes produces a cloud of white fumes. The explanation for it is that :

A. oxygen in air reacts with the emitted HCl gas to form a cloud of chlorine gas

B. strong affinity of HCl gas for moisture in air results in forming of droplets of liquid solution which appears like a cloudy smoke

C. due to strong affinity for water, concentrated hydrochloric acid pulls moisture of air towards itself. This moisture forms droplets of water and hence the cloud

D. concentrated hydrochloric acid emits strong smelling HCl gas all the time.

**Answer: A**



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9. Which among the following factors is the most important in making fluorine oxidizing halogen?

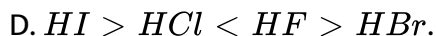
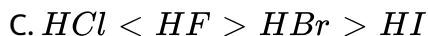
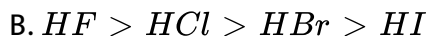
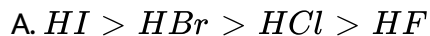
- A. Hydration enthalpy
- B. Ionization enthalpy
- C. Electron gain enthalpy
- D. Bond dissociation enthalpy.

**Answer: D**



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10. The correct order of thermal stability of hydrogen halides (H-X) is :



Answer: B



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11. The number of hydrogen atom(s) attached to phosphorus atom in hypophosphorus acid is

A. zero

B. two

C. one

D. three.

**Answer: B**



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**12.** The molecular shapes of  $SF_4$ ,  $CF_4$  and  $XeF_4$  are :

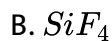
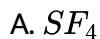
- A. the same with 2, 0 and 1 lone pairs of electrons on the central atom respectively
- B. the same with 1, 1, and 1 lone pair of electrons on the central atom respectively
- C. different with 0, 1 and 2 lone pairs on the central atom respectively
- D. different with 1, 0 and 2 lone pairs on the central atom respectively.

**Answer: D**



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**13.** In which of the following molecules, are all the bonds not equal ?



**Answer: A**



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14. The decreasing order of bond angles from  $NH_3(107^\circ)$  to  $SbH_3(91.3^\circ)$  down the group 15 elements is due to :

A. increasing bond pair : bond pair repulsion

B. increasing p-orbital character on  $sp^3$  orbital

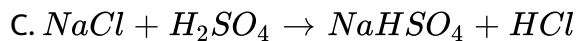
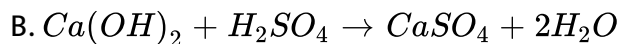
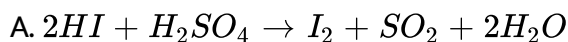
C. decreasing lone pair- bond pair repulsion

D. decreasing electronegativity.

**Answer: B**

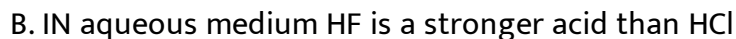


15. Which of the following reaction depicts the oxidising behaviour of  $H_2SO_4$ ?



**Answer: A**

16. Which of the following statement is true ?



C.  $HClO_4$  is a weaker acid than  $HClO_3$

D.  $HNO_3$  is a stronger acid than  $HNO_2$ .

**Answer: D**



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17. What products are expected from the desproprtionation reactin of hypochorous acid ?

A.  $HClO_3$  and  $Cl_2O$

B.  $HClO_2$  and  $HClO_4$

C.  $HCl$  and  $Cl_2O$

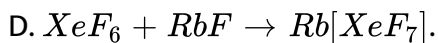
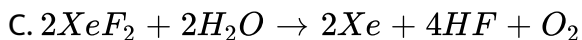
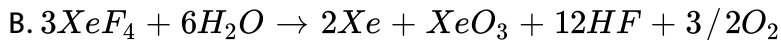
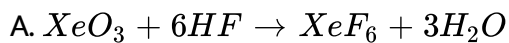
D.  $HCl$  and  $HClO_3$

**Answer: D**



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18. Which one of the following reaction of xenon compounds is not Feasible?



Answer: A



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19. Halogens exist in  $-1$ ,  $+1$ ,  $+3$ ,  $+5$  and  $+7$  oxidation states. The only halogen which exists in  $-1$  oxidation state is :

A. F

B. Cl

C. Br

D. I

**Answer: A**



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**20.** Which of the following contains P-O-P bond ?

A. Hypophosphorus acid

B. Pyrophosphoric acid

C. Phosphorus acid

D. Orthophosphoric acid

**Answer: B**



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**21.** Which of the following statements regarding ozone is not correct ?

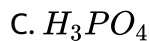
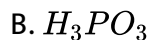
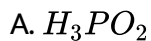
- A. ozone molecule is angular in shape
- B. ozone molecule is hybrid of two contributing structures
- C. oxygen-oxygen bond length in ozone is identical with that of molecular oxygen
- D. ozone is used as germicide and disinfectant for the purification of air .

**Answer: C**



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**22.**  $P_4O_{10}$  is an anhydride of :

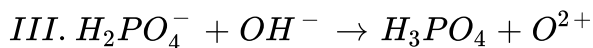
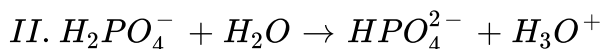
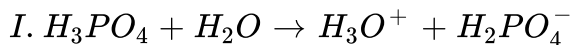


**Answer: C**



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**23.** Three reactions involving  $H_2PO_4^-$  are given below



In which of the above does  $H_2PO_4^-$  act as an acid?

A. (i) only

B. (ii) only

C. (i) and (ii)

D. (iii) only

**Answer: B**



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24. Which of the following statements is wrong ?

- A. The stability of hydrides increases from  $NH_3$  to  $BiH_3$  in group 15 of the periodic table.
- B. Nitrogen cannot form  $d\pi - p\pi$  bond.
- C. Single N - N bond is weaker than single P-P bond
- D.  $N_2O_4$  has two resonating strutures.

Answer: A



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25. Which of the following statements regarding sulphur is incorrect?

- A.  $S_2$  molecule is paramagnetic.
- B. The vapours the  $200^\circ C$  consist mostly of  $S_8$  rings.
- C. At  $600^\circ C$ , the gas mainly consists of  $S_2$  molecules.

D. The oxidation state of sulphur is never less than +4 in its compounds.

**Answer: D**



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26. The types of hybrid orbitals of nitrogen in  $NO_2^+$ ,  $NO_3^-$  and  $NH_4^+$  respectively are expected to be :

A.  $sp$ ,  $sp^2$ ,  $sp^3$

B.  $sp^2$ ,  $sp$ ,  $sp^3$

C.  $sp$ ,  $sp^3$ ,  $sp^2$

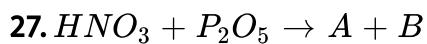
D.  $sp^2$ ,  $sp^3$ ,  $sp$ .

**Answer: B**

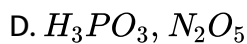
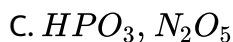
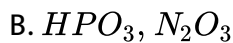
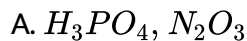


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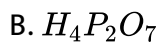
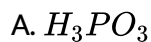
'A' is oxyacid of phosphorus and 'B' is an oxide of nitrogen. 'A' and 'B' are respectively.

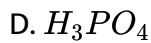


Answer: C



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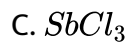
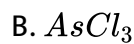


**Answer: A**



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**29.** The molecular having the smaleest bond angle is



**Answer: C**



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30. Nitric acid can be obtained from ammonia via the formation of intermediate compounds

- A. Nitric oxide and nitrogen dioxide
- B. Nitrogen and nitric oxide
- C. Nitric oxide and dinitrogen pentoxide
- D. Nitrogen and nitrous oxide

**Answer: A**



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31. Excess of  $PCl_5$  reacts with concentrated  $H_2SO_4$  giving :

- A. Chlorosulphonic acid
- B. Sulphurous acid
- C. Sulphuryl chloride
- D. Thionyl chloride

**Answer: C**



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**32.** What is the number of valence electrons in iodine monochloride ?

A. 12

B. 14

C. 16

D. 18

**Answer: B**



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**33.** Which of the following noble gases has the highest positive electron gain enthalpy ?

A. Helium

B. Krypton

C. Argon

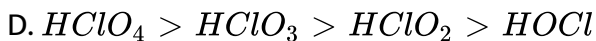
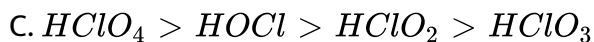
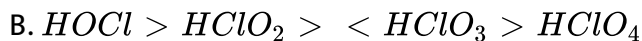
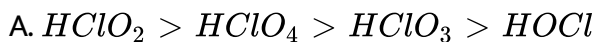
D. Neon

**Answer: D**



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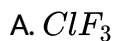
**34.** Among the following oxioacids, the correct decreasing order of acid strength is



**Answer: D**

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35. The inter halogen compound having dimeric structure is :



Answer: D

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36. In which of the following oxides of nitrogen, the oxidation state of the element is the lowest ?

A. Nitric oxide

B. Nitrous oxide

C. Nitrogen dioxide

D. Nitrogen trioxide

**Answer: B**



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**37.** If  $Cl_2$  is passed through hot aqueous NaOH, the products formed have Cl in different oxidation states. These are indicated as

A.  $-1$  and  $+1$

B.  $-1$  and  $+5$

C.  $+1$  and  $+5$

D.  $-1$  and  $+3$

**Answer: B**



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38. Which of the following properties is not shown by  $NO$  ?

- A. It is diamagnetic in the gaseous state
- B. It is a neutral oxide
- C. It combines with oxygen to form nitrogen dioxide
- D. Its bond order is 2.5.

Answer: A



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39. Which among the following is the most reactive gas

- A.  $I_2$
- B.  $ICl$
- C.  $Cl_2$
- D.  $Br_2$



**Answer: B**



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**40.** Which has maximum boiling point ?

A. Kr

B. Xe

C. He

D. Ne

**Answer: B**



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**41.** Sulphuryl chloride ( $SO_2Cl_2$ ) reacts with white phosphorus ( $P_4$ ) to give :

A.  $PCl_5$ ,  $SO_2$

B.  $OPCl_3$ ,  $SOCl_2$

C.  $PCl_5$ ,  $SO_2$ ,  $S_2Cl_2$

D.  $OPCl_3$ ,  $SO_2$ ,  $S_2Cl_2$

**Answer: A**



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**42.** On heating with concentrated NaOH solution in an inert atmosphere of  $CO_2$ , white phosphorus gives a gas. Which of the following statements is incorrect about the gas ?

A. It is more basic than  $NH_3$

B. Its solution in water decomposes in the presence of light.

C. It is less basic than  $NH_3$

D. It is highly poisonous and has smell like rotten fish.

**Answer: A**



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**43.** The species in which the N-atom is in a state of sp hybridisation is

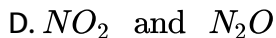
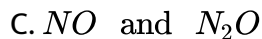
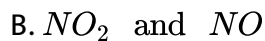
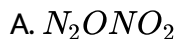


**Answer: A**



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**44.** The reaction of zinc with dilute and concentrated nitric acid, respectively, produce



**Answer: A**



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**45.** The pair in which phosphorus atoms have a formed oxidation state of +3 is

A. orthophosphorus and pyrophosphorus acids

B. pyrophosphorus and hypophosphoric acids

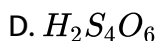
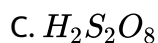
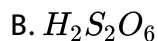
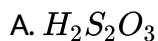
C. orthophosphorus and hypophosphoric acids

D. pyrophosphorus and pyrophosphoric acids

**Answer: A**

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46. The acid in which O-O bonding is present in :



Answer: C

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47. Which of the following noble gases has an unusual property of diffusing through the materials such as rubber, glass or plastic ?

A. Helium

B. Neon

C. Kryton

D. Argon.

**Answer: A**



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**48.** Which of the following solutions will turn violet when a drop of lime juice is added to it ?

A. A solution of NaI

B. A solution mixture of KI and  $NaIO_3$

C. A solution mixture of NaI and KI

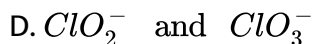
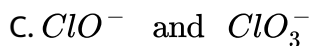
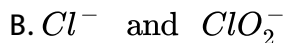
D. A solution mixture of  $KIO_3$  and  $NaIO_3$

**Answer: B**



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49. When chlorine reacts with cold and dilute solution of sodium hydroxide, the products obtained are

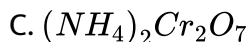
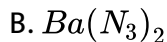
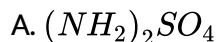


Answer: A



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50. The compound that does not produce nitrogen gas upon thermal decomposition is :



D.  $NH_4NO_2$

**Answer: A**



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**51.** Very pure nitrogen can be obtained by :

- A. Thermal decomposition of  $NH_4Cl$  and  $NaNO_2$
- B. Treating aqueous solution of  $NH_4Cl$  and  $NaNO_2$
- C. Liquefaction and fractional distillation of liquid air
- D. Thermal decomposition of sodium azide.

**Answer: D**



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1. An orange solid ( $A$ ) on heating gave a green residue ( $B$ ), colourless gas ( $C$ ) and water vapour. The dry gas ( $C$ ) on passing over heated magnesium gave a white solid ( $D$ ). ( $D$ ) on reaction with water have a gas ( $E$ ) which formed dense white fumes with  $HCl$ . Identify ( $A$ ) to ( $E$ ) and give the reactions.

A. sodium dichromate

B. potassium dichromate

C. potassium chromate

D. ammonium dichromate.

**Answer: D**

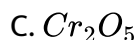


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2. An orange solid ( $A$ ) on heating gave a green residue ( $B$ ), a colourless gas ( $C$ ) and water vapours. The dry gas ( $C$ ) when passed over heated magnesium, gave a white solid ( $D$ ) which evolved a gas ( $E$ ) on reacting

with water. The gas formed dense white fumes with HCl. Identify all the compounds from A to E. Give the reactions involved.

The green residue (B) has the formula



**Answer: C**



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3. An orange solid (A) on heating gave a green residue (B), a colourless gas (C) and water vapours. The dry gas (C) when passed over heated magnesium, gave a white solid (D) which evolved a gas (E) on reacting with water. The gas formed dense white fumes with HCl. Identify all the compounds from A to E. Give the reactions involved.

The white solid (D) is :

A.  $\text{MgO}$

B.  $\text{MgSO}_4$

C.  $\text{MgCl}_2$

D.  $\text{Mg}_2\text{N}_3$

**Answer: D**



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4. The compound (A) is a white solid. When heated strongly, it leaves no residue. On treating (A) with  $\text{NaOH}$  solution, a colourless pungent smelling gas (B) is evolved which is industrially highly useful. When the compound (A) is acidified with dilute  $\text{HCl}$ , a reddish brown gas (C) is evolved.

The compound (A) is :

A. ammonium nitrite

B. ammonium chloride

C. sodium nitrite

D. sodium nitrate.

**Answer: A**



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5. The compound (A) is a white solid. When heated strongly, it leaves no residue. On treating (A) with NaOH solution, a colourless pungent smelling gas (B) is evolved which is industrially highly useful. When the compound (A) is acidified with dilute HCl, a reddish brown gas (C) is evolved.

The pungent smelling gas (B) is

A. sulphur dioxide

B. chlorine

C. hydrogen chloride gas

D. ammonia.

Answer: D



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6. The noble gases have close shell electronic configuration and are monoatomic gases under normal conditions. The low boiling points of the lighter noble gases are due to weak dispersion forces between the atoms and the absence of other inter atomic interactions. The direct reactions of xenon with fluorine leads to a series of compounds with oxidation number +2, +4 and +6.  $XeF_4$  reacts violently with water to give  $XeO_3$ . The compounds of xenon exhibit stereochemistry and their geometries can be deduced considering the total number of electrons in valence shell

Argon is used in arc welding because of its.

- A. ability to lower reactivity of metals
- B. ability to lower the melting point of the solid
- C. flammability

D. high calorific value

Answer: A



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7. The noble gases have closed-shell electronic configuration and are monatomic gases under normal condition. The low boiling points of the lighter noble gases are due to the weak dispersion forces of the lighter noble gases and due to the weak dispersion forces between the atoms and the absence of other interatomic interactions.

The direct reaction of xenon with fluorine leads to a series of compounds with water oxidation number  $+2$ ,  $-4$  and  $+6$ ,  $XeF_4$  reacts violently with water to give  $XeO_2$ . The compound of deduced exhibits inorganic chemistry and their geometries can be deduced considering the total number of electron pairs in the valence shell.

The structure of  $XeO_3$  is

A. linear

B. planar

C. pyramidal

D. T-shaped

**Answer: C**



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8. The noble gases have close shell electronic configuration and are monoatomic gases under normal conditions. The low boiling points of the lighter noble gases are due to weak dispersion forces between the atoms and the absence of other inter atomic interactions. The direct reactions of xenon with fluorine leads to a series of compounds with oxidation number +2, +4 and +6.  $XeF_4$  reacts violently with water to give  $XeO_3$ . The compounds of xenon exhibit stereochemistry and their geometries can be deduced considering the total number of electrons in valence shell

$XeF_4$  and  $XeF_6$  are expected to be :

- A. oxidising
- B. reducing
- C. unreactive
- D. strongly basic

**Answer: A**



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9. There are some deposits of nitrated and phosphates in the earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under laboratory conditions but microbes do it easily. Ammonia forms a large number of complexes with transition metal ions. Hybridisation easily explains the ease of sigma donation capability of  $NH_3$  and  $PH_3$ . Phosphine is a flammable gas and is prepared from white phosphorous. Which of the following statement is correct ?

- A. Phosphates have no biological significance in humans



- B. Between nitrates and phosphates, phosphates are less abundant in earth's crust
- C. Between nitrates and phosphates, nitrates are less abundant in earth's crust
- D. Oxidation of nitrates is possible in soil.

**Answer: C**



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**10.** There are some deposits of nitrated and phosphates in the earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under laboratory conditions but microbes do it easily. Ammonia forms a large number of complexes with transition metal ions. Hybridisation easily explains the ease of sigma donation capability of  $NH_3$  and  $PH_3$ . Phosphine is a flammable gas and is prepared from white phosphorous. Which of the following statement is correct ?

- A. Between  $NH_3$  and  $PH_3$ ,  $NH_3$  is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional
- B. Between  $NH_3$  and  $PH_3$ ,  $PH_3$  is a better electron donor because the lone pair of electrons occupies  $sp^3$  orbital and is more directional .
- C. Between  $NH_3$  and  $PH_3$ ,  $NH_3$  is a better electron donor because lone pair of electrons occupies  $sp^3$  orbital and is more directional .
- D. Between  $NH_3$  and  $PH_3$ ,  $PH_3$  is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.

**Answer: C**



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11. There are some deposits of nitrates and phosphates in the earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under laboratory conditions but microbes do it easily. Ammonia forms a large number of complexes with transition metal ions. Hybridisation easily explains the ease of sigma donation capability of  $NH_3$  and  $PH_3$ . Phosphine is a flammable gas and is prepared from white phosphorous. White phosphorous on reaction with  $NaOH$  gives  $PH_3$  as one of the products. This is a.

- A. dimerisation reaction
- B. disproportionation reaction
- C. condensation reaction
- D. precipitation reaction.

**Answer: B**

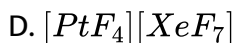
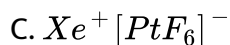
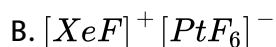
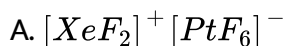


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12. Noble gases were considered inert before 1962. Prior to this, Bartlett and Lohmann had previously used the highly ionization energy of  $O_2$  is  $1165 \text{ kJ mol}^{-1}$ , which is almost the same as the value of  $IE_1$  for Xe ( $1170 \text{ kJ mol}^{-1}$ ). Experiments showed that when deep red  $PtF_6$  vapours were mixed with an equal volume of Xe, the gases combined immediately at room temperature to produce a yellow solid. Soon after this, it was found that Xe and F react directly to give Xe-fluorides.

Choose the correct answer :

What was the yellow solid obtained by them ?



**Answer: C**



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13. Noble gases were considered inert before 1962. Prior to this, Bartlett and Lohmann had previously used the highly ionization energy of  $O_2$  is  $1165 \text{ kJ mol}^{-1}$ , which is almost the same as the value of  $IE_1$  for Xe ( $1170 \text{ kJ mol}^{-1}$ ). Experiments showed that when deep red  $PtE_6$  vapours were mixed with an equal volume of Xe, the gases combined immediately at room temperature to produce a yellow solid. Soon after this, it was found that Xe and F react directly to give Xe-fluorides.

Choose the correct answer :

In what molar ratio must Xe and  $F_2$  combine to give  $XeF_4$ ?

A. 2:1

B. 1:2

C. 1:5

D. 1:20

**Answer: C**



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14. Noble gases were considered inert before 1962. Prior to this, Bartlett and Lohmann had previously used the highly ionization energy of  $O_2$  is  $1165 \text{ kJ mol}^{-1}$ , which is almost the same as the value of  $IE_1$  for Xe ( $1170 \text{ kJ mol}^{-1}$ ). Experiments showed that when deep red  $PtE_6$  vapours were mixed with an equal volume of Xe, the gases combined immediately at room temperature to produce a yellow solid. Soon after this, it was found that Xe and F react directly to give Xe-fluorides.

Choose the correct answer :

The hybridisation state of Xe in  $XeOF_4$  is :

A.  $sp^3$

B.  $sp^3d$

C.  $dsp^2$

D.  $sp^3d^2$

Answer: D



View Text Solution

15. Nitrogen forms  $p\pi - p\pi$  multiple bonds. Nitrogen exists as triply bonded diatomic gaseous molecule. Bond strength is very high which is responsible for inertness at ordinary conditions. The other members of nitrogen family form  $d\pi - p\pi$  bonding .

Choose the correct answer :

Thermal and electrical conductivity is highest in

A. N

B. P

C. As

D. Bi.

**Answer: D**



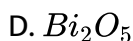
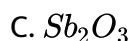
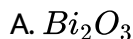
**View Text Solution**

16. Nitrogen forms  $p\pi - p\pi$  multiple bonds. Nitrogen exists as triply bonded diatomic gaseous molecule. Bond strength is very high which is responsible for inertness at ordinary conditions. The other members of

nitrogen family form  $d\pi - p\pi$  bonding .

Choose the correct answer :

Which is most acidic in nature ?



**Answer: D**



**View Text Solution**

17. Nitrogen forms  $p\pi - p\pi$  multiple bonds. Nitrogen exists as triply bonded diatomic gaseous molecule. Bond strength is very high which is responsible for inertness at ordinary conditions. The other members of nitrogen family form  $d\pi - p\pi$  bonding .

Choose the correct answer :

Maximum covalency of Sb will be



A. 3

B. 4

C. 5

D. 6

**Answer: D**



**View Text Solution**

**18.** The reactions of  $Cl_2$  gas with cold-dilute and hot-concentrated NaOH in water give sodium salts of two different oxoacids of chlorine, P and Q, respectively. The  $Cl_2$  gas reacts with  $SO_2$  gas, in presence of charcoal, to give a product R reacts with white phosphorus to give a compound S. On hydrolysis, S gives an oxoacid of phosphorus.

P and Q, respectively, are the sodium salts of

A. hypochlorous and chloric acids

B. hypochlorous and chlorous acids

C. chloric acid and perchloric acids

D. chloric and hypochlorous acids.

**Answer: A**



**Watch Video Solution**

19. The reactions of  $Cl_2$  gas with cold-dilute and hot-concentrated NaOH in water give sodium salts of two different oxoacids of chlorine, P and Q, respectively. The  $Cl_2$  gas reacts with  $SO_2$  gas, in presence of charcoal, to give a product R reacts with white phosphorus to give a compound S. On hydrolysis, S gives an oxoacid of phosphorus.

R, S and T, respectively, are

A.  $SO_2Cl_2$ ,  $PCl_5$  and  $H_3PO_4$

B.  $SO_2Cl_2$ ,  $PCl_3$  and  $H_3PO_3$

C.  $SOCl_2$ ,  $PCl_3$  and  $H_3PO_2$

D.  $SOCl_2$ ,  $PCl_5$  and  $H_3PO_4$

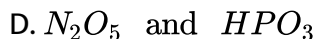
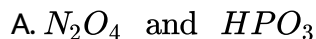
Answer: D



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20. Upon heating  $KClO_3$  in presence of catalytic amount of  $MnO_2$ , a gas  $W$  is formed. Excess amount of  $W$  reacts with white phosphorus to given  $X$ . The reaction of  $X$  with pure  $HNO_3$  gives  $Y$  and  $Z$ .

$Y$  and  $Z$  are, respectively



Answer: D



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21. Upon heating  $KClO_3$  in presence of catalytic amount of  $MnO_2$ , a gas  $W$  is formed. Excess amount of  $W$  reacts with white phosphorus to give  $X$ . The reaction of  $X$  with pure  $HNO_3$  gives  $Y$  and  $Z$ .

$W$  and  $X$  are, respectively



**Answer: A**



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### Straight Objective Type MCQs

1. Oxidation number of  $P$  in  $Ba(H_2PO_2)_2$  is

A. +3

B. +2

C. +1

D. -1

**Answer: C**



**Watch Video Solution**

**2. There is no  $S - S$  bond in**

A.  $S_2O_4^{2-}$

B.  $S_2O_5^{2-}$

C.  $S_2O_3^{2-}$

D.  $S_2O_7^{2-}$

**Answer: D**



**Watch Video Solution**

3. The oxidation states of the most electronegative elements in the products of the reaction between  $BaO_2$  and  $H_2SO_4$  are

A. 0 and 1

B.  $-2$  and  $-1$

C.  $-2$  and 0

D.  $-2$  and  $+1$

**Answer: B**



**Watch Video Solution**

4. Which compound acts as an oxidising as well as reducing agent?

A.  $SO_2$

B.  $MnO_2$

C.  $Al_2O_3$

D.  $CrO_3$

**Answer: A**



**Watch Video Solution**

5. The cyanide ion  $CN$  and  $N_2$  are isoelectronic, but in contrast to  $CN^-$ ,  $N_2$  is chemically inert, because of

- A. Low bond energy
- B. Absence of bond polarity
- C. Unsymmetrical electron distribution
- D. Presence of more number of electrons in the bonding orbitals.

**Answer: B**



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6. The halogen which is most easily reduced is :



Answer: A



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7. The type of hybrid orbitals used by chlorine atom in  $ClO_2^-$  is :



D. None of these.

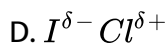
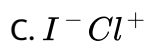
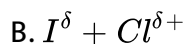
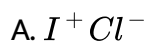


**Answer: A**



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**8. Charge distribution in iodine monochloride is best represented as :**



**Answer: B**



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**9. The element with maximum ionisation potential is :**

A. Boron

B. Carbon

C. Nitrogen

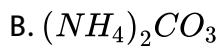
D. Oxygen.

**Answer: C**



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**10. Ammonium compound which upon heating does not give ammonia is :**



**Answer: C**



**View Text Solution**

11. The correct order of increasing acidic strength of  $\text{ClOH}$  (I),  $\text{BrOH}$  (II) and  $\text{IOH}$  (III) is

A.  $I > II > III$

B.  $II > I > III$

C.  $III > II > I$

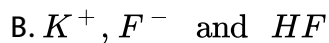
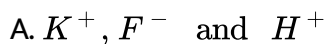
D.  $I > III > II$

Answer: A



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12.  $\text{KF}$  combination with  $\text{HF}$  to form  $\text{KHF}_2$ . The compound contains the species



D.  $[KHF]^+$  and  $F^-$

**Answer: C**



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**13.** The geometry of  $H_2S$  and its dipole moment are :

A. Angular and non-zero

B. Angular and zero

C. Linear and non-zero

D. Linear and zero

**Answer: A**



**Watch Video Solution**

14. The hybridisation of atomic orbitals of nitrogen in  $NO_2^+$ ,  $NO_3^-$  and  $NH_4^+$  respectively are

- A.  $sp$ ,  $sp^3$  and  $sp^2$  respectively
- B.  $sp$ ,  $sp^2$  and  $sp^3$  respectively
- C.  $sp^2$ ,  $sp$  and  $sp$  respectively
- D.  $sp^2$ ,  $sp^3$  and  $sp$  respectively.

**Answer: B**



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15. Amongst  $H_2O$ ,  $H_2S$ ,  $H_2Se$  and  $H_2Te$  the one with highest boiling point is :

- A.  $H_2O$  because of hydrogen bonding
- B.  $H_2Te$  because of higher molecular mass
- C.  $H_2S$  because of hydrogen bonding

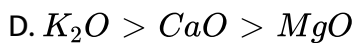
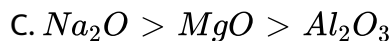
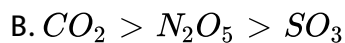
D.  $H_2Se$  because of lower molecular mass

**Answer: A**



**Watch Video Solution**

**16.** The correct order of acidic strength is



**Answer: A**



**Watch Video Solution**

**17.** The number of S-S bonds in sulphur trioxide trimer ( $S_3O_9$ ) is

A. Three

B. two

C. One

D. Zero

**Answer: D**



**Watch Video Solution**

**18.** The reaction  $3\text{ClO}^{-}(\text{aq}) \rightarrow \text{ClO}_3^{-}(\text{aq}) + 2\text{Cl}^{-}(\text{aq})$  an example of :

A. Oxidation reaction

B. Reduction reaction

C. Disproportionation reaction

D. Decomposition reaction

**Answer: C**



**Watch Video Solution**

19. Ammonia can be dried by :

A. Conc.  $H_2SO_4$

B.  $P_4O_{10}$

C. CaO

D. Anhydrous  $CaCl_2$

Answer: C



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20. For  $H_3PO_3$  and  $H_3PO_4$  the correct choice is

A.  $H_3PO_3$  is dibasic and reducing

B.  $H_3PO_3$  is dibasic and non-reducing

C.  $H_3PO_4$  is tribasic and reducing



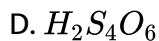
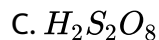
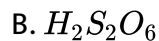
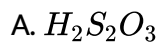
D.  $H_3PO_3$  is tribasic and non-reducing.

**Answer: A**



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**21.** The acid having O - O bond is



**Answer: C**



**Watch Video Solution**

**22.** Number of lone pairs (s) in  $XeOF_4$  is/are

A. 0

B. 1

C. 2

D. 3

**Answer: B**



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**23.** The percentage of p-character in the orbitals forming  $p - p$  bonds in  $P_4$  is

A. 25

B. 33

C. 50

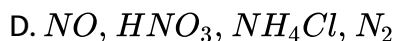
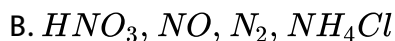
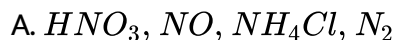
D. 75

**Answer: D**



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24. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen ?



Answer: B

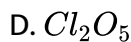
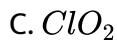
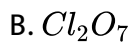
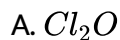


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25. Bleaching powder and bleach solution are produced on a large scale and used in several household products. The effectiveness of bleach solution is often measured by iodometry.

Bleaching powder contains a salt of an oxoacid as one of its components.

The anhydride of that oxoacid is:

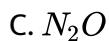


**Answer: A**



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**26.** Concentrated nitric acid upon long standing turns yellowish-brown due to the formation of :



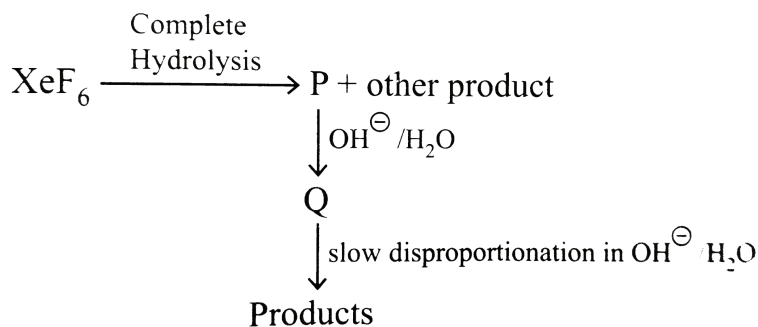
D.  $N_2O_4$

Answer: B



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27. Under ambient condition , the total number of gases released products in the final step of the reaction scheme shown below is



A. 0

B. 1

C. 2

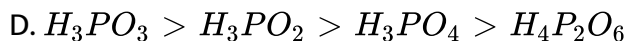
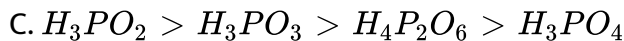
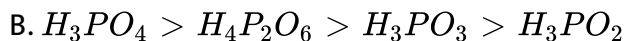
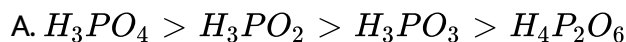
D. 3

**Answer: C**



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**28.** The order of the oxidation state of the phosphorus atom in  $H_3PO_2$ ,  $H_3PO_4$ ,  $H_3PO_3$  and  $H_4P_2O_6$  is



**Answer: B**



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**Multiple Correct Options Type MCQs**

1. For the hydrides of nitrogen family, in going down the group :

- A. stability decreases
- B. reducing activity increases
- C. bond angle HEH decreases
- D. b.p increases.

**Answer: A::B::C**



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2. Nitrogen (i) oxide is produced by

- A. thermal decomposition of ammonium nitrate
- B. disproportionation of  $N_2O_4$
- C. thermal decomposition of ammonium nitrite
- D. interaction of hydroxyl amine and nitrous acid.

**Answer: A::D**



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**3. Highly pure dilute solution of sodium in liquid ammonia**

- A. shows blue colour
- B. exhibits electrical conductivity
- C. produces sodium nitrite
- D. produces hydrogen gas.

**Answer: A::B**



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**4. Sodium nitrate decomposes above  $800^{\circ}C$  to give :**

- A.  $N_2$



B.  $O_2$

C.  $NO_2$

D.  $Na_2O$

**Answer: A::B::D**



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5. White phosphorus ( $P_4$ ) has

A. six P-P single bonds

B. four P-P single bonds

C. four lone pairs of electrons

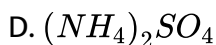
D. PPP angle of  $60^\circ$

**Answer: A::C::D**



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6. A solution of colourless salt on boiling with excess  $NaOH$  produces a non-flammable gas. The gas evolution ceases after sometime upon addition of  $Zn$  dust to the same solution, the gas evolution restarts. The colourless salt (s) is (are).

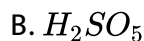
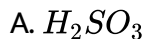


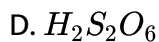
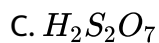
**Answer: A::B**



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7. Which of the following compounds have peroxo linkage ?



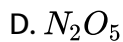
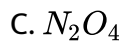
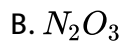
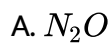


**Answer: B::D**



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8. The nitrogen oxide (s) that contain (s)  $N - N$  bonds (s) is (are).



**Answer: A::B::C**



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9. The correct statement(s) about  $O_3$  is/are

- A. O-O bond lengths are equal
- B. Thermal decomposition of  $O_3$  is endothermic
- C.  $O_3$  is diamagnetic in nature
- D.  $O_3$  has bent structure

Answer: A::C::D



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10. The correct statement(s) regarding,

(i)  $HClO$ , (ii)  $HClO_2$ , (iii)  $HClO_3$  and (iv)  $HClO_4$  is (are)

- A. the number of Cl=O bonds in (ii) and (iii) together is two
- B. the number of lone pair of electrons on Cl in (ii) and (iii) together is three
- C. the hybridisation of Cl in (iv) is  $sp^3$

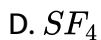
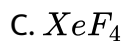
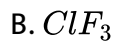
D. amongst (i) to (iv), the strongest acids is (i)

**Answer: B::C**



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**11.** The compound(s) with two lone pairs of electron on the central atom is (are)



**Answer: B::C**



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12. The nitrogen containing compound produced in the reaction of  $HNO_3$  with  $P_4O_{10}$

- A. can be prepared by reaction of  $P_4$  with  $HNO_3$
- B. is diamagnetic
- C. contains one N-N bond
- D. reacts with sodium metal producing a brown gas.

**Answer: A::B::D**



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13. The correct statements about the oxoacids  $HClO_4$  and  $HClO_3$  is (are) :

- A. The central in both the cases is  $sp^3$  hybridised
- B.  $HClO_4$  is formed as a result of reaction between  $Cl_2$  and  $H_2O$ .
- C. The conjugate base of  $HClO_4$  is weaker base more than  $H_2O$

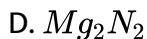
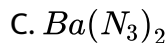
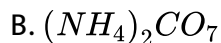
D.  $HClO_4$  is more acidic than  $HClO$  because of resonance stabilisation of anion.

**Answer: A::C::D**



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14. The compound (s) which generate (s)  $N_2$  upon thermal decomposition is (are) :



**Answer: B::C**



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15. Based on the compounds of group 15 elements, the correct statement (s) is (are)

- A.  $Bi_2O_5$  is more basic than  $N_2O_5$
- B.  $NF_3$  is more covalent than  $BiF_3$
- C.  $PH_3$  boils at a lower temperature than  $NH_3$
- D. The N - N single bond is stronger than P - P single bond.

Answer: A::B::C



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### Assertion - Reason Type Questions

1. Assertion Nitrogen has higher first ionisation energy than oxygen.

Reason Atomic radius of nitrogen is smaller than that of oxygen.



- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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2. Assertion : Noble gases have highest ionisation enthalpies in their respective periods.

Reason : Noble gases have stable closed shell electronic configuration.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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**3. Assertion :** Pentahalides of phosphorus are known but not those of nitrogen.

**Reason :** Phosphorus has lower electronegativity than nitrogen.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: B**



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4. Assertion: A fresh stain of iodine is washed with hypo solution.

Reason: Hypo is a bleaching agent and it reduces  $I_2$  to  $I^-$ .

A. If both assertion and reason are correct and reason is correct explanation for assertion.

B. If both assertion and reason are correct but reason is not correct explanation for assertion.

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: A**



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5. Assertion : Sulphuric acid is more viscous than water.

Reason : Concentrated Sulphuric acid has a greater affinity for water.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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6. Assertion :  $SO_3$  has a planar structure.

Reason : S atom in  $SO_3$  is  $sp^2$  hybridised and O-S-O bond angle is  $120^\circ$ .

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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7. Assertion:  $Cl_2$  gas bleaches the articles permanently.

Reason:  $Cl_2$  is a strong reducing agent.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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**8.** Assertion: Helium and beryllium have similar outer electronic configuration of the type  $ns^2$ .

Reason: Both are chemically inert.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: C**



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9. Assertion (A) :  $EA$  of  $O$  is less than that of  $F$  but greater than that of  $N$ .

Reason (R) :  $IE$  is as follows:  $N > O > F$ .

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**

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10. Assertion : Nitride ion ( $N^{3-}$ ) and magnesium ion ( $Mg^{2+}$ ) are both isoelectronic species.

Reason : the charge on nitride is different from  $Mg^{2+}$  ion.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**

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11. Assertion:  $PCl_5$  is covalent in gaseous and liquid states but ionic in solid state.

Reason:  $PCl_5$  in solid state consists of tetrahedral  $PCl_4^+$  cation and octahedral  $PCl_6^-$  anion.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**12.** Assertion :  $\text{HClO}$  is a stronger acid than  $\text{HBrO}$ .

Reason : Cleavage of  $\text{ClO-H}$  bond is easier than that of  $\text{BrO-H}$  bond because  $\text{Cl}$  is more electronegative than  $\text{Br}$ .

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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**13.** Assertion : Phosphoric acid is a tribasic acid.

Reason : Three  $\text{H}$  atoms are directly attached to  $\text{P}$  atom.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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**14.** Assertion:  $HClO_4$  is a stronger acid than  $HClO_3$ .

Reason: Oxidation state of  $Cl$  in  $HClO_4$  is  $+VII$  and in  $HClO_3$  is  $+V$ .

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**15.** Assertion:  $SiF_6^{2-}$  is known but  $SiCl_6^{2-}$  is not.

Reason: Size of fluorine is small and its lone pair of electrons intersects with d-orbitals of  $Si$  strongly.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: A**



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**16.** Assertion: Reaction of  $SO_2$  and  $H_2S$  in the presence of  $Fe_2O_3$  catalyst gives elemental sulphur.

Reason:  $SO_2$  is a reducing agent.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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17. Assertion (A) : F atom has less electron than  $Cl^-$  atom

Reason (R) : Additional electrons are repelled more effectively by  $3p$  electron in  $Cl$  atom than by  $2p$  electron in F atom

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

Answer: C



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**18. Assertion:** Although  $PF_5$ ,  $PCl_5$  and  $PBr_5$  are known, the pentahalides of nitrogen have not been observed.

**Reason:** Phosphorus has lower electronegativity than nitrogen.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**19. Statement 1:** Molecular nitrogen is less reactive than molecular oxygen

**Statement 2:** The bond length of  $N_2$  is less as compared to that of  $O_2$ .

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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**20.** Statement-1 : Sulphur exhibits paramagnetic behaviour in vapour state.

Statement-2 : In vapour state sulphur partly exists as  $S_2$  molecule which has two unpaired electrons in antibonding  $\pi^*$  orbitals.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.



- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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**21.** Assertion : Fluorine ( $F_2$ ) is a stronger oxidising agent than chlorine.

Reason : Fluorine is more electronegative than chlorine.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: B**



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**22.** Assertion : The compounds of noble gas element neon are not known.

Reason : Neon does not have any vacant orbital in the valence shell of its atom.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**

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**23.** Assertion : The basicity of hypophosphorus acid is two.

Reason : Two hydrogen atoms are bonded to phosphorus atoms.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**

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**24.** Assertion (A): In aqueous solution,  $SO_2$  reacts with  $H_2S$  liberating sulphur

Reason (R) :  $SO_2$  is an effective reducing agent.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**25. Assertion :** Acidity of hydrides of group 16 elements increases down the group.

**Reason :** Electronegativity of these elements increases down the group.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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**26. Assertion :** He and Ne do not form any clathrates

**Reason :** Both He and Ne are very small in size

- A. If both assertion and reason are correct and reason is correct explanation for assertion.

- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**27.** Statement I Nitrogen and oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen.

Statement II The reaction between nitrogen and oxygen requires high temperature.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: A**



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**28.** Assertion: Although  $PF_5$ ,  $PCl_5$  and  $PBr_5$  are known, the pentahalides of nitrogen have not been observed.

Reason: Phosphorus has lower electronegativity than nitrogen.

A. If both assertion and reason are correct and reason is correct explanation for assertion.

B. If both assertion and reason are correct but reason is not correct explanation for assertion.

C. If assertion is correct but reason is incorrect.

D. If both assertion and reason are incorrect.

**Answer: B**



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**29. Assertion :** Fluorine is the strongest oxidising agent in halogens.

**Reason :** It displaces other halogens from its aqueous solution.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: A**



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**30.** Assertion : All F - S - F angle in  $SF_4$  are greater than  $90^\circ$  but less than  $180^\circ$ .

Reason : The lone pair - bond pair repulsion is weaker than bond pair - bond pair repulsion

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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**31.** Assertion : Pure  $N_2$  is formed from  $Ba(N_3)_2$

Reason : Thermal decomposition of  $NaN_3$  is used to inflate the air bags

used for safety devices in same cases.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: B**



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**32.** In the ring test of  $\text{NO}_3^-$  ion,  $\text{Fe}^{2+}$  ion reduces nitrate ion to nitric oxide, which combines with  $\text{Fe}^{2+}$  (aq) ion to form brown complex .

Write the reactions involved in the formation of brown ring.

- A. If both assertion and reason are correct and reason is correct explanation for assertion.
- B. If both assertion and reason are correct but reason is not correct explanation for assertion.
- C. If assertion is correct but reason is incorrect.
- D. If both assertion and reason are incorrect.

**Answer: C**



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## Interger Answer Type Questions

1. What is the oxidation state of P in hypophosphorus acid ?



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2. The basicity of phosphoric acid is \_\_\_\_ .



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3. How many S-O bonds are present in Marshall's acid ?



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4. What is the oxidation state of Cl in  $HClO_4$  ?



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5. What is the electronegativity of Fluorine (F) on Pauling's scale ?



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6. What is the oxidation state of N in  $HNO_3$  ?



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7. What is the maximum oxidation state of sulphur in its compounds ?



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8. Based on VSEPR theory, the number of 90 degree F-Br-F angles in  $BrF_5$ , is



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9. Among the following, the number of compounds that can react with  $PCl_5$  to give  $POCl_3$  is  $O_2, CO_2, SO_2, H_2O, H_2SO_4, P_4O_{10}$ .



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10. In the molecule  $ICl_3$ , how many lone pairs of electrons are associated with iodine ?



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11. In the interhalogen compound  $AB_n$ , what is the maximum value of  $n$  ?



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12. What is the basicity of pyrophosphoric acid ?



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13. How many  $\sigma$ -bonds are present in the structure of  $N_2O_3$  ?



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14. The number of  $P - O - P$  and  $P - OH$  bonds present respectively in pyrophosphoric acid molecule are



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15. Number of S-O-S bonds in  $S_3O_9$  is



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16. Number of lone pair of electrons in  $XeF_4$  is



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17. The difference between number of sigma and pi bonds in peroxodisulphuric acid is .



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18. The total number of lone pair of electrons in  $N_2O_3$  is



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19. What is the total number of compounds having at least one bridging oxo group among the molecules given below ?

$N_2O_3$ ,  $N_2O_5$ ,  $P_4O_6$ ,  $P_4O_7$ ,  $H_4P_2O_5$ ,  $H_5P_2O_{10}$ ,  $H_2S_2O_3$ ,  $H_2S_2O_5$ .



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### Matrix-Match Type Questions

1. Match the statement (A,B,C,D) in column I with the statement (p,q,r,s) in column II. The answers are to be properly bobbled.



**Column I**

- (A)  $\text{NH}_3$
- (B)  $\text{BeF}_2$
- (C)  $\text{H}_2\text{O}$
- (D)  $\text{CO}_2$

**Column II**

- (p) Linear
- (q) Polar
- (r)  $\mu = 0\text{D}$
- (s) Angular

	<i>p</i>	<i>q</i>	<i>r</i>	<i>s</i>
(A)	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
(B)	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
(C)	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
(D)	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

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2. Match the statement (A,B,C,D) in column I with the statement (p,q,r,s) in column II. The answers are to be properly bobbled.

**Column I**

- (A)  $\text{NH}_3$   
(B)  $\text{BeF}_2$   
(C)  $\text{H}_2\text{O}$   
(D)  $\text{CO}_2$

**Column II**

- (p) Linear  
(q) Polar  
(r)  $\mu = 0\text{D}$   
(s) Angular

	<i>p</i>	<i>q</i>	<i>r</i>	<i>s</i>
(A)	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
(B)	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>
(C)	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>
(D)	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>

[Watch Video Solution](#)**Brain Storming Multiple Choice Questions (MCQs)**

1. Which of the following statements is wrong ?

- A. Stability of hydrides increases from  $\text{NH}_3$  to  $\text{BiH}_3$  in group 15 of the periodic table

B. Nitrogen cannot form  $d\pi - p\pi$  bond.

C. N-N bond is weaker than P-P bond

D.  $N_2O_4$  has two resonating structures.

**Answer: A**



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2. There is a very little difference in the acid strength in the acids

$H_3PO_4$ ,  $H_3PO_3$  and  $H_3PO_2$  because :

A. phosphorus in these acids exists in different oxidation states

B. the hydrogen in these acids are not all bound to the phosphorus atom and have same number of unprotonated oxygen

C. phosphorus is highly electronegative element

D. phosphorus oxides are less basic.

**Answer: B**

3. When chlorine water is added to an aqueous solution of sodium halide in the presence of chloroform, violet colouration is obtained. When more of chlorine water is added, the violet colour disappears and the solution becomes colourless. This confirms that sodium halide is :

A. Chloride

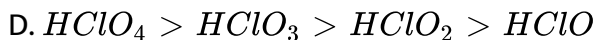
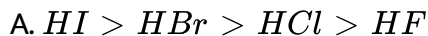
B. fluoride

C. Bromide

D. Iodide.

**Answer: D**

4. Select the correct order of acidity :



Answer: A::B::D



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5. Select the correct statements :

A.  $Cl_2O$  and  $ClO_2$  are used as bleaching agents and as germicides

B.  $ClO_2$  is the anhydride of  $HClO_2$  and  $HClO_3$

C.  $I_2O_5$  is used in the quantitative estimation of CO

D. All are coorect.

Answer: D



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6. The xenon compounds that are isostructural with  $IBr_2^-$  and  $BrO_3^-$  respectively are:

- A. linear  $XeF_2$  and pyramidal  $XeO_3$
- B. bent  $XeF_2$  and pyramidal  $XeO_3$
- C. bent  $XeF_2$  and planar  $XeO_3$
- D. linear  $XeF_2$  and tetrahedral  $XeO_3$ .

**Answer: A**



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7. Compounds ( $A$ ) and  $B$  are treated with dilute  $HCl$  separately. The gases liberated are  $Y$  and  $Z$  respectively.  $Y$  turns acidified  $K_2Cr_2O_7$  paper green while  $Z$  turns lead acetate paper black. The compounds  $A$  and  $B$  are respectively :

A.  $Na_2S$  and  $Na_2SO_3$

B.  $Na_2SO_3$  and  $Na_2S$

C.  $NaCl$  and  $Na_2CO_3$

D.  $Na_2SO_3$  and  $Na_2SO_4$

**Answer: B**



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**8.** One mole of  $H_3PO_3$  on reaction with excess of  $NaOH$  gives :

A. one mole of  $Na_2HPO_3$

B. two moles of  $Na_2H_2PO_3$

C. two moles of  $Na_2HPO_3$

D. one mole of  $Na_3PO_3$

**Answer: A**



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9. Molecular shapes of  $SF_4$ ,  $CF_4$  and  $XeF_4$  are:

- A. the same with 2, 0 and 1 lone pairs of electrons on the central atom respectively
- B. the same with 1, 1, and 1 lone pair of electrons on the central atom respectively
- C. different with 0, 1 and 2 lone pairs on the central atom respectively
- D. different with 1, 0 and 2 lone pairs on the central atom respectively.

**Answer: D**



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