



## CHEMISTRY

### BOOKS - PRADEEP CHEMISTRY (HINGLISH)

#### P-BLOCK ELEMENTS

#### CURIOSITY QUESTION

1. How do the airbags installed in the dashboard of your car work ?



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2. It is often difficult to store radioactive isotopes of Kr and Xe. Suggest a method to store them.



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1. An aqueous 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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2. 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.



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3. A pale yellow substance ( $A$ ) when heated with *conc.*  $HNO_3$  evolves a brown coloured gas ( $B$ ). The substance ( $A$ ) also dissolves in sodium sulphite solution on heating. A clear solution ( $c$ ) is formed which on acidification gives a turbid solution and a pungent smelled gas ( $D$ ) which is formed by the substance ( $A$ ) in air. The solution ( $c$ ) decolourises iodine solution, Identify ( $A$ ) to ( $D$ ).

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4. A colourless inorganic salt ( $A$ ) decomposes completely at about  $25^\circ C$  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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5. When conc.  $H_2SO_4$  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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6. 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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7. Identify (A) to (E).

(a) An inorganic iodide (A) on heating with a solution of  $KOH$  gives a gas (B) and the solution of a compound (C).

(b) The gas (B) on ignition air gives a compound (D) and water.

(c) Copper sulphate is reduced to the metal on passing (B) through the solution.

(d) A precipitate of the compound (E) is formed on reaction of (C) with copper sulphate solution.



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8. Identify (A) to (E).

(a) An inorganic iodide (A) on heating with a solution of  $KOH$  gives a gas (B) and the solution of a compound (C).

(b) The gas (B) on ignition air gives a compound (D) and water.

(c) Copper sulphate is reduced to the metal on passing (B) through the solution.

(d) A precipitate of the compound (*E*) is formed on reaction of (*C*) with copper sulphate solution.

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



Identify in which of the above test-tube, the following change will be observed. Support your answer with the help of a chemical change : (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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10. An aromatic compound A on heating with Br<sub>2</sub> and KOH forms a compound B of molecular formula C<sub>7</sub>H<sub>7</sub>N which on reacting with CHCl<sub>3</sub> and

alcoholic KOH produces a foul smelling compound C. Write the structures and IUPAC names of compounds A, B and C.

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## MCQ

1. Which of the following does not form a pentachloride?

A. P

B. As

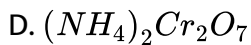
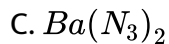
C. Sb

D. N

**Answer: D**

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2. Which of the following on heating does not give nitrogen gas ?



**Answer: A**



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3. The element which forms oxides in all oxidation states +1 to +5 is.

A. N

B. P

C. As

D. Sb



**Answer: A**



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4. Which of the following elements is kept in water?

A. White P

B. Na

C. S

D. Si

**Answer: A**



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5. For  $H_3PO_3$  and  $H_3PO_4$  the correct choice is

A.  $H_3PO_3$  is dibasic and reducing

B.  $H_3PO_4$  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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6. Which of the following is the correct order of increasing enthalpy of vaporisation ?

A.  $NH_3$ ,  $PH_3$ ,  $AsH_3$

B.  $AsH_3$ ,  $PH_3$ ,  $NH_3$

C.  $NH_3$ ,  $AsH_3$ ,  $PH_3$

D.  $PH_3$ ,  $AsH_3$ ,  $NH_3$

**Answer: D**

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7. The number of P-P-P bridges in the structure of phosphorus pentoxide and phosphorus trioxide are respectively

A. 6, 6

B. 5, 5

C. 5, 6

D. 6, 5

**Answer: A**



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8. Which of the following is not hydrolysed?

A.  $AsCl_3$

B.  $PF_3$

C.  $SbCl_3$

D.  $NF_3$

**Answer: D**

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9. The oxidation number of  $S$  in  $S_8$ ,  $S_2F_2$ , and  $H_2S$ , respectively, are

A.  $-2$ ,  $+1$  and  $-2$

B.  $-2$ ,  $-1$  and  $+2$

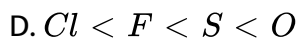
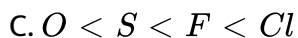
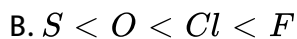
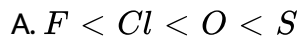
C.  $0$ ,  $+1$  and  $+2$

D.  $0$ ,  $+1$  and  $-2$

**Answer: D**

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10. Which one of the following arrangements represents the correct order of electron gain enthalpy of the given atomic species?



**Answer: C**



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11. The element evolving two different gases on reaction with *conc.*  $H_2SO_4$ .

A. P

B. C

C. Hg

D. S

**Answer: B**



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12. Ozone is tested by

A. Ag

B. Hg

C. Zn

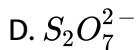
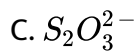
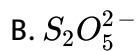
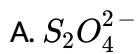
D. Au

**Answer: B**



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13. There is no  $S - S$  bond in



**Answer: D**

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**14. Which of the following compounds exists ?**



**Answer: B**

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15. Which of the following has greatest reducing power?

A. HCl

B. HI

C. HBr

D. HF

**Answer: B**



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16. When  $I_2$  is passed through  $KCl$ ,  $KF$ ,  $KBr$ :

A.  $Cl_2$  and  $Br_2$  are evolved

B.  $Cl_2$  is evolved

C.  $Cl_2$ ,  $Br_2$ ,  $F_2$  are evolved



D. none of these

**Answer: D**

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17. Which products are expected from the disproportionation reaction of hypochlorous acid?

A.  $\text{HClO}_3$  and  $\text{Cl}_2\text{O}$

B.  $\text{HClO}_2$  and  $\text{HClO}_4$

C.  $\text{HCl}$  and  $\text{Cl}_2\text{O}$

D.  $\text{HCl}$  and  $\text{HClO}_3$

**Answer: D**

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18. Which one of the following orders is not in accordance with the property stated against it ?

A.  $F_2 > Cl_2 > Br_2 > I_2$ , bond dissociation energy

B.  $F_2 > Cl_2 > Br_2 > I_2$ , oxidising power

C.  $HI > HBr > HCl > HF$ , acidic property power

D.  $F_2 > Cl_2 > Br_2 > I_2$ , electronegativity

**Answer: A**



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19. A solution of  $KBr$  is treated with each of the following which one would liberate bromine?

A.  $Cl_2$

B. HI

C.  $SO_2$

D.  $I_2$

**Answer: A**



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20. The gas used for inflating the tyres of aeroplanes is

A.  $H_2$

B. He

C.  $N_2$

D. Ar

**Answer: B**



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21. The formation of  $O_2^+ [PtF_6]^-$  is the basis for the formation of xenon fluorides. This is because:

- A.  $O_2$  and Xe have comparable sizes
- B. both  $O_2$  and Xe are gases
- C.  $O_2$  and Xe have comparable ionisation energies
- D.  $O_2$  and Xe have comparable electronegativities

**Answer: C**



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22. Number of lone pairs of electrons on Xe atoms in  $XeF_2$ ,  $XeF_4$ ,  $XeF_6$  and  $XeO_4$  molecules are respectively

- A. 3, 2, 1, 0
- B. 1, 3, 2, 0
- C. 0, 2, 3, 1

D. 3, 2, 0, 1

**Answer: A**

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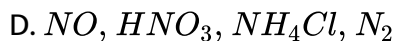
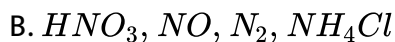
**23.** Which is true regarding nitrogen ?

- A. Less electronegativity
- B. Has low ionisation enthalpy
- C. d-orbitals are available
- D. Ability to form  $p\pi - p\pi$  bonds with itself

**Answer: D**

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24. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen ?

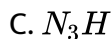
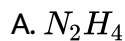


**Answer: B**



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25. In which of the following compounds, nitrogen exhibits highest oxidation state?

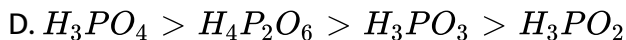
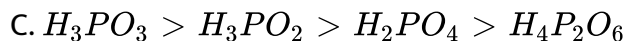
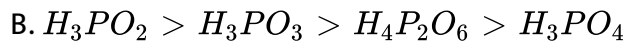
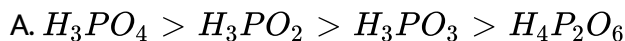


D.  $NH_2OH$

Answer: C

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26. 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: D

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27. The following are some statements related to VA group hydrides

- I) Reducing property increases from  $NH_3$  to  $BiH_3$
- II) Tendency to donate lone pair decreases from  $NH_3$  to  $BiH_3$
- III) Ease of replacing H with  $Cl$  decreases from  $NH_3$  to  $BiH_3$
- IV) Ease of formation of hydrides decreases from  $NH_3$  to  $BiH_3$

The correct statement are

A. I, II, III and IV

B. I, III and IV

C. I, II and IV

D. I and IV

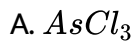
**Answer: A**



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28. The molecule having smallest bond angle is

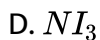
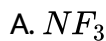




**Answer: B**

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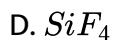
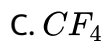
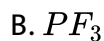
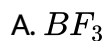
**29.** Among the trihalides of nitrogen, which one is the least basic ?



**Answer: A**

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30. Which of the of the following fluoro -compouds is most likely to beahve as a Lewis base?

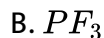
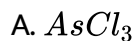


**Answer: B**



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31. Which of the following is not hydrolysed



D.  $NF_3$

Answer: D

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32. The hydrolysis of  $NCl_3$  by  $H_2O$  produces

A.  $NH_2OH$  and  $HOCl$

B.  $NH_2NH_2$  and  $HCl$

C.  $NH_4OH + HOCl$

D.  $NH_2Cl$  and  $HOCl$

Answer: C

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33. Extra pure  $N_2$  can be obtained by heating

A.  $NH_3$  and  $CuO$

B.  $NH_4NO_3$

C.  $(NH_4)_2Cr_2O_7$

D.  $Ba(N_3)_2$

**Answer: D**

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**34.** Thermal decomposition of ammonium dichromate gives

A.  $N_2$ ,  $H_2O$  and  $Cr_2O_3$

B.  $N_2$ ,  $NH_3$  and  $CrO$

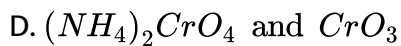
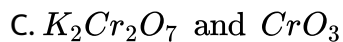
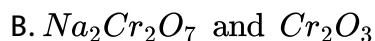
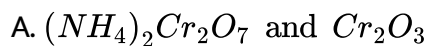
C.  $(NH_4)_2CrO_4$  and  $H_2O$

D.  $N_2$ ,  $H_2O$  and  $CrO_3$

**Answer: A**

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35. The orange solid on heating gives a colourless gas and a greensolid which can be reduced to metal by aluminium powder. The orange and the green solids are respectively

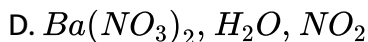
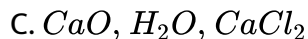
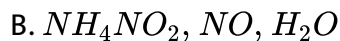
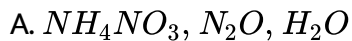


**Answer: A**



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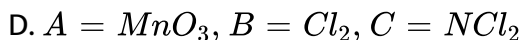
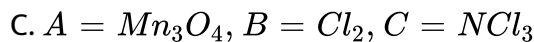
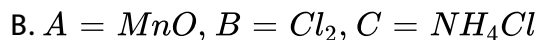
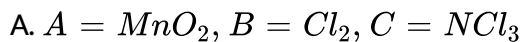
36. An inorganic salt (A) is decomposed on heating to give two products (B) and (C). Compound (C) is a liquid at room temperature and is neutral to litmus while compound (B) is a colourless neutral gas. Compounds (A), (B) and (C) are



**Answer: A**

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37. When a brown compound of Mn (A) is treated with HCl, it gives a gas (B). The gas (B) taken in excess reacts with  $NH_3$  to give an explosive compound (C). The compounds A, B and C are



**Answer: A**

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**38.** The gases produced in the reaction

$Pb(NO_3)_2 \xrightarrow{\Delta}$  and  $NH_4NO_3 \xrightarrow{\Delta}$  are respectively

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

**Answer: D**

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**39.** The reaction between  $NH_2^-$  and  $N_2O$  gives

A. NO

B.  $N_3^-$

C.  $N_2O_5$

D.  $NH_2NH_2$

**Answer: B**

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**40.** Nitrogen dioxide is not produced on heating

A.  $KNO_3$

B.  $Pb(NO_3)_2$

C.  $Cu(NO_3)_2$

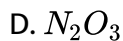
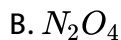
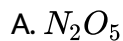
D.  $AgNO_3$

**Answer: A**

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41. The reddish -brown gas formed when nitric oxide is oxidized by air is



**Answer: C**



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42. Which statement is wrong for NO

A. It is anhydride of nitrous acid

B. Its dipole moment is 0.22 D

C. It forms dimer

D. It is paramagnetic

**Answer: A**

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

A. Its bond order is 2.5

B. It is diamagnetic in the gaseous state.

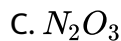
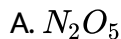
C. It is a neutral oxide

D. It combines with oxygen to form nitrogen dioxide

**Answer: B**

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44. A gaseous substance dissolve in water giving a pale blue solution which decolourises  $KMnO_4$  and oxidises  $KI$  to  $I_2$  in acidic medium :

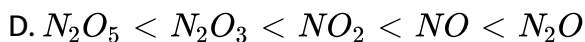
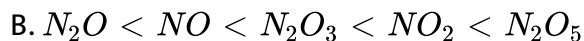
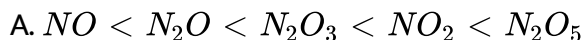


Answer: C



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45. The correct order of the acidic nature of oxides is in the order



**Answer: B**

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**46.** 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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**47.** Concentrated nitric acid upon long standing turns yellowish-brown due to the formation of :

A.  $\text{NO}$

B.  $\text{NO}_2$

C.  $\text{N}_2\text{O}$

D.  $\text{N}_2\text{O}_4$

**Answer: B**

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

A.  $\text{N}_2\text{O}$  and  $\text{NO}_2$

B.  $\text{NO}_2$  and  $\text{NO}$

C.  $\text{NO}$  and  $\text{N}_2\text{O}$

D.  $\text{NO}_2$  and  $\text{N}_2\text{O}$

**Answer: A**

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49. 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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50. Which of the following metal Fe, Zn, Pb, Ag and Pt do not give a metal nitrate on treatment with concentrated  $HNO_3$ ?

A. Fe and Zn

B. Fe and Pt

C. Pb, Ag and Pt

D. Fe, Ag and Pt

**Answer: B**

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51. The brown ring test for nitrates depends on

A. the reduction of nitrate to nitric oxide

B. oxidation of nitric oxide to nitrogen dioxide

C. reduction of ferrous sulphate to iron

D. oxidising action of sulphuric acid

**Answer: A**

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52. The oxidation number of Fe in brown ring  $[Fe(H_2O)_5NO]^{2+}$  is

- A. 0
- B. +1
- C. +2
- D. +3

**Answer: B**



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53.  $[Fe(H_2O)_5NO]^{2+}$  is a complex formed during the brown ring test for  $NO_3^-$  ion. In this complex.

- A. there are three unpaired electrons so that its magnetic moment is 3.87 B.M.
- B. NO transfers its electron to  $Fe^{2+}$  so that iron exists as Fe (I) and NO as  $NO^+$



C. the colour is because of charge transfer

D. all of the above statements are correct

**Answer: D**

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54. Out of the following acids, the one which has the capability to form complex compound and also possesses oxidising and reducing properties is

A.  $HNO_3$

B.  $HNO_2$

C.  $HCOOH$

D.  $HCN$

**Answer: B**

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55. 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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56. Which one of the following forms vortex ring

A.  $P_2O_5$

B.  $PH_3$

C.  $NH_3$

D.  $P_4O_{10}$

**Answer: B**

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57. The reaction of white phosphorus with aqueous  $NaOH$  gives phosphine along with another phosphorus containing compound. The reaction type, the oxidation states of phosphorus in phosphine and the other product are respectively:

- A. redox reaction , -3 and -5
- B. redox reaction , +3 and +5
- C. disproportionation reaction , -3 and -5
- D. disproportionation reaction , -3 and +1

**Answer: D**

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58. The reaction of  $P_4$  with X leads selectively to  $P_4O_6$ . The X is :

- A. Dry  $O_2$
- B. A mixture of  $O_2$  and  $N_2$
- C. Moist  $O_2$
- D.  $O_2$  in the presence of aqueous NaOH

**Answer: B**



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59.  $P_4O_{10}$  is the anhydride of

- A.  $H_3PO_2$
- B.  $H_3PO_3$
- C.  $H_3PO_4$
- D.  $H_4P_2O_7$

**Answer: C**

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**60.** How many bridging atoms are present in  $P_4O_{10}$  ?

A. 6

B. 4

C. 2

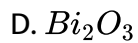
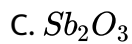
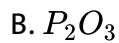
D. 5

**Answer: A**

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**61.** Of the following compounds, the most acidic is

A.  $As_2O_3$



**Answer: B**



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

A. +3

B. +5

C. -3

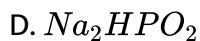
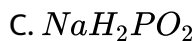
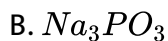
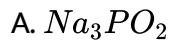
D. +2

**Answer: B**



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63. The correct formula of salt formed by the neutraliation of hypophosphorous acid with NaOH is

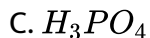
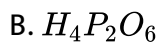
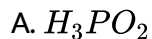


**Answer: C**



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64. Oxyacid of phosphorus that can reduce  $AgNO_3$  to silver is



**Answer: A**

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

- A. orthophosphorous acid and pyrophosphorous acids
- B. pyrophosphorous acid and hypophosphoric acids
- C. orthophosphorous and hypophosphoric acids
- D. pyrophosphorous and pyrophosphoric acids

**Answer: A**

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**66.** Which is the correct statement for the given acids ?

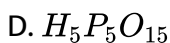
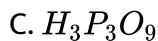
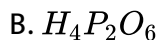
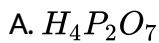


- A. Phosphinic acid is a monoprotic acid while phosphonic acid is a diprotic acid
- B. Phosphinic acid is a diprotic acid while phosphonic acid is a monoprotic acid
- C. Both are diprotic acids
- D. Both are triprotic acids

**Answer: A**

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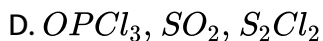
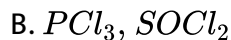
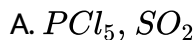
67. Which of the following is a cyclic oxo acid ?



**Answer: C**

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68. Sulphuryl chloride ( $SO_2Cl_2$ ) reacts with white phosphorus ( $P_4$ ) to give \_\_\_\_\_.



**Answer: A**

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69.  $Cl - P - Cl$  bond angles in  $PCl_5$  molecule are

A.  $120^\circ$  and  $90^\circ$

B.  $60^\circ$  and  $90^\circ$

C.  $60^\circ$  and  $120^\circ$

D.  $120^\circ$  and  $30^\circ$

**Answer: A**



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**70.** The compound which has molecular nature in gas phase but ionic in solid state is

A.  $PCl_5$

B.  $CCl_4$

C.  $PCl_3$

D.  $POCl_3$

**Answer: A**

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

- A. sulphuryl chloride
- B. sulphurous acid
- C. chlorosulphonic acid
- D. thionyl chloride

**Answer: A**

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72. Reaction of  $PCl_3$  and  $PhMgBr$  would give

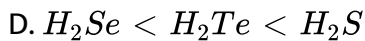
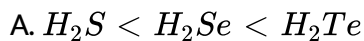
- A. bromobenzene
- B. chlorobenzene
- C. triphenylphosphine

D. dichlorobenzene

Answer: C

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



Answer: A

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74. Which of the following is the wrong statement ?

- A. Ozone is diamagnetic gas
- B.  $\text{ONCl}$  and  $\text{ONO}^-$  are isoelectronic
- C.  $\text{O}_3$  molecule is bent
- D. Ozone is violet-black in solid state

**Answer: B**

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75. Which one of the following group 16 elements does not exist in -2 oxidation state ?

- A. S
- B. Se
- C. O
- D. Po

**Answer: D**

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76. Identify the incorrect statement from the following

- A. Oxides of nitrogen in the atmosphere can cause the depletion of ozone layer
- B. Ozone absorbs the intense ultraviolet radiation of the sun
- C. Depletion of ozone layer is because of its chemical reactions with chlorofluoroalkanes
- D. Ozone absorbs infrared radiation

**Answer: D**

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77. Roasting of sulphides gives the gas X as a by product. This is a colourless gas with choking smell of burnt sulphur and causes great

damage to respiratory organs as a result of acid rain. Its aqueous solution is acidic, acts as reducing agent and its acid has never been isolated. The gas X is :-

A.  $CO_2$

B.  $SO_3$

C.  $H_2S$

D.  $SO_2$

**Answer: D**



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**78.** Nitrogen dioxide and sulphur dioxide have some properties in common, which property is shown by one of these compounds, but not by the other?

A. Is soluble in water

B. Is used as a food preservatives



C. Forms 'acid rain'

D. Is a reducing agent

**Answer: B**

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79. Which one of the following statements is correct when  $SO_2$  is passed through acidified  $K_2Cr_2O_7$  solution?

A.  $SO_2$  is reduced

B. Green  $Cr_2(SO_4)_3$  is formed

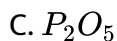
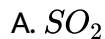
C. The solution turns blue

D. The solution is decolourised

**Answer: B**

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80. Name the gas that can readily decolourise acidified  $KMnO_4$  solution:

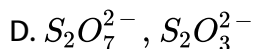
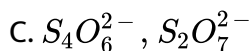
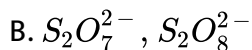
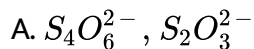


Answer: A



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81. In which pair of ions both the species contain  $S - S$  bond?



**Answer: A**



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**82.** When  $BaCl_2$  is added to an aqueous salt solution, a white ppt. is obtained. The anion among  $CO_3^{2-}$ ,  $SO_3^{2-}$  and  $SO_4^{2-}$  that was present in the solution can be

A.  $CO_3^{2-}$  but not any of the other two

B.  $SO_3^{2-}$  but not any of the other two

C.  $SO_4^{2-}$  but not any of the other two

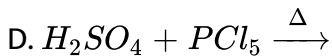
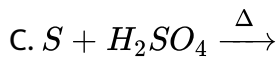
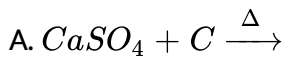
D. any of them

**Answer: D**



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**83.** Sulphur trioxide can be obtained by which of the following reactions :

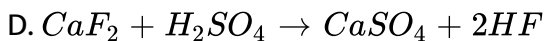
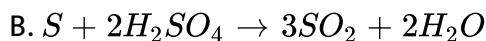


**Answer: B**

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**84.** Hot concentrated sulphuric acid is a moderately strong oxidizing agent.

Which of the following reactions does not show oxidizing behaviour?



**Answer: D**

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85. When formic acid is heated with concentrated  $H_2SO_4$ , the gas evolved is

- A. only  $CO_2$
- B. only CO
- C. a mixture of  $CO$  and  $CO_2$
- D. a mixture of  $SO_2$  and  $CO_2$

**Answer: B**

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86. In  $SOCl_2$ , the Cl-S-Cl and Cl-S-O bond angles are

- A.  $130^\circ$  and  $115^\circ$
- B.  $106^\circ$  and  $96^\circ$

C.  $107^\circ$  and  $108^\circ$

D.  $96^\circ$  and  $106^\circ$

**Answer: D**

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87. The product formed in the reaction of  $SOCl_2$  with white phosphorus is

A.  $PCl_3$

B.  $SO_2Cl_2$

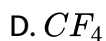
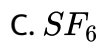
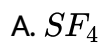
C.  $SCl_2$

D.  $POCl_3$

**Answer: A**

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88. Two types of F-X-F angles are present in which of the following molecule (X = S, Xe, C)



**Answer: A**



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89. Which one of the following elements can have both positive and negative oxidation state?

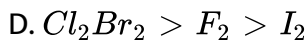
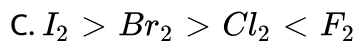
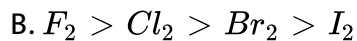
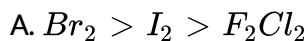


D. F

Answer: C

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90. Which one of the following orders is correct for the bond dissociation enthalpy of halogen molecules?

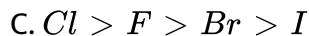
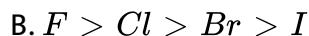
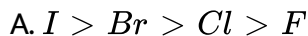


Answer: D

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91. the correct order of electron gain enthalpy with negative sign of  $F$ ,  $Cl$ ,  $Br$  and  $I$ , having atomic number 9, 17, 35 and 53 respectively is

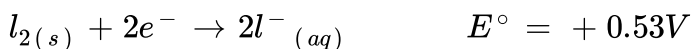
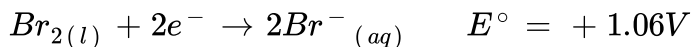
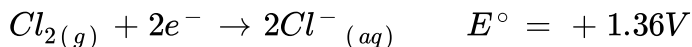
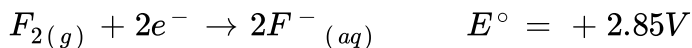


Answer: C

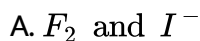


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92. Standard reduction potentials of the half reactions are given below



The strongest oxidising and reducing agents respectively are



B.  $Br_2$  and  $Cl^-$

C.  $Cl_2$  and  $Br^-$

D.  $Cl_2$  and  $I_2$

**Answer: A**

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

A. electron affinity

B. ionization energy

C. hydration energy

D. bond dissociation energy

**Answer: C**

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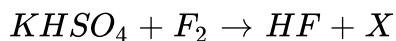
94. When  $Br_2$  is treated with aqueous solutions of NaF, NaCl and NaI separately

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

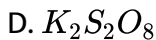
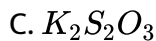
**Answer: C**

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95. What 'X' in the following reaction ?



- A.  $K_2SO_4$
- B.  $K_2S_2O_4$



**Answer: D**

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

A.  $HF < HCl < HBr < HI$  : increasing acid strength

B.  $H_2O < H_2S < H_2Se < H_2Te$  : increasing  $pK_a$  values

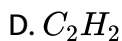
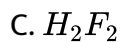
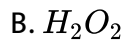
C.  $NH_3 < PH_3 < AsH_3 < SbH_3$  : increasing acidic character

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

**Answer: B**

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97. Shape of  $O_2F_2$  is similar to that of

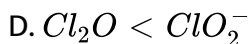
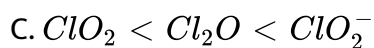


Answer: B



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98. The correct order of increasing bond angles in the following species is

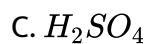
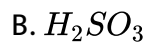


**Answer: A**



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**99.** Which is the strongest acid in the following ?



**Answer: A**



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**100.** Which of the following is not a peroxy acid?

A. Perphosphoric acid

B. Pernitric acid

C. Perdisulphuric acid

D. Perchloric acid

**Answer: D**



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**101.** The following acids have been arranged in order of decreasing acid strength. Identify the correct order.

$\text{ClOH}$  (I) ,  $\text{BrOH}$  (II) ,  $\text{IOH}$ (III)

A.  $I > II > III$

B.  $II > I > III$

C.  $III > II > I$

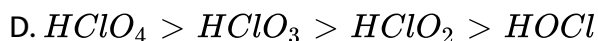
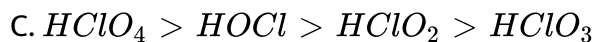
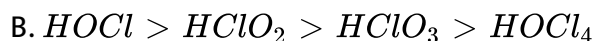
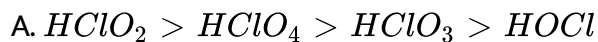
D.  $I > III > II$

**Answer: A**



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102. Among the following oxoacids, the correct decreasing order of acid strength is:



Answer: D



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103. Of the following compounds, which one is the strongest Bronsted acid in an aqueous solution ?





B.  $HClO_2$

C. HOCl

D. HOBr

**Answer: A**

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**104.** The aqueous solution of which of the following salt will have the lowest pH ?

A.  $NaClO$

B.  $NaClO_4$

C.  $NaClO_3$

D.  $NaClO_2$

**Answer: B**

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105. Which of the statements given below 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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106. The products obtained when chlorine gas reacts with cold and dilute aqueous  $NaOH$  are :

- A.  $Cl^-$  and  $ClO^-$
- B.  $Cl^-$  and  $ClO_2^-$
- C.  $ClO^-$  and  $ClO_3^-$

D.  $ClO_2^-$  and  $ClO_3^-$

**Answer: A**

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**107.** 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  $NaIO_3$

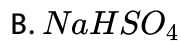
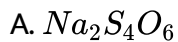
C. A solution mixture of NaI and KI

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

**Answer: B**

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108. Aqueous solution of  $Na_2S_2O_3$  on reaction with  $Cl_2$  gives

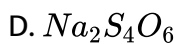
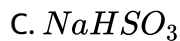
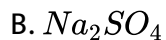
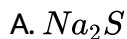


**Answer: B**



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109.  $Na_2S_2O_3$  is oxidised by  $I_2$  to



**Answer: D**

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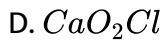
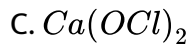
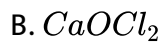
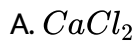
**110.** When  $Cl_2$  gas reacts with hot and concentrated sodium hydroxide solution, the oxidation number of chlorine changes from

- A. zero to +1 and zero to +5
- B. zero to -1 and zero to +5
- C. zero to -1 and zero to +3
- D. zero to +1 and zero to -3

**Answer: B**

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**111.** Which one of the following is present as an active ingredient in bleaching powder for bleaching action?

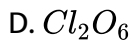
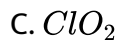
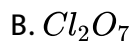
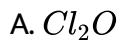


**Answer: C**



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**112.** Bleaching powder contains a salt of an oxoacid as one of its components . The anhydride of that acid is



**Answer: A**

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113. If  $I_2$  is dissolved in aqueous KI, the intense yellow species  $I_3^-$  is formed. The structure of  $I_3^-$  ion is

- A. square pyramidal
- B. trigonal bipyramidal
- C. octahedral
- D. pentagonal bipyramidal

**Answer: B**

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114. The correct statement for the molecule,  $CsI_3$  is

- A. it contains  $Cs^+$ ,  $I^-$  and lattice  $I_2$  molecules
- B. it is a covalent molecule

C. it contains  $CS^+$  and  $I_3^-$  ions

D. it contains  $CS^{3+}$  and  $I^-$  ions

**Answer: C**

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**115.** Among the following which one is 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

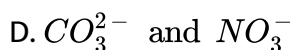
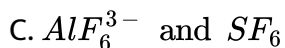
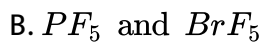
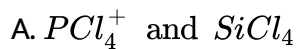
D.  $I_3^+$  has bent geometry

**Answer: C**

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116. In which of the following pairs, the two species are not isostructural?



Answer: B



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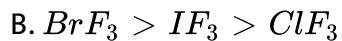
117. Which among the following is the most reactive gas



**Answer: B**

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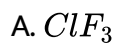
**118.** The stability of interhalogen compounds follows the order

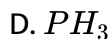


**Answer: A**

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**119.** The species having bond angle of  $120^\circ$  is





**Answer: C**

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**120.** Match the interhalogen compounds of column-I with the geometry in column-II and assign the correct code.

Column I		Column II	
(A) $XX'$	(i)	T-shape	
(B) $XX'_3$	(ii)	Pentagonal bipyramidal	
(C) $XX'_5$	(iii)	Linear	
(D) $XX'_7$	(iv)	Square pyramidal	
	(v)	Tetrahedral	

A.            A    B    C    D  
(a) (iii) (i) (iv) (ii)

B.            A    B    C    D  
(b) (v) (iv) (iii) (ii)

C.            A    B    C    D  
(c) (iv) (iii) (ii) (i)

- D. 

<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>
(d)	(iii)	(iv)	(i) (ii)

**Answer: A**

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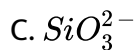
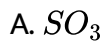
**121.** The structure of  $IF_7$  is

- A. trigonal bipyramid
- B. octahedral
- C. pentagonal bipyramid
- D. square pyramid

**Answer: C**

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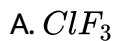
**122.** The species having pyramidal shape is



**Answer: D**

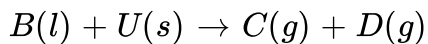
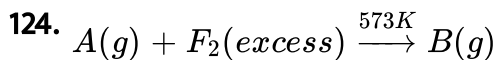
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**123.** The inter halogen compound having dimeric structure is :

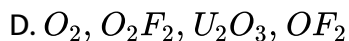
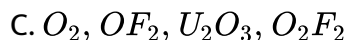
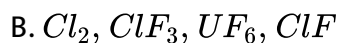
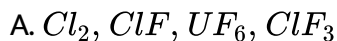


**Answer: D**

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The gases A, B, C and D are respectively



**Answer: B**



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125. 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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**126.** Which one has the highest boiling point?

A. Kr

B. Xe

C. He

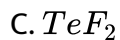
D. Ne

**Answer: B**



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127.  $XeF_2$  is isostructural with

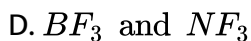
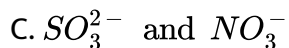
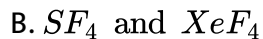
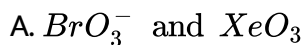


Answer: D



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128. In which of the following pairs, the two species are isostructural :

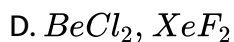
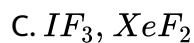
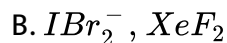
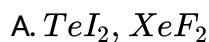




**Answer: A**

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**129.** Which of the following pairs of compound is isoelectronic and isostructure ?



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**130.** The shape of  $XeF_5^-$  will be

A. square pyramidal

B. trigonal bipyramidal

C. planar

D. pentagonal bipyramidal

**Answer: C**

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**131.** The shapes of  $XeO_2F_2$  molecule is

A. trigonal bipyramid

B. square planar

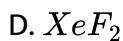
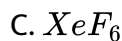
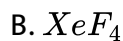
C. tetrahedral

D. see-saw

**Answer: A**

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132. Which of the following has maximum number of lone pairs associated with  $Xe$ ?



**Answer: D**



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133. The shapes of  $SF_4$  and  $XeF_2$  respectively are

A. trigonal bipyramidal and trigonal bipyramidal

B. see-saw and linear

C. T-shape and linear

D. square planar and trigonal bipyramidal

**Answer: B**



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**134.** The correct geometry and hybridisation for  $XeF_4$  are

- A. Octahedral,  $sp^3d$
- B. trigonal bipyramidal,  $sp^3d$
- C. planar triangle,  $sp^3d^3$
- D. square planar,  $sp^3d^2$

**Answer: D**



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

Column I      Column II

(A)  $XeF_6$       (1)  $sp^3d^3$  – distorted octahedral

(B)  $XeO_3$       (2)  $sp^3d^2$  – square planar

(C)  $XeOF_4$       (3)  $sp^3$  – pyramidal

(D)  $XeF_4$       (4)  $sp^3d^2$  – square pyramidal

A.            A      B      C      D  
(a) (iv) (iii) (i) (ii)

B.            A      B      C      D  
(a) (iv) (i) (ii) (iii)

C.            A      B      C      D  
(a) (i) (iii) (iv) (ii)

D.            A      B      C      D  
(a) (i) (ii) (iv) (iii)

**Answer: C**



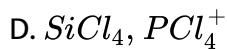
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**136.** In which of the following pairs, both the species are not isostructural?

A. Diamond, silicon carbide

B.  $NH_3$ ,  $PH_3$

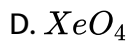
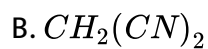
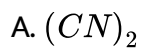
C.  $XeF_4$ ,  $XeO_4$



Answer: C

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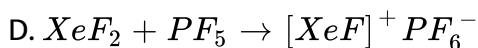
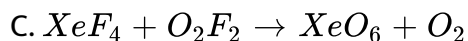
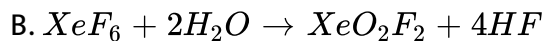
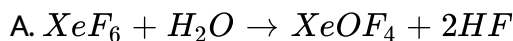
137. Which of the following species has equal number of  $\sigma$  – and  $\pi$  – bonds?



Answer: D

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138. Which of the following reactions is an example of redox reactions ?

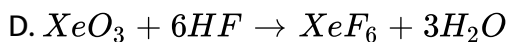
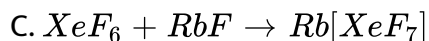
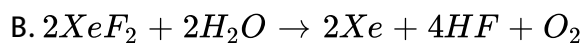
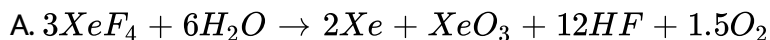


Answer: C



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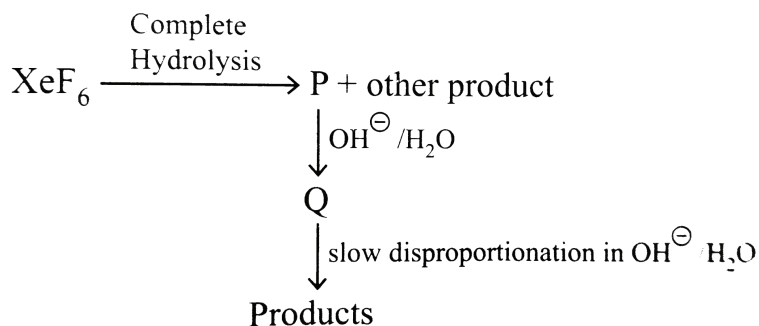
139. Which one of the following reactions of Xenon compound is not feasible ?



Answer: D

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140. 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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141. Which of the following noble gases is used in miner's cap lamp ?

- A. Helium
- B. Neon
- C. Argon
- D. Krypton

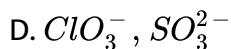
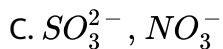
Answer: D



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

- A.  $CO_3^{2-}$ ,  $NO_3^-$
- B.  $ClO_3^-$ ,  $CO_3^{2-}$



**Answer: A::D**

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**143.** The nitrogen containing compound produced in the reaction of  $HNO_3$  with  $P_4O_{10}$

A. can be prepared by reaction of  $P_4$  and  $HNO_3$

B. is diamagnetic

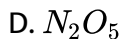
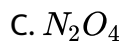
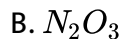
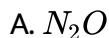
C. contains N-N bond

D. reacts with Na-metal producing brown gas

**Answer: B::D**

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144. The nitrogen oxide (s) that contain (s)  $N - N$  bonds (s) is (are).



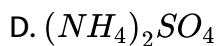
Answer: A::B::C



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145. A solution of colourless salt H 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) H is (are)





Answer: A::B

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146. Which of the following are correct statements ?

A. Oxides of phosphorus,  $P_2O_3$  and  $P_2O_5$  exist as monomers

B. Solid  $PCl_5$  exists as tetrahedral  $[PCl_4]^+$  and octahedral  $[PCl_6]^-$  ions

C. Solid  $PBr_5$  exists as  $[PBr_4]^+ Br^-$

D. Solid  $N_2O_5$  exists as  $NO_2^+ NO_3^-$

Answer: B::C::D

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147. The correct statement(s) about  $O_3$  is/are

- A. O-O bond length are equal
- B. thermal decomposition of  $O_3$  is endothermic
- C.  $O_3$  is diamagnetic in nature
- D.  $O_3$  has a bent structure

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



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148.  $SO_2$  acts as ,

- A. bleaching agent
- B. oxidation agent
- C. reducing agent
- D. disinfectant

Answer: A::B::C::D

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149. HI cannot be prepared by the action of conc.  $H_2SO_4$  on KI because

A. HI is stronger acid than  $H_2SO_4$

B.  $H_2SO_4$  is an oxidising agent

C.  $H_2SO_4$  is stronger than HI

D. HI is a strong reducing agent

Answer: A::B::D

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150. Which one of the following arrangements do not give the correct picture of the trends indicated against it ?

A.  $F_2 > Cl_2 > Br_2 > I_2$  : Bond dissociation energy

B.  $F_2 > Cl_2 > Br_2 > I_2$  : Electronegativity

C.  $F_2 > Cl_2 > Br_2 > I_2$  : Oxidizing power

D.  $F_2 > Cl_2 > Br_2 > I_2$  : Electron gain enthalpy

**Answer: A::D**

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151. Which of the following halides react(s) with  $AgNO_{3(aq)}$  to give a precipitate that dissolves in  $Na_2S_2O_{3(aq)}$

A. HCl

B. HF

C. HBr

D. HI

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

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152. Species which are isoelectronic with  $OF_2$  is/are

- A.  $ClO^-$
- B.  $ClF$
- C.  $NH_2Cl$
- D.  $ClO_2$

Answer: A::B::C

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153. The correct statement(s) about ,  $HClO_4$  and  $HClO$ , is

- A. the conjugate base of  $HClO_4$  is weaker base than  $H_2O$
- B. the central atom in both  $HClO_4$  and  $HClO$  is  $sp^3$  hybridized
- C.  $HClO_4$  is formed in the reaction between  $Cl_2$  and  $H_2O$



D.  $HClO_4$  is more acidic than  $HClO$  because of the resonance stabilization of its anion

**Answer: A::B::D**

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**154.** 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 total number of lone pairs of electrons on  $Cl$  in (ii) and (iii) together is three

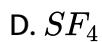
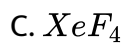
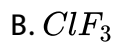
C. The hybridization of  $Cl$  in (iv) as  $sp^3$

D. Amongst (i) to (iv), the strongest acid is (i)

**Answer: B::C**

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155. The compound(s) with two lone pairs of electron on the central atom is (are)



**Answer: B::C**



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156. The noble gases which form clathrates are



D. Xe

**Answer: B::C::D**



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**157.** Which of the following is used in flash tubes in photography ?

A. Ar

B. Ne

C. Kr

D. Xe

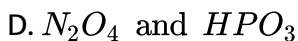
**Answer: C::D**



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158. 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  $Z$ .

$Y$  and  $Z$  are, respectively



**Answer: A**



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159. 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

A.  $O_2$  and  $P_4O_6$

B.  $O_2$  and  $P_4O_{10}$

C.  $O_3$  and  $P_4O_6$

D.  $O_3$  and  $P_4O_{10}$

**Answer: B**



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**160.** Halogens combine with each other to form interhalogen compounds ( $XX'$ ,  $XX'_3$ ,  $XX'_5$  and  $XX'_7$ ). Halide ions often react with molecules of halogens or interhalogens to form polyhalide ions consisting either of the same halogen or of two or three different halogens. Besides these, a few other anions are known, which do not contain any of the halogen atoms but behave like halide ions. These anions are called pseudohalides and consist of two or more atoms of which one is always a nitrogen atom.

The correct order of pseudohalide, polyhalide and interhalogen are



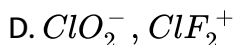
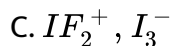
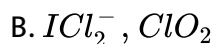
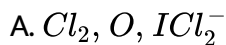
**Answer: B**



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**161.** Halogens combine with each other to form interhalogen compounds ( $XX'$ ,  $XX'_3$ ,  $XX'_5$  and  $XX'_7$ ). Halide ions often react with molecules of halogens or interhalogens to form polyhalide ions consisting either of the same halogen or of two or three different halogens. Besides these, a few other anions are known, which do not contain any of the halogen atoms but behave like halide ions. These anions are called pseudohalides and consist of two or more atoms of which one is always a nitrogen atom.

The isoelectronic pair is

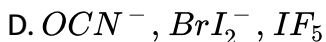
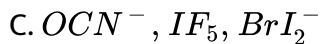
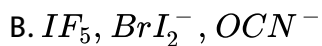
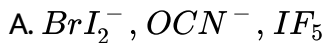


**Answer: D**

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**162.** Halogens combine with each other to form interhalogen compounds ( $XX', XX'_3, XX'_5$  and  $XX'_7$ ). Halide ions often react with molecules of halogens or interhalogens to form polyhalide ions consisting either of the same halogen or of two or three different halogens. Besides these, a few other anions are known, which do not contain any of the halogen atoms but behave like halide ions. These anions are called pseudohalides and consist of two or more atoms of which one is always a nitrogen atom.

The correct order of pseudohalide, polyhalide and interhalogen are

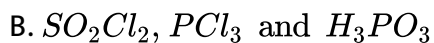
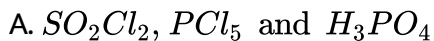


**Answer: D**

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**163.** 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





C.  $SOCl_2$ ,  $PCl_5$  and  $H_3PO_2$

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

**Answer: A**



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**164.** 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 and perchloric acids
- D. chloric and hypochlorous acid

Answer: A

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## FILL IN THE BLANKS

1. Nitrogen does not form pentahalides as it does not have .....

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2. Conc.  $HNO_3$  on dehydration with  $P_4O_{10}$  gives.....

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3. Aqua regia is a mixture of

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4. In gaseous state, nitric oxide is ..... While in the liquid or solid state it is .....

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5. The formula of acidic nitrogen hydride is .....

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6. Nitric acid containing ..... Is called fuming nitric acid.

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7. Laughing gas is obtained when a mixture of  $NH_4Cl$  and .....is heated while nitrogen gas is obtained when a mixture of  $NH_4Cl$  and .....is heated.

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8. 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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9. The products of oxidation of phosphorus acid by hot concentrated sulphuric acid are .....and ..... .

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10. The P-P-P angle in  $\text{P}_4$  molecule is .....degree while S-S-S angle in  $\text{S}_8$  is .....degree.

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11. The molecule of  $PCl_5$  in the solid state is .....in nature consisting of tetrahedral .....cation and octahedral.....anion.

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12. ....is obtained when yellow phosphorus is heated with an aqueous solution of NaOH in an inert atmosphere.

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13. What are the neutral oxides of nitrogen?

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14.  $As_2O_5$  is .....while  $Sb_2O_5$  is..... .

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15. Red phosphorus is.....reactive than white phosphorus as red phosphorous is.....and consists of .....of  $P_4$  units.

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16. Conc.  $H_2SO_4$  chars paper, wood and sugar because it removes.....from them.

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17. Oleum is formed when .....is passed through conc.  $H_2SO_4$ .

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18. Like  $O_2$ ,  $S_2$  vapours are.....due to the presence of two unpaired electrons in the .....orbitals.

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19. The tailing of mercury by ozone is due to the formation of..... .

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20. ....is formed when  $NH_3$  is passed through a solution of calcium hypochlorite.

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21. When chlorine gas is passed through an aqueous solution of potassium iodide containing starch, colour of the solution becomes..... .

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22. The increase in the solubility of iodine in an aqueous solution of potassium iodide is due to the formation of \_\_\_\_\_ .

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23. Among  $N_2O$ ,  $SO_2$ ,  $I_3^+$  and  $I_3^-$ , the linear species are .....and.....

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24.  $CN^\ominus$ ,  $SCN^\ominus$  and  $N_3^\ominus$  are called .....

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25. The halogen which normally does not form oxoacid is .....

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26. The stronger reducing agent among all the halide ions is .....

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27. The first noble gas compound was prepared by reacting Xe with..... .

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28. Amongst peracids of halogens, the strongest oxidising agent is..... .

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29.  $XeF_6$  slowly undergoes hydrolysis by atmospheric moisture to give.....and..... .

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30.  $XeF_4$  is.....molecule in which Xe is.....hybridized.

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31. The noble gas which is radioactive is

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32. For breathing. Deep-sea divers use a mixture of dioxygen and

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33. The gas used in discharged tubes for advertisement is .

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34. In electric bulbs.....inert gas is present with  $N_2$  gas.

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1.  $PCl_5$  is known but  $NCl_5$  is not known.

Or Nitrogen does not form pentahalide.

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2. Explain the difference between covalency and oxidation state by taking the example of  $N_2O_5$ .

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3. 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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4. Tendency to form pentahalides decreases down the group 15 of the periodic table. Account for this observation.





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5. Give the chemical reaction to support that +5 oxidation state of *Bi* is less stable than +3 state.



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6. Bismuth is a strong oxidizing agent in the pentavalent state. Or pentavalent bismuth is a strong oxidizing agent.



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



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8.  $NH_3$  has higher boiling point than  $PH_3$ . Give reason.



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9. Although nitrogen and chlorine have very nearly same electronegativity yet nitrogen forms hydrogen bonding while chlorine does not. Why?



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



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11.  $NCl_3$  is an endothermic compound while  $NF_3$  is an exothermic compound.



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12. Unlike phosphorus, nitrogen show little tendency for catenation.

Or Phosphorus shows greater tendency for catenation than nitrogen.

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13. Ammonia is a good complexing agent. Give reasons.

Or Ammonia acts as a ligand. Explain.

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14. Why is  $N_2O_5$  more acidic than  $N_2O_3$  ?

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15. Give reasons for the following :

(i) NO (Nitric oxide) is paramagnetic in the gaseous state but diamagnetic in the liquid and solid states. Why?

(ii) Nitric oxide becomes brown when released in air.



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



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17. Compound that acts as oxidant as well as reductant



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



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19.  $PCl_5$  is ionic in nature in the solid state. Give reasons.

Or Solid phosphorus pentachloride behaves as an ionic compound.

Explain.

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20. Draw the structure of  $PCl_5$ .

Or Solid  $PCl_5$  is ionic in nature.

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21. Give chemical reaction in support of the statement that all the bonds in  $PCl$  molecule are not equivalent.

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

Or What is the basicity of  $H_3PO_3$  and why ?

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23. The electron gain enthalpy with negative sign for oxygen ( $-141\text{KJmol}^{-1}$ ) is numerically less than that for sulphur ( $-200\text{KJmol}^{-1}$ ). Give reason.

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24. Why the compounds of fluorine with oxygen are called fluorides of oxygen and not the oxides of fluorine?

Or  $OF_2$  should be called oxygen difluoride and not fluorine oxide. Why?

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25. (a) Sulphur has greater tendency for catenation than oxygen. Give reasons.

or Oxygen shows catenation behaviour less than sulphur.

(b) Sulphur exhibits greater tendency for calenation than selenium. Give reasons.

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26. Large difference between the melting and boiling points of oxygen and sulphur can be explained.

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27.  $SO_2$  is reducing while  $TeO_2$  is an oxidising agent. Give reasons.

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28.  $SF_6$  is known but  $SH_6$  is not known. Explain.

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

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30.  $H_2S$  acts only as a reducing agent while  $SO_2$  acts as an oxidising as well as a reducing agent. Why?

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

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32. 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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33. All the bonds in  $SF_4$  are not equivalent. Why?

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34. Sulphur hexafluoride is used as a gaseous electrical insulator.

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35. (a) Suggest a quantitative method for estimation of a gas which protects us from U.V. rays of the sun.

(b) Nitrogen oxides emitted from the exhaust system of supersonic jet aeroplanes slowly deplete the concentration of ozone layer in upper atmosphere. Comment.

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

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**37.** Draw the structure of :



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**38.** Give a chemical reaction in the support of the observation that sulphuric acid has low volatility.

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**39.** Electron gain enthalpies of halogens are largely negative. Explain.

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

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41.  $F_2$  has lower bond dissociation enthalpy than  $Cl_2$ . Why?

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42.  $I_2$  is more soluble in KI than in water. Why ?

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43. Why fluorine does not exhibit any positive oxidation state?

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44. Fluoride ion has higher hydration enthalpy than chloride ion. Give reasons.

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45. Among halogens,  $F_2$  is the strongest oxidising agent.

Or  $F_2$  is a strong oxidising agent in the 17th group.

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46.  $F_2$  is a stronger oxidising agent than  $Cl_2$

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47. Addition of  $Cl_2$  to KI solution gives it a brown colour but excess of  $Cl_2$  turns it colourless. Explain.

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48. Give chemical reaction in support of the observation that iodide ions can be oxidised by oxygen in the acidic medium.

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49. Arrange the following in the decreasing order of their boiling points  
*HF, HCl, HBr*

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50. (i) Hydrogen fluoride is a weaker acid than hydrogen chloride in aqueous solution.

Or Which is a stronger acid in aqueous solution, HF or HCl ?

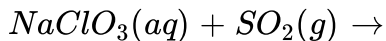
(ii) In aqueous solution, HI is a stronger acid than HCl ?

(iii) F atom is more electronegative than I atom, yet HF has lower acid strength than HI. Explain.

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51. Complete the following reaction equation :



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52. More metal fluorides are ionic in nature than metal chlorides. Assign appropriate reasons.

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53. Why HF acid is stored in wax coated glass bottle ?

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54. Name the gas evolved when concentrated HCl is added to powdered potassium dichromate. On passing the evolved gas through acidified KBr

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

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55. Complete the following reaction equation :  $Ca(OCl)_2 + HCl$ .

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56. Explain bleaching action of chlorine.

Or  $Cl_2$  acts as a bleaching agent.

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

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

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58. Arrange  $\text{HClO}$ ,  $\text{HBrO}$ ,  $\text{HIO}$  decreasing order of acidic strength.

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59. Arrange  $\text{HClO}_4$ ,  $\text{HClO}_3$ ,  $\text{HClO}_2$ ,  $\text{HClO}$  in order of (i) decreasing acidic strength (ii) increasing oxidizing power. Give reasons.

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60. The acidic strength decreases in the order :  $\text{HCl} > \text{H}_2\text{S} > \text{PH}_3$ .

Explain.

Or The acidic strength of compounds increases in the order :

$\text{PH}_3 < \text{H}_2\text{S} < \text{HCl}$ .

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61. Give appropriate reason for each of the following :

Perchloric acid is stronger than sulphuric acid.

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62. How are interhalogen compounds formed? What general compositions can be assigned to them?

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

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64. Why does fluorine not play the role of a central atom in interhalogen compounds ?

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65.  $ClF_3$  molecule has a bent T-shaped structure and not a trigonal planar structure. Explain.

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66. Draw the structure of  $BrF_5$ .

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67. Arrange the following : Xe, He, Kr, Rn, Ne in decreasing order of their electron gain enthalpy.

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68. Noble gases are mostly inert. Assign reasons.

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69. What prompted Bartlett to the discovery of noble gases compounds ?

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70. Which reaction was used by Bartlett to prepare the first noble gas compound.

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71. The majority of noble gas compounds are those of xenon. Explain.

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72. No chemical compound of helium is known

Or Helium forms no real chemical compound.

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73. Give reasons :

(i) Xenon does not form fluorides such as  $XeF_3$  and  $XeF_5$ .

(ii) Out of noble gases, only xenon is known to form established chemical compounds.

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74.  $XeF_2$  has a straight linear structure and not a bent angular structure. Why ?

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

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1. Though nitrogen exhibits +5 oxidation state, it does not form pentahalide, because

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

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3. Write the reaction of thermal decomposition of sodium azide

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4. Why does  $NH_3$  act as a Lewis base?

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5. Why does  $NO_2$  dimerise?





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6. In what way can it be proved that  $PH_3$  is basic in nature ?



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7. Why does  $PCl_3$  fume in moisture ?



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8. Are all the five bonds in  $PCl_5$  equivalent ? Justify.



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9. How do you account for the reducing behaviour of  $H_3PO_2$  ?

Or (i) Draw the structure of phosphinic acid ( $H_3PO_2$ ).

(ii) Write a chemical reaction for its use as a reducing agent.

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10. Elements of group 16 generally show lower value of first ionization enthalpy compared to the corresponding elements of group 15. Why ?

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

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12. Which form of sulphur shows paramagnetic behaviour ?

Or Sulphur in the vapour state exhibits paramagnetism.

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13. What happens when

(i) Concentrated  $H_2SO_4$  is added to calcium fluoride.

(ii)  $SO_3$  is passed through water ?

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14. Halogens have maximum negative electron gain enthalpy. Explain why ?

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15. Although  $\Delta_{eg}H$  of fluorine is less negative than that of chlorine, but fluorine is a stronger oxidising agent than chlorine. Why?

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16. Fluorine exhibits only -1 oxidation state whereas other halogens show +1, +3, +5 and +7 oxidation states also. Explain.

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

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18. When HCl reacts with finely powdered iron, it forms ferrous chloride and not ferric chloride. Why ?

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

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20. Why elements of group 18 known as noble gases?

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21. Why do noble gases have low boiling points ?

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22. Does the hydrolysis of  $XeF_6$  leads to a redox reaction?

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23. Why are pentahalides more covalent than trihalides?

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

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

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26. Mention the conditions required to maximise the yield of ammonia.

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27. How does ammonia react with a solution of  $Cu^{2+}$  ?

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

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29. Bond angle in  $PH_4^+$  is higher than that in  $PH_3$ . Why ?

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

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31. What happens when  $PCl_5$  is heated ?

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

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33. What is the basicity of  $H_3PO_4$  ?

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34. What happens when  $H_3PO_3$  is heated ?

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35. List the important sources of sulphur.

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

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

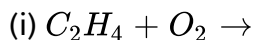
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38. Which of the following does not react with oxygen directly?

$Zn, Ti, Pt, Fe$ .

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39. Complete the following reactions:





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



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41. How is  $O_3$  estimated quantitatively ?



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



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43. Comment on the nature of two S–O bonds formed in  $SO_2$  molecule.

Are the two S–O bonds in this molecule equal ?



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

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

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46. Write the conditions to maximize the yield of  $H_2SO_4$  by contact process.

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47. Why is  $K_{a2} < < K_{a1}$  for  $H_2SO_4$  in water ?

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48. 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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49. Give two examples to show the anomalous behaviour of fluorine.

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

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

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

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

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54. Why is helium used in diving apparatus ?

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

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

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57. 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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58. Why does the reactivity of nitrogen differ from phosphorus?

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

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60. Why does  $NH_3$  form hydrogen bonds with the hydrogen reactivity of group 15 elements.



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



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62. How is ammonia manufactured industrially?



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63. Illustrate how copper metal can give different product on reaction with  $HNO_3$ .



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



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65. The HNH angle value is higher than HPH, HAsH and HSbH angles. Why?

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

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67. Explain why  $NH_3$  is basic while  $BiH_3$  is only feebly basic ?

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68. Nitrogen exists as diatomic molecule and phosphorus as  $P_4$ . Why ?

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

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

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71. Give the disproportionation reaction of  $H_3PO_3$ .

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

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73. Justify the placement of O, S, Se, Te and Po in the same group of the periodic table in terms of electronic configuration, oxidation state and hydride formation.

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

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

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76. Which aerosols deplete ozone ?

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77. Describe the manufacture of  $H_2SO_4$  by contact process?

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78. How is  $SO_2$  an air pollutant ?

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79. Why are halogens strong oxidising agents ?

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80. Explain why fluorine forms only one oxoacid, HOF.



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81. Explain why in spite of nearly the same electronegativity, oxygen forms hydrogen bonding while chlorine does not.



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82. Write two uses of  $ClO_2$ .



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83. Why are halogens coloured?



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84. Write the reaction of  $F_2$  and  $Cl_2$  with water.



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

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

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87. 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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**88.** 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  $Nal$  in water.

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**89.** How are xenon fluorides  $XeF_2$ ,  $XeF_4$  and  $XeF_6$  obtained?

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**90.** With what neutral molecule is  $ClO^\ominus$  isoelectronic Is that molecule a Lewis Base?

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

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**92.** Arrange the following in 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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**93.** Which one of the following does not exist ?

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



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**94.** 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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95. Why do noble gases have comparatively large atomic sizes?



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96. List the uses of neon and argon gases.



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## MCQ - I

1. On addition of conc.  $H_2SO_4$  to a chloride salt, colourless fumes are evolved but in case of iodide salt, violet 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

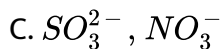
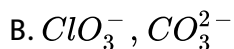
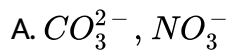
D. Boron

**Answer: C**

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

?



D.

**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) bond is given below.

Compound	NH <sub>3</sub>	PH <sub>3</sub>	AsH <sub>3</sub>	SbH <sub>3</sub>
$\Delta_{\text{diss}}(E-H) / \text{kJ mol}^{-1}$	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 statement is incorrect about the gas?

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

B. It's solution in water decomposes in the presence of light

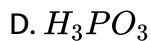
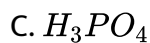
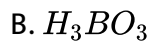
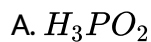
C. It is more basic than  $NH_3$

D. It is less basic than  $NH_3$

**Answer: D**

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



**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. Maximum covalency of nitrogen is .....

A. 3

B. 5

C. 4

D. 6



**Answer: C**



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

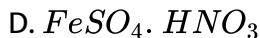
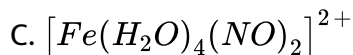
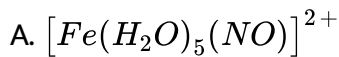
- A. Single  $N - N$  bond is stronger than the single  $P - P$  bond
- B.  $PH_3$  can act as a ligand in the formation of coordination compound with transition elements
- C.  $NO_2$  is paramagnetic in nature
- D. Covalency of nitrogen in  $N_2O_5$  is four

**Answer: A**



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**15.** A brown ring is formed in the ring test for  $NO_3^-$  ion. It is due to the formation of

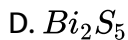
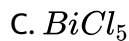
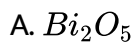


**Answer: A**



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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**

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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**



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

A. +3

B. +5

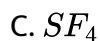
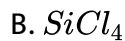
C. +1

D. -3

Answer: C

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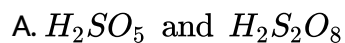
20. Which of the following is not tetrahedral in shape ?



Answer: C

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21. Which of the following are peroxyacids of sulphur ?



B.  $H_2SO_5$  and  $H_2S_2O_7$

C.  $H_2S_2O_7$  and  $H_2S_2O_8$

D.  $H_2S_2O_6$  and  $H_2S_2O_7$

**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  $[PCl_4]^-$  tetrahedral
- D. ionic solid with  $[PCl_4]^+$  tetrahedral and  $[PCl_6]^-$  octahedral

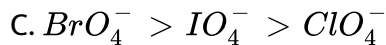
**Answer: D**

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

Ion	$\text{ClO}_4^-$	$\text{IO}_4^-$	$\text{BrO}_4^-$
Reduction potential $E^\circ/\text{V}$	$E^\circ = 1.19 \text{ V}$	$E^\circ = 1.65 \text{ V}$	$E^\circ = 1.74 \text{ V}$

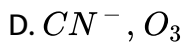
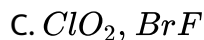
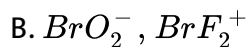
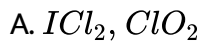


Answer: C



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27. Which of the following is isoelectronic pair ?



**Answer: B**



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## MCQ - II

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 statement are correct ?

- A. Among halogens, radius ratio between iodine and fluorine is maximum
- B. Leaving F-F bond, all halogens have weaker X-X bond than X-X' bond in interhalogens

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

D. Interhalogen compounds are more reactive than halogen compound

**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 are correct ?

- A. All the three N-O bond lengths 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 phosphorous 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.  $SiO_2 < As_2O_3 < P_2O_3 < SO_2$  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 ( $H_2SO_5$ ) 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

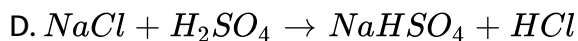
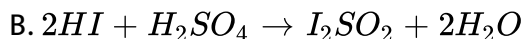
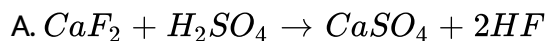
D. Changes in enthalpy is positive for the preparation of  $SO_3$  by catalytic oxidation of  $SO_2$

**Answer: A::B**



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**9.** In which of the following reactions conc.  $H_2SO_4$  is used as an oxidising reagent?



**Answer: B::C**



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**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**

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## SHORT ANSWER 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  $sp^3d$  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.

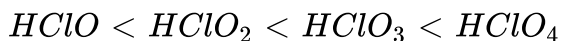
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11. In the ring test of  $NO_3^-$  ion,  $Fe^{2+}$  ion reduces nitrate ion to nitric oxide, which combines with  $Fe^{2+}$  (aq) ion to form brown complex .

Write the reactions involved in the formation of brown ring.

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12. Explain why the acidity 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 and red 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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**22.** Name the elements of group 15. What is their valence shell electronic configuration ?

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**23.** List the various oxidation states of nitrogen and give example of a compound or ion for each case.

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**24.** Write the shapes of the hydrides of group 15 elements. Arrange them in order of

(i) decreasing basic strength (ii) increasing bond angle (iii) decreasing reducing character.

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25. Account for the following observations :

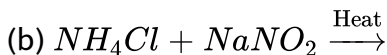
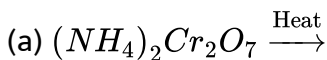
- (i)  $NH_3$  has higher boiling point than  $PH_3$ .
- (ii) Nitrogen ( $N_2$ ) is a fairly inert gas
- (iii) Nitrogen is a gas but phosphorus is a solid.
- (iv) Nitrogen forms trihalides and not pentahalides.

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26. Anomalous behaviour of nitrogen is due to.

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27. Complete the following reactions :



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28. Draw labelled diagram of Haber process for the manufacture of ammonia. What is the importance of Le Chatelier's principle in this process ?

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29. (a) What happens when :

(i) Ammonia gas is reacted with red hot copper oxide.

(ii) Ammonia reacts with  $CuSO_4$  solution.

(iii) Ammonia reacts with Nessler's reagent.

(iv)  $NH_3 + Cl_2$  (excess)

(b) Ammonia is a good complexing agent. Explain.

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30. Draw the resonance structures of the following :

(i)  $N_2O$  (ii)  $NO$  (iii)  $N_2O_3$  (iv)  $NO_2$  and  $N_2O_4$  (v)  $N_2O_5$

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31. Explain Ostwald process for manufacture of nitric acid.

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32. (a) Draw the structure of nitric acid and write its uses.

(b) Draw the structure of  $NO_3^-$

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33. What happens when (i) zinc and (ii) Copper react with (a) conc.  $HNO_3$  and (b) dil.  $HNO_3$ .

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34. Complete the following reactions :

(i)  $Cu + HNO_3(\text{dilute}) \rightarrow (ii)I_2 + \text{conc. } HNO_3(3)$  rarr

(iii)  $C + \text{conc. } HNO_3 \rightarrow$

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**35.** (a) Write balanced chemical equation for reaction between gold and aqua regia.

(b) Describe the method of isolation of elemental phosphorus from  $Ca_3(PO_4)_2$ .

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**36.** Nitrous acid acts as an oxidising as well as a reducing agent while nitric acid only as an oxidising agent. Support your answer with suitable examples.

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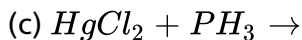
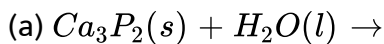
37. Write main differences between the properties of white phosphorus and red phosphorus.

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38. How is phosphine prepared in the laboratory ? Write its balanced equation. How does it react with (i)  $Cl_2$  (ii) acidified  $CuSO_4$  solution (iii)  $O_2$  (iv)  $AgNO_3$  solution (v) HI ?

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39. Complete the following chemical equations :



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40. How is  $PCl_3$  prepared from white phosphorus ? How does it react with (i)  $SO_3$  (ii)  $S_2Cl_2$  ?

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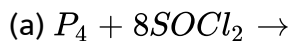
41. Write balanced equation for the formation of  $NCl_3$  and  $PCl_3$ . Give equations for hydrolysis reactions of  $NCl_3$  and  $PCl_3$ .

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42. Give two methods of preparation of  $PCl_5$  and discuss its structure.

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43. Complete the following chemical equations :



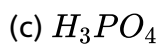
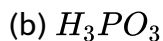
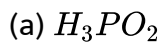
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44. Give structures of  $P_4O_6$  and  $P_4O_{10}$



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45. Draw the structure of the following :



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46. (a) Write chemical equation involved in the preparation of  $H_3PO_3$ .

(b) What is basicity of  $H_3PO_2$  ?

(c) What happens when orthophosphorus acid ( $H_3PO_3$ ) is heated ?

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47. 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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48. Why are elements of oxygen family called chalcogens ?

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49. Give suitable examples to show that sulphur has a strong tendency for catenation.

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50. What is catenation ? Explain why oxygen is diatomic, while sulphur is octatomic,  $S_8$ .

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51. Explain :

(a) Oxygen molecule has formula  $O_2$  whilst sulphur is  $S_8$ .

(b) The tendency to show +6 oxidation state diminishes from sulphur to polonium.

(c) Oxygen shows covalency of two while sulphur shows covalency upto six.

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52. Describe the hydrides of group 16 under the following heads :

(i) Volatility (ii) Thermal stability (iii) Acidic character (iv) Reducing power.

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

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54. Compare the structures of the following : (i)  $SO_2$  and  $SiO_2$  (ii)  $SO_3$  and  $SeO_3$ .

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55.  $SO_2$  can act as an oxidising agent as well as a reducing agent but  $SO_3$  can act only as an oxidising agent. Explain why?

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56. Discuss the structures of (i)  $SF_6$  (ii)  $SF_4$

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57. Anomalous behaviour of oxygen is due to

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58. Give two methods of preparation of dioxygen ( $O_2$ ) and chemical reactions of  $O_2$  with  $SO_2$ ,  $NH_3$  and HCl

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59. (a) Draw the structure of  $O_3$  molecule.

(b) How does ozone react with Hg ?

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60. Give reactions of ozone with following

(i)  $Ag_2O$  (ii)  $H_2O_2$  (iii)  $BaO_2$

(iv) moist KI (v) PbS

(vi)  $\text{SnCl}_2 / \text{HCl}$

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61. Which is an oxidising as well as a reducing agent in the following?

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62. Oxygen ( $\text{O}_2$ ) and ozone ( $\text{O}_3$ ) are

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63. What is allotropy ? Write the various allotropic forms of sulphur.

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64. What is the difference in the molecular structures of rhombic and monoclinic sulphur.

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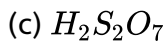
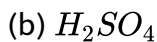
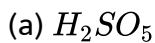
65. Differentiate between rhombic and monoclinic sulphur

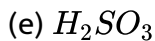
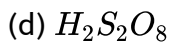
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66. Write the names and formulae of any five oxyacids of sulphur.

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67. Draw the structures of the following :





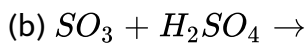
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**68.** Give the principle of manufacture of sulphuric acid by contact process.

Or Discuss the chemistry of manufacture of sulphuric acid by contact process.

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**69.** Complete the following chemical equations :



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70. What happens when (write chemical equations only)

(i) Hot and conc.  $H_2SO_4$  reacts with copper

(ii) KI reacts with conc.  $H_2SO_4$

(iii) Concentrated  $H_2SO_4$  is added to calcium fluoride ?

(iv)  $SO_3$  is passed through water.

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71. What are uses of  $H_2SO_4$

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72. Name the elements which are collectively known as halogens. Write the general electronic Configuration of halogen atoms.

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73. The colour deepens from fluorine to iodine in halogen family. Explain.

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74. Fluorine exhibit only - 1 oxidation state whereas other halogens exhibit +ve oxidation states also. Explain why ?

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

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76. Hydrogen chloride can be prepared by heating alkali metal chloride with concentrated sulphuric acid but hydrogen bromide and hydrogen iodide are not prepared in a similar way. Explain.

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77.  $NO_2$  readily dimerise, whereas  $ClO_2$  does not. Why ?

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78. HF is a weaker acid than HI. Explain.

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79. Give two examples to show the anomalous behaviour of fluorine.

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80. How is HCl prepared in the laboratory ? Write balanced chemical equations for the reaction of HCl with

(i)  $KMnO_4$  (ii)  $MnO_2$  (iii)  $K_2Cr_2O_7$  (iv)  $PbO_2$

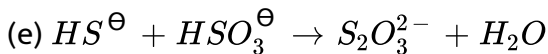
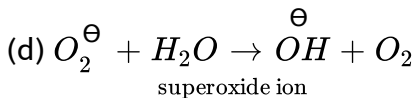
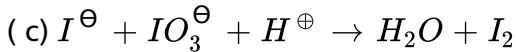
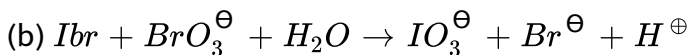
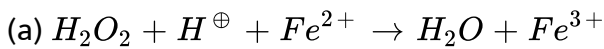
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**81.** How will you prepare  $Cl_2$  gas in the laboratory ? Discuss its oxidising and bleaching properties.



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**82.** Balanced the following equations:



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**83.** Draw structures of

(i) Hypochlorous acid

(ii) Chlorous acid

(iii)  $HClO_4$  or  $HOClO_2$

(iv)  $HClO_3$

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**84.** Write the structures of oxoacids of chlorine and discuss their relative acid strength.

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**85.** Explain why acidic strength of oxyacids of halogens decreases with increasing atomic number.

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**86.** Arrange the following in decreasing order of their oxidising power :

$ClO_4^-$ ,  $BrO_4^-$ ,  $IO_4^-$ .

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87. What are interhalogen compounds ? Why these compounds are more reactive than halogens ?

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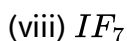
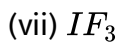
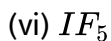
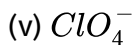
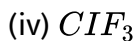
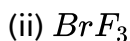
88. What are interhalogen compounds ? How are they classified ?  
Discuss the structure of  $IF_7$ .

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89. Explain hybridization in  $AB_5$  and  $AB_7$  type of interhalogen compounds and draw their structures.

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90. Draw the structures of the following compounds :



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91. What are polyhalides ? How is  $I_3^-$  prepared ? Discuss its structure.



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92. What happens when (i)  $CsI_3$  and (ii)  $RbICl_2$  are heated ? Discuss the structure of  $ICl_4^-$



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93. What are polyhalide ions and polyhalogens. Give one example of each.



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



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95. Give the electronic configuration of noble gases.



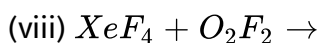
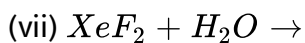
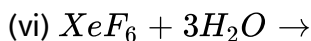
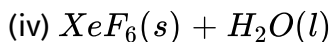
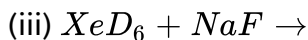
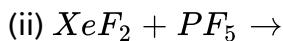
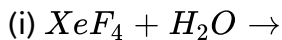
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96. What are clathrate compounds ? Give an example.



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97. Complete the following chemical reaction equation.



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98. What happens when

(i)  $PtF_6$  and xenon are mixed together.

(ii)  $XeF_4$  undergoes hydrolysis.

(iii)  $XeF_6$  undergoes hydrolysis.

(iv)  $XeO_3$  reacts with an aqueous alkali solution.



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

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100. Write the hybridization and also draw their molecular structures ?

(a)  $XeF_2$ , (b)  $XeF_4$ , (c)  $XeF_6$ , (d)  $XeOF_4$ , (e)  $XeO_3$

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101. State two important uses of (i) Neon (ii) Helium, (iii) Argon (iv) Radon

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**MATCHING TYPE QUESTIONS**



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

Column I      Column II

(A)  $XeF_6$       (1)  $sp^3d^3$  – distorted octahedral

(B)  $XeO_3$       (2)  $sp^3d^2$  – square planar

(C)  $XeOF_4$       (3)  $sp^3$  – pyramidal

(D)  $XeF_4$       (4)  $sp^3d^2$  – square pyramidal

A. A(1) B(3) C(4) D(2)

B. A(1) B(2) C(4) D(3)

C. A(4) B(3) C(1) D(2)

D. A(4) B(1) C(2) D(3)

**Answer: A**



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

Column I	Column II
A. $Pb_3O_4$	1. Neutral oxide
B. $N_2O$	2. Acidic oxide
C. $Mn_2O_7$	3. Basic oxide
D. $Bi_2O_3$	4. Mixed oxide

A. A(1) B(2) C(3) D(4)

B. A(4) B(1) C(2) D(3)

C. A(3) B(2) C(4) D(1)

D. A(4) B(3) C(1) D(2)

**Answer: B**



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**3. Match the items of column 1 and column 2 and mark the correct option**

Column 1

Column 2

(A)  $H_2SO_4$  (1) Highest electron gain enthalpy

(B)  $CCl_3NO_2$  (2) Chalcogen

(C)  $Cl_2$  (3) Tear gas

(D) Sulphur (4) Storage batteries

A.  $A(4)$   $B(3)$   $C(1)$   $D(2)$

B.  $A(3)$   $B(4)$   $C(1)$   $D(2)$

C.  $A(4)$   $B(1)$   $C(2)$   $D(3)$

D.  $A(2)$   $B(1)$   $C(3)$   $D(4)$

**Answer: A**

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

Column I	Column II
A. $SF_4$	1. Tetrahedral
B. $BrF_3$	2. Pyramidal
C. $BrO_3^-$	3. Sea-saw shaped
D. $NH_4^+$	4. Bent T-shaped

A.  $A(3)$   $B(2)$   $C(1)$   $D(4)$

B.  $A(3)$   $B(4)$   $C(2)$   $D(1)$

C.  $A(1) B(2) C(3) D(4)$

D.  $A(1) B(4) C(3) D(2)$

**Answer: B**



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5. Match the items of column 1 and column 2 and mark the correct option.

Column 1

(A) Its partial hydrolysis does not change oxidation state of central atom

(B) It is used in modern diving apparatus

(C) It is used to provide inert atmosphere for filling electrical bulbs

(D) Its central atom is in  $sp^3d^2$  hybridisation

A.  $A(1) B(4) C(2) D(3)$

B.  $A(1) B(2) C(3) D(4)$

C.  $A(2) B(1) C(4) D(3)$

D.  $A(1) B(3) C(2) D(4)$

**Answer: C**



6. Match the entries of column I with appropriate entries of column II and choose the correct option out of the four options (a), (b), (c) and (d) given at the end of each question.

Column I	Column II
(A) $PCl_5$	(p) Angular
(B) $IF_7$	(q) Pyramidal
(C) $H_3O^+$	(r) Trigonal bipyramidal
(D) $ClO_2$	(s) Pentagonal bipyramidal

A. A-r, B-s, C-q, D-p

B. A-r, B-q, C-p, D-s

C. A-p, B-s, C-q, D-r

D. A-s, B-p, C-r, D-q

**Answer: C**

7. Match the entries of column I with appropriate entries of column II and choose the correct option out of the four options (a), (b), (c) and (d) given at the end of each question.

Column I	Column II
(A) Helium	(p) Ionization energy comparable to $O_2$
(B) Argon	(q) Provides inert atmosphere in metallurgy
(C) Neon	(r) Cryogenic
(D) Xenon	(s) Advertising sign

A. A-q, B-s, C-p, D-r

B. A-q, B-p, C-s, D-r

C. A-r, B-q, C-s, D-p

D. A-r, B-s, C-q, D-p

**Answer: C**



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8. Match the entries of column I with appropriate entries of column II and choose the correct option out of the four options (a), (b), (c) and (d)

given at the end of each question.

Column I	Column II
(A) $PCl_5$	(p) Angular
(B) $IF_7$	(q) Pyramidal
(C) $H_3O^+$	(r) Trigonal bipyramidal
(D) $ClO_2$	(s) Pentagonal bipyramidal

A. A-r, B-s, C-q, D-p

B. A-r, B-s, C-p, D-q

C. A-s, B-q, C-r, D-p

D. A-q, B-s, C-p, D-r

**Answer: B**



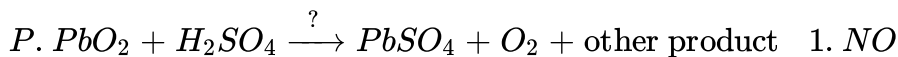
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9. The unbalanced chemical reactions given in Column I show missing reagent or condition (?) which are provided in Column II. Match Column I with Column II and select the correct answer using the codes given below

the Columns.

Column I

Column II



A. 

	P	Q	R	S
(a)	4	2	3	1

B. 

	P	Q	R	S
(a)	3	2	1	4

C. 

	P	Q	R	S
(a)	1	4	2	3

D. 

	P	Q	R	S
(a)	3	4	2	1

Answer: D

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## ASSERTION AND REASON TYPE QUESTIONS

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

Reason : Nitrogen has more electron gain enthalpy than phosphorus.



- A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
- B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
- C. Assertion is correct, but reason is wrong statement.
- D. Both assertion and reason are wrong statement.

**Answer: C**

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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.

- A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

- B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
- C. Assertion is correct, but reason is wrong statement.
- D. Both assertion and reason are wrong statement.

**Answer: C**

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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.

- A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
- B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
- C. Assertion is correct, but reason is wrong statement.

D. Both assertion and reason are wrong statement.

**Answer: B**

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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.

A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.

B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.

C. Assertion is correct, but reason is wrong statement.

D. Both assertion and reason are wrong statement.

**Answer: A**

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5. Assertion (A)  $NaCl$  reacts with concentrated  $H_2SO_4$  to give colourless fumes with pungent smell. But on adding  $MnO_2$  the fumes become greenish yellow.

Reason (R)  $MnO_2$  oxidises HCl to chlorine gas which is greenish yellow.

- A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
- B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
- C. Assertion is correct, but reason is wrong statement.
- D. Both assertion and reason are wrong statement.

**Answer: A**

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6. Assertion:-  $SF_6$  cannot be hydrolysed but  $SF_4$  can be.

Reason:- Six F atoms in  $SF_6$  prevent the attack of  $H_2O$  on sulphur atom of  $SF_6$

- A. Both assertion and reason are correct statements, and reason is the correct explanation of the assertion.
- B. Both assertion and reason are correct statements, but reason is not the correct explanation of the assertion.
- C. Assertion is correct, but reason is wrong statement.
- D. Both assertion and reason are wrong statement.

**Answer: A**



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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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4. Write the names and formulae of any five oxides of nitrogen.

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5. Name important oxides and oxyacids of nitrogen and phosphorus and write their formulae

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6. (a) How is sulphur dioxide prepared in (i) laboratory (ii) industrially ?  
(b) What happens when sulphur dioxide is passed through water and

reacts with sodium hydroxide ? Write balanced equation

(c) Write its any two uses.

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

$H_2O$ ,  $NH_3$ ,  $H_2S$ ,  $HF$  (increasing polar character)

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8. (a) Describe the favourable conditions for the manufacture of (i) ammonia by Haber's process, and (ii) sulphuric acid by contact process.

(b) Draw the structures of the following :

(i)  $PCl_5(g)$

(ii)  $S_8(g)$

(iii)  $ClF_3(g)$

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1. Why the element of second period shows a number of difference in properties from other members of their respective families?

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2. INERT PAIR EFFECT

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

Or of Bi (V) and Sb(V) which may be a stronger oxidising agent and why ?

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4. Give reasons for the least reactivity of nitrogen molecule.

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5. Nitrogen is much less reactive than phosphorus. Explain.

Or Phosphorus is much more reactive than nitrogen. Explain.

Or Nitrogen is relatively inert as compared to phosphorus. Why ?

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6. Arrange the following in order of increasing base strength.

$NH_3$ ,  $PH_3$ ,  $AsH_3$ ,  $SbH_3$ ,  $BiH_3$

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7. Which is least acidic ?  $SbH_3$ ,  $PH_3$ ,  $NH_3$ ,  $AsH_3$

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8. Which is least basic ?  $SbH_3$ ,  $PH_3$ ,  $NH_3$ ,  $AsH_3$  ?



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



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10. Why  $BiH_3$  is strongest reducing agent amongst group 15 hydrides?



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11. Which of the following is/are not known?

$PCl_3$ ,  $AsCl_3$ ,  $SbCl_3$ ,  $NCl_5$ ,  $BiCl_5$ .



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12. Which of the following is more covalent:  $SbCl_5$  or  $SbCl_3$ ?



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13. Write balanced equation when  $NH_3$  is dissolved in water.

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14. 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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15. Write chemical equation for thermal decomposition of ammonium dichromate.

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16. How is nitrogen prepared from ammonia ?



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17. What is laughing gas ? How is it prepared ?

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18. What happens when a mixture of ammonium sulphate and sodium nitrate is heated. Write the equation.

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19.  $Pb(NO_3)_2$  on heating gives a brown gas which undergoes dimerization on cooling? Identify the gas.

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20. What is fuming nitric acid ? What colour is it ?

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21. Write one reducing property of nitrous acid. Also give equation.

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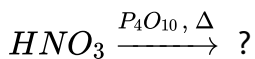
22. Concentrated nitric acid can be stored in aluminium container. Give reason.

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23. The N-O bond in  $NO_2^-$  is shorter than N-O bond in  $NO_3^-$ . Account for this observation.

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24. Complete the following reaction ?





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25. Write balanced equation when powdered aluminium is boiled with caustic soda solution in presence of sodium nitrite.



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26. Write the formula of the compound of iodine which is obtained when conc.  $HNO_3$  oxidises  $I_2$ .



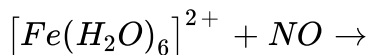
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27. Write the formula of the compound of phosphorus which is obtained when conc.  $HNO_3$  oxidises  $P_4$ .



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**28.** Complete the equation :



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**29.** In the ring test for identification of nitrate ion, what is the formula of the compound responsible for the brown ring formed at the interface of the two liquids ?

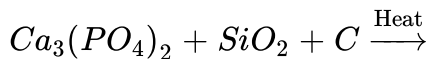
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**30.** Important allotropic forms of phosphorus are white phosphorus, red phosphorus and black phosphorus. Among these which allotropic form is more reactive ? Why ?

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31. Write the chemical equation for the following :



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32. Why is white phosphorus kept under water ?

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33. How will you obtain phosphine from phosphorus ?

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34. On being slowly passed through water,  $PH_3$  forms bubbles but  $NH_3$  dissolves. Why is it so ?

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35. Give the chemical equation for the reaction that occurs between iron and copper sulphate solution.

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36. What happens when  $PCl_5$  is heated ?

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37. Why is  $PCl_5$  more covalent than  $PCl_3$  ?

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38. Why does  $PCl_5$  fume in moisture ?

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39. Complete the following reactions :



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40. Suggest a method for the laboratory

preparation of DCl. Write a balanced

equation for the reaction.



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41. What is the oxidation number of phosphorus in  $H_3PO_2$  molecule ?



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42. What should be the order of acidic strength in the series  $H_3PO_4$ ,  $H_3PO_3$ , and  $H_3PO_2$ ?

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

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44. Why does orthophosphoric acid exist as a syrupy liquid ?

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45. How is pyrophosphoric acid related to orthophosphoric acid ?

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46. Why are the group 16 element called chalcogens ?

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47. What is the outer shell electronic configuration of the chalcogens ?

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48. Write the structure of a chalcogenide dianion.

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49. Name the allotropes of oxygen.

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



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51. Ozone is thermodynamically unstable. Give reasons.



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52. How the supersonic jet aeroplanes are responsible for the depletion of ozone layer ?



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53. Find out the oxidation number of S in (i)  $SO_2Cl_2$  and (ii)  $Na_2S_2O_3$



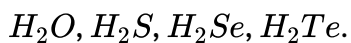
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54. Why  $OF_6$  does not exist but  $SF_6$  exists ?



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55. Predict the relative acidic strength among the following:



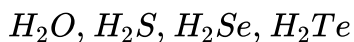
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56. Give reasons :

Thermal stability decreases from  $H_2O$  to  $H_2Te$ .

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57. Arrange the following hydrides of Group 16 elements in the increasing order of thermal stability.



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58. Of  $PH_3$  and  $H_2S$  which is more acidic and why ?

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

$H_2O$ ,  $H_2S$ ,  $H_2Se$ ,  $H_2Te$  - increasing acidic character

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60. (a) What happens when : (i) sulphur dioxide is passed through an aqueous solution of Fe (III) salt ?

(ii) Sulphur dioxide is passed through an aqueous solution of sodium carbonate ?

(b) On passing  $H_2S$  through an aqueous solution of  $SO_2$ , a yellow turbidity is formed. Why ?

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61. Sulphurous acid is reducing agent due to

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62. In the manufacture of sulphuric acid ( $H_2SO_4$ ) the final product obtained is oleum.

(i) What is oleum ?

(ii) Write chemical equation for the conversion of oleum to sulphuric acid.

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63. In solution of  $H_2SO_4$  when  $SO_3$  is bubbled, a compound 'A' is formed, which further reacts with  $H_2O$  to give  $H_2SO_4$ . Explain this process with equation ?

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64. Write one chemical reaction to show that conc.  $H_2SO_4$  can act as an oxidising agent.

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65. Sulphuric acid is a dehydrating agent. Give one example.

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66. Which of the following compounds has a lone pair of electrons at the central atom ?

$H_2S_2O_8$ ,  $H_2S_2O_7$ ,  $H_2SO_3$ ,  $H_2SO_4$

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67. Write the structures of (i) peroxomonosulphuric acid and (ii) peroxodisulphuric acid and find out the oxidation number of sulphur in

them.

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68. Both  $O_2$  and  $F_2$  stabilize high oxidation states but the ability of oxygen to stabilize the higher oxidation state exceeds than that of fluorine. Account for this observation.

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69. Halogens are highly reactive ? Explain.

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70. Which of the following exist as diatomic molecules?

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71. Name the halogen with lowest ionization energy.

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72. Fluorine is the most reactive of all four common halogens.

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73. Most of the reactions of fluorine are exothermic. Give reasons.

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74. Give one chemical method for the preparation of fluorine.

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75. Write the balanced equation for the following reaction.

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

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76. Write the chemical equation to show that chlorine gas can be obtained from bleaching powder.

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77. Write a balanced equation for the reaction of  $Cl_2$  with cold and dilute NaOH.

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78. What happens when chlorine gas is passed through a hot concentrated solution of NaOH ?



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79. What happens when iodine reacts with sodium thiosulphate.



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80. (a) Name the halogen hydricid with highest bond energy.

(b) When HI solution is kept exposed to air, it turns brown after a few days. Why ?



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81.  $KHF_2$  is known but  $KHCl_2$  is not known. Give reasons.



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82. HI cannot be prepared by the action of conc.  $H_2SO_4$  on KI because



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**83.** Arrange the following acids in the correct increasing order of their acidic strength,

HCl, HBr, HI, HF

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**84.** Which of the hydrides of halogens reacts with glass ?

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**85.** Give an example of a disproportionation reaction of  $F_2$  ?

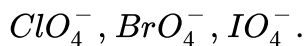
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**86.** Name the halogen which forms only one oxo acid and also write the formula of the oxo acid.



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87. Which one among the following is the strongest oxidizing agent ?



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88. With what neutral molecule is  $\text{ClO}^\ominus$  isoelectronic?



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89. Which neutral molecule would be isoelectronic with  $\text{ClO}^-$  ?



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90. Iodine forms  $\text{I}_3^-$  but  $\text{F}_2$  does not form  $\text{F}_3^-$  ions. Why ?



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91. Can  $FCl_3$  exist ? Comment.

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92.  $IF_7$  exists but  $BrF_7$  does not, why ?

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93. Write two names of interhalogen compounds having  $sp^3d^2$  hybridization.

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94. Noble gases are monoatomic in nature. Explain.

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95. Why does argon not form diatomic molecules like oxygen and nitrogen ?

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96. Name the noble gas which is obtained from  ${}_{86}^{226}\text{Ra}$ . Write its main use.

Or Name the noble gas used in radiotherapy.

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97. Why do boiling points of noble gases increase from helium to radon ?

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98. Which compound led to the discovery of compounds of noble gases ?

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99. Complete the following :  $XeF_2 + PF_5 \rightarrow$

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100.  $XeF_2$  reacts with  $SbF_5$  to form

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

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102. Which element among inert gases has maximum number of compounds ? Write the formula of one of the compounds formed by the element.

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103. Why do not helium, neon and argon form chemical compounds ?

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104. Which is isostructural with (i) ICl (ii)  $BrO_3^-$

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105. Which xenon compound is isostructural with  $ICl_4^-$ .

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106. Write the formula of the noble gas species which is isostructural with  $IBr_2^-$ .

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107. Why do noble gases have low boiling points ?

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108. Which noble gas is used in filling balloons for meteorological observation ?

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## HOTS QUESTIONS

1. (a) You have the following substances :

$NH_3$ ,  $O_2$ ,  $Pt$  and  $H_2O$ . Write equations for the preparation of  $N_2O$  from these substances.

(b) Considering the fact that  $N_2$  makes up about 79% of the atmosphere, why don't animals use the more abundant  $N_2$  instead of  $O_2$  for biological reactions.

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2. A certain element is a metalloid that forms an acidic oxide with the formula  $R_2O_5$ . Identify the element.

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3. (a)  $NCl_3$  gets readily hydrolysed while  $NF_3$  does not. Why ?

(b) What kind of molecules show disproportionation reactions ? Give one example of a compound each of nitrogen and phosphorus which show disproportionation reactions. Write chemical equation in each case.

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4. Account for the following : (a) Chlorine water has both oxidising and bleaching properties.

(b)  $H_3PO_2$  and  $H_3PO_3$  act as good reducing agents while  $H_3PO_4$  does not.

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5. 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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6. Why does chlorine water lose its yellow colour on standing ?

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7. Write down the equation for hydrolysis of  $XeF_4$  and  $XeF_6$ . Which of these reactions is a redox reaction ?

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8. Assign reasons for the following :

(i) When a moist blue litmus paper is dipped in a solution of hypochlorous acid, it first turns red and then latter gets decolourised.

Explain.

(ii) Iodine is liberated when KI is added to a solution of  $Cu^{2+}$  ions but  $Cl_2$  is not liberated when KCl is added to a solution of  $Cu^{2+}$  ions. Why ?

(iii)  $Na_2S_2O_3$  reacts with  $Cl_2$  and  $I_2$  to give different oxidation products. Write the equations of the reactions involved and give a plausible explanation of their contrasting behaviour.

(iv) Name a compound of fluorine which shows +1 oxidation state. How is this compound prepared ? Is this a disproportionation reaction ?

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9.  $SOCl_2$  can act as a weak acid as well as a weak base. Explain.

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1. A few students of class XII were playing in the stadium under the supervision of their coach. All of a sudden, Nitin fell down. The coach immediately rushed towards Nitin and examined the injury. He opened up his sporting kit and pulled out a small plastic pack. He squeezed hard the pack and placed it on the injured portion of his skin. Nitin got some comfort and relief. Later coach took Nitin to hospital for further treatment.

Read the above passage and answer the following questions :

- (i) What values were expressed by coach towards Nitin ?
- (ii) Name the chemical contained in the plastic pack. What is this pack called and how does it work ?
- (iii) Name two other uses of the chemical contained in the small plastic pack.



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2. Many metals occur in the earth's crust as sulphides. To extract metals, the sulphide ores are first roasted in a reverberatory furnace in excess of air when metal oxide is formed and sulphur dioxide is released. Sulphur dioxide is a major air pollutant. It produces acid rain which damages crops, iron structures and buildings/historical monuments made up of marble.

Now answer the following questions :

(i) Name three important sulphide ores.

(ii) What is acid rain ? How does it damage crops, iron structures and buildings made up of iron ?

(iii) As a student of chemistry, what steps do you propose to control air pollution.



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3. Mineral acids such as  $HNO_3$ ,  $HCl$  and  $H_2SO_4$  are widely used in industry and in the laboratory. In fact, applications of  $H_2SO_4$  in industry are so vast that it is actually called King of Chemicals. But unfortunately,

in the recent past, many instances of acid attack by eve teasers and frustrated lovers on the faces of young girls have been reported in newspapers and shown on TV. This is a serious social evil and must be totally eliminated from the society.

Read the above passage and answer the following questions :

- (i) Comment on the statement-should production/manufacture of acids be banned ? Give three valid reasons to justify.
- (ii) As a student of chemistry, what steps would you suggest to combat this social menace ?
- (iii) Recently 'Honourable Supreme Court of India' has suggest some measures to check such incidents of acid attack. Comment.



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**4.** Malti, a domestic servant of Mrs. Saroj, complained of severe pain in the chest while cleaning the utensils. Mrs. Saroj immediately took her to the nearby hospital where she was diagnosed to be suffering from Angina Pectoris (angina pain). The doctor prescribed her the medicine commercially called sorbitrate. Mrs. Saroj also supported her financially to

buy the medicine.

After reading the above passage, answer the following questions :

- (i) What values are displayed by Mrs. Saroj ?
- (ii) What is the cause of the disease Angina Pectoris ?
- (iii) What is sorbitrate made up of and how is it prepared ?
- (iv) How does sorbitrate work ?
- (v) Give one more use of the chemical present in sorbitrate.



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## MATRIX-MATCH TYPE QUESTIONS

1. Match the entries of column I with appropriate entries of column II.

Each entry in column I may have one or more than one correct option from column II. If the correct matches are A-p, s , B-r, C-p, q , D-s, then the correctly bubbled  $4 \times 4$  matrix should be as follows :

Column I	Column II
(A) $SO_2$	(p) Basic
(B) $H_2SO_4$	(q) Acidic
(C) $HNO_3$	(r) Reducing
(D) $NH_3$	(s) Oxidising



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2. Match the entries of column I with appropriate entries of column II.

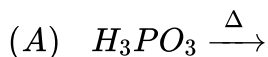
Each entry in column I may have one or more than one correct option

from column II. If the correct matches are A-p, s, B-r, C-p, q, D-s, then the

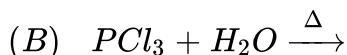
correctly bubbled  $4 \times 4$  matrix should be as follows :

Column I

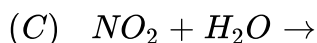
Column II



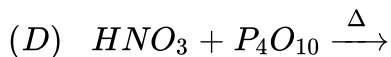
(p) One of the products acts as a reducing agent



(q) One of the products is a tribasic non-reducing acid



(r) Dehydration



(s) In one of the products, central atom has a coordination number of 6



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3. Match the entries of column I with appropriate entries of column II.

Each entry in column I may have one or more than one correct option

from column II. If the correct matches are A-p, s, B-r, C-p, q, D-s, then the

correctly bubbled  $4 \times 4$  matrix should be as follows :

Column I (Reaction)	Column II (Product)
(A) $Cu + dil. HNO_3$	(p) $NO$
(B) $Cu + conc. HNO_3$	(q) $NO_2$
(C) $Zn + dil. HNO_3$	(r) $N_2O$
(D) $Zn + conc. HNO_3$	(s) $Cu(NO_3)_2$
	(t) $Zn(NO_3)_2$

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## INTEGER TYPE QUESTIONS

1. The maximum number of oxidation states which nitrogen can show in its compounds is

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2. The total number of lone pairs of electrons in  $N_2O_3$  is

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3. Amongst the following the metals which become passive when dipped in conc.  $HNO_3$  are Sn, Pb, Fe, Cr, Zn, Ni, Hg, Al, Cu.

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4. The basicity of hypophosphorus acid is .....

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5. X is a pale yellow solid. It hydrolyses to  $POCl_3$  in moist air and finally gets converted into phosphoric acid. Z exists as an ionic solid. The total number of atoms present in its cation is.

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6. 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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7. The difference in the oxidation numbers of two types of sulphur atoms in  $Na_2S_4O_6$  is.....

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8. The total number of diprotic acids among the following is

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

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9. Among the following, the number of elements showing only one non-zero oxidation state is:

O, Cl, F, N, P, Sn, Tl, Na, Ti

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10. What is the oxidation state of Cl in  $HClO_4$  ?

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11. Based on VSEPR theory, the number of 90 degree F-Br-F angles in  $BrF_5$ , is

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12. The ratio of number of  $d\pi - p\pi$  bonds in  $XeO_4$  and  $SO_3$  is.

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13. Amongst the following, the maximum number of isoelectronic molecules/ions are

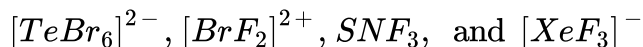
$XeO_3, BrO_3^-, ClF, XeF_2, OF_2, XeF_4, ICl_4^-, ClO^-, IBr_2^-$ .

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14. Among the triatomic molecules/ions,  $BeCl_2$ ,  $N_3^-$ ,  $N_2O$ ,  $NO_2^+$ ,  $O_3$ ,  $SCl_2$ ,  $ICl_2^-$ ,  $I_3^-$  and  $XeF_2$ , the total number of linear molecule (s)/ions(s) where the hybridization of the central atom does not have contribution from the d-orbital (s) is

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15. The sum of the number of lone pair of electrons on each central atom in the following species is



(Atomic number : N = 7, F = 9, S = 16, Br = 35, Te = 52, Xe = 54)

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ASSERTION-REASON TYPE QUESTIONS

1. Statement -1 : Although  $NaH_2PO_2$  contains two H-atoms, it is not an acid salt.

Statement -2 : It contains two ionisable hydrogens.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for Statement-1

C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

**Answer: C**



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2. 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. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for Statement-1
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

**Answer: A**

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3. Assertion (A): Salts of  $ClO_3^\ominus$  and  $ClO_4^\ominus$  are well known but those of  $FO_3^\ominus$  are unknown.

Reason (R ): F is more electronegative than O, while Cl is less electronegative than O.

- A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for Statement-1
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

**Answer: B**

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4. Assertion (A):  $CIF$  is more reactive than  $F_2$ .

Reason (R ): The F-F bond is weaker than CIF bond.

- A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1.

- B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for Statement-1
- C. Statement-1 is True, Statement-2 is False.
- D. Statement-1 is False, Statement-2 is True.

**Answer: D**

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5. Assertion (A): ICl on hydrolysis gives HI and HOCl.

Reason (R ): Water can attack iodine more readily.

- A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1.
- B. Statement-1 is True, Statement-2 is True , Statement-2 is not a correct explanation for Statement-1
- C. Statement-1 is True, Statement-2 is False.

D. Statement-1 is False, Statement-2 is True.

**Answer: D**

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6. Assertion. Nitrogen and oxygen are the main components in the atmosphere but these do not react to form oxides of nitrogen.

Reason. The reaction between nitrogen and oxygen requires high temperature.

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: A**

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7. Assertion. Nitrogen is less reactive than molecular oxygen.

Reason. The bond length of  $N_2$  is shorter than that of oxygen.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**

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8. Assertion.  $HNO_3$  renders iron passive.

Reason. Iron reacts with  $HNO_3$  to form ferric nitrate.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: C**



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9. Assertion. When NO reacts with  $FeSO_4$ , a brown coloured complex is formed.

Reason. In the complex, the coordination number of Fe is + 6.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**

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10. Assertion  $NF_3$  is weaker ligands than  $N(CH_3)_3$

Reason  $NF_3$  ionises to give  $F^\ominus$  ions in aqueous solution .

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: C**

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11. Assertion: On cooling, the brown colour of nitrogen dioxide disappears.

Reason: On cooling,  $NO_2$  undergoes dimerisation resulting in the pairing of the odd electron in  $NO_2$ .

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: A**



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**12.** Assertion :  $P_4$  is more reactive than  $N_2$

Reason: P-P single bond in  $P_4$  is much weaker than  $N \equiv N$  triple bond in  $N_2$

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: A**



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**13.** Assertion (A) Elementary phosphorus exists in three principal allotropic forms , ie .white (or yellow),red (or violet ) and black.

Reason (R ) Of the three forms, white phosphorus is the most important and most reactive.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**



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14. Assertion :  $H_3PO_3$  is a diacidic acid.

Reason: There are two H atoms directly attached to P.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: C**



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15. Assertion (A)  $H_2O$  is the only hydride of group - 16 which is liquid at ordinary temperature.

Reason (R ) In ice , each oxygen atom is surrounded by two covalent bonds and two hydrogen bonding.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**



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**16.** Assertion : H-S-H bond angle in  $H_2S$  is closer to  $90^\circ$  but H-O-H bond angle in  $H_2O$  is  $104.5^\circ$

Reason: lp-lp repulsion is stronger in  $H_2S$  than in  $H_2O$

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: C**

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17. Assertion:  $SeCl_4$ , does not have a tetrahedral structure.

Reason:  $Se$  in  $SeCl_4$  has two lone pairs.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.



B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: C**

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**18. Assertion :**The S-S-S bond in  $S_8$  molecule is  $105^\circ$ .

**Reason :** $S_8$  has V-shape.

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: D**

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**19.** Assertion: All F-S-F angle in  $SF_4$  is 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 true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: C**



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20. 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 true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

Answer: C



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21. Assertion. Ozone is a powerful oxidising agent in comparison to  $O_2$

Reason. Ozone is diamagnetic but  $O_2$  is paramagnetic.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**



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22. Assertion:  $F - F$  bond in  $F_2$  molecule is strong.

Reason:  $F$ -atom is small in size.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**

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**23.** Assertion. The O-O bond length in  $H_2O_2$  is shorter than that of  $O_2F_2$ .

Reason.  $H_2O_2$  is an ionic compound.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: D**

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**24.** Assertion.  $F_2$  has high reactivity.

Reason. F-F bond has low bond dissociation enthalpy.

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: A**

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25. Assertion.  $SiF_6^{2-}$  is known but  $SiCl_6^{2-}$  is not.

Reason. Size of F is small and its lone pair of electrons interact with d-orbitals of Si strongly.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: A**



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26. Assertion. HOF bond angle is higher than HOCl bond angle in HOX.

Reason. Oxygen is more electronegative than halogens.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

Answer: D



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27. Assertion. The  $HF_2^-$  ion exists in the solid state and also in liquid state but not in aqueous solution.



Reason. The magnitude of hydrogen bonds in between HF-HF molecule is weaker than that in between HF and  $H_2O$  molecules.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: A**



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**28.** 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 true, and reason is the correct explanation of the assertion.
- B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.
- C. If assertion is true, but reason is false.
- D. If both assertion and reason are false

**Answer: B**

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**29.** Assertion : Noble gases have positive electron gain enthalpy.

Reason : Noble gases have stable closed shell electronic configuration.

- A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: A**

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**30.** Assertion. Xenon forms fluorides.

Reason. Because 5d orbitals are available for valence shell expansion.

A. If both assertion and reason are true, and reason is the correct explanation of the assertion.

B. If both assertion and reason are true, but reason is not the correct explanation of the assertion.

C. If assertion is true, but reason is false.

D. If both assertion and reason are false

**Answer: B**

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## IMPORTANT QUESTIONS FOR BOARD EXAMINATION

1. NO (nitric oxide) is paramagnetic in the gaseous state but diamagnetic in the liquid and solid states. Why ?

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

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3. A certain element is a metalloid that forms an acidic oxide with the formula  $R_2O_5$ . Identify the element.

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4.  $PCl_5$  is known but  $NCl_5$  is not known.

Or Nitrogen does not form pentahalide.

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5. Give an example to show the effect of concentration of nitric acid on the formation of oxidation product ?

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6. Discuss the chemistry of the 'Ring Test for Nitrates' ?

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7. Why is nitrous acid oxidant as well as reductant?

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8. (i) Are all the five bonds in  $PCl_5$  equivalent? Justify.

(ii) How do you account for the reducing behaviour of  $H_3PO_2$ ?

(iii) Why is  $BiH_3$  the strongest reducing agent amongst all the hydrides of Group 15 elements?

(iv) What happens when white phosphorus is heated with concentrated NaOH solution in an inert atmosphere of  $CO_2$ ?

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9. Write balanced chemical equation for the reaction of white phosphorus with thionyl chloride.

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

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11. (i) Sulphur has greater tendency for catenation than oxygen. Explain.

(ii) Explain why  $SF_4$  is easily hydrolysed but  $SF_6$  is not easily hydrolysed ?

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

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13. Which aerosols deplete ozone ?

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14. Ozone is an oxidising as well as a bleaching agent. Support this statement by giving one example of each.

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15. Explain why HF is less viscous than water?

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16. Write balanced equation for the reaction of  $Cl_2$  with (i) cold and dilute NaOH and (ii) hot concentrated solution of NaOH.

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17. Deduce the molecular shape of  $BrF_3$  on the basis of VSEPR theory and  $BrF_5$  on the basis of hybridization.

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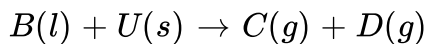
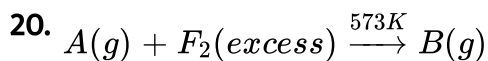


18. Arrange  $HClO_4$ ,  $HClO_3$ ,  $HClO_2$ ,  $HClO$  in order of (i) decreasing acidic strength (ii) increasing oxidizing power. Give reasons.

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19. HI cannot be prepared by the action of conc.  $H_2SO_4$  on KI because

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The gases A, B, C and D are respectively

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21. Explain the following :

- (i) ICl is more reactive than  $I_2$
- (ii)  $H_3PO_3$  undergoes disproportionation.
- (iii)  $K_{a2}$  is less than  $K_{a1}$  for  $H_2SO_4$  in water.

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

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23. Write the hybridization and draw the molecular structure of the following :

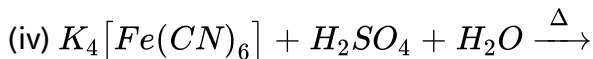
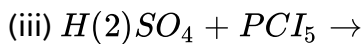
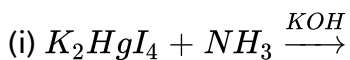
- (i)  $XeF_2$ ,
- (ii)  $XeO_3$ ,
- (iii)  $XeO_2F_4$ .

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24. Write equations for the reactions of water with  $XeF_2$ ,  $XeF_4$  and  $XeF_6$ . Which of them is a disproportionation reaction ?

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25. Complete the following chemical equations :



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