

**EXERCISE-01****CHECK YOUR GRASP****SELECT THE CORRECT ALTERNATIVE (ONLY ONE CORRECT ANSWER)**

1. The final product obtained when boric acid is heated to red heat is –  
(A) Metaboric acid                      (B) Tetraboric acid                      (C) Boron oxide                      (D) Pyroboric acid
2. Which of the following can be detected by the borax-bead test ?  
(A)  $\text{Ni}^{2+}$                       (B)  $\text{Co}^{2+}$                       (C)  $\text{Pb}^{+2}$                       (D) Both (A) & (B)
3. Boric acid polymerizes due to –  
(A) The presence of hydrogen bonds                      (B) Its acidic nature  
(C) Its geometry                      (D) Its monobasic nature
4. Aluminium is obtained by–  
(A) Reduction of  $\text{Al}_2\text{O}_3$  with coke  
(B) Electrolysis of  $\text{Al}_2\text{O}_3$  dissolved in  $\text{Na}_3\text{AlF}_6$   
(C) Reduction of  $\text{Al}_2\text{O}_3$  with chromium  
(D) Heating cryolite and alumina
5. In thermite welding, aluminium acts as –  
(A) A solder                      (B) A flux                      (C) An oxidising agent                      (D) A reducing agent
6. From  $\text{B}_2\text{H}_6$ , all the following can be prepared except –  
(A)  $\text{B}_2\text{O}_3$                       (B)  $\text{H}_3\text{BO}_3$                       (C)  $\text{B}_2(\text{CH}_3)_6$                       (D)  $\text{NaBH}_4$
7. The product formed in the reaction,  
 $\text{BCl}_3 + \text{H}_2\text{O} \longrightarrow$  Product is –  
(A)  $\text{H}_3\text{BO}_3 + \text{HCl}$                       (B)  $\text{B}_2\text{O}_3 + \text{HOCl}$                       (C)  $\text{B}_2\text{H}_6 + \text{HCl}$                       (D) No reaction
8. The hydrides of boron are called  
(A) Boron hydrogen compounds                      (B) Hydrogen borides  
(C) Boranes                      (D) Hydroboric acids
9. Which one of the following mixed sulphates is not an alum ?  
(A)  $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$                       (B)  $\text{K}_2\text{SO}_4 \cdot \text{Cr}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
(C)  $\text{Na}_2\text{SO}_4 \cdot \text{Fe}(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$                       (D)  $\text{CuSO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$
10. Higher percentage of carbon is found in –  
(A) Anthracite                      (B) Lignite                      (C) Bituminous                      (D) Peat
11. Silicones have the general formula –  
(A)  $\text{SiO}_4^{4-}$                       (B)  $\text{Si}_2\text{O}_7^{6-}$                       (C)  $(\text{R}_2\text{SiO})_n$                       (D)  $(\text{SiO}_{3/2})_n^{2-}$
12. In which of the following there exists a  $p\pi - d\pi$  bonding –  
(A) Diamond                      (B) Graphite                      (C) Dimethylamine                      (D) Trisilylamines
13. Glass or silica soluble in –  
(A)  $\text{HClO}_4$                       (B)  $\text{HF}$                       (C) Aqua-regia                      (D)  $\text{H}_2\text{SO}_4$

14. Producer gas is a mixture of –  
 (A) CO and N<sub>2</sub> (B) CO<sub>2</sub> and H<sub>2</sub> (C) CO and H<sub>2</sub> (D) CO<sub>2</sub> and N<sub>2</sub>
15. Which variety of glass is used for manufacture of optical glasses ?  
 (A) Sodium glass (B) Flint glass (C) Ground glass (D) Quartz
16. The colour imparted by Co(II) compounds to glass is –  
 (A) Green (B) Deep-Blue (C) Yellow (D) Red
17. The species present in solution when CO<sub>2</sub> is dissolved in water are –  
 (A) CO<sub>2</sub>, H<sub>2</sub>CO<sub>3</sub>, HCO<sub>3</sub><sup>-</sup>, CO<sub>3</sub><sup>2-</sup> (B) H<sub>2</sub>CO<sub>3</sub>, CO<sub>3</sub><sup>2-</sup>  
 (C) CO<sub>3</sub><sup>2-</sup>, HCO<sub>3</sub><sup>-</sup> (D) CO<sub>2</sub>, H<sub>2</sub>CO<sub>3</sub>
18. P<sub>2</sub>O<sub>5</sub> is used extensively as a –  
 (A) Dehydrating agent (B) Catalytic agent  
 (C) Reducing agent (D) Preservative
19. The number of molecules of water needed to convert one molecules of P<sub>2</sub>O<sub>5</sub> into orthophosphoric acid is –  
 (A) 2 (B) 3 (C) 4 (D) 5
20. In warfare smoke screens are prepared from –  
 (A) PH<sub>3</sub> (B) CaC<sub>2</sub> (C) P<sub>2</sub>O<sub>5</sub> (D) COCl<sub>2</sub>
21. In Haber's process for the manufacture of ammonia, the catalyst used is –  
 (A) Finely divided nickel (B) Finely divided molybdenum  
 (C) Finely divided iron (D) Finely divided platinum
22. Which one of the following nitrogen oxides is the anhydride of nitrous acid ?  
 (A) N<sub>2</sub>O (B) N<sub>2</sub>O<sub>3</sub> (C) N<sub>2</sub>O<sub>4</sub> (D) NO
23. Which acts both an oxidising as well as reducing agent –  
 (A) HNO<sub>3</sub> (B) HNO<sub>2</sub> (C) H<sub>2</sub>SO<sub>4</sub> (D) HCl
24. NO<sub>2</sub> is released by heating –  
 (A) Pb(NO<sub>3</sub>)<sub>2</sub> (B) KNO<sub>3</sub> (C) NaNO<sub>2</sub> (D) NaNO<sub>3</sub>
25. A deep brown gas is formed by mixing two colourless gases which are –  
 (A) NO<sub>2</sub> and O<sub>2</sub> (B) N<sub>2</sub>O and NO (C) NO and O<sub>2</sub> (D) NH<sub>3</sub> and HCl
26. A metal X on heating in nitrogen gas gives Y. Y on treatment with H<sub>2</sub>O gives a colourless gas which when passed through CuSO<sub>4</sub> solution gives a blue colour. Y is –  
 (A) Mg(NO<sub>3</sub>)<sub>2</sub> (B) Mg<sub>3</sub>N<sub>2</sub> (C) NH<sub>3</sub> (D) MgO
27. Oil of vitriol is –  
 (A) H<sub>2</sub>SO<sub>4</sub> (B) H<sub>2</sub>SO<sub>3</sub> (C) H<sub>2</sub>S<sub>2</sub>O<sub>9</sub> (D) H<sub>2</sub>S<sub>2</sub>O<sub>8</sub>
28. The compound which gives off oxygen on moderate heating is –  
 (A) Cupric oxide (B) Mercuric oxide (C) Zinc oxide (D) Aluminium oxide



SELECT THE CORRECT ALTERNATIVES (ONE OR MORE THEN ONE CORRECT ANSWERS)

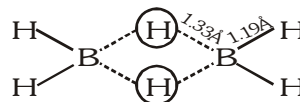
1. A mixture of boric acid with ethyl alcohol burns with green edged flame due to the formation of –  
(A) Ethyl borax                      (B) Ethyl borate                      (C) Methyl borax                      (D) Methyl borate
2.  $\text{AlCl}_3$  on hydrolysis gives –  
(A)  $\text{Al}_2\text{O}_3 \cdot \text{H}_2\text{O}$                       (B)  $\text{Al}(\text{OH})_3$                       (C)  $\text{Al}_2\text{O}_3$                       (D)  $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$
3. When a solution of sodium hydroxides is added in excess to the solution of potash alum, we obtain –  
(A) A white precipitate                      (B) Bluish white precipitate  
(C) A clear solution                      (D) A crystalline mass
4.  $\text{BCl}_3$  does not exist as dimer but  $\text{BH}_3$  exist as dimer ( $\text{B}_2\text{H}_6$ ) because –  
(A) Chlorine is more electronegative than hydrogen  
(B) There is  $p\pi - p\pi$  back bonding in  $\text{BCl}_3$  but  $\text{BH}_3$  does not contain such multiple bonding  
(C) Large sized chlorine atoms do not fit in between the small boron atoms whereas small sized hydrogen atoms get fitted in between boron atoms  
(D) None of the above
5. Amorphous boron on burning in air forms –  
(A)  $\text{B}(\text{OH})_3$                       (B) Mixture of  $\text{B}_2\text{O}_3$  and BN  
(C) Only  $\text{B}_2\text{O}_3$                       (D) Only BN
6. Which of the following statements is correct ?  
(A)  $\text{BCl}_3$  and  $\text{AlCl}_3$  are both Lewis acids and  $\text{BCl}_3$  is stronger than  $\text{AlCl}_3$   
(B)  $\text{BCl}_3$  and  $\text{AlCl}_3$  both Lewis acids and  $\text{AlCl}_3$  is stronger than  $\text{BCl}_3$   
(C)  $\text{BCl}_3$  and  $\text{AlCl}_3$  are both equally strong Lewis acids  
(D) Both  $\text{BCl}_3$  and  $\text{AlCl}_3$  are not Lewis acids.
7. Which one of the following does not exist in the free form ?  
(A)  $\text{BF}_3$                       (B)  $\text{BCl}_3$                       (C)  $\text{BBr}_3$                       (D)  $\text{BH}_3$
8. Thermite is a mixture of –  
(A) 3 Parts of powdered Al and 1 part of  $\text{Fe}_2\text{O}_3$                       (B) 1 part of powdered Al and 3 parts of  $\text{Fe}_2\text{O}_3$   
(C) 1 part of powdered Al and 1 part of  $\text{Fe}_2\text{O}_3$                       (D) 2 Parts of powdered Al and 1 part of  $\text{Fe}_2\text{O}_3$
9. Borax is used as cleansing agent because on dissolving in water it gives –  
(A) Alkaline solution                      (B) Acidic solution                      (C) Bleaching solution                      (D) Colloidal solution
10. Trisilylamine [ $\ddot{\text{N}}(\text{SiH}_3)_3$ ] has a –  
(A) Planar geometry                      (B) Tetrahedral geometry  
(C) Pyramidal geometry                      (D) None of these

11. The halide that is not hydrolysed is –  
 (A)  $\text{SiCl}_4$  (B)  $\text{SiF}_4$  (C)  $\text{CCl}_4$  (D)  $\text{PbCl}_4$
12. What is false about  $\text{N}_2\text{O}_5$  ?  
 (A) It is anhydride of  $\text{HNO}_3$  (B) It is a powerful oxidizing agent  
 (C) Solid  $\text{N}_2\text{O}_5$  is called nitronium nitrate (D) Structure of  $\text{N}_2\text{O}_5$  contains no  $[\text{N} \rightarrow \text{O}]$  bond
13.  $\text{SbCl}_3$  and  $\text{BiCl}_3$  on hydrolysis gives –  
 (A)  $\text{Sb}^{+3}$  and  $\text{Bi}^{+3}$  (B)  $\text{Sb}(\text{OH})_3$  and  $\text{Bi}(\text{OH})_3$   
 (C)  $\text{SbOCl}$  and  $\text{BiOCl}$  (D) None
14. The percentage of nitrogen in urea is about –  
 (A) 70 (B) 63 (C) 47 (D) 28
15. Sequence of acidic character is –  
 (A)  $\text{SO}_2 > \text{CO}_2 > \text{CO} > \text{N}_2\text{O}_5$  (B)  $\text{SO}_2 > \text{N}_2\text{O}_5 > \text{CO} > \text{CO}_2$   
 (C)  $\text{N}_2\text{O}_5 > \text{SO}_2 > \text{CO} > \text{CO}_2$  (D)  $\text{N}_2\text{O}_5 > \text{SO}_2 > \text{CO}_2 > \text{CO}$
16. Tip of saftymatch stick are made up of –  
 (A) Sulphur and potassium (B) Sulphur  
 (C) Sulphur, dichromate and phosphorus (D) Sulphur, dichromate and potassium
17. Of the following, which has three electron bond in its structure ?  
 (A) Nitrous oxide (B) Nitric oxide  
 (C) Dinitrogen trioxide (D) Nitrogen pentoxide
18. Which of the following leaves no residue on heating ?  
 (A)  $\text{Pb}(\text{NO}_3)_2$  (B)  $\text{NH}_4\text{NO}_3$  (C)  $\text{Cu}(\text{NO}_3)_2$  (D)  $\text{NaNO}_3$
19.  $\text{H}_2\text{SO}_4$  has very high corrosive action on skin because –  
 (A) it reacts with proteins  
 (B) it acts as an oxidising agent  
 (C) it acts as a dehydrating agent  
 (D) it acts as dehydrating agent and absorption of water is highly exothermic
20. A black sulphide when treated with ozone becomes white. The white compound is –  
 (A)  $\text{ZnSO}_4$  (B)  $\text{CaSO}_4$  (C)  $\text{BaSO}_4$  (D)  $\text{PbSO}_4$
21. Which of the following does not react with  $\text{AgCl}$  –  
 (A)  $\text{Na}_2\text{S}_2\text{O}_3$  (B)  $\text{NH}_4\text{OH}$  (C)  $\text{NaNO}_3$  (D)  $\text{NH}_3$

22. By passing  $\text{H}_2\text{S}$  gas in acidified  $\text{KMnO}_4$  solution, we get –  
 (A)  $\text{K}_2\text{S}$  (B)  $\text{S}$  (C)  $\text{K}_2\text{SO}_3$  (D)  $\text{MnO}_2$
23. Chloride of lime is –  
 (A)  $\text{CaOCl}_2$  (B)  $\text{Ca}(\text{OCl})_2$  (C)  $\text{CaCl}_2$  (D)  $(\text{CaO})_2 \text{Cl}$
24. Which one of the following oxy acid of fluorine exists ?  
 (A)  $\text{HOF}$  (B)  $\text{HFO}_3$  (C)  $\text{HFO}_4$  (D)  $\text{HFO}_2$
25. Chromyl chloride test is performed for the confirmation of the presence of the following in mixture –  
 (A)  $\text{SO}_4^{2-}$  (B)  $\text{Cr}^{+++}$  (C)  $\text{Cl}^-$  (D)  $\text{Cr}^{+++}$  and  $\text{Cl}^-$
26. Iodine gas turns starch iodide paper –  
 (A) Blue (B) Red (C) Colourless (D) Yellow
27. Essential trace element involved in physiology of thyroid glands –  
 (A)  $\text{K}$  (B)  $\text{Mg}$  (C)  $\text{Ni}$  (D)  $\text{I}_2$
28. When chlorine is passed over dry slaked lime at room temperature, the main reaction product is –  
 (A)  $\text{Ca}(\text{ClO}_2)_2$  (B)  $\text{CaCl}_2$  (C)  $\text{CaOCl}_2$  (D)  $\text{Ca}(\text{OCl}_2)_2$
29. Iodine is formed when  $\text{KI}$  reacts with a solution of –  
 (A)  $\text{ZnSO}_4$  (B)  $\text{CuSO}_4$  (C)  $\text{FeSO}_4$  (D)  $(\text{NH}_4)_2\text{SO}_4$
30. Which amongst the following reactions cannot be used for the preparation of the halogen acid ?  
 (A)  $2\text{KBr} + \text{H}_2\text{SO}_4(\text{Conc.}) \longrightarrow \text{K}_2\text{SO}_4 + 2\text{HBr}$   
 (B)  $2\text{NaCl} + \text{H}_2\text{SO}_4(\text{Conc.}) \longrightarrow \text{NaHSO}_4 + \text{HCl}$   
 (C)  $\text{NaHSO}_4 + \text{NaCl} \longrightarrow \text{Na}_2\text{SO}_4 + \text{HCl}$   
 (D)  $\text{CaF}_2 + \text{H}_2\text{SO}_4(\text{conc.}) \longrightarrow \text{CaSO}_4 + 2\text{HF}$
31.  $\text{HI}$  can be prepared by all the following methods except –  
 (A)  $\text{PI}_3 + \text{H}_2\text{O}$  (B)  $\text{KI} + \text{H}_2\text{SO}_4$   
 (C)  $\text{H}_2 + \text{I}_2 \longrightarrow$  (D)  $\text{I}_2 + \text{H}_2\text{S}$
32. When  $\text{I}_2$  is passed through  $\text{KCl}$ ,  $\text{KF}$ ,  $\text{KBr}$  solution –  
 (A)  $\text{Cl}_2$  and  $\text{Br}_2$  are evolved (B)  $\text{Cl}_2$  is evolved  
 (C)  $\text{Cl}_2$ ,  $\text{Br}_2$ ,  $\text{F}_2$  are evolved (D) None of these
33. Which two of the following salts are used for preparing iodized salt–  
 (i)  $\text{KIO}_3$  (ii)  $\text{KI}$  (iii)  $\text{I}_2$  (iv)  $\text{HI}$   
 (A) (i) and (ii) (B) (i) and (iii) (C) (ii) and (iv) (D) (iii) and (iv)
34. Helium is obtained from which of the following.?  
 (A) Natural gases trapped under rock formations. (B) Liquid air  
 (C) Radioactive decay (D) Gasoline
35. The statement, which prompted Neil Bartlett to prepare the first noble gas compound was –  
 (A)  $\text{Xe-F}$  bond has high bond energy  
 (B)  $\text{F}_2$  has exceptionally low bond energy  
 (C)  $\text{PtF}_6$  is a strong oxidant  
 (D)  $\text{O}_2$  molecule and  $\text{Xe}$  atom have very similar ionization energies.

36. Pick out the correct statement for  $\text{XeF}_6$
- (A)  $\text{XeF}_6$  is hydrolysed partially to form  $\text{XeOF}_4$
- (B) It react with  $\text{SiO}_2$  to form  $\text{XeOF}_4$
- (C) On complete hydrolysis, it forms  $\text{XeO}_3$
- (D) All

37. The molecular shapes of diborane is shown:  
Consider the following statements for diborane



1. Boron is approximately  $\text{sp}^3$  hybridised
2. B-H-B angle is  $180^\circ$
3. There are two terminal B-H bonds for each boron atom
4. There are only 12 bonding electrons available

Of these statements –

- (A) 1, 3 and 4 are correct
- (B) 1, 2 and 3 are correct
- (C) 2, 3 and 4 are correct
- (D) 1, 2 and 4 are correct
38. Borax is actually made of two tetrahedral and two triangular units joined together and should be written as :  $\text{Na}_2 [\text{B}_4\text{O}_5(\text{OH})_4] \cdot 8\text{H}_2\text{O}$ .

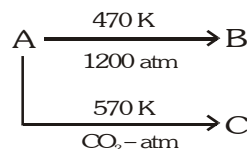
Consider the following statements about borax:

1. Each boron atom has four B-O bonds
2. Each boron atom has three B-O bonds
3. Two boron atoms have four B-O bonds while other two have three B-O bonds
4. Each boron atom has one-OH groups

Select correct statement(s) –

- (A) 1, 2                      (B) 2, 3                      (C) 3, 4                      (D) 1, 3

39. Three allotropes (A), (B) and (C) of phosphorous in the following change are respectively –



- (A) White, black, red      (B) Black, white, red      (C) Red, black, white      (D) Red, violet, black
40. One mole of calcium phosphide on reaction with excess of water gives –
- (A) One mole of phosphine                      (B) Two moles of phosphoric acid
- (C) Two moles of phosphine                      (D) One mole of phosphorus penta-oxide

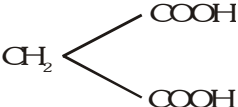
41.  $\text{Ca} + \text{C}_2 \longrightarrow \text{CaC}_2 \xrightarrow{\text{N}_2} \text{A}$

Compound (A) is used as a/an –

- (A) Fertilizer                      (B) Dehydrating agent      (C) Oxidising agent      (D) Reducing agent
42. Which one of the following statements is not true regarding diborane?
- (A) It has two bridging hydrogens and four perpendicular to the rest.
- (B) When methylated, the product is  $\text{Me}_4\text{B}_2\text{H}_2$
- (C) The bridging hydrogens are in a plane perpendicular to the rest.
- (D) All the B-H bond distances are equal.

43. A red coloured mixed oxide (X) on treatment with concentrate  $\text{HNO}_3$  gives a compound (Y). (Y) with HCl, produces a chloride compound (Z) which can also be produced by treating (X) with concentrate HCl. Compounds (X), (Y) and (Z) will be –
- (A)  $\text{Mn}_3\text{O}_4$ ,  $\text{MnO}_2$ ,  $\text{MnCl}_2$  (B)  $\text{Pb}_3\text{O}_4$ ,  $\text{PbO}_2$ ,  $\text{PbCl}_2$   
 (C)  $\text{Fe}_3\text{O}_4$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{FeCl}_2$  (D)  $\text{Fe}_3\text{O}_4$ ,  $\text{Fe}_2\text{O}_3$ ,  $\text{FeCl}_3$
44. Match List-I with List-II
- | List-I Chemical reaction   | List-II Name of process |
|--|-------------------------|
| (1) $4\text{NH}_3 + 5\text{O}_2 \xrightarrow{800^\circ\text{C}/\text{Pt}} 4\text{NO} + 6\text{H}_2\text{O}$  | (a) Contact process     |
| (2) $4\text{HCl} + \text{O}_2 \xrightarrow[450-500^\circ/\text{V}_2\text{O}_5]{3230^\circ\text{C}/\text{CuCl}_2} 2\text{Cl}_2 + 2\text{H}_2\text{O}$ | (b) Ostwald's process   |
| (3) $2\text{SO}_2 + \text{O}_2 \longrightarrow 2\text{SO}_3$   | (c) Deacon's process    |
| (4) $2\text{N}_2 + 3\text{H}_2 \xrightarrow{\text{Fe+Mo}} 2\text{NH}_3$  | (d) Haber's process     |
| (A) 1-a, 2-b, 3-d, 4-c (B) 1-b, 2-c, 3-a, 4-d (C) 1-a, 2-d, 3-c, 4-b (D) 1-a, 2-c, 3-b, 4-d  |                         |
45. A gas which exists in three allotropic forms  $\alpha$ ,  $\beta$  and  $\gamma$  is –
- (A)  $\text{SO}_2$  (B)  $\text{SO}_3$  (C)  $\text{CO}_2$  (D)  $\text{NH}_3$
46.  $\text{HNO}_3 + \text{P}_4\text{O}_{10} \longrightarrow \text{HPO}_3 + \text{A}$  ; The product A is –
- (A)  $\text{N}_2\text{O}$  (B)  $\text{N}_2\text{O}_3$  (C)  $\text{NO}_2$  (D)  $\text{N}_2\text{O}_5$
47. Which of the following statements is/are correct regarding  $\text{B}_2\text{H}_6$ ?–
- (A) Banana bonds are longer but stronger than normal B–H bonds  
 (B)  $\text{B}_2\text{H}_6$  is also known as 3c-2e compound  
 (C) The hybrid state of B in  $\text{B}_2\text{H}_6$  is  $\text{sp}^3$  while that of  $\text{sp}^2$  in  $\text{BH}_3$   
 (D) It cannot be prepared by reacting  $\text{BF}_3$  with  $\text{LiBH}_3$  in the presence of dry ether
48. Which of the following pairs of nitrates gives the same gaseous products on thermal decomposition?
- (A)  $\text{KNO}_3$  and  $\text{Pb}(\text{NO}_3)_2$  (B)  $\text{KNO}_3$  and  $\text{NaNO}_3$   
 (C)  $\text{Pb}(\text{NO}_3)_2$  and  $\text{Cu}(\text{NO}_3)_2$  (D)  $\text{NaNO}_3$  and  $\text{Ca}(\text{NO}_3)_2$
49. When an inorganic compound (X) having 3c - 2e as well as 2c -2e bonds reacts with ammonia gas at a certain temperature, gives a compound (Y) iso-structural with benzene. Compound (X) with ammonia at a high temperature, produces a hard substance (Z). Then –
- (A) (X) is  $\text{B}_2\text{H}_6$  (B) (Z) is known as inorganic graphite  
 (C) (Z) having structure similar to graphite (D) (Z) having structure similar to (X)
50. Boric acid –
- (A) Exists in polymeric form due to inter-molecular hydrogen bonding  
 (B) Is used in manufacturing of optical glasses  
 (C) Is a tri-basic acid  
 (D) With borax, it is used in the preparation of a buffer solution.
51. Select correct statement(s) –
- (A) Borax is used as a buffer  
 (B) 1 M borax solution reacts with equal volumes of 2 M HCl solution  
 (C) Titration of borax can be made using methyl orange as the indicator  
 (D) Coloured bead obtained in borax-bead test contains metaborate.



52. Select correct statement about  $B_2H_6$  –
- (A) Bridging groups are electron-deficient with 12 valence electrons  
 (B) It has 2c-2e B-H bonds  
 (C) It has 3c-2e B-H-B bonds  
 (D) All of above are correct statements
53. Which of the following is/are correct for group 14 elements –
- (A) The stability of dihalides are in the order  $CX_2 < SiX_2 < GeX_2 < SnX_2 < PbX_2$   
 (B) The ability to form  $p\pi-p\pi$  multiple bonds among themselves increases down the group  
 (C) The tendency for catenation decreases down the group  
 (D) They all form oxides with the formula  $MO_2$
54. The solubility of anhydrous  $AlCl_3$  and hydrous  $AlCl_3$  in diethyl ether are  $S_1$  and  $S_2$  respectively. Then –
- (A)  $S_1 = S_2$  (B)  $S_1 > S_2$  (C)  $S_1 < S_2$  (D)  $S_1 < S_2$  but not  $S_1 = S_2$
55. Concentrated  $HNO_3$  reacts with iodine to give –
- (A) HI (B) HOI (C)  $HOIO_2$  (D)  $HOIO_3$
56. Conc.  $H_2SO_4$  cannot be used to prepare HBr from NaBr because it –
- (A) Reacts slowly with NaBr (B) Oxidises HBr  
 (C) Reduces HBr (D) Disproportionates HBr
57.  $CH_2$    $\xrightarrow{P_4O_{10}, 150^\circ C}$  X. Compound (X) is –
- (A) Malonic acid (B) Carbon suboxide (C) Tartaric acid (D) Acetic acid
58.  $H_3BO_3 \xrightarrow{T_1} X \xrightarrow{T_2} Y \xrightarrow{\text{red hot}} B_2O_3$  if  $T_1 < T_2$  then X and Y respectively are –
- (A) X = Metaboric acid and Y = Tetraboric acid  
 (B) X = Tetraboric acid and Y = Metaboric acid  
 (C) X = Borax and Y = Metaboric acid  
 (D) X = Tetraboric acid and Y = Borax
59. In a molecule of phosphorus (V) oxide, there are –
- (A) 4P – P, 10P – O and 4P = O bonds (B) 12P – O and 4P = O bonds  
 (C) 2P – O and 4P = P bonds (D) 6P – P, 12P – O and 4P = P bonds
60. Conc.  $HNO_3$  is yellow coloured liquid due to –
- (A) Dissolution of NO in conc.  $HNO_3$   
 (B) Dissolution of  $NO_2$  in conc.  $HNO_3$   
 (C) Dissolution of  $N_2O$  in conc.  $HNO_3$   
 (D) Dissolution of  $N_2O_3$  in conc.  $HNO_3$
61. When chlorine gas is passed through an aqueous solution of a potassium halide in the presence of chloroform, a violet colouration is obtained. On passing more of chlorine water, the violet colour is disappeared and solution becomes colourless. This test confirms the presence of ..... in aqueous solution. –
- (A) Chlorine (B) Fluorine (C) Bromine (D) Iodine

62. An inorganic salt (A) is decomposed at about 523 K to give products (B) and (C). compound (C) is a liquid at room temperature and is neutral to litmus paper while oxide (B) on burning with white phosphorous, given a dehydrating agent (D). compounds (A), (B), (C) and (D) will be identified as –
- (A)  $\text{NH}_4\text{NO}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{O}$ ,  $\text{P}_2\text{O}_5$
- (B)  $\text{NH}_4\text{NO}_2$ ,  $\text{N}_2\text{O}$ ,  $\text{H}_2\text{O}$ ,  $\text{P}_2\text{O}_5$
- (C)  $\text{CaCO}_3$ ,  $\text{CaO}$ ,  $\text{H}_2\text{O}$ ,  $\text{CaCl}_2$
- (D)  $\text{CaCO}_3$ ,  $\text{CaO}$ ,  $\text{H}_2\text{O}$ ,  $\text{Ca}(\text{OH})_2$
63. Aqueous solution of borax reacts with 2 mol of acids. This is because of –
- (A) Formation of 2 mol of  $\text{B}(\text{OH})_3$  only.
- (B) Formation of 2 mol of  $[\text{B}(\text{OH})_4]^-$  only.
- (C) Formation of 1 mol each of  $\text{B}(\text{OH})_3$  and  $[\text{B}(\text{OH})_4]^-$
- (D) Formation of 2 mol each of  $[\text{B}(\text{OH})_4]^-$  and  $\text{B}(\text{OH})_3$ , of which only  $[\text{B}(\text{OH})_4]^-$  reacts with acid
64. Borax is used as a buffer since –
- (A) Its aqueous solution contains equal amount of weak acid and its salt
- (B) It is easily available
- (C) Its aqueous solution contains equal amount of strong acid and its salt
- (D) Statement that borax is a buffer, is wrong.
65. When fluoride is heated with conc.  $\text{H}_2\text{SO}_4$  and  $\text{MnO}_2$  the gas evolved is –
- (A)  $\text{HF}$
- (B)  $\text{F}_2$
- (C)  $\text{SF}_4$
- (D) None

Brain Teasers					Answer Key						Exercise-2				
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	B	B	C	C	B	A	D	B	A	A	C	D	C	C	D
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	C	B	B	D	D	C	B	A	A	C	A	D	C	B	A
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	B	D	A	A,C	D	D	A	C	A	C	A	D	B	B	B
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	D	A,B,C	B,C	A,B,C	A,B,D	A,B,C,D	B,C	A,C,D	B	C	B	B	A	B	B
Que.	61	62	63	64	65										
Ans.	D	A	D	A	A										

**EXERCISE-03****MISCELLANEOUS TYPE QUESTIONS****TRUE / FALSE**

1. Goldschmidt thermite process is used in the extraction of aluminium.
2. Cryolite is added to alumina as to lower the fusion temperature and make the mass good conductor of electricity.
3. Nitrous acid acts both as an oxidising and a reducing agent.
4.  $\text{NF}_3$  is stable but  $\text{NCl}_3$  and  $\text{NI}_3$  are explosive in nature.
5. Bleaching action of  $\text{SO}_2$  is due to reduction and temporary.
6. Mercury in presence of ozone is oxidised to mercuric oxide.
7. Hydrofluoric acid cannot be kept in glass vessels.
8. The amount of chlorine obtained from a sample of bleaching powder by treatment with excess of dilute acid or  $\text{CO}_2$  is called available chlorine.

**FILL IN THE BLANKS**

1. The increase in solubility of iodine in an aqueous solution of KI is due to the formation of .....
2. Silver fluoride is fairly.....in water.
3. HI cannot be prepared by the action of conc.  $\text{H}_2\text{SO}_4$  on KI because  $\text{H}_2\text{SO}_4$  is an .....agent.
4. Antichlor is a compound which converts .....into .....
5. Iodine reacts with hot NaOH solution giving the products as NaI and .....
6. In the known interhalogen compounds, the maximum number of halogen atom is .....
7. Conc.  $\text{HNO}_3$  reacts with iodine to give .....
8. The only halogen that is not found in nature is .....
9. Tincture of iodine contains  $\text{I}_2$ ,.....and.....
10. Iodine deficiency in diet is known to cause.....

**MATCH THE COLUMN**

1.

<u>Column-I</u>		<u>Column-II</u>	
(A)	Hypo phosphoric acid	(p)	All hydrogen are ionizable in water
(B)	Pyro phosphoric acid	(q)	Lewis acid
(C)	Boric acid	(r)	Monobasic in water
(D)	Hypo phosphorus acid	(s)	$\text{sp}^3$ hybridized central atom

### ASSERTION & REASON QUESTIONS

These questions contains, Statement I (assertion) and Statement II (reason).

- (A) Statement-I is true, Statement-II is true ; Statement-II is correct explanation for Statement-I.  
(B) Statement-I is true, Statement-II is true ; Statement-II is not a correct explanation for statement-I  
(C) Statement-I is true, Statement-II is false  
(D) Statement-I is false, Statement-II is true

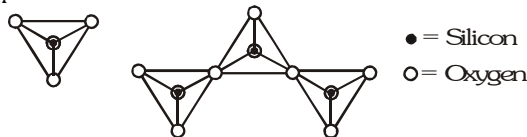
1. **Statement -I** : Silicones are very inert polymers.  
**Because**  
**Statement -II** : Both Si—O and Si—C bond energies are very high.
2. **Statement -I** : Chlorine gas disproportionates in hot & conc. NaOH solution  
**Because**  
**Statement -II** : NaCl and NaOCl are formed in the above reaction.
3. **Statement -I** :  $\text{Al}(\text{OH})_3$  is amphoteric in nature.  
**Because**  
**Statement -II** : It can not be used as an antacid.
4. **Statement -I** : Oxygen is more electronegative than sulphur, yet  $\text{H}_2\text{S}$  is acidic, while  $\text{H}_2\text{O}$  is neutral.  
**Because**  
**Statement -II** : H-S bond is weaker than O-H bond.
5. **Statement -I** : Conc.  $\text{H}_2\text{SO}_4$  can not be used to prepare pure HBr from NaBr.  
**Because**  
**Statement -II** : It reacts slowly with NaBr.
6. **Statement -I** : Aluminium and zinc metal evolve  $\text{H}_2$  gas from NaOH solution.  
**Because**  
**Statement -II** : Several non-metals such as P, S, Cl, etc. yield a hydride instead of  $\text{H}_2$  gas from NaOH
7. **Statement -I** : Borax bead test is applicable only to coloured salt.  
**Because**  
**Statement -II** : In borax bead test, coloured salts are decomposed to give coloured metal metaborates.
8. **Statement -I** :  $\text{Cl}_2$  gas bleaches the articles permanently.  
**Because**  
**Statement -II** :  $\text{Cl}_2$  is a strong reducing agent.
9. **Statement -I** :  $\text{HClO}$  is stronger acid than  $\text{HBrO}$   
**Because**  
**Statement -II** : Greater is the electronegativity of the halogen, greater will be attraction of electron pair towards it and hence more easily the  $\text{H}^+$  ion will be released.

## COMPREHENSION BASED QUESTIONS

### Comprehension # 1

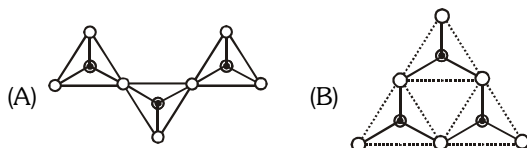
The name 'Silica' covers an entire group of minerals, which have the general formula  $\text{SiO}_2$ , The most common of which is quartz. Quartz is a framework silicate with  $\text{SiO}_4$  tetrahedral arranged in spirals. the spirals can turn in a clockwise or anticlockwise direction – a feature that results in there being two mirror images, optically active, varieties of quartz.

1. The following pictures represent various silicate anions. Their formulae are respectively –



- (A)  $\text{SiO}_3^{2-}$                        $\text{Si}_3\text{O}_7^{2-}$                       (B)  $\text{SiO}_4^{4-}$                        $\text{Si}_3\text{O}_{10}^{8-}$   
 (C)  $\text{SiO}_4^{2-}$                        $\text{Si}_3\text{O}_9^{2-}$                       (D)  $\text{SiO}_3^{4-}$                        $\text{Si}_3\text{O}_7^{8-}$

2.  $\text{Si}_3\text{O}_9^{6-}$  (having three tetrahedral) is represented as –



- (C) Both                      (D) None of these

3. The silicate anion in the mineral kaolinite is a chain of three  $\text{SiO}_4$  tetrahedral that share corners with adjacent tetrahedral. The mineral also contains  $\text{Ca}^{2+}$  ions,  $\text{Cu}^{2+}$  ions, and water molecules in a 1:1:1 ratio. Mineral is represented as –

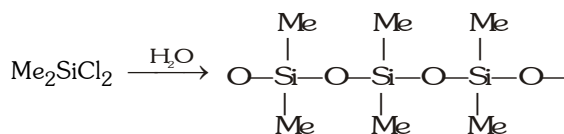
- (A)  $\text{CaCuSi}_3\text{O}_{10} \cdot \text{H}_2\text{O}$                       (B)  $\text{CaCuSi}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$   
 (C)  $\text{Ca}_2\text{Cu}_2\text{Si}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$                       (D) None of these

### Comprehension # 2

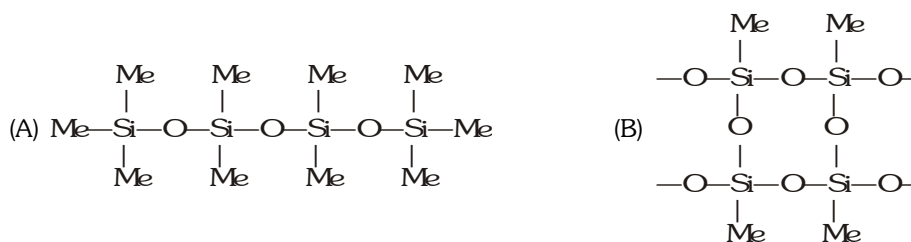
Silicones are synthetic polymers containing repeating  $\text{R}_2\text{SiO}$  units. Since, the empirical formula is that of a ketone ( $\text{R}_2\text{CO}$ ), the name silicone has been given to these materials. Silicones can be made into oils, rubbery elastomers and resins. they find a variety of applications because of their chemical inertness, water repelling nature, heat-resistance and good electrical insulating property.

Commercial silicon polymers are usually methyl derivatives and to a lesser extent phenyl derivatives and are synthesised by the hydrolysis of

$\text{R}_2\text{SiCl}_2$  [R = methyl (Me) or phenyl ( $\phi$ )]

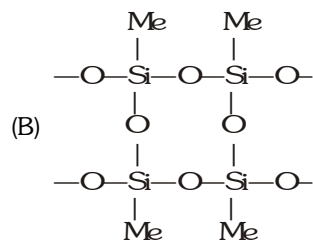
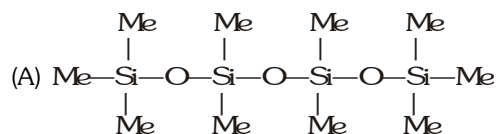


1. If we mix  $\text{Me}_3\text{SiCl}$  with  $\text{Me}_2\text{SiCl}_2$ , we get silicones of the type –



- (C) Both of the above                      (D) None of the above

2. If we start with  $\text{MeSiCl}_3$  as the starting material, silicones formed is -



- (C) Both of the above  
(D) None of the above

MISCELLANEOUS TYPE QUESTION	ANSWER KEY	EXERCISE -3
• <u>True / False</u>		
1. F    2. T    3. T    4. T    5. T    6. F    7. T    8. T		
• <u>Fill in the Blanks</u>		
1. $\text{KI}_3$ 2. Soluble    3. Oxidising    4. $\text{Cl}_2$ , Hydrochloric acid    5. $\text{NaIO}_3$ 6. Eight    7. $\text{HIO}_3$ 8. At		
9. KI, Rectified spirit    10. Goiter		
• <u>Match the Column</u>		
1. (A) $\rightarrow$ p,s ; (B) $\rightarrow$ s ; (C) $\rightarrow$ q,r ; (D) $\rightarrow$ r,s		
• <u>Assertion - Reason Questions</u>		
1. A    2. C    3. C    4. A    5. C    6. B    7. A    8. C    9. A		
• <u>Comprehension Based Questions</u>		
Comprehension # 1 : 1. B    2. B    3. C		
Comprehension # 2 : 1. A    2. B		

**EXERCISE-04 [A]****CONCEPTUAL SUBJECTIVE EXERCISE**

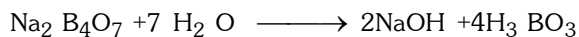
- 1 Colourless salt (A) + NaOH (excess)  $\xrightarrow{\Delta}$  gas (B) giving white fumes with HCl + alkaline solution (C)  
(C) + Zn  $\longrightarrow$  gas (B)  
(A)  $\xrightarrow{\Delta}$  gas (D) + liquid (E)  
D,E Both triatomic  
Identify (A,B,C,D) and (E)
- 2 Complete and balance the following reactions-
- (a)  $\text{Cu} + \text{dil. HNO}_3 \longrightarrow \text{NO} + \dots + \dots$
- (b)  $\text{Pb}(\text{NO}_3)_2 \xrightarrow{\text{heat}} \text{PbO} + \dots + \dots$
- (c)  $\text{CuSO}_4 + \text{NH}_4\text{OH}(\text{excess}) \longrightarrow \dots$
- (d)  $\text{AgCl} + \text{NH}_4\text{OH} \longrightarrow \dots$
- 3 Aqua-regia dissolves gold. Write reaction.
- 4 Precipitation of second group sulphides in qualitative analysis is carried out with  $\text{H}_2\text{S}$  in presence of HCl and not nitric acid. Why?
- 5  $\text{KMnO}_4$  should not be dissolved in conc.  $\text{H}_2\text{SO}_4$ . Why?
- 6 What happens when  $\text{H}_2\text{S}$  gas is passed through nitric acid ?
- 7 What happens when –
- (1) Hydrogen sulphide is bubbled through an aqueous solution of sulphur dioxide.
- (2) Hydrogen sulphide is passed through acidified ferric chloride solution.
- (3) Sulphur is boiled with caustic soda solution.
- 8 Sodium salt (A) of a dibasic acid  $\xrightarrow{\text{HCl}}$  gas (B) and clear solution gas (B) and clear solution turns  $\text{K}_2\text{Cr}_2\text{O}_7$  to green and also lime water milky. identify (A) and (B).
- 9 A certain salt 'X' gives the following test.
- (i) Its aqueous solution is alkaline to litmus.
- (ii) On strongly heating it swells to give glassy bead.
- (iii) When concentrated  $\text{H}_2\text{SO}_4$  is added to solution of 'X', white crystals of a weak acid. separate out.  
Identify 'X' and write down all reaction.
- 10  $\text{SnCl}_2$  gives white precipitate with  $\text{HgCl}_2$  which turns grey later on, but  $\text{SnCl}_4$  does not. Explain why ?
- 11 Identify A and B (Compound/reaction condition)
- $$\text{PbS} \xrightarrow[\text{in air}]{\text{Heat}} \text{A} + \text{PbS} \xrightarrow{\text{B}} \text{Pb} + \text{SO}_2$$
- 12 A bottle of liquor ammonia should be cooled before opening. Why ?
- 13 Iodine is liberated in the reaction between KI and  $\text{Cu}^{2+}$  but chlorine is not liberated when KCl is added to  $\text{Cu}^{2+}$ . Why?
- 14 What happens when an aqueous solution of hydrazine reacts with:
- (i) An aqueous solution of  $\text{I}_2$
- (ii) An alkaline solution of copper sulphate
- (iii) An aqueous alkaline solution of potassium ferricyanide
- (iv) an ammoniacal solution of silver nitrate.

- 15 An acid (A) is pale-blue. The potassium salt of this acid does not give any reaction with  $\text{BaCl}_2$  but gives white crystalline precipitate (B) with  $\text{Ag}^+$  ions. The acid (A) reacts with urea to liberate two gases (C) and (D). Gas (D) is used in synthesis of Urea also. On adding thiourea in acid (A) followed by addition of  $\text{FeCl}_3$ /dilute  $\text{HCl}$  red coloured substance (E) is obtained. Identify substances (A) to (E).

CONCEPTUAL	SUBJECTIVE	EXERCISE	ANSWER KEY	EXERCISE -4(A)
1.	(A) $\text{NH}_4 \text{NO}_3$ $\text{H}_2\text{O}$	(B) $\text{NH}_3$	(C) $(\text{NaNO}_3 + \text{NaOH})$	(D) $\text{N}_2\text{O}$ (E)
2.	(a) $2\text{HNO}_3 \rightarrow \text{H}_2\text{O} + 2\text{NO} + 3(\text{O})$ $3\text{Cu} + 3(\text{O}) + 6\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 3\text{H}_2\text{O}$ <hr/> $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$ <hr/> (b) $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$ (c) $\text{CuSO}_4 + 2\text{NH}_4\text{OH} \rightarrow \text{Cu}(\text{OH}_2) + (\text{NH}_4)_2\text{SO}_4$ $\text{Cu}(\text{OH}_2) + (\text{NH}_4)_2\text{SO}_4 + 2\text{NH}_4\text{OH} \rightarrow [\text{Cu}(\text{NH}_3)_4]\text{SO}_4 + 4\text{H}_2\text{O}$ (g) $\text{AgCl} + \text{NH}_4\text{OH} \rightarrow \text{AgOH} + \text{NH}_4\text{Cl}$ $\text{AgOH} + \text{NH}_4\text{Cl} + \text{NH}_4\text{OH} \rightarrow \text{Ag}(\text{NH}_3)_2\text{Cl} + 2\text{H}_2\text{O}$ <hr/> $\text{AgCl} + 2\text{NH}_4\text{OH} \rightarrow \text{Ag}(\text{NH}_3)_2\text{Cl} + 2\text{H}_2\text{O}$ <hr/>			
3.	Noble metals like gold, platinum, iridium, rhodium etc., do not react with nitric acid. However, these metals dissolve in aqua-regia (3 parts conc. $\text{HCl}$ and one part conc. $\text{HNO}_3$ ). Aqua-regia gives nascent chlorine which attacks these metals. <b>Gold:</b> $[\text{HNO}_3 + 3\text{HCl} \rightarrow \text{NOCl} + 2\text{H}_2\text{O} + 2\text{Cl}] \quad 3$ Nitrosyl chloride $[\text{Au} + 3\text{Cl} \rightarrow \text{AuCl}_3] \quad 2$ $[\text{AuCl}_3 + \text{HCl} \rightarrow \text{HAuCl}_4] \quad 2$ <hr/> $2\text{Au} + 3\text{HNO}_3 + 11\text{HCl} \rightarrow 2\text{HAuCl}_4 + 3\text{NOCl} + 6\text{H}_2\text{O}$ Chloroauric acid			
4.	$\text{HNO}_3$ , a strong oxidant, will oxidise $\text{H}_2\text{S}$ to give colloidal sulphur. Thus precipitation of second group sulphide will not occur. $\text{H}_2\text{S} \xrightarrow[\text{HNO}_3]{[\text{O}]} \text{H}_2\text{O} + \text{S}$			
5.	$\text{KMnO}_4$ forms explosive covalent compound, $\text{Mn}_2\text{O}_7$ with conc. $\text{H}_2\text{SO}_4$ . $2\text{KMnO}_4 + \text{H}_2\text{SO}_4 \text{ conc.} \longrightarrow \text{K}_2\text{SO}_4 + \text{Mn}_2\text{O}_7 + \text{H}_2\text{O}$ However, it can be dissolved in dil. $\text{H}_2\text{SO}_4$ to give nascent oxygen if it is to be used as oxidant.			
6.	Yellow colloidal sulphur is formed. $2\text{HNO}_3 + \text{H}_2\text{S} \longrightarrow 2\text{NO}_2 + 2\text{H}_2\text{O} + \text{S}$			
7.	(1) (Moist) $\text{SO}_2 + 2\text{H}_2\text{S} \longrightarrow 3\text{S} + 2\text{H}_2\text{O}$ (2) $2\text{FeCl}_3 + \text{H}_2\text{S} \longrightarrow 2\text{FeCl}_2 + 2\text{HCl} + \text{S}$ (3) $4\text{S} + 6\text{NaOH} \longrightarrow \text{Na}_2\text{S}_2\text{O}_3 + 2\text{Na}_2\text{S} + 3\text{H}_2\text{O} \xrightarrow{\text{excess sulphur}} \text{Na}_2\text{S}_5$			

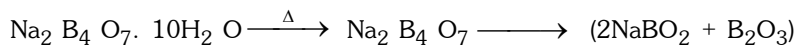


9.  $\text{Na}_2 \text{B}_4 \text{O}_7 \cdot 10\text{H}_2 \text{O}$

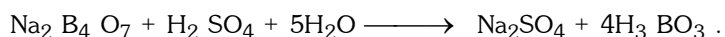


Weak

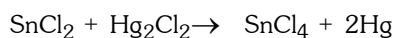
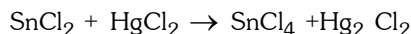
Due to presence of NaOH. the aqueous solution is alkaline to litmus.



Glassy Bead



10.  $\text{SnCl}_2$  is strong reducing agent and reduces  $\text{HgCl}_2$  to  $\text{Hg}_2\text{Cl}_2$ (white) which is further reduced to Hg (grey).

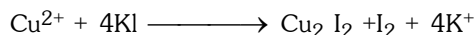


11. A =  $\text{PbO}$  or  $\text{PbSO}_4$

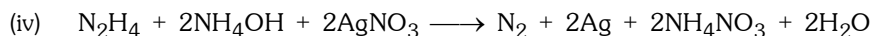
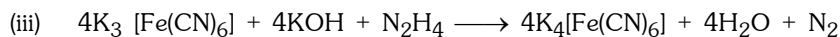
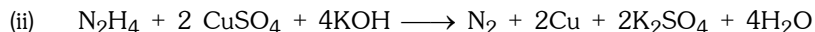
B = high temperature

12. It should be cooled to lower the pressure of  $\text{NH}_3$  inside the bottle, otherwise  $\text{NH}_3$  will bump out of the bottle.

13. The  $\text{I}^-$  ion acts as strong reducing agent where as  $\text{Cl}^-$  acts as reductant only in presence of strong oxidant and therefore KI reduces  $\text{Cu}^{2+}$  to  $\text{Cu}^+$



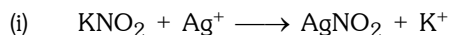
14. (i)  $\text{N}_2\text{H}_4 + 2\text{I}_2 \longrightarrow \text{N}_2 + 4\text{HI}$



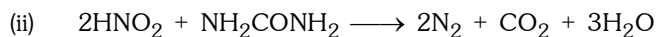
15. (A) =  $\text{HNO}_2$ (Nitrous acid) ; (B) =  $\text{AgNO}_2$  (Silver nitrite)

(C) =  $\text{N}_2$  ; (D) =  $\text{CO}_2$  ;

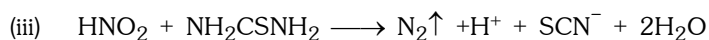
(E) =  $\text{Fe}(\text{SCN})_3$  (Ferric thiocyanate)



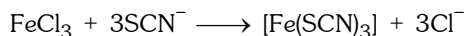
(B) Silver nitrite



(A) (Urea) (C) (D)



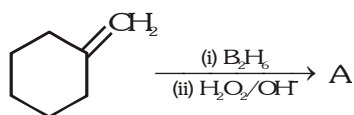
(A) Thiourea



(E) Ferric thiocyanate

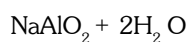
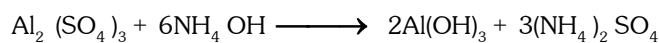
**EXERCISE-04 [B]****BRAIN STORMING SUBJECTIVE EXERCISE**

1. A white crystalline comp. 'A' Swell up on heating and gives violet coloured flame on bunsen flame Its, aq. solution gives the following reaction.
- (i) A white ppt. with  $\text{BaCl}_2$  in presence of  $\text{HCl}$ .
- (ii) When treated with excess of  $\text{NH}_4\text{OH}$  it gives white gelatinous ppt., which dissolve in  $\text{NaOH}$ .
2. A binary salt (A) on reaction with  $\text{H}_2\text{O}$  gives (B) aq. and (C) hydrocarbon. (C) gas on passing into ammonical  $\text{AgNO}_3$  gives white ppt. (D).  $\text{CO}_2$  gas turns (B) aq. milky. Identify (A), (B), (C) and (D).
3.  $\text{FeCl}_3$  solution gives blood red colour with  $\text{NH}_4\text{SCN}$ . If  $\text{H}_2\text{S}$  gas is passed and filtered then filtrate does not give red colour with  $\text{NH}_4\text{SCN}$  Explain.
4. How will you obtain the following from sulphuric acid.
- (a)  $\text{SO}_2$                                       (b)  $\text{SO}_3$                                       (c)  $\text{SO}_2\text{Cl}_2$
5. Complete the following reactions:



6. An inorganic compound (A) of S, Cl and oxygen has vapour density 67.5. It reacts with water to form two acids (B) and (C). (A) also reacts with  $\text{KOH}_{(\text{aq})}$  to forms two salts (D) and (E). (D) and (E) gives white precipitate with  $\text{AgNO}_3$  and  $\text{BaCl}_2$  solutions respectively. What are (A) to (E)?
7. A certain compound (X) gives brick red flame on performing the flametest and shows the following reactions.
- (i) When  $\text{KI}$  is added to an aqueous suspension of (X) containing acetic acid, iodine is liberated.
- (ii) When  $\text{CO}_2$  is passed through an aqueous suspension of (X) the turbidity transforms to a ppt.
- (iii) When a paste of (X) in water is heated with ethyl alcohol, a product of anaesthetic use is obtained. Identify (X) and write down chemical equations for reactions at step (i), (ii) and (iii).
-

1. A :  $K_2SO_4$   $Al_2(SO_4)_3$  24  $H_2O$



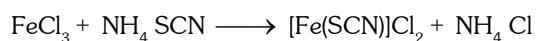
2. (A) :  $CaC_2$  ( $Ca^{2+}$ ,  $C_2^{2-}$  binary)

(B) :  $Ca(OH)_2$

(C) :  $C_2H_2$

(D) :  $C_2Ag_2$

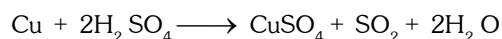
3.  $FeCl_3$  on reacting with  $NH_4SCN$  gives complex ion  $[Fe(SCN)]^{2+}$  which is of red colour.



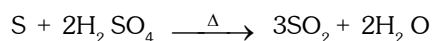
blood red colour

$FeCl_3$  while reacting with  $H_2S$ , gives  $FeCl_2$  which is not reacting with  $NH_4SCN$ . So no colour is obtained.

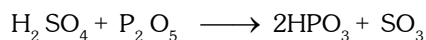
4. (a)  $SO_2$  is obtained by heating copper with conc.  $H_2SO_4$



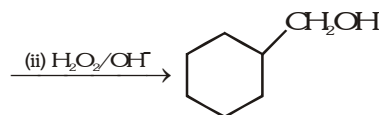
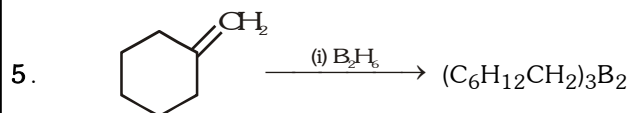
It can also be obtained by boiling sulphur with conc.  $H_2SO_4$ .



(b) When treated with  $P_2O_5$   $H_2SO_4$  loses water and forms  $SO_3$



(c)  $SO_2Cl_2$  is formed when conc.  $H_2SO_4$  is treated with excess of  $PCl_5$ .

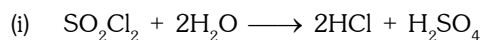


6. Vapour density of S, Cl and oxygen compound = 67.5

$\therefore$  Molecular weight of compound = 135

the molecular, weight suggest it may be  $SO_2Cl_2$

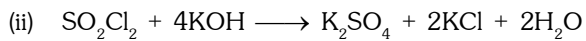
The give reaction are



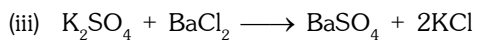
(A)

(B)

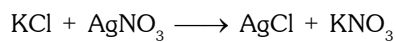
(C)



(D) (E)

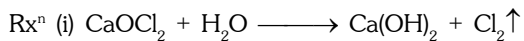


(D) Insoluble

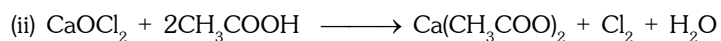


(E) Insoluble

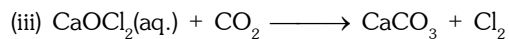
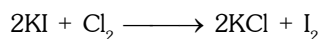
7. (X) gives brick red flame so, it contains  $\text{Ca}^{2+}$ . Reactions (i), (ii) and (iii) suggest that the probable compound is bleaching powder ( $\text{CaOCl}_2$ ).



smell

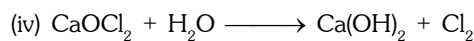


(X)

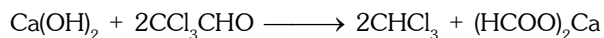
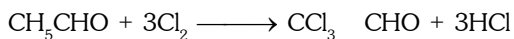
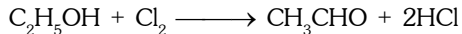


Turbid

white ppt



(X)



(Anaesthetic)

**EXERCISE-05 [A]****PREVIOUS YEARS QUESTIONS**

1. Aluminium is industrially prepared by: [AIEEE-2002]  
(1) Fused cryolite                      (2) Bauxite ore                      (3) Alunite                      (4) Borax
2. In case of nitrogen  $\text{NCl}_3$  is possible but not  $\text{NCl}_5$  while in case of phosphorous,  $\text{PCl}_3$  as well as  $\text{PCl}_5$  are possible. This is due to :- [AIEEE-2002]  
(1) Availability of vacant d-orbitals in P but not in N  
(2) Lower electronegativity of P than N  
(3) Lower tendency of H-bond formation in P than N  
(4) Occurrence of P in solid while N in gaseous state at room temperature
3. Which products are expected from the disproportionation of hypochlorous acid : [AIEEE-2002]  
(1)  $\text{HClO}_3$  and  $\text{Cl}_2\text{O}$                       (2)  $\text{HClO}_2$  and  $\text{HClO}$   
(3)  $\text{HCl}$  and  $\text{Cl}_2\text{O}$                       (4)  $\text{HCl}$  and  $\text{HClO}_3$
4. Identify the incorrect statement among the following [AIEEE-2002]  
(1) Ozone reacts with  $\text{SO}_2$  to give  $\text{SO}_3$   
(2) Silicon reacts with  $\text{NaOH(aq.)}$  in the presence of air to give  $\text{Na}_2\text{SiO}_3$  and  $\text{H}_2\text{O}$   
(3)  $\text{Cl}_2$  reacts with excess of  $\text{NH}_3$  to give  $\text{N}_2$  and  $\text{HCl}$   
(4)  $\text{Br}_2$  reacts with hot and strong  $\text{NaOH}$  solution to give  $\text{NaBr}$ ,  $\text{NaBrO}_4$  and  $\text{H}_2\text{O}$
5. In  $\text{XeF}_2$ ,  $\text{XeF}_4$ ,  $\text{XeF}_6$  the number of lone pairs on Xe is respectively : [AIEEE-2002]  
(1) 2,3,1                      (2) 1,2,3                      (3) 4, 1, 2                      (4) 3,2,1
6. What may be expected when phosphine gas is mixed with chlorine gas: [AIEEE-2003]  
(1)  $\text{PCl}_5$  and  $\text{HCl}$  are formed and mixture cools down  
(2)  $\text{PH}_3 \cdot \text{Cl}_2$  is formed with warming up  
(3) The mixture only cools down  
(4)  $\text{PCl}_3$  and  $\text{HCl}$  are formed and the mixture warms up
7. For making good quality mirrors, plates of float glass are used. These are obtained by floating molten glass over a liquid metal which does not solidify before glass. The metal used can be : [AIEEE-2003]  
(1) Sodium                      (2) Magnesium                      (3) Mercury                      (4) Tin
8. Graphite is a soft solid lubricant extremely difficult to melt. The reason for this anomalous behaviour is that graphite : [AIEEE-2003]  
(1) Has molecules of variable molecular masses like polymers  
(2) Has carbon atoms arranged in large plates of rings of strongly bonded carbon atoms with weak interplate bonds  
(3) Is a non crystalline substance  
(4) Is an allotropic form of diamond
9. Concentrated hydrochloric acid when kept in open air sometimes produces a cloud of white fumes. This is due to : [AIEEE-2003]  
(1) Strong affinity of  $\text{HCl}$  gas for moisture in air results in forming of droplets of liquid solution which appears like a cloudy smoke  
(2) Due to strong affinity for water, conc.  $\text{HCl}$  pulls moisture of air towards self. The moisture forms droplets of water and hence the cloud  
(3) Conc.  $\text{HCl}$  emits strongly smelling  $\text{HCl}$  gas all the time  
(4) Oxygen in air reacts with emitted  $\text{HCl}$  gas to form a cloud of  $\text{Cl}_2$  gas
10. Aluminium chloride exists as dimer,  $\text{Al}_2\text{Cl}_6$  in solid state as well as in solution of non-polar solvents such as benzene. When dissolved in water, it gives- [AIEEE-2004]  
(1)  $\text{Al}^{3+} + 3\text{Cl}^-$                       (2)  $[\text{Al}(\text{H}_2\text{O})_6]^{3+} + 3\text{Cl}^-$   
(3)  $[\text{Al}(\text{OH})_6]^{3-} + 3\text{HCl}$                       (4)  $\text{Al}_2\text{O}_3 + 6\text{HCl}$

11. The soldiers of Napoleon army while at Alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White Metallic tin buttons get converted to grey powder. This transformation is related to:- [AIEEE-2004]
- (1) An interaction with water vapour contained in humid air
  - (2) A change in crystalline structure of tin
  - (3) A change in the partial pressure of  $O_2$  in air
  - (4) An interaction with  $N_2$  of air at low temperature
12. Which one of the following statements regarding helium is incorrect [AIEEE-2004]
- (1) It is used to produce and sustain powerful superconducting magnets
  - (2) It is used as a cryogenic agent for carrying out experiments at low temperatures
  - (3) It is used to fill gas balloons instead of hydrogen because it is lighter than hydrogen and non-inflammable
  - (4) It is used in gas-cooled nuclear reactors
13. The structure of diborane contains [AIEEE- 2005]
- (1) Four 2c-2e bonds and four 3c-2e bonds
  - (2) Two 2c-2e bonds and two 3c-2e bonds
  - (3) Two 2c-2e bonds and four 3c-2e bonds
  - (4) Four 2c-2e bonds and two 3c-2e bonds
14. Heating an aqueous solution of aluminium chloride to dryness will give :- [AIEEE-2005]
- (1)  $AlCl_3$
  - (2)  $Al_2Cl_6$
  - (3)  $Al_2O_3$
  - (4)  $Al(OH)Cl_2$
15. Which one of the following is the correct statement [AIEEE-2005]
- (1) Boric acid is a protonic acid
  - (2) Beryllium exhibits coordination number of six
  - (3) Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase
  - (4)  $B_2H_6$ ,  $2NH_3$  is known as "inorganic benzene"
16. In silicon dioxide : [AIEEE-2005]
- (1) Each silicon atom is surrounded by four oxygen atoms and each oxygen atom is bonded to two silicon atoms
  - (2) Each silicon atom is surrounded by two oxygen atoms and each oxygen atom is bonded to two silicon atoms
  - (3) Silicon atom is bonded to two oxygen atoms
  - (4) There are double bonds between silicon and oxygen atoms
17. The number of hydrogen atoms attached to phosphorus atom in hypophosphorous acid is : [AIEEE-2005]
- (1) Zero
  - (2) Two
  - (3) One
  - (4) Three
18. The correct order of the thermal stability of hydrogen halide (H-X) is : [AIEEE-2005]
- (1)  $HI > HBr > HCl > HF$
  - (2)  $HF > HCl > HBr > HI$
  - (3)  $HCl < HF > HBr < HI$
  - (4)  $HI > HCl < HF > HBr$
19. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence: [AIEEE-2007]
- (1)  $GeX_2 \ll SiX_2 \ll SnX_2 \ll PbX_2$
  - (2)  $SiX_2 \ll GeX_2 \ll PbX_2 \ll SnX_2$
  - (3)  $SiX_2 \ll GeX_2 \ll SnX_2 \ll PbX_2$
  - (4)  $PbX_2 \ll SnX_2 \ll GeX_2 \ll SiX_2$

20. Regular use of which of the following fertilizer increases the acidity of soil : [AIEEE-2007]  
 (1) Potassium nitrate  
 (2) Urea  
 (3) Superphosphate of lime  
 (4) Ammonium sulphate
21. Four species are listed below : [AIEEE-2008]  
 (i)  $\text{HCO}_3^-$  (ii)  $\text{H}_3\text{O}^+$  (iii)  $\text{HSO}_4^-$  (iv)  $\text{HSO}_3\text{F}$   
 Which one of the following is the correct sequence of their acid strength?  
 (1)  $\text{iv} < \text{ii} < \text{iii} < \text{i}$  (2)  $\text{ii} < \text{iii} < \text{i} < \text{iv}$   
 (3)  $\text{i} < \text{iii} < \text{ii} < \text{iv}$  (4)  $\text{iii} < \text{i} < \text{iv} < \text{ii}$
22. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is [AIEEE-2008]  
 (1)  $\text{R}_4\text{Si}$  (2)  $\text{RSiCl}_3$  (3)  $\text{R}_2\text{SiCl}_2$  (4)  $\text{R}_3\text{SiCl}$
23. Which one of the following reactions of Xenon compounds is not feasible ? [AIEEE-2009]  
 (1)  $2\text{XeF}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{Xe} + 4\text{HF} + \text{O}_2$   
 (2)  $\text{XeF}_6 + \text{RbF} \rightarrow \text{Rb}[\text{XeF}_7]$   
 (3)  $\text{XeO}_3 + 6\text{HF} \rightarrow \text{XeF}_6 + 3\text{H}_2\text{O}$   
 (4)  $3\text{XeF}_4 + 6\text{H}_2\text{O} \rightarrow 2\text{Xe} + \text{XeO}_3 + 12\text{HF} + 1.5\text{O}_2$
24. Boron cannot form which one of the following anions ? [AIEEE-2011]  
 (1)  $\text{B}(\text{OH})_4^-$  (2)  $\text{BO}_2^-$  (3)  $\text{BF}_6^{3-}$  (4)  $\text{BH}_4^-$
25. In view of the signs of  $\Delta_r G$  for the following reactions  
 $\text{PbO}_2 + \text{Pb} \rightarrow 2 \text{PbO}, \Delta_r G < 0$   
 $\text{SnO}_2 + \text{Sn} \rightarrow 2 \text{SnO}, \Delta_r G > 0,$   
 Which oxidation states are more characteristic for lead and tin ? [AIEEE-2011]  
 (1) For lead + 4, for tin + 2  
 (2) For lead + 2, for tin + 2  
 (3) For lead + 4, for tin + 4  
 (4) For lead + 2, for tin + 4
26. Which of the following statement is wrong ? [AIEEE-2011]  
 (1) Single N-N bond is weaker than the single P-P bond  
 (2)  $\text{N}_2\text{O}_4$  has two resonance structures  
 (3) The stability of hydrides increases from  $\text{NH}_3$  to  $\text{BiH}_3$  in group 15 of the periodic table  
 (4) Nitrogen cannot form  $d\pi\text{-}p\pi$  bond
27. Which of the following statements regarding sulphur is incorrect ? [AIEEE-2011]  
 (1) At 600 C the gas mainly consists of  $\text{S}_2$  molecules  
 (2) The oxidation state of sulphur is never less than +4 in its compounds  
 (3)  $\text{S}_2$  molecule is paramagnetic  
 (4) The vapour at 200 C consists mostly of  $\text{S}_8$  rings

PREVIOUS YEARS QUESTIONS						ANSWER KEY					EXERCISE -5[A]				
Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans	2	1	4	4	4	1	3	2	3	2	2	3	4	3	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27			
Ans	1	2	2	3	4	3	2	3	3	4	3	2			

**EXERCISE-05 [B]****PREVIOUS YEARS QUESTIONS**

1. The number of P—O—P bonds in cyclic metaphosphoric acid is – [IIT-2000]  
(A) Zero (B) Two (C) Three (D) Four
2. The correct order of acidic strength is – [IIT- 2000]  
(A)  $\text{Cl}_2\text{O}_7 > \text{SO}_2 < \text{P}_4\text{O}_{10}$  (B)  $\text{CO}_2 > \text{N}_2\text{O}_5 > \text{SO}_3$   
(C)  $\text{Na}_2\text{O} > \text{MgO} > \text{Al}_2\text{O}_3$  (D)  $\text{K}_2\text{O} > \text{CaO} > \text{MgO}$
3. Amongst  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{S}$ ,  $\text{H}_2\text{Se}$  and  $\text{H}_2\text{Te}$ , the one with the highest boiling point is – [IIT- 2000]  
(A)  $\text{H}_2\text{O}$  because of hydrogen bonding (B)  $\text{H}_2\text{Te}$  because of higher molecular weight  
(C)  $\text{H}_2\text{S}$  because of hydrogen bonding (D)  $\text{H}_2\text{Se}$  because of lower molecular weight.
4. Ammonia can be dried by – [IIT- 2000]  
(A) Conc.  $\text{H}_2\text{SO}_4$  (B)  $\text{P}_4\text{O}_{10}$  (C)  $\text{CaO}$  (D) Anhydrous  $\text{CaCl}_2$
5. Which of the following are hydrolysed – [REE 2000]  
(A)  $\text{NCl}_3$  (B)  $\text{BCl}_3$  (C)  $\text{CCl}_4$  (D)  $\text{SiCl}_4$
6. The set with correct order of acidity is – [IIT- 2001]  
(A)  $\text{HClO} < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}_4$  (B)  $\text{HClO}_4 < \text{HClO}_3 < \text{HClO}_2 < \text{HClO}$   
(C)  $\text{HClO} < \text{HClO}_4 < \text{HClO}_3 < \text{HClO}_2$  (D)  $\text{HClO}_4 < \text{HClO}_2 < \text{HClO}_3 < \text{HClO}$
7. The reaction,  $3\text{ClO}^- (\text{aq}) \longrightarrow \text{ClO}_3^- (\text{aq}) + 2\text{Cl}^- (\text{aq})$  is an example of – [IIT- 2001]  
(A) Oxidation reaction (B) reduction reaction  
(C) Disproportionation reaction (D) Decomposition reaction
8. The number of S—S bonds in sulphur trioxide trimer,  $(\text{S}_3\text{O}_9)$  is – [IIT- 2001]  
(A) Three (B) Two (C) One (D) Zero
9. **Statement-I** : Between  $\text{SiCl}_4$  and  $\text{CCl}_4$ , only  $\text{SiCl}_4$  reacts with water [IIT- 2001]  
**Because** :  
**Statement-II** :  $\text{SiCl}_4$  is ionic and  $\text{CCl}_4$  is covalent  
(A) If both assertion and reason are correct and reason is the correct explanation of the assertion  
(B) If both assertion and reason are correct, but reason is not the correct explanation of the assertion  
(C) If assertion is correct, but reason is incorrect  
(D) If assertion is incorrect, but reason is correct.
10. Specify the coordination geometry around and hybridisation of N and B atoms in a 1 : 1 complex of  $\text{BF}_3$  and  $\text{NH}_3$  – [IIT 2001]  
(A) N: tetrahedral  $\text{sp}^3$  ; B : tetrahedral  $\text{sp}^3$   
(B) N: pyramidal  $\text{sp}^3$  ; B : pyramidal  $\text{sp}^3$   
(C) N: pyramidal  $\text{sp}^3$  ; B : planar  $\text{sp}^2$   
(D) N: pyramidal  $\text{sp}^3$  ; B : tetrahedral  $\text{sp}^3 \text{ d}$
11. Polyphosphates are used as water softening agents because they – [IIT- 2002]  
(A) Form soluble complexes with anionic species  
(B) Precipitate anionic species  
(C) Form soluble complexes with cationic species  
(D) Precipitate cationic species



12. Identify, the correct order of acidic strength of  $\text{CO}_2$ ,  $\text{CuO}$ ,  $\text{CaO}$ ,  $\text{H}_2\text{O}$  – [IIT- 2002]  
 (A)  $\text{CaO} < \text{CuO} < \text{H}_2\text{O} < \text{CO}_2$  (B)  $\text{H}_2\text{O} < \text{CuO} < \text{CaO} < \text{CO}_2$   
 (C)  $\text{CaO} < \text{H}_2\text{O} < \text{CuO} < \text{CO}_2$  (D)  $\text{H}_2\text{O} < \text{CO}_2 < \text{CaO} < \text{CuO}$
13. Identify the correct order of solubility of  $\text{Na}_2\text{S}$ ,  $\text{CuS}$ , and  $\text{ZnS}$  in aqueous medium – [IIT- 2002]  
 (A)  $\text{CuS} > \text{ZnS} > \text{Na}_2\text{S}$  (B)  $\text{ZnS} > \text{Na}_2\text{S} > \text{CuS}$   
 (C)  $\text{Na}_2\text{S} > \text{CuS} > \text{ZnS}$  (D)  $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$
14.  $\text{H}_3\text{BO}_3$  is – [IIT- 2002]  
 (A) Monobasic acid and weak Lewis acid (B) Monobasic and weak Bronsted acid  
 (C) Monobasic and strong Lewis acid (D) Tribasic and weak Bronsted acid
15.  $(\text{Me})_2\text{SiCl}_2$  on hydrolysis will produce – [IIT- 2003]  
 (A)  $(\text{Me})_2\text{Si}(\text{OH})_2$  (B)  $(\text{Me})_2\text{Si} = \text{O}$   
 (C)  $[-\text{O}-(\text{Me})_2\text{Si}-\text{O}-]_n$  (D)  $\text{Me}_2\text{SiCl}(\text{OH})$
16. When  $\text{I}^-$  is oxidised by  $\text{MnO}_4^-$  in alkaline medium,  $\text{I}^-$  converts into – [IIT- 2003]  
 (A)  $\text{IO}_3^-$  (B)  $\text{I}_2$  (C)  $\text{IO}_4^-$  (D)  $\text{IO}^-$
17. Which is the most thermodynamically stable allotropic form of phosphorus? [IIT- 2004]  
 (A) Red (B) White (C) Black (D) Yellow
18. Which of the following is not oxidised by  $\text{O}_3$ ? [IIT- 2005]  
 (A)  $\text{KI}$  (B)  $\text{FeSO}_4$  (C)  $\text{KMnO}_4$  (D)  $\text{K}_2\text{MnO}_4$
19. Which blue-liquid is obtained on reacting equimolar amounts of two gases at  $-30^\circ\text{C}$ ? [IIT- 2005]  
 (A)  $\text{N}_2\text{O}$  (B)  $\text{N}_2\text{O}_3$  (C)  $\text{N}_2\text{O}_4$  (D)  $\text{N}_2\text{O}_5$
20. Name of the structure of silicates in which three oxygen atoms of  $[\text{SiO}_4]^{4-}$  are shared is – [IIT- 2005]  
 (A) Pyrosilicate (B) Sheet silicate  
 (C) Linear chain silicate (D) Three dimensional silicate
21.  $\text{B}(\text{OH})_3 + \text{NaOH} \rightleftharpoons \text{NaBO}_2 + \text{Na}[\text{B}(\text{OH})_4] + \text{H}_2\text{O}$  how can this reaction is made to proceed in forward direction? [IIT- 2006]  
 (A) Addition of cis 1, 2 diol (B) Addition of borax  
 (C) Addition of trans 1, 2 diol (D) Addition of  $\text{Na}_2\text{HPO}_4$
22. The percentage of p-character in the orbitals forming P-P bonds in  $\text{P}_4$  is – [IIT- 2007]  
 (A) 25 (B) 33 (C) 50 (D) 75
23. Among the following, the paramagnetic compound is – [IIT- 2007]  
 (A)  $\text{Na}_2\text{O}_2$  (B)  $\text{O}_3$  (C)  $\text{N}_2\text{O}$  (D)  $\text{KO}_2$
24. Draw the structure of a cyclic silicate,  $(\text{Si}_3\text{O}_9)^{6-}$  with proper labelling – [IIT-1998, 4 M]
25. Complete and balance the following chemical equations – [IIT-1998, 2 M]  
 (i)  $\text{P}_4\text{O}_{10} + \text{PCl}_5 \longrightarrow$  (ii)  $\text{SnCl}_4 + \text{C}_2\text{H}_5\text{Cl} + \text{Na} \longrightarrow$
26. Work out the following using chemical equations [IIT- 1998, 2M]  
 "Chlorination of calcium hydroxide produces bleaching powder"

27. Hydrogen peroxide acts both as an oxidizing and as a reducing agent in alkaline solution towards certain first row transition metal ion. Illustrate both these properties of  $\text{H}_2\text{O}_2$  using chemical equations – [IIT- 1998, 4 M]
28. Give reasons for the following in one or two sentences only. [IIT- 1999]  
 $\text{BeCl}_2$  can be easily hydrolysed."
29. In the contact process for industrial manufacture of sulphuric acid, some amount of sulphuric acid is used as a starting material. Explain briefly. What is the catalyst used in the oxidation of  $\text{SO}_2$ ? [IIT- 1998, 4 M]
30. Give an example of oxidation of one halide by another halogen. Explain the feasibility of the reaction. [IIT- 2000]
31. Write the balanced chemical equation for developing photographic films. [IIT- 2001]
32. Draw the molecular structures of  $\text{XeF}_2$ ,  $\text{XeF}_4$  and  $\text{XeO}_2\text{F}_2$ , indicating the location of lone pair (s) of electrons. [IIT- 2000]
33. Give reason [IIT- 2000]  
 Why elemental nitrogen exists as a diatomic molecule whereas elemental phosphorus is a tetra atomic molecule.
34. Compounds X on reduction with  $\text{LiAlH}_4$  gives a hydride Y containing 21.72% hydrogen alongwith other products. The compound Y reacts with air explosively resulting in boron trioxide. Identify X and Y. Give balanced reactions involved in the formation of Y and its reaction with air Draw the structure of Y. [IIT- 2001]
35. Starting from  $\text{SiCl}_4$ , prepare the following in steps not exceeding the number given in parenthesis (reactions only) [IIT- 2001]  
 (i) Silicon (1) (ii) Linear silicon containing methyl group only (4) (iii)  $\text{Na}_2\text{SiO}_3$  (3)
36. Identify (X) in the following synthetic scheme and write their structures. [IIT- 2001]  
 $\text{Ba}^*\text{CO}_3 + \text{H}_2\text{SO}_4 \longrightarrow \text{X (gas)}$  ( $\text{C}^*$  denotes  $\text{C}^{14}$ )
37. Write the balanced equations for the reactions of the following compounds with water: [IIT- 2002]  
 (i)  $\text{Al}_4\text{C}_3$  (ii)  $\text{CaNCN}$  (iii)  $\text{BF}_3$  (iv)  $\text{NCl}_3$  (v)  $\text{XeF}_4$
38. Identify the following:  

$$\text{Na}_2\text{CO}_3 \xrightarrow[\text{(aq)}]{\text{SO}_2} \text{A} \xrightarrow{\text{Na}_2\text{CO}_3} \text{B} \xrightarrow[\Delta]{\text{elemental S}} \text{C} \xrightarrow{\text{I}_2} \text{D}$$
 [IIT- 2003]  
 Also mention the oxidation state of S in all the compounds.
39. Arrange the following oxides in the increasing order of Bronsted basicity. [IIT- 2004]  
 $\text{Cl}_2\text{O}_7$ ,  $\text{BaO}$ ,  $\text{SO}_3$ ,  $\text{CO}_2$ ,  $\text{B}_2\text{O}_3$

**MATCH THE COLUMN**

[IIT- 2003]

40.	Column-I	Column-II
	(A) $\text{Bi}^{3+} \longrightarrow (\text{BiO})^+$	(p) Heat
	(B) $[\text{AlO}_2]^- \longrightarrow \text{Al}(\text{OH})_3$	(q) Hydrolysis
	(C) $\text{SiO}_4^{4-} \longrightarrow \text{Si}_2\text{O}_7^{6-}$	(r) Acidification
	(D) $(\text{B}_4\text{O}_7^{2-}) \longrightarrow [\text{Bi}(\text{OH})_3]$	(s) Dilution by water

41. **Statement-I** : In water, orthoboric acid behaves as a weak monobasic acid. [IIT- 2007]

**Because :**

**Statement-II** : In water, orthoboric acid acts as a proton donor.

- (A) Statement-I is True, Statement-II is True; Statement-II is a correct explanation for Statement-I  
(B) Statement-I is true, Statement-II is True ; Statement-II is not a correct explanation for Statement-I  
(C) Statement-I is True, Statement-II is false  
(D) Statement-I is False, Statement-II is True.

**Comprehension # 1 (Q-42, 43, 44)**

The noble gases have closed-shell electronic configuration and are monoatomic gases under normal conditions. The low boiling point of the lighter noble gases are due to weak dispersion forces between the atoms and the absence of other interatomic interactions. The direct reaction of xenon with fluorine leads to a series of compounds with oxidation number + 2, + 4 and + 6.  $\text{XeF}_4$  reacts violently with water to give  $\text{XeO}_3$ . The compounds of xenon exhibit rich stereochemistry and their geometries can be deduced considering the total number of electron pairs in the valence shell. [IIT- 2007]

42. Argon is used in arc welding because of its –

- (A) Low reactivity with metal (B) Ability to lower the melting point of metal  
(C) Flammability (D) High calorific value

43. The structure of  $\text{XeO}_3$  is –

- (A) Linear (B) Planar (C) Pyramidal (D) T-shaped

44.  $\text{XeF}_4$  and  $\text{XeF}_6$  are expected to be –

- (A) Oxidising (B) Reducing (C) Unreactive (D) Strongly basic

**Comprehension # 2 (Q-45, 46, 47)**

There are some deposits of nitrates and phosphates in earth's crust. Nitrates are more soluble in water. Nitrates are difficult to reduce under the laboratory conditions but microbes do it easily. Ammonia forms large number of complexes with transition metal ions. Hybridization easily explains the ease of sigma donation capability of  $\text{NH}_3$  and  $\text{PH}_3$ . Phosphine is a flammable gas and is prepared from white phosphorous. [IIT- 2008]

45. Among the following, the correct statement is :-

- (A) Phosphates have no biological significance in humans  
(B) Between nitrates and phosphates, phosphates are less abundant in earth's crust  
(C) Between nitrates and phosphates, nitrates are less abundant in earth's crust  
(D) Oxidation of nitrates is possible in soil

46. Among the following, the correct statement is :-

- (A) Between  $\text{NH}_3$  and  $\text{PH}_3$ ,  $\text{NH}_3$  is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional  
(B) Between  $\text{NH}_3$  and  $\text{PH}_3$ ,  $\text{PH}_3$  is a better electron donor because the lone pair of electrons occupies  $\text{sp}^3$  orbital and is more directional  
(C) Between  $\text{NH}_3$  and  $\text{PH}_3$ ,  $\text{NH}_3$  is a better electron donor because the lone pair of electrons occupies  $\text{sp}^3$  orbital and is more directional  
(D) Between  $\text{NH}_3$  and  $\text{PH}_3$ ,  $\text{PH}_3$  is a better electron donor because the lone pair of electrons occupies spherical 's' orbital and is less directional.

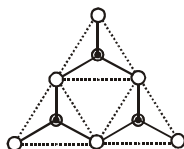
47. White phosphorus on reaction with NaOH gives  $\text{PH}_3$  as one of the products. This is a :-  
 (A) dimerization reaction (B) disproportionation reaction  
 (C) condensation reaction (D) precipitation reaction
48. The reaction of  $\text{P}_4$  with X leads selectively to  $\text{P}_4\text{O}_6$ . The X is [JEE 2009]  
 (A) Dry  $\text{O}_2$  (B) A mixture of  $\text{O}_2$ , and  $\text{N}_2$   
 (C) Moist  $\text{O}_2$  (D)  $\text{O}_2$  in the presence of aqueous NaOH
49. The nitrogen oxide(s) that contain(s) N-N bond(s) is (are) [JEE 2009]  
 (A)  $\text{N}_2\text{O}$  (B)  $\text{N}_2\text{O}_3$  (C)  $\text{N}_2\text{O}_4$  (D)  $\text{N}_2\text{O}_5$
50. In the reaction [JEE 2009]  

$$2\text{X} + \text{B}_2\text{H}_6 \longrightarrow [\text{BH}_2(\text{X})_2]^+[\text{BH}_4]^-$$
 the amine(s) X is (are)  
 (A)  $\text{NH}_3$  (B)  $\text{CH}_3\text{NH}_2$  (C)  $(\text{CH}_3)_2\text{NH}$  (D)  $(\text{CH}_3)_3\text{N}$
51. 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 [JEE 2012]  
 (A) redox reaction ; -3 and -5  
 (B) redox reaction ; +3 and +5  
 (C) disproportionation reaction ; -3 and +1  
 (D) disproportionation reaction ; -3 and +3
52. Bleaching powder contains a salt of an oxoacid as one of its components. The anhydride of that oxoacid is : [JEE 2012]  
 (A)  $\text{Cl}_2\text{O}$  (B)  $\text{Cl}_2\text{O}_7$  (C)  $\text{ClO}_2$  (D)  $\text{Cl}_2\text{O}_6$
53. With respect to graphite and diamond, which of the statement(s) given below is (are) correct ? [JEE 2012]  
 (A) Graphite is harder than diamond.  
 (B) Graphite has higher electrical conductivity than diamond.  
 (C) Graphite has higher thermal conductivity than diamond.  
 (D) Graphite has higher C-C bond order than diamond.

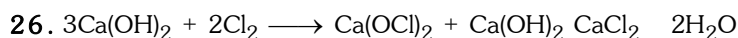
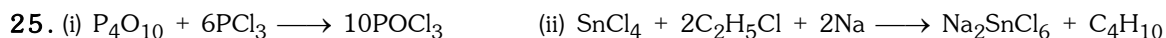
- 1. C      2. A      3. A      4. C      5. B,D      6. A      7. C  
 8. D      9. C      10. A      11. C      12. A      13. D      14. A  
 15. C      16. A      17. C      18. C      19. B      20. B      21. A  
 22. D      23. D

24. In cyclic  $(\text{Si}_3\text{O}_9)^{6-}$ , three tetrahedral of  $\text{SiO}_4$  are joined together by sharing of two oxygen atoms per tetrahedral.

Structure of  $(\text{Si}_3\text{O}_9)^{6-}$

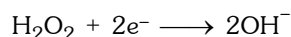


In it dark circles ( ) represent Si and open circles (O) represent oxygen atom or iron.

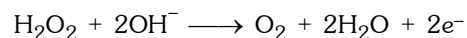


Bleaching powder is a mixture of  $\text{CaOCl}_2$   
and hydrated basic calcium chloride.

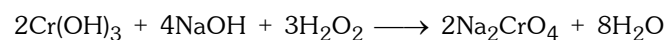
27. When  $\text{H}_2\text{O}_2$  acts as oxidizing agent, therefore, following reaction takes place:



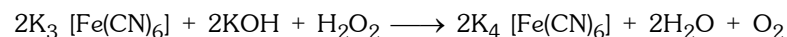
while, regarding its action on reducing agent, the following reaction takes place :



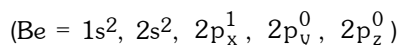
Oxidizing character :



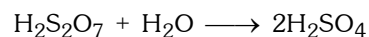
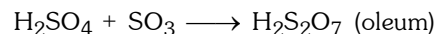
Reducing character:



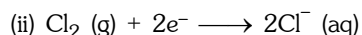
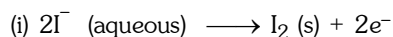
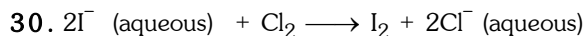
28.  $\text{BeCl}_2$  is hydrolysed due to high polarising power and presence of vacant p-orbitals in Be atom.



29. In  $\text{SO}_3 + \text{H}_2\text{O} \longrightarrow \text{H}_2\text{SO}_4$  reaction,  $\text{H}_2\text{SO}_4$  is obtained in misty form and reaction is explosive (highly exothermic). By adding  $\text{H}_2\text{SO}_4$  the above reaction is prevented.

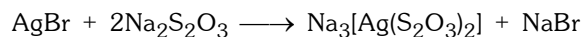


The catalyst used is  $\text{V}_2\text{O}_5$  and  $\text{K}_2\text{O}$  is used as promotor for the oxidation of  $\text{SO}_2$  into  $\text{SO}_3$ .

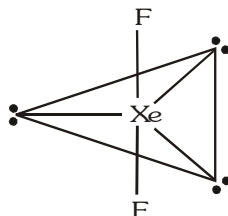


Thus,  $\text{I}^-$  is oxidised into  $\text{I}_2$  by  $\text{Cl}_2$  due to higher oxidised potential of  $\text{Cl}_2$  than  $\text{I}_2$

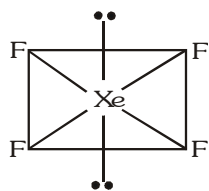
31. Unreacted AgBr is removed by hypo ( $\text{Na}_2\text{S}_2\text{O}_3$ )



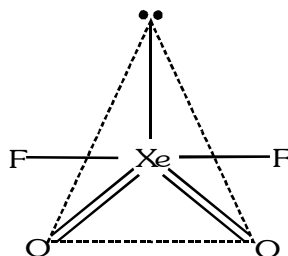
32.



In it Xe is  $\text{sp}^3\text{d}$ -hybrid but its shape is linear due to involvement of VSEPR theory. (i.e., due to presence of three free pair of electrons, geometry of  $\text{XeF}_2$  is distorted from trigonal bipyramidal to linear).



In it Xe is  $\text{sp}^3\text{d}^2$ -hybrid but its shape is square planar due to involvement of VSEPR theory. (i.e., due to presence of two free pair of electrons, geometry of  $\text{XeF}_4$  is distorted from octahedral to square planar).



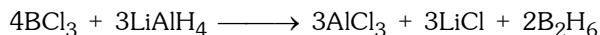
In it Xe is  $\text{sp}^3$  d-hybrid but its geometry is planar due to involvement of VSEPR theory. (i.e., due to presence of a free pair of electron, its geometry is distorted from trigonal bipyramidal to planar).

33. In nitrogen, d-orbitals are not present, so in it the possibility of intramolecular multiplicity exists which leads to the completion of octet through  $\pi$ -bond between two nitrogen atoms.

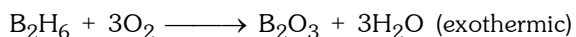
In phosphorus, d-orbitals are present, so in it due to large size of P, the P-P bonds are longer and hence intramolecular multiplicity is ruled out. So, for the completion of octet, it forms the bonds with three other 'P' atoms. Hence due to this reason it shows molecular formula as  $\text{P}_4$ .

34. X :  $\text{BCl}_3$

Y :  $\text{B}_2\text{H}_6$

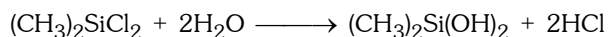
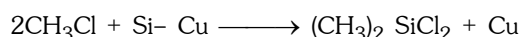
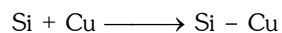
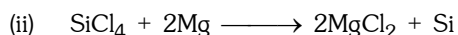


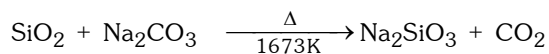
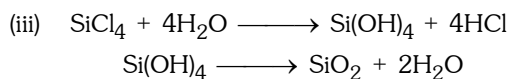
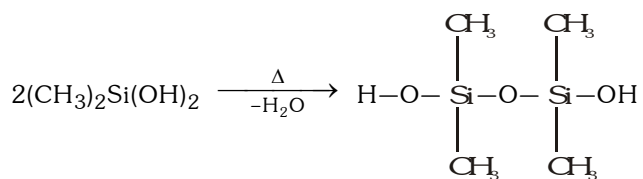
X



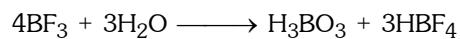
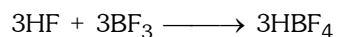
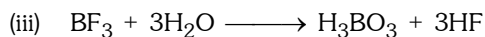
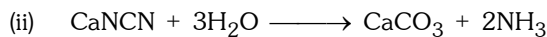
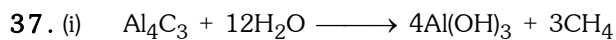
Y

35. (i)  $3\text{SiCl}_4 + 4\text{Al} \longrightarrow 3\text{Si} + 4\text{AlCl}_3$  (in one step)

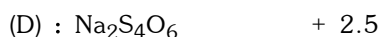
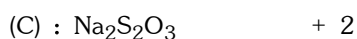
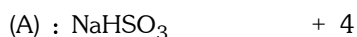




36.  $^{14}\text{CO}_2$

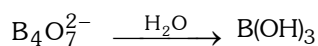
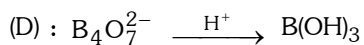
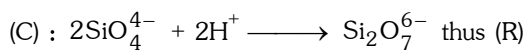
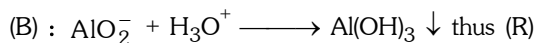


38. Oxidation state



39.  $\text{Cl}_2\text{O}_7 < \text{SO}_3 < \text{CO}_2 < \text{B}_2\text{O}_3 < \text{BaO}$

40. Thus, Q and R



Thus, (Q) and (R)

41. (C)

Comprehension # 1

42.. (A)

43. (C)

44. (A)

Comprehension # 2

45. (C)

46. (C)

47. (B)

48. (B)

49. (A, B, C)

50. (B, C)

51. (C)

52. (A)

53. (B, D)