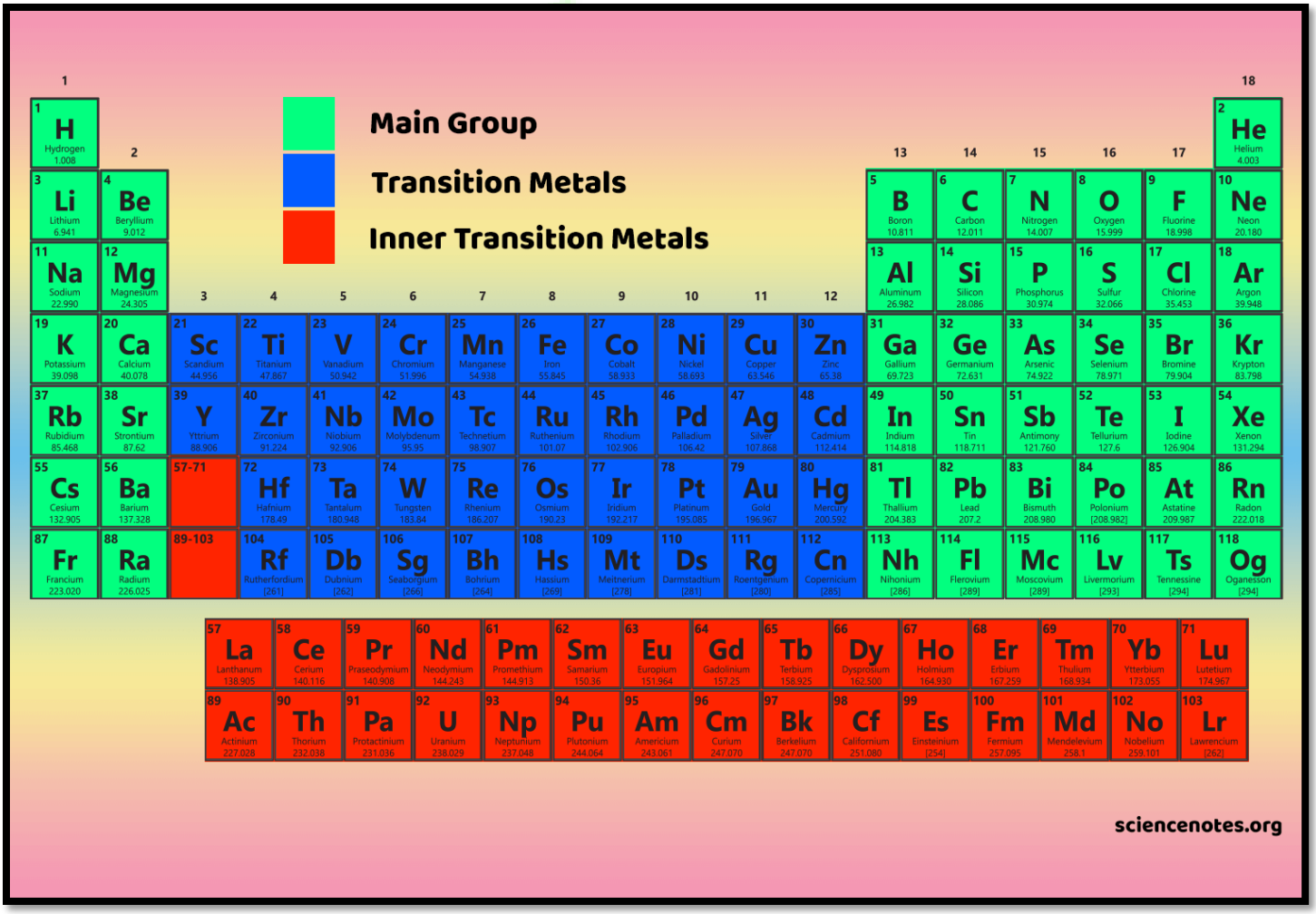
MADCHEM CLASSES

# CSIR NET CHEMICAL SCIENCE




## Main Group PYQ NET Ass. With Solution

Best Classes For
CSIR NET Chemical Science
GATE CY | IIT JAM CY
Preparation

1. Alkali metal superoxides are obtained by the reaction of **[NET JUNE 2011]**
   (a) Oxygen with alkali metals in liquid ammonia.
   (b) Water with alkali metals in liquid ammonia
   (c) $H_2O_2$ with alkali metals.
   (d) $H_2O_2$ with alkali metals in liquid ammonia.

2. $H_2O_2$ reduces. **[NET JUNE 2011]**
   (A) $[Fe(CN)_6]^{3-}$ (B) $KlO_4$ (C) $Ce(SO_4)_2$ (D) $SO_3^{2-}$
   (a) A and B only (b) B and C only (c) C and D only (d) B and D only

3. Match List–I (compounds) with List–II (application) and select the correct answer using the codes given below the lists. **[NET JUNE 2011]**

| List –I | List–II |
|---|---|
| (A) Trisodium phosphate | (i) Plasticizer |
| (B) Triaryl phosphates | (ii) Water softener |
| (C) Triethylphosphate | (iii) Toothpaste |
| (D) Calcium hydrogen phosphate | (iv) Insecticides |

   (a) (A)–ii (B) –i (C) –iv (D)–iii (b) (A)–i (B) –ii (C) –iv (D)–iii
   (c) (A) –ii (B)–iii (C)–iv (D)–i (d) (A)–iii (B) –i (C)–ii (D)–iv

4. Among the following the number of anhydrides of acids are **[NET JUNE 2011]**
   CO, No, $N_2O$, $B_2O_3$, $N_2O_5$, $SO_3$ and $P_4O_{10}$.
   (a) 3 (b) 4 (c) 5 (d) 6

5. Lewis acidity of $BCl_3$, $BPh_3$ and $BMe_3$ with respect to pyridine follows the order **[NET DEC 2011]**
   (a) $BCl_3 > BPh_3 > BMe_3$ (b) $BMe_3 > BPh_3 > BCl_3$
   (c) $BPh_3 > BMe_3 > BCl_3$ (d) $BCl_3 > BMe_3 > BPh_3$

6. Among the following pairs **[NET DEC 2011]**
   (1) Oxygen–sulfur (2) nitrogen –phosphorus
   (3) Phosphorous arsenic (4) chlorine-iodine
   Those in which the first ionization energies differ by more than 300 kJ $mole^{-1}$ are :
   (a) (1) and (3) only (b) (1) and (2) only (c) (2) and (3) only (d) (3) and (4) only

7. The reaction between NH4Br and Na metal in liquid ammonia (solvent) results in the products **[NET DEC 2011]**
   (a) NaBr, HBr (b) NaBr, $H_2$ (c) $H_2$, HBr (d) HBr, $H_2$

8. The meterial that exhibits the highest electrical conductivity among the following sulfur-nitrogen compound is **[NET DEC 2011]**
   (a) $S_4N_4$ (b) $S_7$ NH (c) $S_2N_2$ (d) $(SN)_x$

9. A Sodalite cage in zeolites is **[NET DEC 2011]**
   (a) a truncated tetrahedron (b) an icosahedron
   (c) a truncated octahedron (d) a dodecahedron

10. The final product (s) of the reaction $P(OR)_3$ + R'X is/are **[NET DEC 2011]**
    (a) $R'PO(OR)_2$ and RX (b) $[R'PO(OR)_2]$ X
    (c) $[R'RPO_2(OR)]X$ (d) ROR' and $p(OR)_2X$

11. At any temperature for the following reaction (D and T are deuterium and tritium respectively) correct statement is : **[NET DEC 2011]**

(A) $HCl + F \rightarrow HF + Cl$, (B) $DCl + F$ (C) $TCl + F \rightarrow Cl$

(a) (A) is fastest (b) (B) is fastest (c) (C) is fastest

(d) All the above reactions have the same rate constant

12. The styx code of $B_4H_{10}$ is : **[NET DEC 2011]**

(a) 4120 (b) 4220 (c) 4012 (d) 3203

13. Bayer's process involves. **[NET DEC 2011]**

(a) Synthesis of $B_2H_6$ from $Na_BH_4$ (b) Synthesis of $NaBH_4$ from borax

(c) Synthesis of $NaBH_4$ from $B_2H_6$ (d) Synthesis of $B_3N_3H_6$ from $B_2H_6$

14. The size of the d orbitals in Si, P, S and Cl follows the order. **[NET JUNE 2012]**

(a) Cl > S > P > Si (b) Cl > P > S > Si (c) P > S > Si > Cl (d) Si > P > S > Cl

15. The strength of $p_x$–$d_\pi$ bonding in E–O (E = Si, P, S and Cl) follows the order. **[NET JUNE 2012]**

(a) Si – O > P–O > S–O > Cl–O (b)P–O > Si –O > S–O > Cl–O

(c) S–O > Cl–O > P–O > Si–O (d) Cl–O > S–O > P–O > Si–O

16. The quantitative determination of $N_2H_4$ with $KlO_3$ prcceds in a mixture of $H_2O/CCl_4$ as follows

$N_2H_4 + KlO_3 + 2HCl \rightarrow N_2 + KCl + ICl + 3H_2O$

The end point for the titrimetric reaction is : **[NET JUNE 2012]**

(a) Consumption of $N_2H_4$

(b) ICl formation

(c) Disappearance of the yellow color due to $Cl_2$ in CCl layer.

(d) Displacement of the rod color due to $I_2$ in $CCl_4$ layer.

17. Among the halides, $NCl_3$(A), $PCl_2$(B) and $AsCl_3$(C), those which product two different acids. **[NET JUNE 2012]**

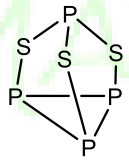
(a) A and B (b) A and C (c) B and C (d) A, B and C

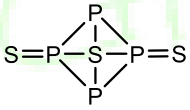
18. The decreasing order of dipole moment of molecules is **[NET JUNE 2012]**

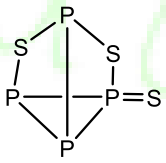
(a) $NF_3 > NH_3 > H_2O$ (b) $NH_3 > NF_2 > H_2O$

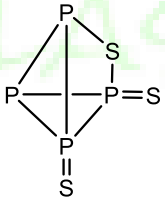
(c) $H_2O > NH_3 > NF_3$ (d) $H_2O > NF_2 > NH_3$

19. The correct structure of $P_4S_3$ is : **[NET JUNE 2012]**

(a) 

(b) 

(c) 

(d) 

20. The most used acid catalyst in oil industry and the relevant process are respectively **[NET JUNE 2012]**

(a) Aluminophosphate and reforming

(b) Aluminosilicate and cracking

(c) Aluminosilicate and reforming

(d) Aluminophosphate and cracking

21. The total number of Cu–O bonds present in the cyrstalline copper (II) acetate monohydrate is : **[NET DEC 2012]**

(a) 10 (b) 6 (c) 8 (d) 4

22. The electronegativity differences is the highest for the pair **[NET DEC 2012]**
(a) Li, Cl (b) K, F (c) Na, Cl (d) Li, F

23. Boric acid is a weak acid in aqueous solution. But its acidity increases significantly in the presence of ethylene glycol, because. **[NET DEC 2012]**
(a) ethylene glycol releases additional $H^+$
(b) $B(OH)_4^-$ is consumed in forming a compound with ethylene glycol.
(c) ethylene glycol neutralizes $H^+$ released by boric acid.
(d) Boric acid dissociates better in the mixed-solvent.

24. Silicates with continuous 3d frame work ae **[NET DEC 2012]**
(a) Neso-silicates (b) Soro-silicates (c) Phyllo-silicates (d) Tecto-silicates

25. Which of the following pairs has thehighest difference in their firs ionization energy ? **[NET JUNE 2013]**
(a) Xe, Cs (b) Kr, Rb (c) Ar, K (d) Ne, Na

26. Which of the following is used as propellant for whipping creams ? **[NET JUNE 2013]**
(a) $N_2O$ (b) NO (c) $N_2O_3$ (d) $N_2O_5$

27. Flame proof fabrices contain **[NET JUNE 2013]**
(a) $H_2NC(O)\ NH_2.\ Na_2SO_4$ (b) $H_2NC(S)\ NH2.\ Na_2SO_4$
(c) $H_2NC(O)NH_2,\ PO_4$ (d) $H_2NC(S)\ NH_2.\ H_3PO_4$

28. Among the compounds A-D, those which hydrolyse easily are **[NET JUNE 2013]**
(a) $NCI_3$ (b) $NF_3$ (c) $BiCl_3$ (d) $PCl_3$

29. Which of the pairs will generally result in tetrahedral coordination complexes, when ligands are $Cl^-$ or $OH^-$ **[NET JUNE 2013]**

30. Electron change in reduction of $Ce(SO_4)_2$, $KMnO_4$, $HNO_2$ and $I_2$ with hydrazine in acidic medium, respectively is **[NET JUNE 2013]**
(a) 1e, 1e, 2e and 4e (b) 1e, 3e, 2e and 4e (c) 2e, 3e, 1e and 4e (d) 2e, 4e, 1e and 3e

31. Among the oxides of nitrogen, $N_2O_3$, $N_2O_4$ and $N_2O_5$, the compound (s) having N–N bond is/are **[NET JUNE 2013]**
(a) $N_2O_4$ and $N_2O_5$ (b) $N_2O_3$ and $N_2O_5$ (c) $N_2O_3$ and $N_2O_4$ (d) $N_2O_5$ only

32. The correct equilibrium order for the interconversion of different forms of $SiO_2$ is **[NET JUNE 2013]**
(a) Tridymite ⇌ quartz ⇌ cristobalite ⇌ liquid $SiO_2$
(b) quartz ⇌ Tridymite ⇌ cristobalite ⇌ liquid $SiO_2$
(c) quartz ⇌ cristobalite ⇌ tridymite ⇌ liquid $SiO_2$
(d) Cristobalite ⇌ Tridymite ⇌ quartz ⇌ liquid $SiO_2$

33. Commonly used scintillator for measuring radiation is **[NET DEC 2013]**
(a) NaI(Al) (b) NaI(Tl) (c) CsI(TI) (d)CsI(AI)

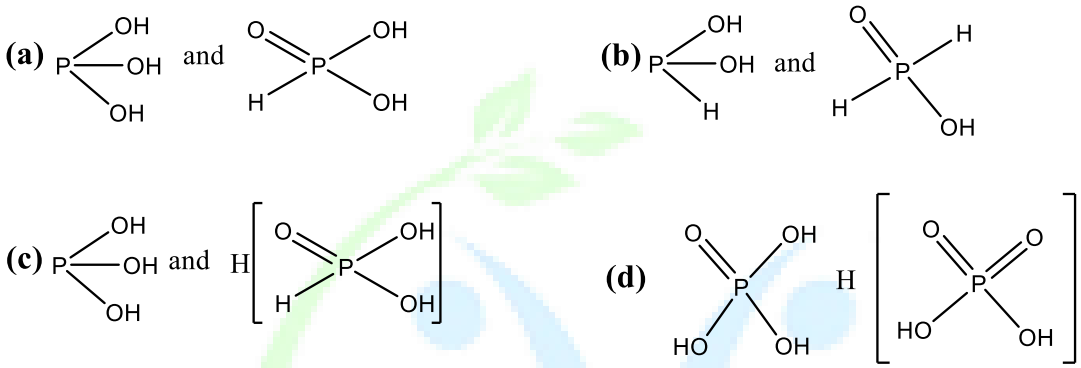
34. Among the molten alkali metals, the example of an immuscible pair (in all proportions) is **[NET DEC 2013]**
(a) K and Na (b) K and Cs (c) Li and Cs (d) Rb and Cs

35. Among the following, an example of a hypervalent species is **[NET DEC 2013]**
(a) $BF_3.\ OEt_2$ (b) $SF_4$ (c) $[PF_6]^-$ (d) $Sb_2S_3$

36. Treatment of $ClF_3$ with $SbF_5$ leads to the formation of a/an **[NET DEC 2013]**
(a) Polymeric material (b) covalent cluster
(c) ionic compound (d) lewis acid- base adduct

37. The reason for the chemical inertness of gaseous nitrogen at room temperature is best adduct **[NET DEC 2013]**
(a) high bonding energy only (b) electronic configuration
(c) HOMO–LUMO gap only (d) High bond energy and HOMO–LUMO gap

38. Two tautomeric forms of phosphorus acid are **[NET DEC 2013]**



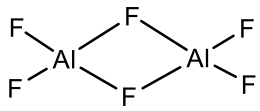

39. In a specific reaction, hexachlorocyclotriphosphazene, $N_3P_3Cl_6$ was reacted with a metal fluoride to obtain mixed halo derivatives namely $N_3P_3Cl_5F$(A), $N_3P_3Cl_4F_2$(B), $N_3P_3Cl_3F_3$ (C),$N_3P_3Cl_2F_4$(D), $N_3P_3ClF_5$(E). Compositions among these which can give isomeric products are **[NET DEC 2013]**
(a) A, B and C (b) B, C and D (c) C, D and E (d) E, A and B

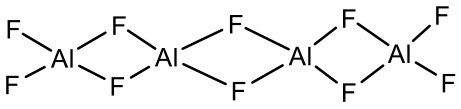
40. Xenon forms several fluorides and oxofluorides which exihibit acidic behaviour. The correct sequence of descending Lewis acidity among the given species is represented by **[NET DEC 2013]**
(a) $XeF_6 > XeOF_4 > XeF_4 > XeO2F_2$ (b) $XeOF_4 > XeO_2F_2 > XeOF_4 > XeF_6$
(c) $XeF_4 > XeO_2F_2 > XeOF_4 > XeF_6$ (d) $XeF_4 > XeF_6 > XeOF_4 > XeO_2F_2$

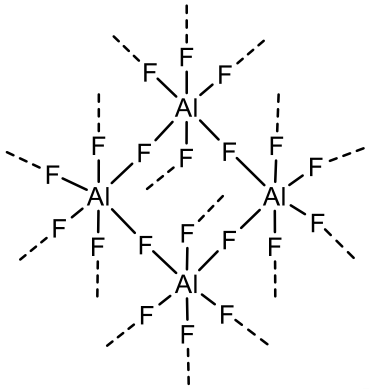
41. The gases $SO_2$ and $SO_3$ were reacted separately with CIF gas under ambient conditions. The major product expected from the two reactions respectively, are **[NET DEC 2013]**
(a) $SOF_2$ and $ClOSO_2F$ (b) $SOF_2$ and $SO_2F_2$
(c) $SO_2ClF$ and $SO_2F_2$ (d) $SO_2ClF$ and $ClOSO_2F$

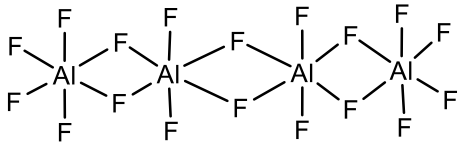
42. The correct statement for ozone is **[NET DEC 2013]**
(a) It absorbs radiations in wavelength region 290–320 nm.
(b) It is mostly destroyed by NO radical in atomsphere
(c) It is non toxic even at 100 ppm level
(d) Its concentration near poles is high due to its paramagnetic nature.

43. The solid state structure of aluminum fluoride is **[NET DEC 2013]**

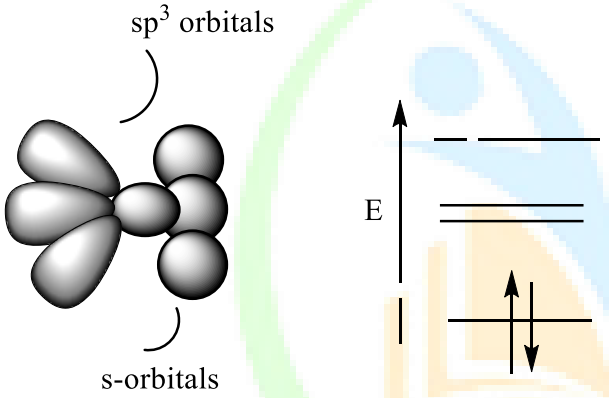
(a) 

(b) 

(c) 

(d) 

44. The orbital interactions shown below represent **[NET DEC 2013]**




(a) $CH_3$–Al interactions in $Al_2(CH_3)_6$
(b) B–H interactions in $B_2H_6$
(c) $CH_3$–Li Interaction in $Li_4(CH_3)_4$
(d) $CH_4CH_2$ Mg interactions in $EtMgBr(OEt)_2$

45. Among the following species, (A) Ni(II) as dimethylglyoximate, (B) Al(III) as oximate, (C) Ag(I) as chloride, those that precipitate with the urea hydrolysis method are **[NET JUNE 2014]**
(a) A, B and C (b) A and B (c) A and C (d) B and C

46. Ozone present in upper atmosphere protects people on the earth **[NET JUNE 2014]**
(a) Due to its diamagnetic nature (b) due to its blue colour
(c) Due to absorption of radiation of wavelength at 255 nm
(d) by destroying chlorofluoro carbons

47. Chromite are on fusion with sodium carbonate gives **[NET JUNE 2014]**
(a) $Na_2CrO_4$ and $Fe_2O_3$ (b) $Na_2Cr_2O_7$ and $Fe_2O_3$
(c) $Cr_2(CO_3)_3$ and $Fe(OH)_3$ (d) $Na_2CrO_4$ and $Fe2(CO_3)_3$

48. Reactions of elemental as with hot and conc. $HNO_3$ and $H_2SO_4$, respectively, give **[NET JUNE 2014]**
(a) $As_4O_6$ and $As_2(SO_4)_3$ (b) $As(NO_3)_5$ and $As_2(SC)_3$
(c) $As_4O_6$ and $H_3AsO_4$ (d) $H_3AsO_4$ and $As_4O_6$

49. The correct order of decreasing electronegative of the following atoms is , **[NET JUNE 2014]**
(a) As > Al > Ca > S (b) S > As > Al > Ca (c) Al > Ca > S > As (d) S > Ca > As > Al

50. The correct order of the size of S, $S^{2-}$, $S^{2+}$ and $S^{4+}$ species is, **[NET JUNE 2014]**
(a) $S > S^{2+} > S^{4+} > S^{2-}$ (b) $S^{2+} > S^{4+} > S^{2-} > S$ (c) $S^{2-} > S > S^{2+} > S^{4+}$ (d) $S^{4+} > S^{2-} > S > S^{2+}$

51. Among $F^-$, $Na^+$, $O^{2-}$ and $Mg^{2+}$ ions, those having the highest and the lowest ionic radii respectively are **[NET DEC 2014]**
(a) $O^{2-}$ and $Na^+$ (b) $F^-$ and $Mg^{2+}$
(c) $O^{2-}$ and $Mg^{2+}$ (d) $Mg^{2+}$ and $O^{2-}$

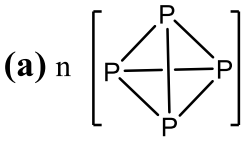
52. The correct order of the retention of cations on a sulfonated cation exchange resin column is **[NET DEC 2014]**
(a) $Ag^+ > K^+ > Na^+ > Li^+$ (b) $K^+ > Na^+ > Ag^+ > Li^+$
(c) $Li^+ > Na^+ > K^+ > Ag^+$ (d) $Li^+ > Na^+ > Ag^+ > K^+$

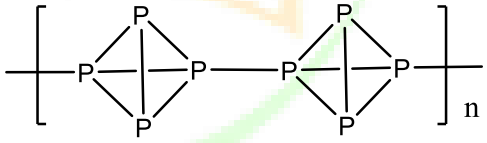
53. The main products of the reaction of equimolar quantities of $XeF_6$ with $NaNO_3$ are **[NET DEC 2014]**
(a) $XeOF_4$, NaF and $NO_2F$ (b) $XeO_2F_2$, NaF, NOF and $F_2$
(c) $XeOF_4$, $NaNO_2$ and $F_2$ (d) $XeF_4$, $NaNO_2$ and $F_2O$

54. 12–Crown –4 binds with the alkali metal ions in the following order : **[NET DEC 2014]**
$Li^+ >> Na^+ > K^+ > Cs^+$. It is due to the
(a) Right size of cation
(b) Change in entropy being positive
(c) Conformational flexibility of crown ether
(d) Hydrophobicity of crown ether

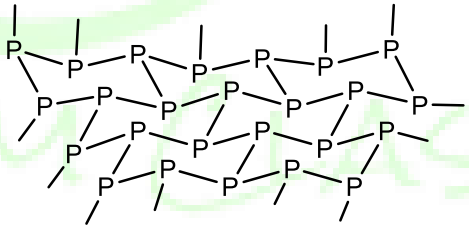
55. The species having the strongest gas phase proton affinity among the following, **[NET JUNE 2015]**
(a) $N^{3-}$ (b) $NF_3$ (c) $NH_3$ (d) $N(CH_3)_3$

56. All forms of phosphorus upon melting, exist as **[NET JUNE 2015]**

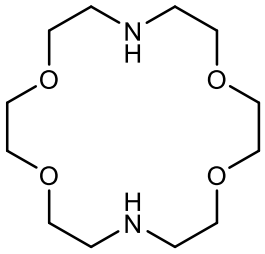
**(a)** 

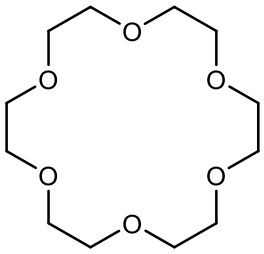
**(b)** 

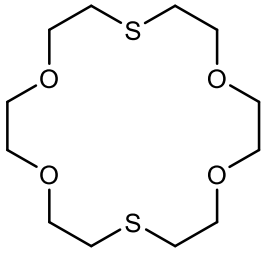
**(c)** 

**(d)** 

57. The magnitude of the stability constants for $K^+$ ion complexes of the following supra-molecular hosts follows the order, **[NET JUNE 2015]**


(A)


(B)

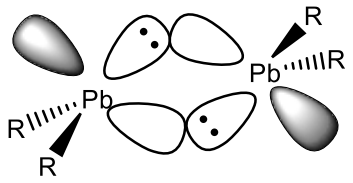

(C)

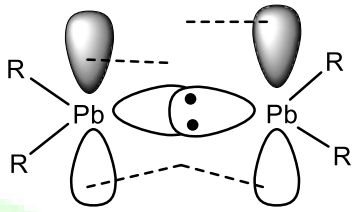
(a) B > A > C (b) C > A > B (c) A > B > C (d) C > B > A

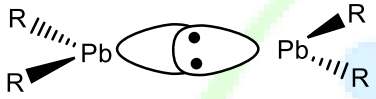
58. The oxoacid of phosphorus having P atoms in +4, +3, and +4 oxidation states respectively, is **[NET JUNE 2015]**

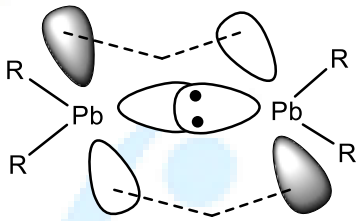
(a) $H_5P_3O_{10}$ (b) $H_5P_3O_7$ (c) $H_5P_3O_8$ (d) $H_5P_3O_9$

59. Considering the inert pair effect on lead, the most probable structure of $PbR_2$[R = 2. 6–$C_6H_3$(2, 6–$Pr_2C_6H_3)_2$] is **[NET JUNE 2015]**

(a) 


(b) 


(c) 


(d) 


60. The reaction of $SbCl_3$ with 3 equivalents of EtMgBr yields compound X. Two equivalents of $SbI_3$ react with one equivalent of X to give Y. In the solid state, Y has a 1D – polymeric structure in which each Sb is in a square pyramidal environment. Compounds X and Y respectively, are **[NET JUNE 2015]**

(a) $SbEt_3$ and $[Sb(Et)I_2]n$ (b) $Sb(Et_2)$ Cl and $[Sb(Et_2)Cl]n$
(c) $SbEt_3$ and $[SbEt_2 Br_2]n$ (d) Sb(Et) $Br_2$ and [SbEt(I)(Br)]n

61. The ring size and the number of linked tetrahedral present in $[Si_6O_{18}]^{12-}$ are, respectively **[NET DEC 2015]**

(a) 6 and 6 (b) 12 and 6 (c) 12 and 12 (d) 6 and 12

62. The formation constant for the complexation of $M^+$ (M = Li, Na, K and Cs) with cryptand, C222 follows the order **[NET DEC 2015]**

(a) $Li^+ < Cs^+ < Na^+ < K^+$ (b) $Li^+ < Na^+ < K^+ < Cs^+$
(c) $K^+ < Cs^+ < Li^+ < Na^+$ (d) $Cs^+ < K^+ < Li^+ < Na^+$

63. Consider the following reaction : **[NET DEC 2015]**

$N_3P_3Cl_6 + 6HNMe_2 \rightarrow N_3P_3Cl_3(NMe_2)_3 + 3$
[A]

$Me_2NH$ HCl

The number of possible isomers For [A] is

(a) 4 (b) 3 (c) 2 (d) 5

64. The reaction of $BCl_3$ with $NH_4Cl$ gives product A which upon reduction by $NaBH_4$ gives product B. Product B upon reacting with HCl affords compound C, which is **[NET DEC 2015]**

(a) $Cl_3B_3N_3H_9$ (b) $[ClBNH]_3$ (c) $[HBNH]_3$ (d) $(ClH)_3B_3N_3(ClH)_3$

65. The numbers of P–S and P–P bonds in the compound $P_4S_3$ are, respectively, **[NET JUNE 2016]**

(a) 6 and 3 (b) 4 and 3 (c) 3 and 6 (d) 6 and 2

66. Which of the following react (s) with $AsF_5$ in liquid $BrF_3$? **[NET JUNE 2016]**

(a) $XeF_6$ only (b) $XeF_6$ and $XeF_4$ (c) $XeF_6$ and $XeF_2$ (d) $XeF_4$ and $XeF_2$

67. Among KF, $SnF_4$ and $SbF_5$, solute(s) that increases(s) the concentration of $BrF_4^-$ in $BrF_3$, is / are **[NET JUNE 2016]**

(a) KF only (b) KF and $SnF_4$ (c) $SnF_4$ and $SbF_5$ (d) KF, $SnF_4$ and $SbF_5$

68. Among the following, choose the correct products that are formed in the reaction of $S_2Cl_2$ with ammonia in $CCl_4$ : **[NET DEC 2016]**

$NH_4Cl$(A), $S_4N_4$(B), $S_8$(C), and $S_3N_3Cl_3$(D).

(a) A, B and C (b) A, B and D (c) B, C and D (d) A, C and D

69. The final product(s) of the reaction of arachno borane, $B_4H_{10}$ with $NMe_3$ is/are **[NET DEC 2016]**

(a) $[BH_3.\ NMe_3]$ and $[B_3H_7.\ NMe_3]$

(b) $[BH_2(NMe_3)_2]^+\ [B_3H_8]^-$

(c) $[B_4H_{10}.\ NMe_3]$

(d) $[B_4H_{10}.\ NMe_3]$ and $[BH_2(NMe_3)_2]^+[B_3H_8]^-$

70. Both potassium and sulfuric acid form intercalation compounds with graphite. The graphite layers are **[NET JUNE 2017]**

(a) Reduced in both the cases

(b) Oxidized in both the cases

(c) oxidized in the case of potassium and reduced in the case of sulphuric acid

(d) Reduced in the case of potassium and oxidized in the case of sulphuric acid

71. Choose the incorrect statement for the phosphomolybdate anion, $[PMO_{12}O_{40}]^{3-}$.**[NET DEC 2017]**

(a) It has a Keggin structure.

(b) Phosphorus is in +5 oxidation state.

(c) It is extremely basic.

(d) It forms crystalline precipitates with $[R_4N]^+$ (R = bulkyl or aryl group)

72. A binary fluoride (Z) of xenon combines with two moles of NaF to give a product which on hearting to 100°C affords compounds A. the alkaline hydrolysis of A gives perxenate salt. Z and A are, respectively, **[NET JUNE 2018]**

(a) $XeF_2$ and $XeF_4$ (b) $XeF_4$ and $XeF_6$ (c) $XeF_6$ and $XeF_4$ (d) $XeF_6$ and $XeF_6$

73. Consider the following statements for $Be_2Cl_4$(I), $B_2Cl_4$(II) and $Ga_2Cl_4$(III): **[NET JUNE 2018]**

(A) There is an M–M(m = Be, B, Ga) bond in all.

(B) The oxidation state of Be, B and Ga is +2.

(C) The geometry around the central atom is planar for all.

(D) The geometry around the central atom is planar in I and II only.

The correct statement(s) is / are

(a) A, B and C (b) A and B (c) D only (d) B, C and D

74. The reaction of decaborane $B_{10}H_{14}$ with acetylene in the presence of $Et_2S$ gives **[NET DEC 2018]**

(a) $C_2B_{10}H_{12}$ (b) $C_2B_8H_{10}$ (c) $C_2B_{10}H_{14}$ (d) $C_2B_9H_{11}$

75. In compound $N_3P_3F_6$, the geometry around nitrogen and phosphorus, respectively, are **[NET DEC 2018]**

(a) Pyramidal and tetrahedral (b) planar and tetrahedral

(c) pyramidal and planar (d) planar and trigonal bipyramidal

76. The number of 2c–2e bonds ('x') of a molecule is related to 'N' (valence electrons) and 'n' (skeletal atoms) by x = (8n– N)/2. For $P_4S_3$, the values of x, N and n, respectively, are **[NET DEC 2018]**
(a) 7, 38, 9 (b) 7, 24, 9 (c) 9, 38, 7 (d) 9, 24, 7

77. $B_2H_6$ reacts with **[NET DEC 2018]**
(A) water to give boric and $H_2$ (B) oxygen to give $B_2O_3$ and $H_2$
(C) Water to give boric acid and $H_2O$ (D) oxygen to give $B_2O_3$ and $H_2O$

78. The species that results by replacing one quarter of Si(IV) in pyrophyllite $[Al_2(OH)_2Si_4O_{10}]$ with Al(III) [charge balance by K(I)] is **[NET JUNE 2019]**
(a) muscovite (b) phlogopite (c) montmorillonite (d) talc

79. The oxidation state of sulphur in the dithionous and dithionic acids, respectively, are **[NET JUNE 2019]**
(a) +4, +6 (b) +4, +5 (c) +3, +5 (d) +3, +6

80. The total number of symmetry elements in diborane molecule is **[NET JUNE 2019]**
(a) 2 (b) 4 (c) 6 (d) 8

81. In the synthesis of polydimethylsiloxane, the chain forming, branching and terminating agents respectively, are **[NET JUNE 2019]**
(a) $Me_2SiCl_2$, $Me_3SiCl$ and $MeSiCl_3$ (b) $Me_2SiCl_2$, $MeSiCl_3$ and $Me_3SiCl$
(c) $MeSiCl_3$, $Me_2SiCl_2$ and $Me_3SiCl$ (d) $Me_2SiCl_2$, $MeSiCl_3$ and $Me_4Si$

82. Choose the correct statement(s) among the following **[NET JUNE 2019]**
(I) LiF is more soluble than $LiClO_4$ in water.
(II) The standard reduction potential [$E^o$] of Li is more negative than that of Na.
(III) The heat of hydration of $Li^+(g)$ is greater than that of $Na^+(g)$
(a) I and II (b) I and III (c) II and III (d) III only

83. Choose the correct statment(s) among the following **[NET JUNE 2019]**
(I) The dihedral angle in $O_2F_2$ is $0^o$.
(II) $OF_2$ is generally prepared by reacting fluorine gas with dilute (2%) aq. NaOH solution
(III) $O_2F_2$ can be readily reduced by $H_2S$.
(a) I and II only (b) I, II and III (c) II and III only (d) II only

84. The common heptacity observed for coordination of $C_{60}$ to metal center is **[NET DEC 2019]**
(a) 2 (b) 4 (c) 5 (d) 6

85. The correct statements for dithionite and dithionate anions from the following are **[NET DEC 2019]**
(a) Both have S-S bond
(b) Both are dianionic
(c) Oxidation state of sulphur is +3 and +5, respectively
(d) Sulphur in dithionate has lone pair of electrons.
(a) A, B and C (b) A, B and D (c) B, C and D (d) A and B only

86. The roleof $H_3PO_4$ in the estimation of Fe(II) with $K_2Cr_2O_2$ using diphenylamine sulphonate as indicator is to **[NET DEC 2019]**
(a) Avoid aerial oxidation of Fe (II)
(b) reduce the electrode potential of $Fe^{3+} \rightarrow Fe^{2+}$
(c) Stabilize the indicator

(d) stabilize $K_2 Cr_2 O_7$

87. The species that results by replacing one quarter of Si(IV) in pyrophyllite $[Al_2(OH)_2Si_4O_{10}]$ with Al(III) [charge balance by K(I)] is **[NET DEC 2019]**
(a) muscovite (b) phlogopite (c) montmorillonite (d) talc

88. The reaction of $IO_3^-$ with I– in aqueous acidic medium results in **[NET DEC 2019]**
(a) $I_2$ and $H_2O$ (b) $I_2$ and $H_2O_2$ (c) $IO^-$ and $H_2O$ (d) $IO^-$ and $H_2O_2$

89. The oxidation state of sulphur in the dithionous and dithionic acids, respectively, are **[NET DEC 2019]**
(a) +4, +6 (b) +4, +5 (c) +3, +5 (d) +3, +6

90. In the synthesis of polydimethylsiloxane, the chain forming, branching and terminating agents respectively, are **[NET DEC 2019]**
(a) $Me_2SiCl_2$, $Me_3SiCl$ and $MeSiCl_3$ (b) $Me_2SiCl_2$, $MeSiCl_3$ and $Me_3SiCl$
(c) $MeSiCl_3$, $Me_2SiCl_2$ and $Me_3SiCl$ (d) $Me_2SiCl_2$, $MeSiCl_3$ and $Me_4Si$

91. The correct statements regarding B among the following **[NET DEC 2019]**
(I) Nuclear spin of $^{11}B$ is greater than that of $^{10}B$
(II) The polarities of B–H bond and C–H bonds are opposite
(III) Cross–section of neutron absorption for $^{10}B$ is much more than that of $^{11}B$
(IV) B reacts with boiling aq. NaOH solution to form $NaB(OH)_4$
(a) II and III (b)I and II (c) III and IV (d) II and IV

92. Choose the correct statement(s) among the following **[NET DEC 2019]**
(I) LiF is more soluble than $LiClO_4$ in water.
(II) The standard reduction potential [$E^o$] of Li is more negative than that of Na.
(III) The heat of hydration of $Li^+(g)$ is greater than that of $Na^+(g)$
(a) I and II (b) I and III (c) II and III (d) III only

93. During the binding of $O_2$ to myoglobin (consider heme in xy-plane) the molecular orbital of $O_2$ and atomic orbital of Fe involved in the formation of the σ-bond is **[NET NOV 2020]**
(a) π* and $dz^2$ (b) π* and dxz (c) π and dxz (d) π and $dz^2$

94. For the given reaction **[NET NOV 2020]**
$[*Co(L)_n]^{2+} + [Co(L)_n]^{3+} \rightarrow [*Co(L)_n]^{3+} + [Co(L)_n]^{2+}$
the correct statement with respect to the rate of electron transfer process is
o-phen = o-phenanthroline; *Co is labeled atom
(a) fast electron transfer ; L = $NH_3$; n = 6
(b) slow electron transfer ; L = o-phen; n = 3
(c) Very slow electron transfer; L = $NH_3$ ; n = 6
(d) Very slow electron transfer; L = o-phen ; n = 3

95. Identify the correct statement for the two reactions given below **[NET FEB 2022]**
$Xe + PtF_6 \xrightarrow{SF_6} [Xe]+[PtF_6]^-$
$XeF_4 + Me_4NF \rightarrow [Me_4N]^+[XeF_5]^-$
(a) Xe and $XeF_4$ both act as acids.
(b) Xe and $XeF_4$ both act as bases.
(c) Xe acts as an acid and $XeF_4$ axts as a base.

(d) Xe acts as a base and $XeF_4$ acts as an acid.

96. Which of the following reaction(s) do(es)NOT occur **[NET FEB 2022]**

(i) $[NPCl_2]_3 + 6NaF \xrightarrow[reflux]{MeCN} [NPF_2]_3 + 6NaCl$

(ii) n $PCl_5$ + n $NH_4Cl$ $\xrightarrow[reflux]{C_6H_5Cl}$ $[NPCl_2]_n$ + 4 n HCl [n = 3, 4, 5 ....]

(iii)n $PF_5$ + n $NH_4F$ $\xrightarrow[reflux]{C_6H_5Cl}$ $[NPF_2]_n$ + 4 n HF[n = 3, 4, 5...]

(a) (i) and (iii) (b) (i) and (ii) (c) (i) only (d) (iii) only

97. Choose the correct statement(s) from the following : **[NET FEB 2022]**

(i) The trend in Lewis acidity among silicon halides is $SiI_4 < SiBr_4 < SiCl_4 < SiF_4$.

(ii) Tin(II) chloride can act as a Lewis acid and not as a Lewis base.

(iii) Aluminosilicates can display Bronsted acidity.

(a) (i) and (ii) (b) (i) and (iii) (c) (ii) and (iii) (d) (ii) only

98. Which of the statements (A–D) given below are correct for $B_2H_6$ molecule : **[NET FEB 2022]**

A. Addition of $Et_2O$. $BF_3$ $NaBH_4$ in a polyether solvent produces $B_2H_6$.

B. It has $D_{2d}$ summetry.

C. Reaction of $B_2H_6$ with $NMe_3$ gives $Me_3N$. $BH_3$.

D. It is diamagnetic.

(a) A, B, and C (b) A, C and D (c) A and B only (d) B and D only

99. Consider the following statements describing the properties of $(CF_3)_3B.CO$. **[NET SEP 2022]**

A. The CO stretching frequency in IR is less than 2143 $cm^{-1}$ .

B. The 19F NMR spectrum shows one singlet resonance only.

C. The point group of $(CF_3)_3B.CO$ is C3v.

D. $(CF_3)_3B.CO$ reacts with KF to form $K[(CF_3)_3BC(O)F]$.

(a) A,C and D only (b) C and D only (c) A, B and C only (d) A and D only

100. The nucleophilic substitution of RR'R"SiX(R,R',R"= lkyl groups) by a nucleophile Y gives the product RR'R"SiY. Among the following. **[NET SEP 2022]**

A. Silyliumcation is formed during the reaction.

B. It is a second order reaction.

C. The cleavage of the Si-X bond is not the rate determining step.

D. The product always shows inversion of configuration.

Identify the correct statements.

(a) B and C only (b) A and B only (c) C and D only (d) B,C and D only

101. The reaction of HF with SnO produces P and with $SnCl_4$ produces Q. Reaction of one of them (P,Q) with NaF yields the species $Na_4[Sn_3F_{10}]$. Among the following, **[NET SEP 2022]**

A. $[Sn_3F_{10}]^{4-}$ is obtained from P.

B. In the solid state, P exhibits a ring structure.

C. Stereogenic lone pairs of electrons are presents in both P and Q.

D. Q is weaker Lewis acid than P.

Identify the correct statements.

(a) A and B only (b) C and D only (c) A,B and C only (d) B,C and D only

102. Among $Si_3N_4$, α-BN, AIN and (SN)x, the compound with the highest conductivity is **[NET SEP 2022]**

(a) $Si_3N_4$ (b) α-BN (c) AIN (d) $(SN)_x$

## ANSWER KEY

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. A | 2. B | 3. A | 4. B | 5. A | 6. B | 7. B | 8. D | 9. C | 10. A |
| 11. A | 12. C | 13. B | 14. D | 15. D | 16. D | 17. C | 18. D | 19. A | 20. B |
| 21. A | 22. B | 23. B | 24. D | 25. D | 26. A | 27. C | 28. D | 29. C | 30. A |
| 31. C | 32. B | 33. B | 34.C | 35. C | 36. C | 37. D | 38. A | 39. B | 40. A |
| 41. D | 42. A | 43. C | 44. C | 45. B | 46. C | 47. A | 48. D | 49. B | 50. C |
| 51. C | 52. A | 53. A | 54. A | 55. A | 56. A | 57. C | 58. C | 59. A | 60. A |
| 61. B | 62. A | 63. B | 64. A | 65. A | 66. C | 67. A | 68. A | 69. A | 70. D |
| 71. C | 72. D | 73. C | 74. A | 75. B | 76. C | 77. B | 78. A | 79. C | 80. D |
| 81. B | 82. C | 83. C | 84. C | 85. A&B | 86. B | 87. A | 88. A | 89. C | 90. B |
| 91. A | 92. C | 93. A | 94. C | 95. D | 96. D | 97. A | 98. A, C, D | 99. B | 100 A |
| 101. A | 102. D | | | | | | | | |

# SOLUTION

**1.**

**Ans.** **(a)**

**Sol.** Alkali metals in liq. $NH_3$ act as source of electrons and are supposed to be a good one-electron reducing agents.

$$m + (x + y)NH_3 \rightarrow [M(NH_3)_x]^+ + [e(NH_3)y]^-$$

These solvated electrons can reduce $O_2$ molecule to superoxide ion.

$$[e(NH_3)y]- + O_2 \rightarrow O_2^- + y\ NH_3$$

These superoxide ions can combine with solvated metal ion to give Alakli metal superoxides.

$$[M(NH_3)_x]^+ + O_2^- \rightarrow MO_2 + xNH_3$$

**2.**

**Ans.** **(b)**

**Sol.** $H_2O_2$ oxidize, $Fe^{+2}$ to $Fe^{+3}$, $[Fe(CN)_6]^{4-}$ (II) to $[Fe(CN)_6]^{3-}$ (II), $NH_2OH$ to $HNO_3$, $SO_3^{2-}$ to $SO_4^{2-}$

$H_2O_2$ reduce $KMnO_4$, $KIO_4$, $Ce(SO_4)_2$ [All are stronger O.A. than $H_2O_2$)

Note: In the question, only $I^{+7}$ and $Ce^{+4}$ are in their highest oxidation states, so the only possibility of reduction by $H_2O_2$ exists.

**3.**

**Ans.** **(a)**

**Sol.**

| **Compound** | **Uses** |
|---|---|
| (A) $Na_3\ PO_4$ | Water softener, paint stripper |
| (B) $Ar_3PO_4$ | Plasticizers |
| (C) $Et_3PO_4$ | Insecticides |
| (D) $CaHPO_4.\ 2H_2O$ | Toothpaste |

**4.**

**Ans.** **(b)**

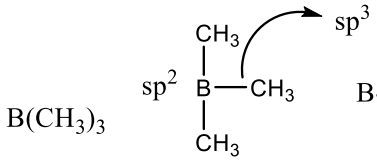
**Sol.**

| | |
|---|---|
| $B_2O_3 + 3H_2O \rightarrow 2H_3BO_3$ | (orthoboric acid) |
| $N_2O_5 + H_2O \rightarrow 2HNO_3$ | (Nitric acid) |
| $SO_3 + 2H_2O \rightarrow H_2SO_8$ | (Sulfuric acid) |
| $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$ | (Orthphosphoric acid) |

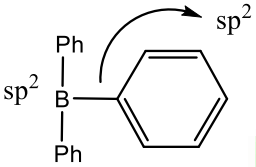
**5.**

**Ans.** **(a)**

**Sol.** $BCl_3 \rightarrow p\pi - p\pi$ back bonding




$B(CH_3)_3$ B-attracts B-$CH_3$ electron(Hyperconjugation)




$BPh_3$ B and C both are sp2-hybridised. No shifting of electrons (Resonance).

$BCl_3 > BPh_3 > BMe_3$

**6.**

**Ans.** **(b)**

**Sol.** (A) $IE_1$ for O and S are 1314 and 1000 kJ $mol^{-1}$.

difference = 1314–1000 = 314

(B) For N and P IE1 are 1402 and 1012.

difference = 1402–1012 = 390

(C) For P and As $IE_1$ are 1012 and 947

difference = 1012–947 = 165 (less 300 kJ $mol^{-1}$).

(D) Also for IE1 difference is less than 300 kJ $mol^{-1}$.

**7.**

**Ans.** **(b)**

**Sol.** $Na \xrightarrow{liq.NH_3} Na^+ (NH_3)_x + e^-(NH_3)y$

$NH_4^+ Br^- + e^- (NH_3)_y \rightarrow NH_3 + \frac{1}{2} H_2 + y\ NH_3 + Br^-$

$Na + (NH_3)_x + Br^- \rightarrow NaBr + xNH_3$

**8.**

**Ans.** **(d)**

**Sol.** $(SN)_x \rightarrow$ becasue it is a giant cross linked molecule and have mobile electrons.

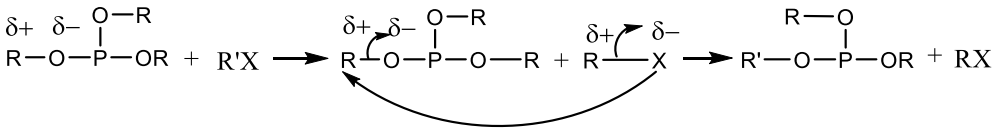
**9.**

**Ans.** **(c)**

**10.**

**Ans.** **(a)**

**Sol.**




Because P–O bond very strong affinity very high not easily break. So, R–O bond break.

**11.**

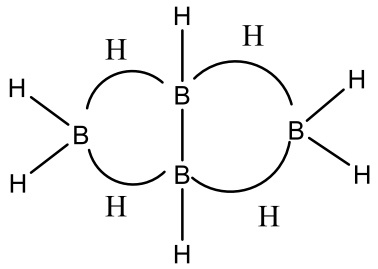
**Ans.** **(a)**

**Sol.** Heavier isotope contains heavier bonding. Heavier the bonding reaction rate show. But in lighter isotope bonding is weak. so reaction rate is faster.

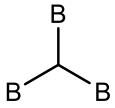
**12.**

**Ans.** **(c)**

**Sol.**



s = number of B–H–B bonds = 4

t = number of B–B–B or  bonds = 0

y = number of B–B bonds = 1

x = number of $BH_2$ groups + twice the $BH_3$ groups = 2

Therefore, styx code = 4012

**13.**

**Ans.** **(b)**

**Sol.** $Na_2B_4O_7 + 16Na + 8H_2 + 7SiO_2 \rightarrow 4NaBH_4 + 7Na_2SiO_3$

**14.**

**Ans.** **(d)**

**Sol.** Size of d-orbitals decrease with decrease in size of element. The decreasing order of size is Si > P > S > Cl

Therefore decreasing order of size of d-orbitals is Si > P > S > Cl

**15.**

**Ans.** **(d)**

**Sol.** Smaller the inter nuclear distance between two atoms, stronger will be the π–bonds. The increasing or due of inter nuclear distance is Cl–O < S–O < P –O < Si–O

Therefore strength of pπ – dπ bonding is Cl–O > S–O > P–O > Si–O

**16.**

**Ans.** **(d)**

**17.**

**Ans.** **(c)**

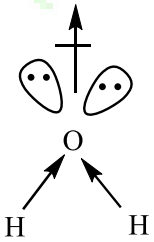
**Sol.** $NCl_3 + 4H_2O \rightarrow NH_4OH + 3HOCl$; $PCl_3 + 3H_2O \rightarrow H_3PO_3 + 3HCl$ (two different Acids)

$AsCl_3 + 3H_2O \rightarrow H_3AsO_3 + 3H_3$ (two different acids)

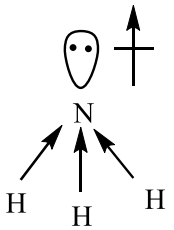
**18.**

**Ans.** **(d)**

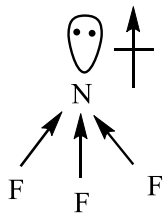
**Sol.**



More electronegativity difference between O and H



Less electrongeativity difference between N and H



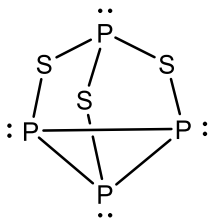
E.N. of F is greater than that of N

Therefore, order of dipole moment is $H_2O > NH_3 > NF_3$.

**19.**

**Ans.** **(a)**

**Sol.**



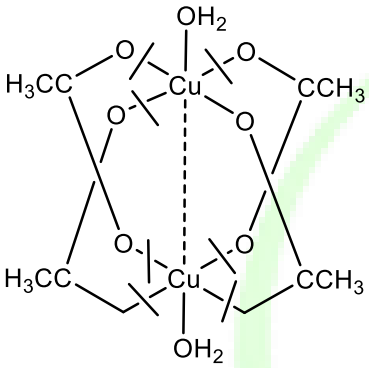
**20.**

**Ans.** **(b)**

**21.**

**Ans.** **(a)**

**Sol.**



10 Cu-O bonds

**22.**

**Ans.** **(b)**

**Sol.** Among these elements K is least electrongative and F is most electronegative. Therefore electronegativity difference is highest for the pair K,F.

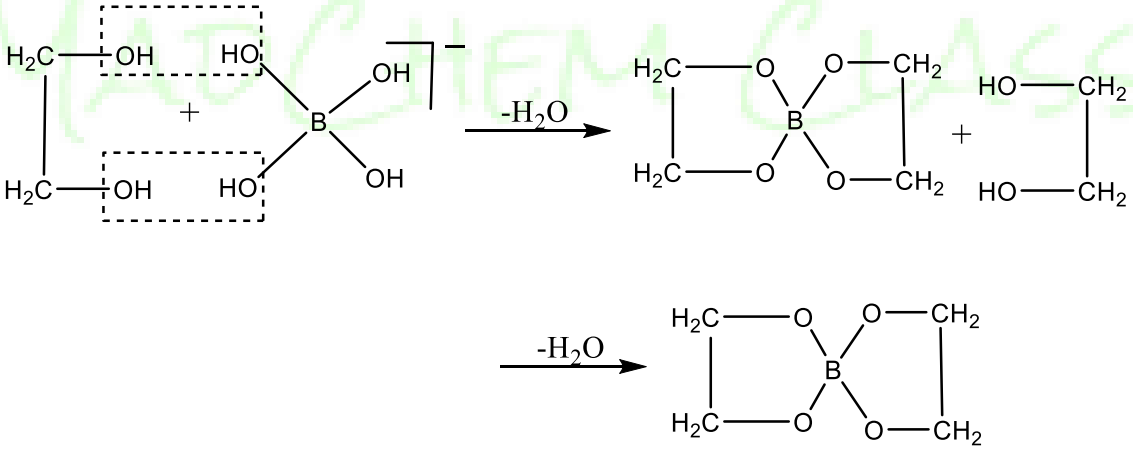
**23.**

**Ans.** **(b)**

**Sol.** $B(OH)_3 + OH \rightleftharpoons [B(OH)_4]^-$

reversible reaction

In presence of ethylene glycol, $B(OH)_4^-$ is consumed as shown below and boric acid behaves as strong acid.



**24.**

**Ans.** **(d)**

**25.**

**Ans.** **(d)**

**Sol.** First ionization potential of Ne––2080

First ionization potential of Na–495

1585 eV

ionisation Energy = Difference in ionization potential of Neon and Sodium (Ne–Na)

So, 1585 eV is the largest difference in given pairs. The reason being as we move down the group number of electron and proton increases simultaneously with addition of new energy shells so increase in distance from Nucleus to electron is more pronounced as that of increases in electron and proton resultantly $Z_{eff}$ (effective nuclear charge) decreases and first ionization potential also decreases down the group.

**26.**

**Ans.** **(a)**

**Sol.** Nitrous acid ($N_2O$) which is commonly known as laughing gas used as a propellant in whipping cream. So, also known as whippits or nangs.

**27.**

**Ans.** **(c)**

**Sol.** The Flame proof fabrices contain urea and phosphoric acid ($H_2NC(O)\,NH_2.\,H_3PO_4$)

**28.**

**Ans.** **(d)**

**Sol.** $BiCl_3$ is not readily hydrolysed by water to give BiOCl.

$$BiCl_3 + H_2O \rightarrow BiOCl + 2HCl$$

But BiOCl redissolve in conc. HCl to produce $BiCl_3$ after evaporation. It has quasi molecular structure . $PCl_3$ is easily hydrolysed by water.

**29.**

**Ans.** **(c)**

**Sol.** Co(II), Zn(II) and Be(II) form tetrahedral complexes with $Cl^-$ or $OH^-$.

Be(II) has no d-orbitals, therefore it form tetrahedral complexes.

Co(II) and Zn(II) form tetrahedral complexes with halides and $OH^-$.

**30.**

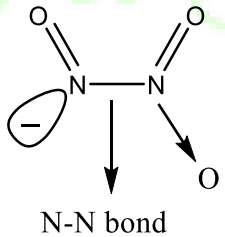
**Ans.** **(a)**

**Sol.** $Ce(SO_4)_2$ and $KMnO_4$ gives one electron on reduction with hydrazine in acidic medium and $HNO_2$ and $I_2$ gives two electron and four electron on reduction with hydrazine in acidic medium.

**31.**

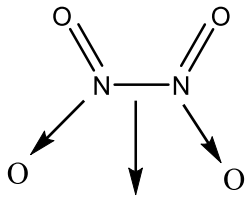
**Ans.** **(c)**

**Sol.** (A) $N_2O_3 : HNO_2 + HNO_2 \xrightarrow{-H_2O} N_2O_3$



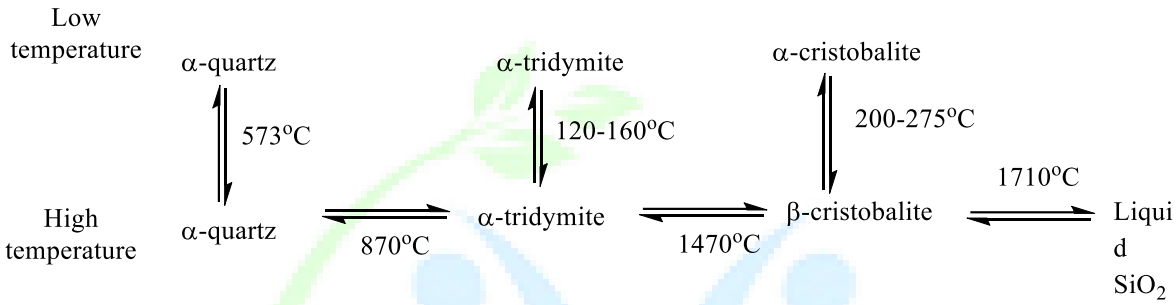

N-N bond

(B) $N_2O_4 : HNO_3 + HNO_2 \xrightarrow{-H_2O} N_2O_4$




N-N bond

**32.**
**Ans.** **(b)**
**Sol.**




**33.**
**Ans.** **(b)**

**34.**
**Ans.** **(c)**
**Sol.** Large difference between the size of Li and Cs. So, it is difficult to get a solid solution of these two metals.

**35.**
**Ans.** **(c)**
**Sol.** More than 8 electrons in the valence shell of P in $[PF_6^-]$.

**36.**
**Ans.** **(c)**
**Sol.** $ClF_3 + SbF_5 \rightarrow [ClF_2^+]\,[SbF_6]^-$

**37.**
**Ans.** **(d)**
**Sol.**

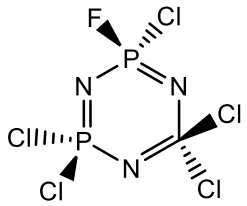
$\sigma_g 1s^2\ \sigma_u^* 1s^2\ \sigma_g 2s^2\ \sigma_u^* 2S^2\ \sigma_g 2p_z^2\ \begin{matrix}\pi_u 2p_x^2 \\ \pi_u 2p_y^2\end{matrix}\ \begin{matrix}\pi_g^* 2p_x \\ \pi_g^* 2p_y\end{matrix}\ \pi_u^* 2p_z$

Bond order $= \frac{6-0}{2} = 3$ bond order $\propto$ bonding energy

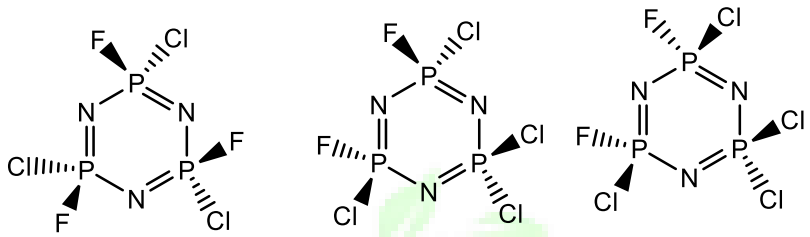
High bond energy and HOMO-LUMO gap.

**38.**
**Ans.** **(a)**
**Sol.** $H_3PO_3$ is a dibasic and reducing in nature.

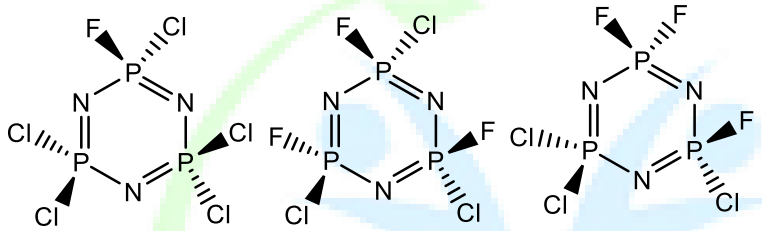
**39.**
**Ans.** **(b)**
**Sol.** (A) $N_3P_3Cl_5F$ = only one isomer



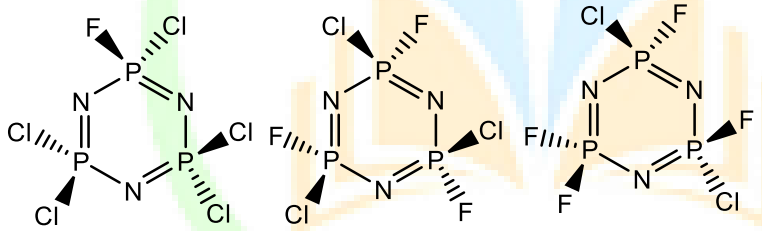
(B) $N_3P_3Cl_3F_3$ = three isomer



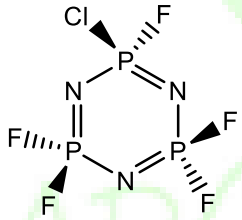
(C) $N_3P_3Cl_3F_4$ = three isomer



(D) $N_3P_3Cl_2F_4$ = three isomer



(E) $N_3P_3ClF_4$ = one isomer



**40.**

**Ans.** **(a)**

**Sol.** Relative acidic strength of xenon fluorides follows order

$XeF_6 > XeO_3 > F > XeOF_4 > XeF_4 > XeO_2F_2 > XeF_2$

This order depends upon

(i) Number of lone pair (ii) Number of 'F' atoms

**41.**

**Ans.** **(d)**

**Sol.** $SO_2 + ClF \rightarrow SO_2ClF$

$ClF + SO_3 \rightarrow ClOSO_2F$

**42.**

**Ans.** **(a)**

**Sol.** (i) Ozone is diamagnetic in nature

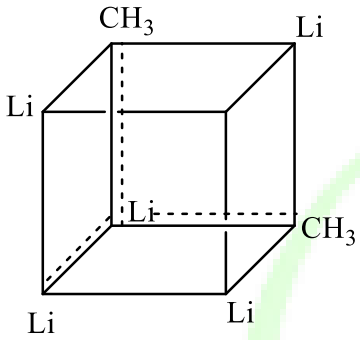
(ii) It is non toxic even at 1ppm level
(iii) It is not destroyed by no radial in atmosphere

$\{NO + O_3 \rightarrow NO_2 + O_2\}$

(iv) It absorbs radiation in wave length region 290–320 nm

**43.**
**Ans.** **(c)**
**Sol.** $AlF_3$ has octahedral arrangement in 3–dimethyl structure which causes high methyl point of $AlF_3$ in comparison to $AlCl_3$, $AlBr_3$ and $All_3$. $AlCl_3$ dimer has layered structure.

**44.**
**Ans.** **(c)**
**Sol.**




The diagram clearly indicates the four centered-two electron interaction (4c–2e). This takes place in $Li_4(CH_3)_4$. The sp3 hybrid orbitals is of carbon while the three s-orbitals are of three surrounding lithium atoms.

**45.**
**Ans.** **(b)**
**46.**
**Ans.** **(c)**
**Sol.** Ozone is a diamagnetic gas which is of dark blue coloured due to absorption of red light.
($\lambda$ = 557 and 602 nm)
Ozone depliction discovered by J.C. Farman over Halley Bay in Antarctica.
Ozone also show strong absorption in $\lambda$ = 255 UV which good for earth and living beings as this 'UV-b' is most dangerous

$\lambda$ = 255 = UV – b

**47.**
**Ans.** **(a)**
**Sol.** Chromium is extracted from chromite ore :

(I) $4FeCr_2O_4 + 8Na_2CO_3 + 7O2 \xrightarrow[1100^oC]{fusion} 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$

(II) $2Na_2CrO_4 + H_2SO_4 \rightarrow Na_2SO_4 + Na_2Cr_2O_7 + H_2O$

(III) $Na_2Cr_2O_7 + 2C \rightarrow Cr_2O_7 + Na_2CO_3 + CO$

(IV) $Cr_2O_3 + 2Al \rightarrow Al_2O_3 + 2Cr$

**48.**

**Ans.** **(d)**

**Sol.** $As \xrightarrow[Hot.\ and\ conc.]{HNO_3} H_3AsO_4$ Arsenic acid (V)

$[H_3AsO_3] \xrightarrow{H_2SO_4} As_4O_6$

$H_2SO_4$ → Arseneous acid (III)

The reason is that $HNO_3$ is better oxidising agent than $H_2SO_4$ also acts as dehydrating agent.

**49.**

**Ans.** **(b)**

**Sol.** The electrongativities of elements are

| Ca | Al | As | S |
|---|---|---|---|
| 1.0 | 1.5 | 2.0 | 2.5 |

**50.**

**Ans.** **(c)**

**Sol.** As positive charge increases the size decreases while with increase in negative charge increase the size. This is due to increase in $Z_{eff}$ in former case while decrease in $Z_{eff}$ in later case.

Hence, order of size is $S^{2-} > S > S^{2+} > S^{4+}$

**51.**

**Ans.** **(c)**

**Sol.** All the ions are isoelectronic. Therefore, the size depends upon effective nuclear charge. size of isoelectronic ions $\propto \frac{1}{Z_{eff.}}$

| | $F^-$ | $O^{2-}$ | $Na^+$ | $Mg^{2+}$ |
|---|---|---|---|---|
| Atomic number | 9 | 8 | 11 | 12 |
| Number of electrons | 10 | 10 | 10 | 10 |

Hence, the order of size will be

$O^{2-}$ $F^-$ $Na^+$ $Mg^{2+}$

Since, atomic number increases.

Therefore, $Z_{eff}$ increases

Therefore, size decreases.

**52.**

**Ans.** **(a)**

**Sol.** The retention of ion in exchanges column depends upon the size of ion. Smaller the size of cation, stronger will be its binding ability. In cation exchanger column the aqueous solution of ion is passed where binding ability depends upon hydrated radii.

$K^+(aq)$ $Na^+(aq)$ $Li^+(aq)$

Since, size of hydrated ion increases

Therefore, binding ability deceases

$Ag^+(aq)$ show polarization effect, hence, has high binding ability.

**53.**

**Ans.** **(a)**

**Sol.** The reaction of $XeF_6$ with $NaNO_3$ takes place as

$XeF_6 + NaNO_3 \rightarrow XeOF_4 + NaF + F.NO_2$

**54.**

**Ans.** **(a)**

**Sol.** The crown ether binds metal cation in their cavity. They are selective as they have fixed ring size.

| Crown ether | Metal cation |
|---|---|
| crown–4 | $Li^+$ |

| | |
|---|---|
| crown–5 | $Na^+$ |
| crown–6 | $K^+$ |
| crown–7 | $Rb^+$ |
| crown–8 | $Cs^+$ |

Therefore, 12–crown–4 is best suited for $Li^+$ cation. After then as the size increases binding capacity decreases.

**55.**

**Ans.** **(a)**

**Sol.** Gas phase proton affinities

$N^{3-}$ = 308 kJ/mole

$NF_3$ = 604 kJ/mole

$NH_3$ = 872 kJ/mole

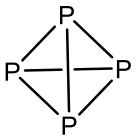
$N(CH_3)_3$ = 974 kJ/mole

Proton affinity decide the energy release when a molecule/ion accept a proton. Higher the value of gas phase proton affinities more will be basicity. Hence, $N_3^-$ is most basic.

**56.**

**Ans.** **(a)**

**Sol.** All the allotropic phosphorous forms changes into white P4 discrete units. Which has structure.




**57.**

**Ans.** **(c)**

**Sol.** The crown ether form complex with metal cation of I–st group. This depend upon

(i) size of cavity

(ii) complexation ability

$K^+$ is best filled in crown–6 and 'N' is good donar than O and S therefore the order of hosts will be A > B > C

**58.**

**Ans.** **(c)**

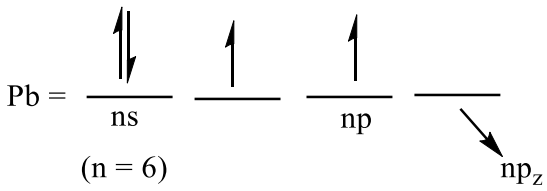
**Sol.** The average of oxidation states is $\frac{+4+3+4}{3} = +\frac{11}{3}$

| | |
|---|---|
| $H_5P_3P_{10}$ | $+5 + 3x - 20 = 0$ |
| | $3x = +15 \quad \therefore x = +5$ |
| $H_5P_3O_7$ | $+5 + 3x - 14 = 0$ |
| | $x = +3$ |
| $H_5P_3O_8$ | $+5 + 3x - 16 = 0$ |
| | $x = +\frac{11}{3}$ |
| $H_5P_3O_9$ | $+5 + 3x - 18 = 0$ |
| | $x = +\frac{13}{3}$ |

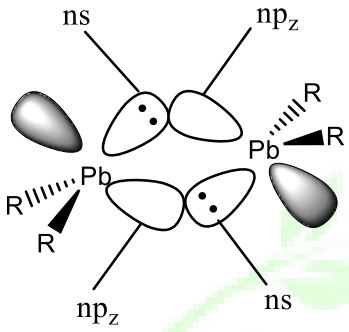
**59.**

**Ans.** **(a)**

**Sol.** Due to IPE $ns^2$ electron-pair become inactive. In Pb




Therefore, the structure must be




**60.**

**Ans.** **(a)**

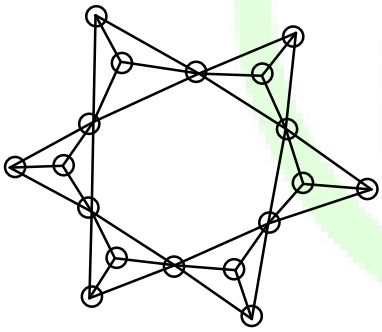
**Sol.** $SbCl_3 + 3EtMgBr \rightarrow SbEt_3 + 3MgBrCl$

$2SbEt_3 + SbI_3 \rightarrow [Sb(Et)I_2]_n + SbEt_2 I$

**61.**

**Ans.** **(b)**

**Sol.** The structure of $[Si_6O_{18}]^{12-}$ is



Hence, the number of linked tetrahedrals = 6

The size of ring = 12

Therefore, correct option is (b)

**62.**

**Ans.** **(a)**

**Sol.** The stability (formation constant for complexation of cryptate complex depends upon)

(1) size of cavity

(2) size of metal cation

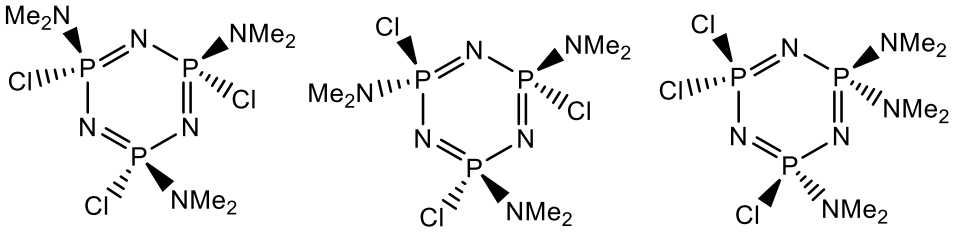
| cryptand | suitable cation |
|---|---|
| crypt–211 | $Li^+$ |
| crypt–221 | $Na^+$ |
| crypt–222 | $K^+$ |

Hence, $k^+$ ion will form most stable complex with cryptand -222.

**63.**

**Ans.** **(b)**

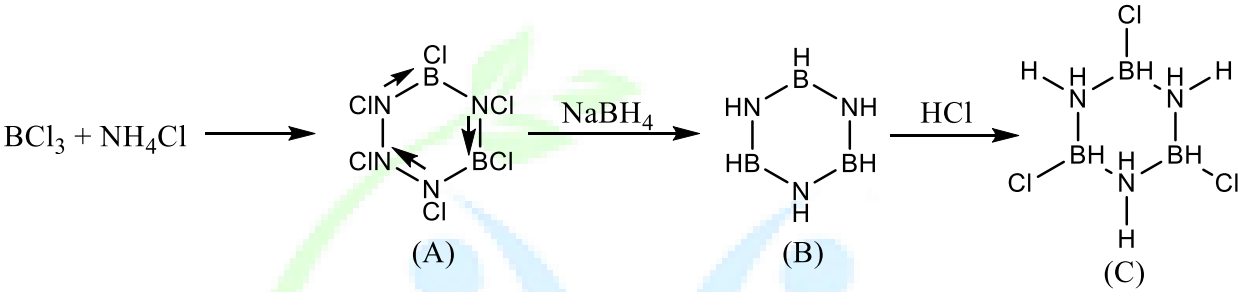
**Sol.**



**64.**

**Ans.** **(a)**

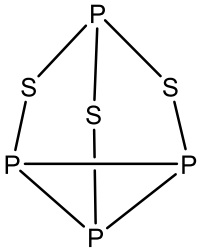
**Sol.**




**65.**

**Ans.** **(a)**

**Sol.** Stricture of $P_4S_3$ is



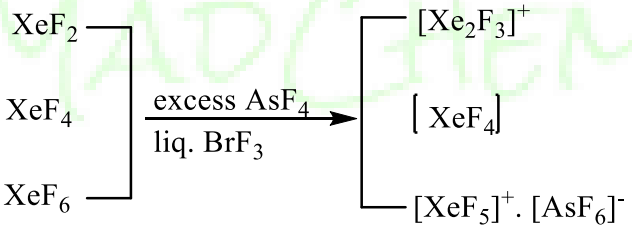
Number of P–S bond = 6

Number of P–P bond = 3

**66.**

**Ans.** **(c)**

**Sol.**




Separation of $XeF_4$ from a mixture involves preferential complexation of $XeF_2$ and $XeF_6$ and $XeF_4$ is

**67.**

**Ans.** **(a)**

**Sol.** $KF + BrF_3 \rightarrow K^+ + BrF_4^-$

$SnF_4 + 2BrF_3 \rightarrow 2[BrF_2] + [SnF_6]^{2-}$

$SbF_4 + 2BrF_3 \rightarrow 2[BrF_2]^+ + [Sn_6]_{2-}$

$SbF_5 + BrF_3 \rightarrow BrF_2^+ + [SbF_6]^-$

This only KF increases the concentration of $BrF_4^-$ in $BrF_3$.

**68.**

**Ans.** **(a)**

**Sol.** $6S_2Cl_2 + 16NH_3 \xrightarrow{CCl_4 \text{ or } C_6H_6} S_4N_4 + S_8 + 12\ NH_4Cl$

**69.**

**Ans.** **(a)**

**Sol.** $B_4H_{10} + NMe_3 \rightarrow Me_3NB_3H_7 + Me_3\ NBH_3$

**70.**

**Ans.** **(d)**

**Sol.** $K^+$ graphite $\Rightarrow$ [graphite]– $K^+$

$H_2SO_4$ + graphite = [graphite]$^+$ $HSO_4^-$

**71.**

**Ans.** **(c)**

**Sol.** $[PMo_{12}O_{40}]^{3-}$ is less basic. It is slightly less basic than $ClO_4^-$

**72.**

**Ans.** **(d)**

**Sol.** $XeF_6 + 2NF \rightarrow Na_2[XeF_8] \xrightarrow{100^oC} [XeF_6] \xrightarrow{alkaline\ hydrolysis}$ Perxenate

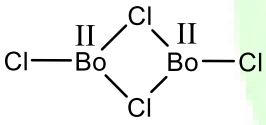
(z) (A)

+2NaF

**73.**

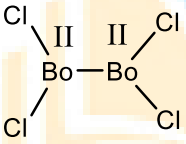
**Ans.** **(c)**

**Sol.** Structure of $Be_2Cl_4$, $B_2Cl_4$ and $Ga_2Cl_4$ are




$Be_2Cl_4$

Planar




$B_2Cl_4$

Planar

I III

$Ga[GaCl_4]$

$Ga_2Cl_4$

Tetrahedral

No M M bond

**74.**

**Ans.** **(a)**

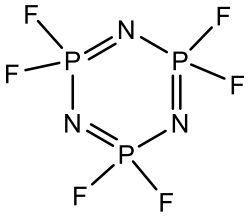
**Sol.**

$$B_{10}H_{14} + 2Et_2S \longrightarrow B_{10}H_{12}(Et_2S)_2 \xrightarrow[-2Et_2S,\ -H_2]{HC\equiv CH} C_2B_{10}H_{12}$$

**75.**

**Ans.** **(b)**

**Sol.**



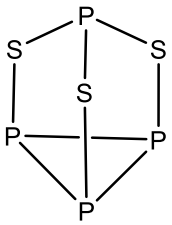

N = Planar ($sp^2$)

P = Tetrahedral ($sp^3$)

**76.**

**Ans.** **(c)**

**Sol.**




$P_4S_3$

Valence electron(N) = P = $2s^2\ 2p^3 \Rightarrow 5$

S = $2s^2\ 2p^4 = 6 \Rightarrow 4 \times 5 + 6 \times 3 = 38$

2c-2e bond (x) = 9

$x = \frac{8n-N}{2} \Rightarrow n = \frac{2x+N}{8} = \frac{18+38}{8} = 7$

**77.**

**Ans.** **(b)**

**Sol.** $B_2O_3 + H_2O \xleftarrow{O_2} B_2H_6 \xrightarrow{6H_2O} 2B(OH)_3 + H_2$

**78.**

**Ans.** **(a)**

**Sol.** $[Al_2(OH)_2Si_4O_{10}] \xrightarrow[by\ Al\ (III) and\ Charge\ balance\ by\ K(I)]{Replaced\ \frac{1}{4}\ of\ Si(IV)} KAI_2(OH)_2(Si_3Al)O_{10}$

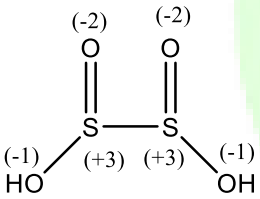
Pyrophylite — Muscovite

**79.**

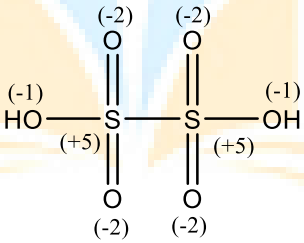
**Ans.** **(c)**

**Sol.**

Dithionous acid, $H_2S_2O_4$ (+3)



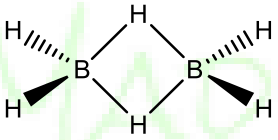

Dithionic acid, $H_2S_2O_6$ (+5)




**80.**

**Ans.** **(d)**

**Sol.**



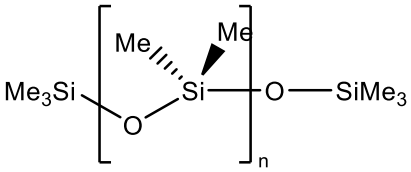

$D_{2h}$ point group

Total = 4n = 4 × 2 = 8 symmetry operation.

**81.**

**Ans.** **(b)**

**Sol.** Poly dimethyl siloxane (PDMS) is :

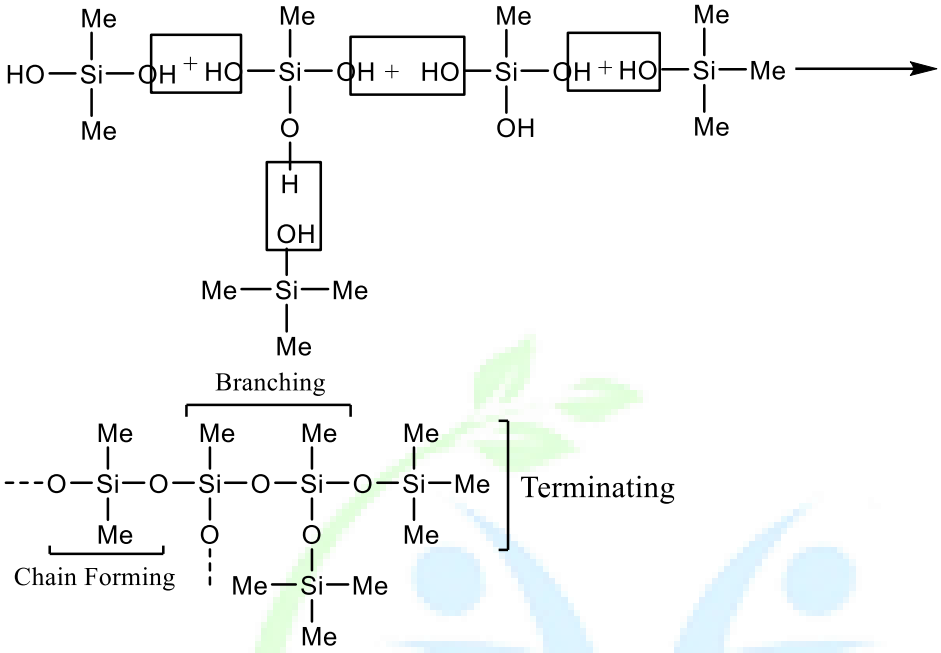



In siloxanes

$Me_3SiCl$ : Used as terminating agents $Me_3SiCl + H_2O \rightarrow Me_3Si(OH) + HCl$

$Me_2SiCl_2$: used as chain forming $Me_2SiCl_2 + 2H_2O \rightarrow Me_2Si(OH)_2 + 2HCl$

$MeSiCl_3$ : used as cross linkers for branching $MeSiCl_3 + 3H_2O \rightarrow MeSi(OH)_3 + 3HCl$




**82.**

**Ans.** **(c)**

**Sol.** • LiF is sparingly soluble in water but for large anions such as $ClO_4^-$, the $Li^+$ salts are soluble in water.

• Standard reduction potential [$E^0$] of Li is more negative than that of Na.

$Li^+(aq) + e^- \rightarrow Li(s)$ $\quad E^0_{red} = -3.04$

$Na^+(aq) + e^- \rightarrow Na(s)$ $\quad E^0_{red} = -2.71$

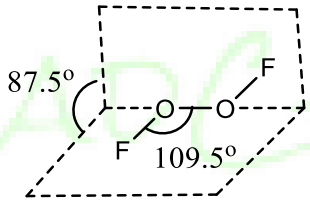
• Enthalpy of hydration :

$Li^+(g)[-520kJ/mol] > Na^+(g)[-406kJ/mol]$

**83.**

**Ans.** **(c)**

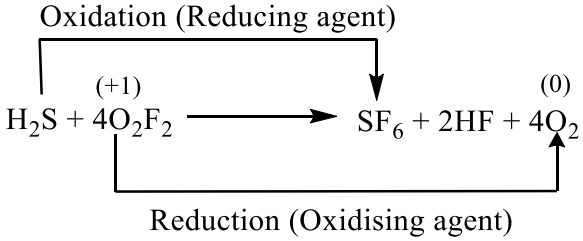
**Sol.**




The structure of $O_2F_2$ resembles that of $H_2O_2$, in its large dihedral angle, which approaches 90°.

• The reaction of fluorine with a dil. aqueous solution of NaOH gives OF2 with sodium fluoride as a side- product.

$2F_2 + 2NaOH \rightarrow OF_2 + 2NaF + H_2O$



**84.**

**Ans.** **(c)**

**Sol.** Standization using $kIO_3$,

$S_2O_3^{2-}$ + $kIO_3$ + kI + HCl → $I_2$ + kCl + $H_2O$

↓ ↓ ↓

(A) (B) (C)

$I_2$ + $Na_2S_2O_8$ → NaI + $Na_2S_4O_6$

↓ $S_2O_3^{-2}$ $S_4O_6^{2-}$

(C) ↓

(D)

**85.**

**Ans.** **(a) & (b)**

**Sol.** $XeO_4^{-2}$ , $XeO_3$, $XeO_2Fe_2$

$Fe_3(CO)_{12}$ + Na/liq → $[Fe(CO)_4]^{-2}$

Mn → Can stable in +2 (or low o.s)

TC higher metal can show or stable in higher

Re oxidation state

**86.**

**Ans.** **(b)**

**Sol.** $H_3PO_4$ is used in the estimation of Fe(II) with $K_2Cr_2O_7$ using diphenylamine suphonate as indicator to reduce the electrode potential for the $Fe^{3+} \rightarrow Fe^{2+}$ reaction by stabilising the ferric ion.

**87.**

**Ans.** **(a)**

**Sol.** $[Al_2(OH)_2Si_4O_{10}]$ $\xrightarrow[\text{by } Al\ (III) \text{and Charge balance by } K(I)]{Replaced\ \frac{1}{4}\ of\ Si(IV)}$ $KAI_2(OH)_2(Si_3Al)O_{10}$

Pyrophylite Muscovite

**88.**

**Ans.** **(a)**

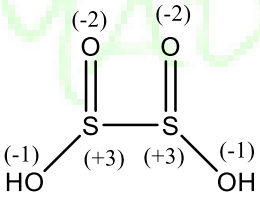
**Sol.** $IO_3^-(aq)$ + $5I^-$ (aq) + $6H^+(aq)$ → $3I_2(aq)$ + $3H_2O(l)$

**89.**

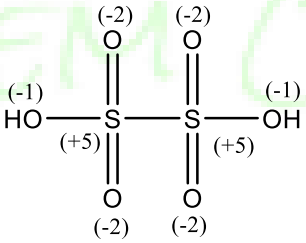
**Ans.** **(c)**

**Sol.**

Dithionous acid, $H_2S_2O_4$ (+3)



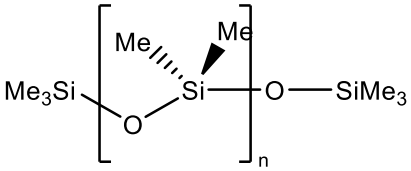

Dithionic acid, $H_2S_2O_6$ (+5)




**90.**

**Ans.** **(b)**

**Sol.** Poly dimethyl siloxane (PDMS) is :

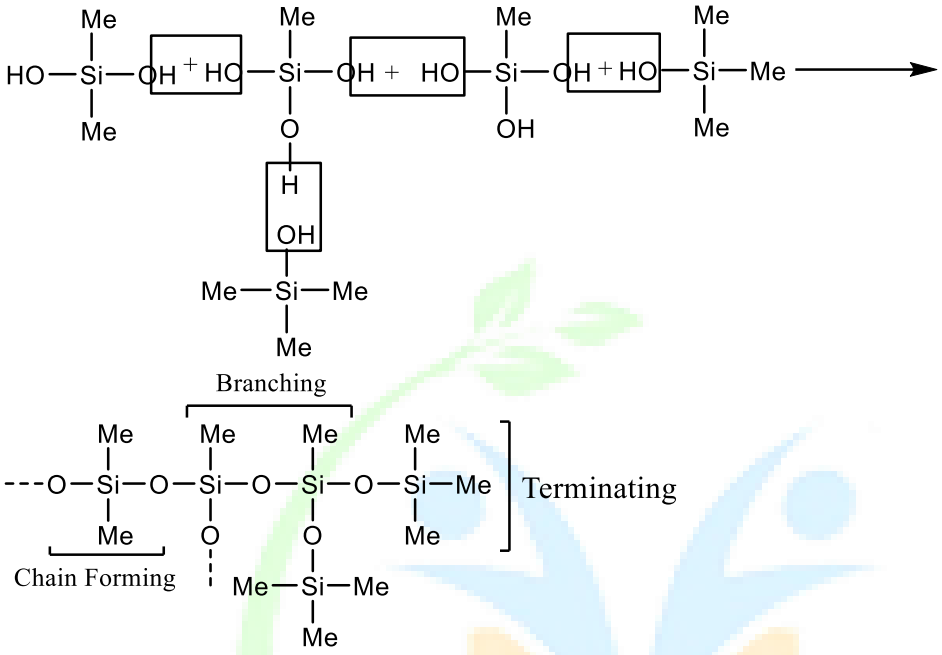


In siloxanes

$Me_3SiCl$ : Used as terminating agents $Me_3SiCl + H_2O \rightarrow Me_3Si(OH) + HCl$

$Me_2SiCl_2$: used as chain forming $Me_2SiCl_2 + 2H_2O \rightarrow Me_2Si(OH)_2 + 2HCl$

$MeSiCl_3$ : used as cross linkers for branching $MeSiCl_3 + 3H_2O \rightarrow MeSi(OH)_3 + 3HCl$




**91.**

**Ans.** **(a)**

**Sol.** • Nuclear spin of 10B = 3

Nuclear spin of 11B = 3/2


This indicates that polarities of B–H and C–H bonds are opposite

• Thermal neutron absorption cross section for $^{10}B$ = 3837 Barn and for $^{11}B$ = 0.005 Barn

• Boron resists attack by boiling conc. aqueous NaOH or fused NaOH upto 500°C.

$B + NaOH(aq) \rightarrow$ No reaction

Boron react with fused alkali to give sodium metaborate and $H_2$.

**92.**

**Ans.** **(c)**

**Sol.** • LiF is sparingly soluble in water but for large anions such as $ClO_4^-$, the $Li^+$ salts are solublein water.

• Standard reduction potential [$E^0$] of Li is more negative than that of Na.

$Li^+(aq) + e^- \rightarrow Li(s)$ $\quad E^0_{red} = -3.04$

$Na^+(aq) + e^- \rightarrow Na(s)$ $\quad E^0_{red} = -2.71$

• Enthalpy of hydration :

$Li^+(g)[-520kJ/mol] > Na^+(g)[-406kJ/mol]$

**93.**

**Ans.** **(a)**

**Sol.** HOMO of $O_2 \rightarrow \pi^*$

Bonding of $O_2$ along 2 dinection so $dz^2$

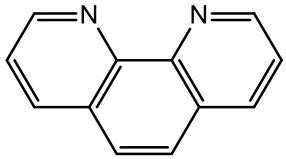
Orbital of Fe

**94.**

**Ans.** **(c)**

**Sol.** $[*Co(L)_n]^{2+} + [Co(L)_n]^{3+} \rightarrow [*Co(L)_n]^{3+} + [Co(L)_n]^{2+}$

$NH_3$ = Not a good π-acceptor n = 6

O-phen  good π acceptor n = 3

bidentate

π–acceptor ligands complex andergo fast electron transfer by accepting electrons in antibonding orbitals.

So, correct Ans (c) very slow electron transfer L = $NH_3$, n = 6

**95.**

**Ans.** **(d)**

**Sol.** (1) $Xe + PtF_6 \xrightarrow{SF_6} [Xe^{+1}] + [PtF_6]$

(2) $XeF_4 + Me_4NF \rightarrow [MeN]^+ [XeF_5^+]$

In (1) Xe gives 1 electron So it act as a base

In (2) $XeF_4$ excepts a fluoride So act as acid .

**96.**

**Ans.** **(d)**

**Sol.** $nPl_5 + nNH_4Cl \rightarrow [NPCl_2]_n + 4nHCl$

$[NPCl_2]_3 + 6NaF \rightarrow [NPF_2]_n + 6NaCl$

So, (i) and (ii) recur

Correct (4) (iii) C only (not possible)

**97.**

**Ans.** **(a)**

**Sol.** Si–F (F is most electronegative so

Si–Cl it pulls the electrons

Si–Bi and $SiF_4$ is the most acidic in terms of Lewis acidity

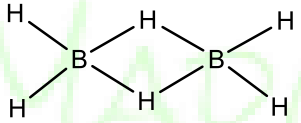
(a) is correct

(b) $SnCl_2$ is So it is a Lewis acid Aluminium silicates do not show Bronsted acidity.

**98.**

**Ans.** **(a), (c), (d)**

**Sol.** $B_2H_6$

 point group

26 planes

$Et_2O.BCl_3 \xrightarrow{NaBH_4} B_2H_6$

Bully anine → Symmetrical cleavage

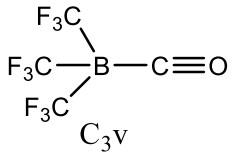
$B_2H_6 \xrightarrow{NMe_3} Me_3N : BH_3$

Diamagnetic

**99.**

**Ans.** **(b)**

**Sol.**



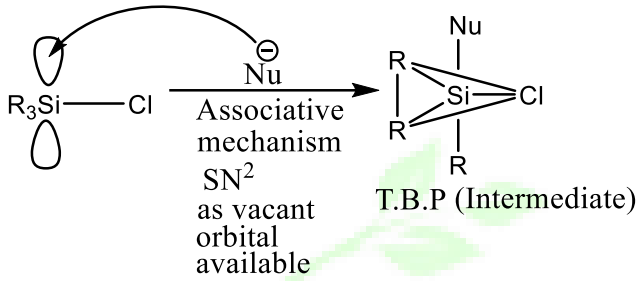

$CO \longrightarrow 2143$

If lewuis acid is attached then IR value ↑es.

**100.**

**Ans.** **(a)**

**Sol.**




T.B.P (Intermediate)

**101.**

**Ans.** **(a)**

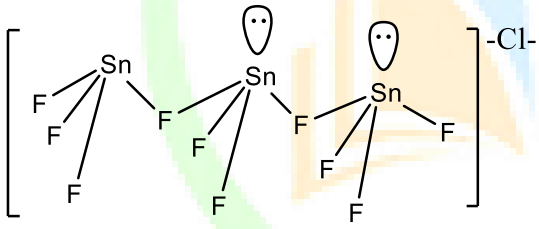
**Sol.** $HF + SnO \rightarrow P \quad (Sn F_2)$

$HF + SnCl_4 \rightarrow Q\ (SnF_4)$

$SnF_2 + NaF \rightarrow Na_4[Sn_3F_{10}]$

or

$[Sn_3F_{10}]^{-4}$




In the solid state P exhibit a ring structure .

**102.**

**Ans.** **(d)**

**Sol.** $(SN)_x$ is good conductor.

***