CHEMICAL BONDING

PROBLEMS BASED ON GIVEN TOPICS

- Attainment of s stable configuration
- Types of Bonds
- Transitions between the main types of bonding
  - Ionic bonds
  - Covalent bonds
  - Oxidation numbers
  - Coordinate bonds
  - Double and triple bonds
  - Metallic bonds and metallic structures
- The Covalent bond
  - The Lewis theory
  - Sidgwick-Powell theory
- Valence bond theory
  - What is the essence of hybridization?
  - Features of hybrid orbitals
  - Calculation of steric number
- Valence shell electron pair repulsion (VSEPR) theory
  - Effect of lone pair
  - Effect of double bond
  - Effect of electronegativity
  - Back bonding
- The extent od d orbital participation in molecular bonding
- Types of covalent bonds (sigma (σ) and (pi (π)) bonds)
  - Bridge bonding
- Molecular orbital method
- LCAO method
  - s-s combination of orbitals
  - s-p combination of orbitals
  - p-p combination of orbitals
  - d-d combination of orbitals
  - Non-bonding combination of orbitals
- Rules for linear combination of atomic orbitals
  - H_2^+ molecule ion
  - H_2 molecule
  - He_2^+ molecule ion
  - He_2 molecule
  - Li_2 molecule
  - Be_2 molecule
  - B_2 molecule
  - C_2 molecule
  - N_2 molecule
  - O_2 molecule
  - O_2^- ion
  - F_2 molecule
- Examples of molecular orbital treatment for heteronuclear diatomic molecules
  - MO molecule
  - CO molecule
- The ionic bond
  - Radius ratio rules
  - Calculation of some limiting radius ratio values
- Dipole moment
  - Application of dipole moment
  - Some special cases
- Close packing
- Ionic compound of the type AX (ZnS, NaCl, CsCl)
  - Structures of zinc sulphide
  - Sodium chloride structure
  - Caesium chloride structure
- Ionic compounds of the type AX_2 (CaF_2, TiO_2, SiO_2)
  - Calcium fluoride (fluorite) structure
  - Rutile structure
  - β-cristobalite (silica) structure

- Layer structures (CdI_2, $CdCl_2$, [NiAs]))
  - Cadmium iodide structure
  - Cadmium chloride structure
  - Nickel arsenide structure
- Lattice energy
- Stoichiometric defectes
  - Schottky defects
  - Frenkel defects
- Nonstoichiometric defects
  - Metal excess
  - Metal deficiency
- Born - Haber cycle
- Polarizing power and polarizability - Fajans' Rules
  - Properties of ionic compounds affected by polarization
- Melting point of ionic compounds
- Solubility of ionic compounds
  - Prediction of solubility order in ionic compounds
- Electrical conductivity and colour
- Acidic nature of oxides
- Thermal stability of ionic compounds
- Weak forces
  - Attractive intermolecular forces
  - Repulsive intermolecular forces
  - Lennard- Jones potential
- Interactions between ions and covalent molecules
- The metallic bond
  - Conductivity
  - Lustre
  - Malleability and cohesive force
  - Bond lengths
- Theories of bonding in metals
  - Free electron theory
  - Valence bond theory
  - Molecular orbital or band theory
- Conductors, Insulators and semiconductors

CHAPTER 1

Chemical Bonding

EXERCISE # I

❑ **Only one correct answer :**

1. Compound having ionic bond as well as covalent bond -

(*a*) KI_3 (*b*) NaN_3

(*c*) $LiAlH_4$ (*d*) All

2. Which is planar ion ?

(*a*) $\overset{\ominus}{C}H_3$ (*b*) $\overset{\ominus}{C}Me_3$

(*c*) $\overset{\ominus}{B}F_4$ (*d*) $C(CN)_3^-$

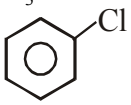
3. Which of the molecule is non polar as well as nonplanar ?

(*a*) CS_2 (*b*) BF_3

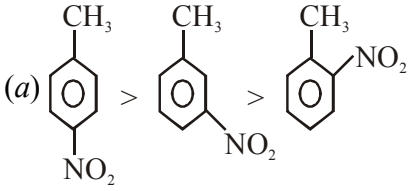
(*c*) CCl_4 (*d*) $B_3N_3H_6$

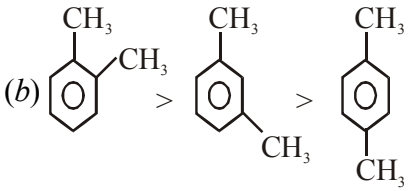
4. Which of the molecule is polar as well as planar ?

(*a*) $H_3C - C \equiv CH$ (*b*) SF_4

(*c*)  (*d*) $CHCl_3$

5. What is the correct order of dipole moment of the molecule ?

(*a*) 

(*b*) 

(*c*) HF > HCl > HBr > HI

(*d*) All

6. Which of the following molecule has highest dipole moment among methyl halide ?

(*a*) CH_3F (*b*) CH_3Cl

(*c*) CH_3Br (*d*) CH_3I

7. In which of the following compound, central atom has highest oxidation state -

(*a*) N_2O_5 (*b*) IF_7

(*c*) OsO_4 (*d*) $HMnO_4$

8. Number of planes containing maximum number of atoms in SeF_6 is x and number of planes containing at least three chlorine atoms in PCl_5 is y. Then the value of x – y is -

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

9. In trigonal bipyramidal geometry -

(*a*) There are 3 arrangement where 3 atoms are at an angle 120° with respect to each other.

(*b*) There are 6 arrangement where 2 atoms are at an angle 90° with respect to each other

(*c*) There is 1 arrangement where 2 atoms are at an angle 180° with respect to each other

(*d*) All

10. The shape of cationic part and anionic part when molten I_2Cl_6(liquid) undergo ionisation -

(*a*) trigonal planar and trigonal bipyramidal respectively

(*b*) linear and octahedral respectively

(*c*) angular and square planar respectively

(*d*) trigonal planar and tetrahedral respectively

11. Which of the molecule does not exist ?

(*a*) ClF_3 (*b*) ICl_3

(*c*) BrF_3 (*d*) ClI_3

12. Which compound has N–O–N linkage?

(*a*) N_2O_3 (*b*) N_2O_4

(*c*) N_2O_5 (*d*) All

13. The maximum number of 90° angles between bond pair - bond pair electrons observed in which hybridisation -

(*a*) d sp^2 (*b*) sp^3d

(*c*) sp^3d^2 (*d*) sp^3d^3

14. Which of the following case C – C bond length will be highest ?

(*a*) $CF_3 - CF_3$ (*b*) $F_2CH - CHF_2$

(*c*) $FCH_2 - CH_2F$ (*d*) $F_2CH - CF_3$

15. The hybridisation state of central atom of anionic part of product when XeF_2 and PF_5 combined is -

(*a*) sp^3 (*b*) sp^3d

(*c*) sp^3d^2 (*d*) sp^3d^3

16. Which of the following pair has same shape and total number of lone pair and σ bond pair on central atom -

(*a*) XeF_6, XeF_5^- (*b*) $XeOF_4$, XeF_5^+

(*c*) XeO_2F_2, $XeOF_4$ (*d*) XeF_4, XeO_3

17. Which of the following is bent in shape with sp^2 hybridisation in central atom ?

(*a*) $SnCl_2$ (*b*) Triplet carbene ($\overset{\cdot\cdot}{C}H_2$)

(*c*) Both (*a*) & (*b*) (*d*) None

18. Silicate in which discrete tetrahedral unit is present are also called naso silicate. Identify example of nasosilicate :-

(*a*) $BaTi(Si_3O_9)$

(*b*) $Sc_2Si_2O_7$

(*c*) $Ca_2Mg_5(Si_4O_{11})_2(OH)_2$

(*d*) Be_2SiO_4

19. Bond order of SO_2 and O_3 are respectively :-

(*a*) 2 & 1.5 (*b*) 1.5 & 1.5

(*c*) 1.5 & 1.33 (*d*) 2.4 & 1.5

20. Sorosilicates contain units made of two tetrahedral that share an oxygen. The example of sorosilicate -

(*a*) $BaTi(Si_3O_9)$

(*b*) $Sc_2Si_2O_7$

(*c*) $Ca_2Mg_5(Si_4O_{11})_2(OH)_2$

(*d*) Be_2SiO_4

21. Two compounds X_1 & X_2 have general molecular formula AB_4.

X_1 is nonplanar all A – B bond lengths are identical

X_2 is nonplanar but all A – B bond lengths are not identical

X_1 and X_2 can be -

(*a*) Square planar structure and tetrahedral structure

(*b*) Square planar structure and sea saw strucuture

(*c*) Sea saw structure and tetrahedral structure

(*d*) tetrahedral structure and Sea saw structure

22. The minimum number of 90° angles between bond pair - bond pair of electrons is observed in -

(*a*) sp^3 hybridisation

(*b*) sp^3d hybridisation

(*c*) sp^3d^2 hybridisation

(*d*) sp^3d^3 hybridisation

23. Incorrect option regarding bond angle -

(*a*) $PH_3 > PF_3$

(*b*) $H_2O < F_2O < Cl_2O$

(*c*) $NH_3 > NF_3$

(*d*) $\widehat{HOH}$ in H_2O < $\widehat{HOC}$ in CH_3OH

24. $F - \widehat{M} - F$ bond angle is maximum for -

(*a*) BeF_2 (*b*) MgF_2

(*c*) CaF_2 (*d*) SrF_2

25. Number of sp^3 hybridised carbon and sp hybridised carbon present in $C(CN)_4$ molecule is-

(*a*) 0, 5 (*b*) 0, 5

(*c*) 1, 4 (*d*) 4, 1

26. $\widehat{OXeO}$ bond angle in XeO_4 and XeO_3F_2 are respectively :-

(*a*) 120° & 109°28'

(*b*) 109°28' & 120°

(*c*) > 109°28' & < 120°

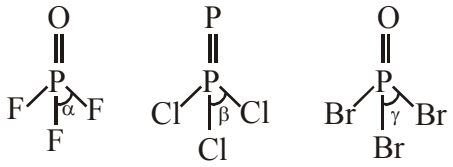
(*d*) 110° & 110°

27. $\widehat{ONX}$ (X = halogen atom) in NOF (A) ; NOCl (B) ; NOBr (C) -

(*a*) A = B = C (*b*) A > B > C

(*c*) C > B > A (*d*) A > C > B

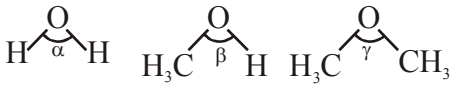
28. Which of the following option regarding bond angle is correct ?



(*a*) $\alpha < \beta < \gamma$ (*b*) $\alpha = \beta = \gamma$

(*c*) $\alpha > \beta > \gamma$ (*d*) $\alpha > \gamma < \beta$

29. Which of the following option regarding bond angle is correct ?



(*a*) $\alpha < \beta < \gamma$ (*b*) $\alpha = \beta = \gamma$

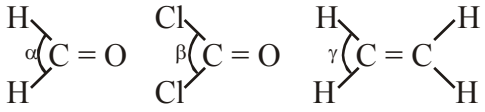
(*c*) $\alpha > \beta > \gamma$ (*d*) $\alpha > \gamma < \beta$

30. Which of the following option regarding bond angle is correct ?

(*a*) $\alpha < \beta < \gamma < \delta$ (*b*) $\alpha = \beta = \gamma = \delta$

(*c*) $\alpha > \beta > \gamma > \delta$ (*d*) $\alpha > \gamma > \beta > \delta$

31. Which of the following option regarding bond angle is correct ?



(*a*) $\alpha < \beta < \gamma$ (*b*) $\alpha = \beta = \gamma$

(*c*) $\alpha > \beta > \gamma$ (*d*) None

32. Which of the following statements is correct ?

(*a*) In trigonal bipyramidal electron geometry, if two lone pair is present then shape of the molecular is linear

(*b*) In pentagonal bipyramidal electron geometry, if two lone pair is present then shape of the molecule is distorted octahedron.

(*c*) In octahedral electron geometry, if two lone pair is present then shape of the molecule is square planar.

(*d*) In tetrahedral electron geometry, if two lone pair is present the shape of the molecule is trigonal planar .

33. F–P–F bond angle in PF_3Cl_2 can be approximately:-

(*a*) only 120° (*b*) only 180°

(*c*) 90° & 180° (*d*) 90° & 120°

34. Which one is correct order regarding property of molecule ?

(*a*) % p character in hybrid orbital $sp > sp^2 > sp^3$

(*b*) bond angle $NO_2^- > NO_3^- > NO_2^+$

(*c*) C–H bond length $CH_3 - F > CH_2F_2 > CHF_3$

(*d*) $\widehat{HMH}$ $CH_4 > H_2O > NH_3$

35. What is the difference in between bond angles in cationic species of PCl_5 and PBr_5 in solid state ?

(*a*) 60° (*b*) 109°28'

(*c*) 0° (*d*) 90°

36. Select the incorrect statement for molecule $Cl_3P = CH_2$

(*a*) P is sp^3 hybridised and Sea saw strcuture

(*b*) molecule has $p\pi$-$d\pi$ bond

(*c*) C atom is sp^2 hybridised

(*d*) Planar molecule

37. Number of exactly 90° angle in SF_4 is -

(*a*) 4 (*b*) 3

(*c*) 1 (*d*) zero

38. The maximum % of s character on central atom present in -

(*a*) N_2H_2 (*b*) NH_3

(*c*) $\overset{+}{N}H_4$ (*d*) NH_2OH

39. Product of which reaction can form dimer ?

(*a*) $Cl_2 + F_2 \rightarrow$ Product (excess)

(*b*) $I_2 + Cl_2 \rightarrow$ Product (equimolar)

(*c*) $I_2 + Cl_2 \rightarrow$ Product (excess)

(*d*) $Br_2 + F_2 \rightarrow$ Product (excess)

40. XeF_4 when combines with SbF_5 the product formed is ionic. The hybridisation of cationic part and anionic part is respectively.

(*a*) sp^3d^2 , sp^3d^2 (*b*) sp^3d , sp^3d

(*c*) sp^3d^2 , sp^3d (*d*) sp^3d , sp^3d^2

41. Which of the following geometry is not formed from sp^3d hybridisation of the central atom ?

(*a*) Linear (*b*) Tetrahedral

(*c*) T-shaped (*d*) Sea-saw

42. The orbital not participated in sp^3d^2 hybridisation-

(*a*) p_x (*b*) d_{z^2}

(*c*) p_z (*d*) d_{xz}

43. $SnCl_2$; $SnCl_3^+$; I_3^+; I_3^-; H_3O^+

Which of the following shape does not describe any of the above species ?

(*a*) Angular (*b*) Linear

(*c*) Pyramidal (*d*) Tetrahedral

44. All possible bond angles in octahedral geometry like PCl_6^- is -

(*a*) 109°28' (*b*) 90°, 180°

(*c*) 90°, 120° (*d*) 109°28', 180°

45. % s character in hybrid orbital -

(*a*) $sp^3d < sp^3 < sp^2 < sp$

(*b*) $sp < sp^2 < sp^3 < sp^3d$

(*c*) $sp^3d < sp < sp^2 < sp^3$

(*d*) $sp^2 < sp^3 < sp < sp^3d$

46. Which of the following pair of species have identical shape ?

(*a*) I_3^+; I_3^- (*b*) NO_2^+; NO_2^-

(*c*) TeF_5^-; XeF_5^+ (*d*) SF_4, XeO_4

47. In which case maximum number of atoms are present in same plane -

(*a*) $B_3N_3H_6$ (*b*) $C(CN)_4$

(*c*) I_2Cl_6 (*d*) IF_7

48. Cl – O bond order -

(*a*) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$

(*b*) $ClO^- > ClO_2^- > ClO_3^- > ClO_4^-$

(*c*) $ClO_3^- > ClO_3^- > ClO^- > ClO_4^-$

(*d*) $ClO_2^- > ClO^- > ClO_3^- > ClO_4^-$

49. Find the overlapping which do not result in σ bond formation, if z axis is considered to be intermolecular axis -

(*a*) $s + p_x$ (*b*) $p_z + d_{z^2}$

(*c*) $s + p_z$ (*d*) $d_{x^2-y^2} + d_{z^2}$

50. Molecule AH_n does not exist because d orbital contraction is not possible. Select the correct statement -

(*a*) A belongs to 2nd period

(*b*) Hybridisation of A may be sp^2 or sp^3

(*c*) A must have more than 4 valence electrons

(*d*) Minimum value of n must be 5

51. $BF_3 + O(SiH_3)_3 \rightarrow$ No reaction.

Which following factor has no significance ?

(*a*) lone pair of oxygen are involved in back bonding with Si

(*b*) F can easily donate its lone pair to boron in comparison of oxygen

(*c*) $O(SiH_3)_2$ is very stable due to back bonding

(*d*) $O(SiH_3)_2$ can't act as Lewis base

52. Choose the correct order of bond angles for given compound -

(*a*) $NO_2 > O_3$ (*b*) $O_3 > NO_2$

(*c*) $NO_2^- = O_3$ (*d*) Can't be preicted

53. The molecule having only one lone pair is / are -

(*a*) ClF_3 (*b*) NH_3

(*c*) H_2O (*d*) PCl_3

54. Which of the following species is non polar ?

(*a*) ClF_3 (*b*) ICl_4^-

(*c*) I_3^+ (*d*) OCN^-

55. The molecule which does not consist of any F–X–F bond angle which is less than 90° -

(X = central atom) -

(*a*) ClF_3 (*b*) IF_7

(*c*) PF_5 (*d*) SF_4

56. Highest boiling point is observed in -

(*a*) CH_4 (*b*) BF_3

(*c*) Silica (*d*) CO_2

57. In a compound AB_3, A is a central atom and B is surrounding atom. Then which of the following combination of A and B gives minimum $B\hat{A}B$ bond angle :-

(*a*) A = N ; B = Cl (*b*) A = P ; B = Cl

(*c*) A = N ; B = H (*d*) A = P ; B = H

58. % of s character in the orbital occupied by lone pair in H_2O.
(Given : $\cos 104.5° = -0.25$, $\hat{HOH} = 104.5°$)
(*a*) 25% (*b*) 20%
(*c*) 80% (*d*) 30%

59. % of s character in the orbital occupied by lone pair in NH_3 molecule.
(Given : $\cos 107° = -0.292$)
(*a*) 68% (*b*) 32%
(*c*) 38% (*d*) 25%

60. Which of the following orbital is commonly involved in hybridisation of only in two of following species PCl_5 ; PCl_4^+ ; PCl_6^- ; PCl_3 ?
(*a*) d_{z^2} (*b*) $d_{x^2-y^2}$
(*c*) s (*d*) p_x, p_y, p_z

61. Which of the following order is correct for increasing p-character in orbitals used for bonding by central atom ?
(*a*) $SiH_4 > CH_4$ (*b*) $PH_4^+ > PH_3$
(*c*) $H_2S > H_2O$ (*d*) $NH_3 > PH_3$

62. Which of the following molecule does exist as oxy acid of fluorine ?
(*a*) HFO_4 (*b*) HFO_3
(*c*) HFO_2 (*d*) HOF

63. Which of the following fluoride does exist ?
(*a*) OF_6 (*b*) OF_4
(*c*) IF_7 (*d*) ClF_7

64. Which of the following is thermally most stable?
(*a*) H_2O (*b*) H_2S
(*c*) H_2Se (*d*) H_2Te

65. Shape of the molecule is decided by -
(*a*) σ bond (*b*) π bond
(*c*) both (*d*) None

66. Which of the following bond has highest bond dissociation energy ?
(*a*) σ bond (*b*) π bond
(*c*) H-bond (*d*) None

67. Which of the following is example of strongest π bond if the molecular axis is x axis ?
(*a*) $2p_x - 4p_x$ (*b*) $2p_y + 2p_y$
(*c*) $2p_y + 3d_{xy}$ (*d*) $2p_z + 4p_z$

68. Which of the following set of overlap can not provide π bond formation ?
(*a*) 3d – 2p (*b*) 2p – 3p
(*c*) 2p – 2p (*d*) 3p – 1s

69. The number of σ bond and π bond ratio in N_2 and P_2 molecule are -
(*a*) $\frac{1}{2}, \frac{1}{2}$ (*b*) 1, 1
(*c*) $\frac{1}{2}$, 1 (*d*) 1, $\frac{1}{2}$

70. Which orbitals of two atoms can produce σ bond?
(*a*) $d_{z^2} \longrightarrow$ overlap on z axis $\leftarrow d_{z^2}$
(*b*) $d_{xy} \longrightarrow$ overlap on x axis $\leftarrow d_{xy}$
(*c*) $d_{x^2-y^2} \longrightarrow$ overlap on y axis $\leftarrow d_{x^2-y^2}$
(*d*) $d_{xz} \longrightarrow$ overlap on y axis $\leftarrow d_{xz}$

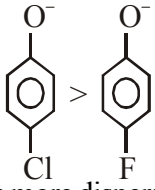
71. Consider the following molecules,
I $(CH_3)_3\underline{N}$; II $CH_3 - \underline{N} = \underline{C} = O$; III $(CH_3)_3\underline{P}$
In which molecule, geometry around underlined atom is not changed when all CH_3 groups are replaced by SiH_3 group.
(*a*) II, III
(*b*) III only
(*c*) II only
(*d*) I & II

72. pπ – dπ bonding is most effective in -
(*a*) PF_3 (*b*) PCl_5
(*c*) PBr_3 (*d*) PI_3

73. In which case back bonding takes place -
$CCl_3 - \underset{\underset{O}{\|}}{C} - O^-$ (A) ; $\overline{C}Cl_3$ (B) ;
CCl_2 (C) ; $Cl_3C - O^-$ (D)
(*a*) only B
(*b*) B,C & D
(*c*) B & C
(*d*) A,B,C,D

74. p-flurophenol is less acidic than p-chlorophenol because -
(*a*) –I effect –F > –Cl
(*b*) –I effect of –Cl > –F

(*c*) Congugate base, of p-fluoro phenol is more stable than conjugate base of p-chloro phenol due to vacant d-orbital present in F.

(*d*) Stability  because the charge on oxygen in more dispersed in vacant d orbital of –Cl atom.

75. The correct order of viscosity of ethanol , ethylene glycol and glycerol is :-

(*a*) ethanol > ethylene glycol > glycerol

(*b*) ethanol > glycerol > ethylene glycol

(*c*) ethylene glycol> ethanol > glycerol

(*d*) glycerol > ethylene glycol > ethanol

76. Which of the following pair of molecular orbital is the pair of degenerate orbital ?

(*a*) $\pi 2p_y$, $\pi^* 2p_y$ (*b*) $\sigma 2p_x$, $\pi 2p_y$

(*c*) $\pi^* 2p_y$, $\pi^* 2p_{yz}$ (*d*) $\sigma 1s$, $\sigma 2s$

77. The O – O bond length in O_2 ; $O_2[AsF_4]$; KO_2 is :-

(*a*) $O_2[AsF_4] < O_2 < KO_2$

(*b*) $O_2 < O_2[AsF_4] < KO_2$

(*c*) $KO_2 < O_2[AsF_4] < O_2$

(*d*) $O_2[AsF_4] < KO_2 < O_2$

78. In $B(OCH_3)_3$ (methyl borate), due to back bonding $\widehat{COB}$ angle.

(*a*) becomes equal to 109°28'

(*b*) less than 109°28'

(*c*) more than 109°28'

(*d*) can't be predicted

79. For succinic acid which of the following option is correct ?

(K_1 & K_2 are Ist dissociation constant and IInd dissociation constant respectively)

(*a*) $\frac{K_1}{K_2} > 1$ (*b*) $\frac{K_1}{K_2} < 1$

(*c*) $\frac{K_1}{K_2} = 1$ (*d*) All

80. If back bonding does not take place in $N(SiH_3)_3$ then what will be the hybridisation of N atom and Si atom -

(*a*) sp^2, sp^3 (*b*) sp^2, sp^2

(*c*) sp^3, sp^2 (*d*) sp^3, sp^3

81. In which of the following, correct shape and hybridisation of central atom is given ?

	Ion	Shape	Hybridisation of central atom
(*a*) I.	MnO_4^{-1}	Tetrahedral	sp^3
(*b*) II.	CrO_4^{-2}	Square planar	d^3s
(*c*) III.	XeF_4	Tetrahedral	sp^3d^2
(*d*) IV.	$CoCl_4^{-2}$	Tetrahedral	sp^3

82. The hybridisation of N in $N(SiH_3)_3$; N in $H_3Si-N=C=S$; O in $O(SiH_3)_3$ are respectively :-

(*a*) sp^3 , sp^2, sp^3 (*b*) sp^2 , sp^2, sp^2

(*c*) sp^2 , sp, sp^2 (*d*) sp^3 , sp, sp^2

83. Back bonding does not take place for which molecule :-

(*a*) H_2N-BH_2 (*b*) SCl_2

(*c*) H_2N-PH_2 (*d*) $^{\ominus}CF_3$

84. In the dimer of BeH_2 , the kind of overlap present in bridge bond :-

(*a*) sp^3–s–sp^3 (*b*) sp^3–s

(*c*) sp^2–s–sp^2 (*d*) sp^2–sp^2–sp^2

85. In pentagonal bipyramidal geometry -

(*a*) Groups / atoms which are occupied at equatorial position will be at 72°

(*b*) Groups / atoms which are occupied at axial position will be at 180°

(*c*) Equatorial groups & axial groups are at 90° w.r.t. each other

(*d*) All

86. In which of the following molecule 3C–2e bonding is present ?

(*a*) Monomer of diborane

(*b*) Monomer of $(BeH_2)_n$

(*c*) $(AlH_3)_n$

(*d*) All of these

87. Find the number of molecule having 3c–2e bond:-

(i) O_2Cl_2 (i) Al_2Cl_6

(iii) $Al(CH_3)_3$ (iv) $[Be(CH_3)_2]$

(*a*) 0 (*b*) 1

(*c*) 2 (*d*) 3

88. Which of the following is correct regarding I_2Cl_6 ?

(*a*) It is planar like Al_2Cl_6

(*b*) It is non-planar like Al_2Cl_6

(*c*) During ionisation of I_2Cl_6 , cationic part and anionic part formed are bent and square planar respectively.

(*d*) It has 2c–2e as well as 3c–2e bond

89. Find the molecule in which different bond angle is observed but dipole moment of the molecule is zero :-

(*a*) PCl_4^+ (*b*) BF_3

(*c*) PCl_3F_2 (*d*) PCl_2F_3

90. Which of the following molecule is planar as well as polar ?

(*a*) $B_3N_3H_6$ (*b*) ClO_2

(*c*) NH_3 (*d*) SOF_4

91. Which of the following molecule contains atleast one lone pair of electron on central atom and has non-zero dipole moment ?

(*a*) XeF_2 (*b*) $CClF_3$

(*c*) XeF_4 (*d*) NH_3

92. During the hydrolysis of $SiCl_4$ transition state is formed in Ist step. What is the hybridisation of central atom in that transition state ?

(*a*) sp^3d (*b*) sp^3d^2

(*c*) sp^3 (*d*) sp^2

93. Which of the following oxide when reacts with water, mixture of acids is formed ?

(*a*) CO_2 (*b*) N_2O_5

(*c*) Mn_2O_7 (*d*) NO_2

94. Which of the following compounds gives only oxyacid as a final product by the hydrolysis in cold condition ?

(*a*) NF_3 (*b*) $SbCl_3$

(*c*) $H_2S_2O_7$ (*d*) SO_2Cl_2

95. X (1mole) + $H_2O \longrightarrow H_3PO_3$(1 mole) + H_3PO_4 (1 mole) ;

X is :-

(*a*) $H_4P_2O_8$ (*b*) $H_4P_2O_6$

(*c*) $H_4P_2O_7$ (*d*) $H_4P_2O_5$

96. $AsCl_3 + H_2O \longrightarrow X_1 + HCl$

$SbCl_3 + H_2O \longrightarrow X_2 + HCl$

$BiCl_3 + H_2O \longrightarrow X_3 + HCl$

X_1 ; X_2 ; X_3 are respectively :-

(*a*) AsOCl , SbOCl , BiOCl

(*b*) $As(OH)_3$, $Sb(OH)_3$, $Bi(OH)_3$

(*c*) $As(OH)_3$, SbOCl , BiOCl

(*d*) AsOCl , $Sb(OH)_3$, $Bi(OH)_3$

97. Which of the following compound when undergoes hydrolysis oxyacid of halogen is formed as one of the product ?

(*a*) SF_4 (*b*) XeF_4

(*c*) NCl_3 (*d*) SeF_6

98. $SiCl_4$ undergoes hydrolysis by :-

(*a*) S_N1 mechanism (*b*) S_N2 mechanism

(*c*) S_Ni mechanism (*d*) E_2 mechanism

99. Which of the molecule do not undergo hydrolysis at room temperature :-

(I) NF_3 (II) CCl_4

(III) SF_4 (IV) SF_6

(*a*) II, III (*b*) I, II, III

(*c*) only II (*d*) I, II, IV

100. PCl_3 and PCl_5 when undergo hydrolysis, products formed are respectively :-

(*a*) Tribasic acid (H_3PO_3) & Tribasic acid (H_3PO_4)

(*b*) Dibasic acid (H_3PO_3) & Dibasic acid (H_3PO_4)

(*c*) Dibasic acid H_3PO_3 & Tribasic acid H_3PO_4

(*d*) Tribasic acid H_3PO_3 & Dibasic acid H_3PO_4

101. $TeF_6 + H_2O \rightarrow$ Oxyacid P_1

$SeF_6 + H_2O \rightarrow$ Oxyacid P_2

P_1 & P_2 are respectively :-

(*a*) H_2TeO_4 , H_2SeO_4 (*b*) H_6TeO_6 , H_6SeO_6

(*c*) H_2TeO_4 , H_6SeO_6 (*d*) H_6TeO_6 , H_2SeO_4

102. NF_3 at drastic condition undergoes hydrolysis through :-

(*a*) S_N1 mechanism

(*b*) S_N2 mechanism

(*c*) E_2 mechanism

(*d*) E_1 mechanism

103. CCl_4 when undergoes reaction with superheated steam the product formed is :-

(*a*) CO_2 (*b*) $CHCl_3$

(*c*) $COCl_2$ (*d*) $CCl_3(OH)$

104. Which xenon fluoride when undergoes hydrolysis, redox reaction does not take place :-

(*a*) XeF_2 (*b*) XeF_4

(*c*) XeF_6 (*d*) All

105. In which of the molecule, hydrolysis can not generate oxyacid of central atom :-

(*a*) NCl_3 (*b*) PCl_3

(*c*) SF_4 (*d*) P_4O_{10}

106. Which of the following compounds are obtained as common product during hydrolysis of XeF_4 and XeF_6 ?

(*a*) Xe

(*b*) HF

(*c*) XeO_3

(*d*) both (*b*) and (*c*)

107. In methyl radical, % of p character of C–H bond is :-

(*a*) greater than % p character of C–F bond in trifluoro methyl radical

(*b*) less than % p character of C–F bond in trifluoro methyl radical

(*c*) is same as % p character of C–F bond is trifluoro methyl radical

(*d*) none

108. NeF_2 , $KrCl_2$; ArH_2 do not exist because :-

(*a*) Nonavailability of d orbital for Ne, Kr, Ar

(*b*) d orbital contraction is not possible for NeF_2 , $KFCl_2$, ArH_2

(*c*) Inertness of noble gases to form compounds

(*d*) Ne^{2+} , Kr^{2+} , Ar^{2+} have noble gas configuration

109. Which of the following statement is incorrect ?

(*a*) In $\dot{C}lO_3$, odd electron resides in one of the sp^3 hybridised orbital

(*b*) $\dot{C}HF_2$ is pyramidal in nature

(*c*) $\dot{C}H_3 + \dot{C}H_3 \longrightarrow H_3C - CH_3$. $\Delta G°$ of this reaction in +ve.

(*d*) NO_2 is called mixed anhydride

110. Correct order of boiling point of noble gases :-

(*a*) He > Ne > Ar > Kr > Xe

(*b*) He > Xe > Kr > Ar > Ne

(*c*) Xe > Kr > Ar > Ne > He

(*d*) Kr > Ar > He > Xe > Ne

111. Correct order of boiling point :-

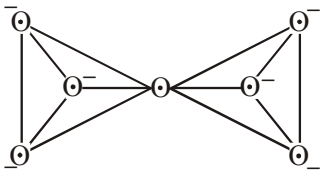
(*a*) HF > HI > HBr > HCl

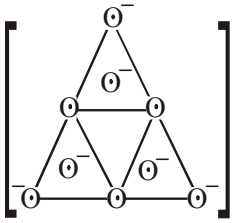
(*b*) $H_2O > H_2Te > H_2Se > H_2S$

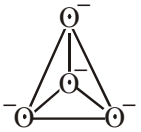
(*c*) $PbH_4 > SnH_4 > SiH_4 > CH_4$

(*d*) All

112. Which diagram correctly represents Wallastonite $Ca_3Si_3O_9$.

(*a*) 

(*b*) 

(*c*) 

(*d*) None

113. In amphibole which are essentially double chain silicate, which of the following statement is correct :-

(*a*) No. of oxygen shared in every tetrahedral unit is 2

(*b*) No. of oxygen shared in every tetrahedral unit is 3

(*c*) 2 & 3 oxygen atoms shared in tetrahedral unit alternatively

(*d*) None

114. In diopsite $CaMg(SiO_3)_2$, the type of silicate and number of oxygens shared in tetrahedral unit are respectively :-

(*a*) Double chain silicate ; 3

(*b*) Single chain silicate ; 2

(*c*) Single chain silicate ; 3

(*d*) Double chain silicate ; 2

115. Which of the compound has odd e^- molecule and central atom is sp^3 hybridised :-

(*a*) NO_2 (*b*) ClO_2

(*c*) ClO_3 (*d*) NO

116. Which can form dimer ?

(*a*) BCl_3 (*b*) $B(OCH_3)_3$

(*c*) $Al(CH_3)_3$ (*d*) BBr_3

117. In boric acid hybridisation state of B and O are respectively :-

(*a*) sp^2, sp^2

(*b*) sp^2, sp^3

(*c*) sp^3, sp^2

(*d*) sp^3, sp^3

118. Correct statement :-

(*a*) 8-hydroxy quinoline can be separated from 4-hydroxy quinoline by fractional distillation

(*b*) As branching of isomeric alkane increases boiling point decreases

(*c*) Salicylic acid has less boiling point that p hydroxy benzoic acid because former compound can form intramolecular H bonding but latter compound form intermolecular H bonding.

(*d*) All

119. Which of the following statement is correct ?

(*a*) 12 crown-4-ether dissolves Li^+ most effectively because cavity size is 75 pm

(*b*) 15 crown-5-ether dissolves Na^+ most effectively because cavity size is 110 pm

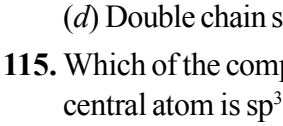
(*c*) 18 crown-6-ether dissolves Rb^+ most effectively because cavity size is 160 pm

(*d*) All

120. Dipole-dipole interaction exist between which pair :-

(*a*) KCl, H_2O (*b*)  , EtOH

(*c*)  , CCl_4 (*d*) Acetone and acetonitrile

121.  In I_5^- :-

(*a*) a = b (*b*) a > b

(*c*) b > a (*d*) a = b = 2 pm

122. The internuclear interaction that is independent on the inverse cube of distance between the molecule is :-

(*a*) London force

(*b*) Ion-Ion interaction

(*c*) Ion dipole interaction

(*d*) H-bonding

123. Which of the compound does not have H-bonding?

(*a*) K_2HPO_4 (*b*) $KHCO_3$

(*c*) K_2HPO_3 (*d*) KHF_2

124. Select incorrect statement :-

(*a*) Ammonium is more soluble than Na^+

(*b*) He/Ne can not form clathrate

(*c*) ICl is more reactive than I_2

(*d*) $H_3O_4^+$, H-bonding is absent

125. Which of the following has highest pk_a in aqueous solution ?

(*a*) CH_3NH_2 (*b*) $(CH_3)_2NH$

(*c*) $(CH_3)_3N$ (*d*) NH_3

126. Which of the following compound of heating gives N_2 gas ?

(*a*) NH_4NO_3 (*b*) NH_4NO_2

(*c*) $NaNO_3$ (*d*) Li_3N

127. KCl and KI will be soluble (highly) in :-

(*a*) H_2O, H_2O respectively

(*b*) H_2O & acetone respectively

(*c*) Acetone, H_2O respectively

(*d*) Acetone, Acetone respectively

128. Highest polarising power is observed in :-

(*a*) Na^+ (*b*) K^+

(*c*) Cu^+ (*d*) Zn^{2+}

129. Highest polarisability is observed in :-

(*a*) F^- (*b*) Cl^-

(*c*) Br^- (*d*) I^-

130. Most covalent halide :-

(*a*) $CaCl_2$ (*b*) $PbCl_2$

(*c*) $AlCl_3$ (*d*) $FeCl_2$

131. Which of the following is thermally most stable ?

(*a*) Na_2CO_3 (*b*) $BeCO_3$

(*c*) $MgCO_3$ (*d*) $CaCO_3$

132. Which of the following compound has highest lattice energy ?

(*a*) NaCl (*b*) MgO

(*c*) ScN (*d*) TiC

133. Which compound has highest covalent character?

(*a*) NaCl (*b*) $MgCl_2$

(*c*) $AlCl_3$ (*d*) $SiCl_4$

134. Which of the following order is correct regarding solubility of group IIA halide ?

(*a*) $BeX_2 < MgX_2 < CaX_2 < SrX_2 < BaX_2$

(*b*) $LiX > NaX > KX > RbX < CsX$

(*c*) $BeX_2 > MgX_2 > CaX_2 > SrX_2 > BaX_2$

(*d*) $LiX < NaX < KX < RbX < CsX$

135. Which compound is least thermally stable ?

(*a*) $LiNO_3$ (*b*) $NaNO_3$

(*c*) KNO_3 (*d*) $RbNO_3$

136. Out of $BeCl_2$, $CaCl_2$, CsCl, KCl ; $BeCl_2$ has :-

(*a*) highest ionic chracter

(*b*) highest solubility in H_2O

(*c*) highest lattice energy

(*d*) lowest charge : size ratio in cation

137. % s-character of the hybrid orbitals used for C–H bond formation in CH_2F_2 molecule :-

$(\widehat{HCH})_{CH_2F_2} = 111.9°$, $\cos 111.9° = -0.3729$

(*a*) 27.1% (*b*) 37.3%

(*c*) 29% (*d*) 30%

138. In PTFE (polytetrafluoro ethene) the hybridisation of carbon atom is :-

(*a*) sp (*b*) sp^2

(*c*) sp^3 (*d*) sp^3d

139. In vinyl acetylene the hybridisation of carbon atom :-

(*a*) only sp^2 (*b*) only sp^3

(*c*) both sp^2, sp^3 (*d*) both sp, sp^2

140. The correct order of B–F bond lengths :-

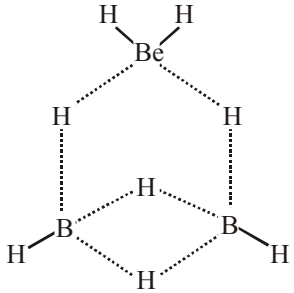
(*a*) $BF_3 < BF_2 - NH_2 < BF_2 - OH < BF_4^-$

(*b*) $BF_2NH_2 < BF_2 - OH < BF_3 < BF_4^-$

(*c*) $BF_3 < BF_4^- < BF_2 - OH < BF_2 - NH_2$

(*d*) $BF_3 < BF_2 - OH < BF_2 - NH_2 < BF_4^-$

141. Total 2c–2e and 3c–2e bonds in $Be(BH_4)_2$ are respectively :-



(*a*) 6,4 (*b*) 4,6

(*c*) 4,4 (*d*) 4,8

142. What will be the oxidation state of P in $H_4P_2O_8$ & HPO_3 ?

(*a*) +5, +5 (*b*) +5, +3

(*c*) +5, 0 (*d*) +5, +7

143. The mineral $Na_2Fe_3^{II}Fe_2^{III}[Si_8O_{22}](OH)_2$ (chrocidolite) is a :-

(*a*) pyroxene chain silicate

(*b*) Sheet silicate

(*c*) amphiboles chain silicate

(*d*) 3D-silicate

144. The silicate anion in the mineral kinoite is a chain of three SiO_4 tetrahedra that share corners with adjacent tetrahedra. The mineral also conain Ca^{2+} ions, Cu^{2+} ions, and water molecules in a 1 : 1 : 1 ratio. Mineral is represented as :-

(*a*) $CaCuSi_3O_{10}.\ H_2O$

(*b*) $CaCuSi_3O_{10}.\ 2H_2O$

(*c*) $Ca_2Cu_2Si_3O_{10}.\ 2H_2O$

(*d*) None of these

145. An atom A has atomic number less than 21. What will be the hybridisation of ACl_3, if ACl_3 has zero dipole moment ?

(*a*) pure p (*b*) sp

(*c*) sp^2 (*d*) sp^3

146. Which of the following halide of silver is water soluble ?

(*a*) AgF (*b*) AgCl

(*c*) AgBr (*d*) AgI

147. Acetylene gets dissolved in acetone, it is because of :-

(*a*) intramolecular hydrogen bonding

(*b*) intermolecular hydrogen bonding

(*c*) london forces

(*d*) ionic interaction

148. $Ca_3(PO_4)_2 + SiO_2 \rightarrow$ Calcium silicate + P_1

$P_1 + C \rightarrow P_2 + CO$

P_1, P_2 are respectively :-

(*a*) P_4O_6, P_4 (*b*) P_4O_{10}, P_4

(*c*) P_4O_6, PH_3 (*d*) P_4O_{10}, PH_3

149. In methylene sulphur tetrafluoride ($CH_2 = SF_4$) ; the hydrogen atoms are in the same plane with the :-

(*a*) equatorial fluorine atoms

(*b*) axial fluorine atoms

(*c*) axial as well as equatorial fluorine atoms

(*d*) None

150. In which of the following compounds phosphorous atoms are at the corner of tetrahedral unit :-

(*a*) P_4 (*b*) $P_2O_7^{2-}$

(*c*) PO_4^{3-} (*d*) KH_2PO_3

151. Which of the following equilibria would have the least value of K_p at a common temperature?

(*a*) $MgCO_3 \rightleftharpoons MgO + CO_2$

(*b*) $CaCO_3 \rightleftharpoons CaO + CO_2$

(*c*) $SrCO_3 \rightleftharpoons SrO + CO_2$

(*d*) $BaCO_3 \rightleftharpoons BaO + CO_2$

152. The solubility of anhydrous $AlCl_3$ and hydrated $AlCl_3$ 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*) none

153. The critical temperature of water is higher than that of O_2 because the H_2O molecule has :-

(*a*) fewer electrons than O_2

(*b*) two covalents bonds

(*c*) V-shape

(*d*) more dipole moment

154. Which of the following boiling point order is correct ?

(*a*) $He > T_2 > D_2$

(*b*) $He < T_2 < D_2$

(*c*) $T_2 > He > D_2$

(*d*) $He < D_2 < T_2$

155. Two ice cubes are pressed over each other and unite to form one cube. Which force is responsible for holding them together :-

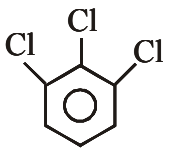
(*a*) Vander wall's forces

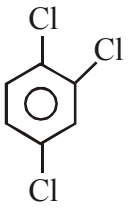
(*b*) Covalent attraction

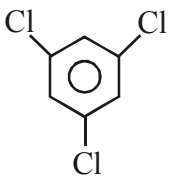
(*c*) H-bond formation

(*d*) Dipole-dipole attraction

156. Which has maximum dipole moment ?

(*a*) 

(*b*) 

(*c*) 

(*d*) 

157. $NMe_3 + H_2O_2 \rightarrow$ product

What is the formal charge of N in product ?

(*a*) +1 (*b*) –1

(*c*) +2 (*d*) 0

158. When container containing calcium carbide and calcium phosphide are pierced and thrown in the sea, then the gases evolved burn and serve as a signal called as Holme's signal. The gases evolved are :-

(*a*) C_2H_4, P_2H_4 (*b*) CH_4, P_2H_4

(*c*) C_2H_4, PH_3 (*d*) C_2H_2, PH_3

159. Elements of which groups are polymorphic (exist in more than one allotropic form) :-

(*a*) group 13 (*b*) group 14

(*c*) group 15 (*d*) group 16

160. Boric acid and fluoro boric acid are respectively :-

(*a*) Monobasic acid and monobasic acid

(*b*) Monobasic acid and tribasic acid

(*c*) Tribasic acid and tribasic acid

(*d*) Tribasic acid and monobasic acid

161. In CO_2, SO_2, SiO_2 central atom is covalently bonded with m_1, m_2, m_3 number of oxygen atoms respectivley then :-

(*a*) $m_1 = 2, m_2 = 2, m_3 = 2$

(*b*) $m_1 = 4, m_2 = 4, m_3 = 4$

(*c*) $m_1 = 2, m_2 = 4, m_3 = 4$

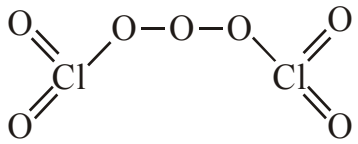
(*d*) $m_1 = 2, m_2 = 2, m_3 = 4$

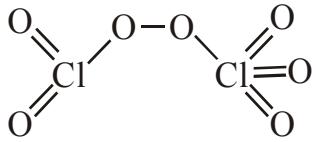
162. Which of the following reactions is spontaneous ?

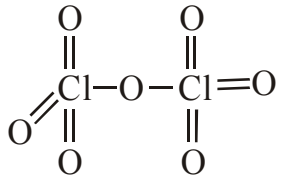
(*a*) $Pb^{2+} \rightarrow Pb^{4+} + 2e$ (*b*) $Sn^{2+} \rightarrow Sn^{4+} + 2e$

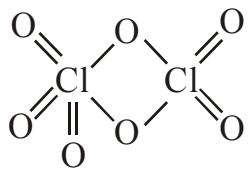
(*c*) $Tl^{1+} \rightarrow Tl^{3+} + e$ (*d*) $Bi^{3+} \rightarrow Bi^{+5} + 2e$

163. The correct structure of Cl_2O_7 :-

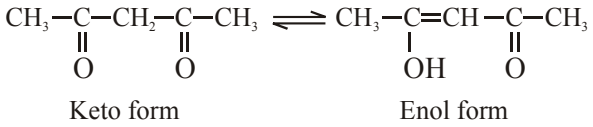
(*a*) 

(*b*) 

(*c*) 

(*d*) 

164. Which of the following option is correct :-



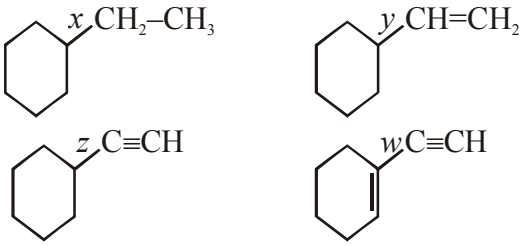
Keto form Enol form

(*a*) enol form is less stable than keto form due to hydrogen bonding

(*b*) keto and enol form both are of same stability

(*c*) enol form is more stable than keto form due to hydrogen bonding

(*d*) none

165. 

x, y, z, w are bond length between C–C bond. The correct order is :-

(*a*) x > y > z > w (*b*) x > z > w > y

(*c*) x > y > w > z (*d*) none

166. In energy level diagram or O_2^{2+}, 13^{th} electron is present in :-

(*a*) σ_{2p_x} orbital

(*b*) π_{2p_y} or π_{2p_z} orbital

(*c*) $\pi^*_{2p_y}$ or $\pi^*_{2p_z}$ orbital

(*d*) $\sigma^*_{2p_x}$ orbital

167. There is largest energy difference between M.O. of dioxygen :-

(*a*) σ_{2p_x} , π_{2p_y} (*b*) π_{2p_y} , $\pi^*_{2p_y}$

(*c*) σ_{2p_x} , σ^*_{2s} (*d*) $\sigma^*_{2p_x}$, σ_{2s}

168. Which of the energy order is same for both M.O. diagram of N_2 and O_2?

(*a*) $\sigma^*_{2s} < \sigma_{2p_x}$ (*b*) $\sigma^*_{2s} < \sigma_{2s}$

(*c*) $\sigma_{2p_x} < \pi_{2p_y}$ (*d*) $\pi^*_{2p_y} < \pi_{2p_y}$

169. Assuming 2s-2p mixing is not operative the paramagnetic species among the following :-

(*a*) Be_2 (*b*) B_2

(*c*) C_2 (*d*) N_2

170. If the filling of electrons in M.O. of O_2 does not obey Hund's rule , then which of the following property in O_2 gets changed :-

(*a*) bond order

(*b*) magnetic behaviour

(*c*) number of electrons in bonding M.O.

(*d*) number of electrons in antibonding M.O.

171. Which allotrope of phosphorous is thermodynamically most stable ?

(*a*) white phosphorous

(*b*) black phosphorous

(*c*) purple phosphorous

(*d*) red phosphorous

172. In which case , both of the following species are paramagnetic ?

(*a*) O_2 , Na_2O_2 (*b*) BaO_2 , KO_3

(*c*) O_2 , KO_3 (*d*) N_2 , KN_3

173. Which of the following species is expected to be coloured ?

(*a*) KO_3 (*b*) Li_2O

(*c*) Na_2O (*d*) K_2O_2

174. If inter nuclear axis is z axis then HOMO orbital(s) of CO is :-

(*a*) $\sigma^*_{2p_z}$ (*b*) N.B.M.O

(*c*) $\pi^*_{2p_y} = \pi^*_{2p_z}$ (*d*) None of these

175. Find the number of nodal plane in δ^* (ABMO) :-

(*a*) 1 (*b*) 2

(*c*) 3 (*d*) 4

176. If internuclear axis is assumed to be z axis then which of the following pair(s) of orbitals are HOMO of O_2 molecule :-

(*a*) π_{2p_x} , π_{2p_y} (*b*) $\pi^*_{2p_y}$, $\pi^*_{2p_z}$

(*c*) $\pi^*_{2p_x}$, $\pi^*_{2p_y}$ (*d*) $\sigma^*_{2p_z}$, σ_{2p_z}

177. Which of the following molecule or molecular ion has highest number of total electron in antibonding molecular orbital ?

(*a*) O_2 (*b*) N_2

(*c*) N_2^+ (*d*) O_2^{2-}

178. If we consider no mixing of 2s and 2p orbitals, then the bond order and magnetic moment of the diatomic molecule C_2 is :-

(*a*) 3 & dimagnetic (*b*) 2 & dimagnetic

(*c*) 2 & paramagnetic (*d*) 2.5 & dimagnetic

179. If C–C bond in C_2H_6 undergoes heterolytic fission, the hybridisation of two resulting carbon atoms is / are:-

(*a*) sp^2 both (*b*) sp^3 both

(*c*) sp^2 , sp^3 (*d*) sp^3 , sp^3

180. Which of the following halide when undergo hydrolysis the intermediate form during the reaction have sp^3 , sp^3d , sp^3d^2 hybridisation ?

(*a*) SF_6 (*b*) SF_4

(*c*) PCl_5 (*d*) PCl_3

181. Which halogen does not react with water ?

(*a*) F_2 (*b*) Cl_2

(*c*) Br_2 (*d*) I_2

182. Which halogen when reacts with water, it oxidises water to form O_2 gas at a fastest rate ?

(*a*) F_2 (*b*) Cl_2

(*c*) Br_2 (*d*) I_2

183. $BCl_3 + H_2O \rightarrow P_1 + P_2$

Correct statement regarding P_1 and P_2 :-

(*a*) P_1, P_2 both are proton donor acid

(*b*) P_1, P_2 no one is proton donor acid

(*c*) In between P_1, P_2 one is proton donor acid & another is not a proton donor acid

(*d*) P_1, P_2 both are base

184. $BF_3 + H_2O \rightarrow B(OH)_3 + X_1$ $\quad X_1 + BF_3 \rightarrow X_3$

$SiF_4 + H_2O \rightarrow Si(OH)_4 + X_2$ $\quad X_2 + SiF_4 \rightarrow X_4$

X_3 & X_4 are respectively :-

(*a*) HF, HF (*b*) HBF_4 , $HSiF_5$

(*c*) H_2BF_5 , H_2SiF_6 (*d*) HBF_4 , H_2SiF_6

185. In the cyclo-S_8 molecule of rhombic sulphur, all the S–S bond length and all the S–S–S bond angles are respectively

(*a*) 204 pm and 105° (*b*)102 pm and 120°

(*c*) 204 pm and 180° (*d*) 102 pm and 60°

186. Which is correct physical state of boron halide ?

(*a*) BF_3 is gas ; BCl_3, BBr_3 both are liquids ; BI_3 is solid

(*b*) BF_3 is solid ; BCl_3, BBr_3 both are liquids ; BI_3 is gas

(*c*) BF_3, BCl_3 both are gases ; BBr_3 is liquid ; BI_3 is solid

(*d*) None

187. Which of the following is correct statement ?

(*a*) HF forms more effective hydrogen bonding than H_2O but ΔH_{vap} of HF is less than ΔH_{vap} of water

(*b*) HF forms less effective hydrogen bonding than H_2O but ΔH_{vap} of HF is more than ΔH_{vap} of water

(*c*) HF forms less effective hydrogen bonding than H_2O and ΔH_{vap} of HF is less than ΔH_{vap} of water

(*d*) HF forms more effective hydrogen bonding than H_2O and ΔH_{vap} of HF is more than $(\Delta H)_{vap}$ of water

188. $SnCl_2$, $HgCl_2$ can not coexist together because :-

(*a*) Sn^{2+} oxidises Hg^{2+}

(*b*) Sn^{2+} reduces Hg^{2+} to Hg^{+1} & finally Hg^{+1} converted into Hg metal

(*c*) Sn^{2+} oxidises Hg to Hg^{2+}

(*d*) Sn^{2+} reduces Hg^{4+} to Hg^{2+}

189. In aqueous solution, the hydronium ion is further hydrated to give speices like :-

(*a*) $H_5O_2^+$ (*b*) $H_7O_3^+$

(*c*) $H_9O_4^+$ (*d*) All

190. In aqeuous solution, the hydroxyl ion (OH^-) is hydrated to give speices like :-

(*a*) $H_3O_2^-$ (*b*) $H_5O_3^-$

(*c*) $H_7O_4^-$ (*d*) All

191. The number of P–O–P linkage in cyclictetrametaphosphoric acid ($H_4P_4O_{12}$) which is formed during stepwise hydrolysis of P_4O_{10} ?

(*a*) zero (*b*) two

(*c*) three (*d*) Four

192. Which type of π bonds present in solid Cl_2O_6 ?

(*a*) $2p\pi$-$3d\pi$

(*b*) $2p\pi$-$3p\pi$

(*c*) $3p\pi$-$3d\pi$

(*d*) both (*a*) & (*b*)

193. Which of the following molecule is diamagnetic and has last electron in sigma (σ) B.M.O. :-

(*a*) O_2 (*b*) N_2

(*c*) B_2 (*d*) C_2

194. Which of the following has dipole-dipole interaction between the species possessing permanent dipole ?

(*a*) liquid-NH_3 (*b*) liquid-He

(*c*) solid-I_2 (*d*) liquid-Br_2

195. Select the most ionic and most covalent compound respectively from the following :-

CrO_5, Mn_2O_7, PbO, P_4O_{10}, SnO_2

(*a*) CrO_5, Mn_2O_7 (*b*) PbO, Mn_2O_7

(*c*) CrO_5, SnO_2 (*d*) CrO_5, P_4O_{10}

196. Which of the following statements is true for $IO_2F_2^-$ according to VSEPR theory ?

(*a*) the lone pair and two I–O double bonds occupy the equatorial positions of trigonal bipyramid

(*b*) it has sp^3d hybridisation and T-shaped

(*c*) its structure is analogous of SF_4

(*d*) (*a*) and (*c*) both

197. What is the hybridisation of boron atoms in compound $Mg[B_2O(OH)_6]$?

(*a*) both sp^3

(*b*) one sp^2 and other sp^3

(*c*) one sp^3 and other sp^3d

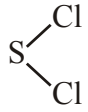
(*d*) both sp^2

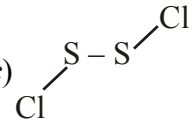
198. A diatomic molecule has a dipole moment of 1.2 D. If its bond length is equal to 10^{-10} m. Then the fractions of an electronic charge on each atom will be :-

(*a*) 42% (*b*) 52%

(*c*) 37% (*d*) 25%

199. Which of the following is correct structure of S_2Cl_2 ?

(*a*)  (*b*) Cl–S–S–Cl

(*c*)  (*d*) Cl=S=S=Cl

200. Which of the following atomic orbital does not participate in trigonal bipyramidal electron geometry i.e., sp^3d hybridisation :-

(*a*) d_{z^2} (*b*) $d_{x^2-y^2}$

(*c*) p_y (*d*) p_x

EXERCISE # II

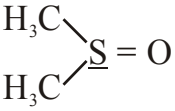
❑ **One or More Than One Correct Answer :**

1. In which of the following compounds, central atom has one lone pair of e^-?

(*a*) BrF_5 (*b*) $XeOF_4$

(*c*) SF_2Cl_2 (*d*) $SOCl_2$

2. For which of the following compounds, underlined atom has +1 oxidation state ?

(*a*) $\underline{T\ell}I_3$ (*b*) 

(*c*) $\underline{Cl} - F$ (*d*) $\underline{K}I_3$

3. In which of the following compounds, total six lone pair is present ?

(*a*) Melamine $[C_3N_3(NH_2)_3]$

(*b*) $HClO_2$

(*c*) Cl_2O_7

(*d*) SO_3

4. Which of the following are linear in shape ?

(*a*) N_3^- (*b*) I_3^+

(*c*) I_3^- (*d*) XeF_2

5. How many ions are non planar ions ?

(*a*) XeF_5^- (*b*) SO_3^{2-}

(*c*) SO_4^{2-} (*d*) ClO_4^-

6. Which of the following molecule have sp^3d^2 hybridised atom with square planar shape ?

(*a*) XeF_4 (*b*) ICl_4^-

(*c*) BrF_4^- (*d*) I_2Cl_6

7. Which of the following molecule have sp^3d^2 hybridised atom with square pyramidal shape ?

(*a*) BrF_5 (*b*) XeF_5^+

(*c*) $XeOF_4$ (*d*) TeF_5^-

8. Choose the correct option :-

(*a*) In d^3s hybridisation, the d-orbital involved is $d_{x^2-y^2}$, d_{z^2}, d_{xy}

(*b*) In sp^3d hybridisation, the d-orbital involved is d_{z^2}

(*c*) In sp^3d^2 hybridisation, the d-orbital involved is $d_{x^2-y^2}$, d_{z^2} respectively

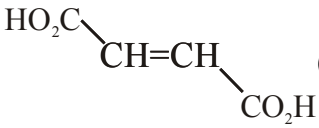
(*d*) In sp^3d^2 hybridisation, the d-orbital involved is d_{xy}, d_{zx} respectively

9. Which of the following are polar and planar ?

(*a*) CO

(*b*) SF_6

(*c*) CH_2Cl_2

(*d*)  (fumaric acid)

10. Which of the following are nonpolar and nonplanar ?

(*a*) PCl_5

(*b*) SF_6

(*c*) $H_3C–C\equiv C–CH_3$

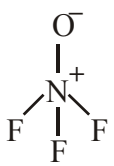
(*d*) XeF_4

11. Which of the following molecule do exist ?

(*a*) NeF_2 (*b*) $\overset{+}{N}F_4$

(*c*) IF_3^{2-} (*d*) $GeCl_6^{2-}$

12. Choose the correct statements -

(*a*) the correct structure of NOF_3 is 

(*b*) maximum number of atoms lying is one plane of $C(CN)_4$ molecule is 5

(*c*) among halogens Cl_2 only exist as solid state

(*d*) only oxyacid of fluorine which can be isolated is HOF where fluorine has +1 oxidation state

13. In which of the following compound, d_{z^2} orbital is involved in hybridisation of their central atom-

(*a*) BrF_3 (*b*) H_3O^+

(*c*) CH_3^+ (*d*) SF_6

14. Which of the following are pyramidal in shape ?

(*a*) Amide ion (NH_2^-)

(*b*) XeO_3

(*c*) ClO_3^- (Chlorate ion)

(*d*) Sulphite ion

15. Which of the following are angular in shape with sp^3 hybridisation on central atom ?

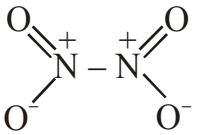
(*a*) I_3^+

(*b*) ClO_2^- (chlorite ion)

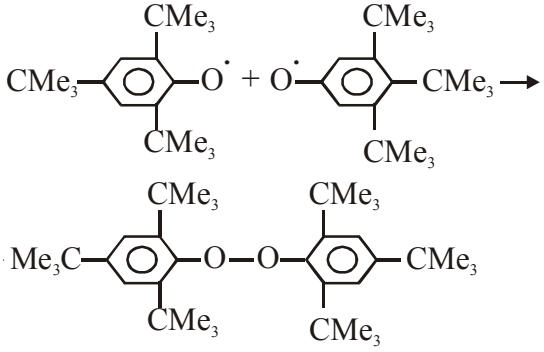
(*c*) HOCl (Hypochlorous acid)

(*d*) Water

16. Which process are non spontaneous ?

(*a*) $NO_2 + NO_2 \rightarrow$ 

(*b*) $ClO_2 + ClO_2 \rightarrow O = Cl - O - O - Cl = O$

(*c*) 

(*d*) $\dot{C}H_3 + \dot{C}H_3 \longrightarrow CH_3 - CH_3$

17. Colourless gas (X) + $O_2 \longrightarrow$ Brown colour gas NO_2 (Y)

Correct statements are :

(*a*) X, O_2, Y all are example of odd electron molecule

(*b*) Y maintains planarity on dimerisation

(*c*) X, Y are examples of odd electron molecule but O_2 is not

(*d*) Y during dimerisation forms compound which is diamagnetic in nature

18. For which of the following compounds, d_{z^2} orbital is involved in hybridisation ?

(*a*) BrF_3 (*b*) SF_6

(*c*) H_3O^+ (*d*) SF_4

19. For the molecule, OF_2 (I) ; HOF (II) ; H_2O (III), which statements are correct -

(*a*) d_{O-F} bond length I > II

(*b*) d_{O-F} bond length II > I

(*c*) d_{O-H} bond length II > III

(*d*) d_{O-H} bond length III > II

20. Which of the following statements is correct ?

(*a*) $\dot{C}H_3 \Rightarrow$ Hybridisation of carbon is sp^2

(*b*) $\dot{C}F_3 \Rightarrow$ Hybridisation of carbon is sp^2

(*c*) $C_2F_4 \Rightarrow$ Hybridisation of carbon is sp^3

(*d*)  $\Rightarrow$ Hybridisation of carbon having positive charge is sp^2

21. Incorrect order -

(*a*) C – C bond length $FCH_2CH_2F > CHF_2CHF_2 > F_3C–CF_3$

(*b*) Oxidation state of P $H_3PO_4 > PCl_3 > NaH_2PO_2 > P_4$

(*c*) Number of 90° repulsion between bond pair $XeF_4 > PF_5 > PF_6^-$

(*d*) Number of lone pair present on central atom $XeOF_2 > Cl^+OF_4^- > ClOF_2 > BH_4^-$

22. Which molecular geometry are most likely to result from an octahedral electron geometry ?

(*a*) square planar (*b*) square pyramidal

(*c*) linear (*d*) v-shaped

23. Bond energy order -

(*a*) sp^3 C–H > sp^2 C – H > sp C – H

(*b*) sp C–H > sp^2 C – H > sp^3 C – H

(*c*) F – F > Cl – Cl > Br – Br > I – I

(*d*) C – F > C – Cl > C – Br

24. Which of the following statements are correct ?

(*a*) ClF_2^- is linear but ClF_2^+ is bent

(*b*) In pentagonal bipyramidal geometry, axial orbital length is greater than equitorial bnond length

(*c*) In trigonal bipyramidal geometry, axial orbital length is greater than equitorial bond length

(*d*) Dimer of ICl_3 i.e., I_2Cl_6 has planar structure with sp^3d^2 hybridisation

25. Which of the following molecule itself exist but has no definite hybridisation ?

(*a*) XeF_3^- (*b*) PH_3

(*c*) H_2S (*d*) None

26. Which of the following pair of species have different hybridisation but same shape ?

(*a*) ICl_2^- and $BeCl_2$ (gas phase)

(*b*) PCl_5 (liq.) and $XeOF_4$

(*c*) ICl_4^-, $Pt(NH_3)_2Cl_2$

(*d*) XeF_2 and $HC \equiv CH$

27. Which of the following options are correct regarding XeO_3F_2 and $XeOF_4$ molecule ?

(*a*) $d_{Xe-O}(XeO_3F_2) < d_{Xe-O}(XeOF_4)$

(*b*) $d_{Xe-F}(XeO_3F_2) < d_{Xe-F}(XeOF_4)$

(*c*) shapes are trigonal bipyramidal and square pyramidal respectively

(*d*) the nature of π bond is $5d\pi - 2p\pi$ type

28. Considering internuclear axis is x axis, then which of the following overlapping are possible -

(*a*) $s + p_x \rightarrow \sigma$

(*b*) $p_x + p_x \Rightarrow \pi$

(*c*) $p_x + d_{xy} \Rightarrow \pi$

(*d*) $d_{xy} + p_y \Rightarrow \pi$

29. Which of the following molecule has dative bond ?

(*a*) NH_4^+ (*b*) NOF_3

(*c*) PCl_3 (*d*) SF_6

30. Which of the following process involves absorption of energy ?

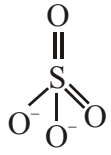
(*a*) $S(g) + e^- \rightarrow S^-(g)$

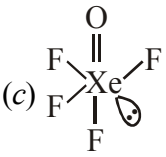
(*b*) $Xe(g) + e^- \rightarrow Xe^-(g)$

(*c*) $O^-(g) + e^- \rightarrow O^{2-}(g)$

(*d*) $Cl^-(g) \rightarrow Cl(g) + e^-$

31. Which of the following representation of molecules are not correct -

(*a*) $N = \overline{N} = N$ (*b*) 

(*c*)  (*d*) 

32. Which of the following molecule have only $p\pi - d\pi$ type of π bonds ?

(*a*) SO_3 (*b*) XeO_4

(*c*) XeO_2F_2 (*d*) SO_2

33. The correct order of single bond energy ?

(*a*) P–P > N–N (*b*) S–S > O–O

(*c*) C–C > Si–Si (*d*) C–H > C–D

34. Which of the following compound are planar ?

(*a*) ClF_3 (*b*) ICl_4^-

(*c*) I_3^+ (*d*) OCN^-

35. Choose the correct statements regarding SF_4 molecule -

(*a*) Hybridisation of sulphur occurs in Ist excited state.

(*b*) Total number of l.p – b.p. repulsion at 90° is 2

(*c*) There are six possible F–S–F bond angles which are less than 180°

(*d*) It is hypervalent molecule

36. In which of the following compounds, sigma coordinate bond is absent -

(*a*) NO_3^- (*b*) CO

(*c*) NH_4^+ (*d*) HNC

37. Which of the following molecule is aromatic ?

(*a*) $B_3N_3H_6$ (*b*) $B_3H_3O_3$

(*c*) $C_3N_3Cl_3$ (*d*) $C_{12}O_9$

38. Correct statements about $C_{12}O_9$ is are :-

(*a*) It is example of cyclic trianhydride

(*b*) It is formed when melittic acid undergoes heating

(*c*) It is example of cyclic ether

(*d*) It is non aromatic

39. Correct order regarding dipole moment -

(*a*) HF < HCl < HBr < HI

(*b*) $CH_3F < CH_3Cl < CH_3Br < CH_3I$

(*c*) $CH_3Cl > CH_3F > CH_3Br > CH_3I$

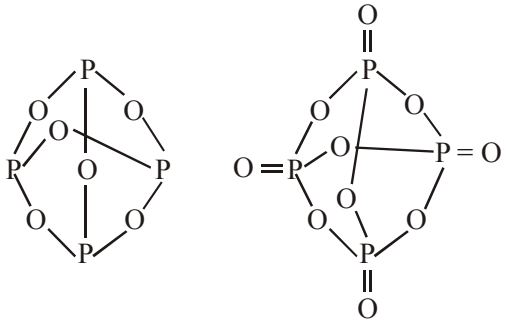
(*d*) $CH_3Cl > CH_2Cl_2 > CHCl_3 > CCl_4$

40. What is the correct order of dipole moment ?

(*a*) $NH_3 > NF_3$ (*b*) $H_2O > F_2O$

(*c*) $XeO_4 > XeO_3$ (*d*) $XeO_3F_2 > XeO_2F_2$

41. Correct statement regarding P_4O_6 & P_4O_{10} -



(*a*) Both have same number of P–O–P linkage

(*b*) Both have same number of P=O linkage

(*c*) Both have same valancey of phosphorus

(*d*) Both have same number of P–P linkage

42. Example of a three - dimensional silicate is :

(*a*) Feldspars

(*b*) Ultramarines

(*c*) Beryls

(*d*) Zeolites

43. Which of the following statements are correct ?

(*a*) d orbital used in hybridisation of P in PBr_5(s) is dz^2

(*b*) all possible angles in BF_2Cl is 120°

(*c*) PI_5(s) does not exist due to steric crowding

(*d*) PH_5 does not exist because of no possibility of d orbital contraction

44. Select the correct statements -

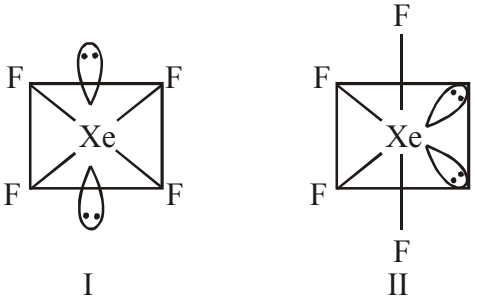
(*a*) In HN_3, the bond angle $H-\widehat{N}-N$ is less than 120°

(*b*) In CH_2Cl_2, at least 2 bond angles are identical

(*c*) In ClF_3, $F_{ax}\widehat{Cl}F_{ax}$ is exactly equal to 180°

(*d*) In $Na_2S_4O_6$, the number of S-S linkage is zero

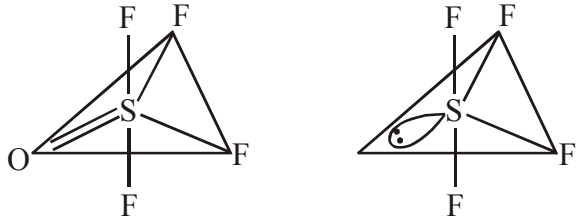
45. In XeF_4, 2 possible structures are given as follows -



I II

	l.p.l.p repulsion at 90°	l.p.-b.p repulsion at 90°	b.p-b.p repulsion at 90°
(*a*) Str.-I	0	7	5
(*b*) Str.-I	0	8	4
(*c*) Str.-II	0	7	4
(*d*) Str.-II	1	6	4

46.



I II

Correct option regarding I & II :-

(*a*) $\left[\widehat{F_{ax}\,S\,F_{ax}}\right]_I = 180°, \left[\widehat{F_{ax}\,S\,F_{ax}}\right]_{II} = 180°$

(*b*) $\left[\widehat{F_{ax}\,S\,F_{ax}}\right]_I < 180°, \left[\widehat{F_{ax}\,S\,F_{ax}}\right]_{II} < 180°$

(*c*) $\left[\widehat{F_{eq}\,S\,F_{eq}}\right]_I = 120°, \left[\widehat{F_{eq}\,S\,F_{eq}}\right]_{II} = 120°$

(*d*) $\left[\widehat{F_{eq}\,S\,F_{eq}}\right]_I < 120°, \left[\widehat{F_{eq}\,S\,F_{eq}}\right]_{II} < 120°$

47. Correct order of bond angle -

(*a*) $PF_3 < PCl_3 < PBr_3 < PI_3$

(*b*) $F_2O < H_2O < Cl_2O$

(*c*) $PH_3 < PF_3$

(*d*) $NH_3 < NF_3$

48. Correct order of bond angle -

(*a*) $H_2O > F_2O$

(*b*) $H_2O > H_2S > H_2Se > H_2Te$

(*c*) $SbH_3 > AsH_3 > PH_3 > NH_3$

(*d*) $\overset{+}{N}O_2 > NO_2 > NO_2^- > NO_3^-$

49. The correct statements are -

(*a*) the reduction of bond angle in H_2O is greater than reduction of bond angle in NH_3 from 109°28'.

(*b*) in both compounds hybrid orbitals containing lone pair have p character more than 75%.

(*c*) % s character of lone pair at nitrogen atom in NH_3 is less than % s character of each lone pair at oxygen atom in H_2O.

(*d*) in NH_3 & BF_3, all bonds in each molecule is identical.

50. Which of the following molecules have cation and anion pair ?

(*a*) $PBr_5(g)$ (*b*) $PBr_5(s)$

(*c*) $N_2O_5(s)$ (*d*) dry ice

51. Which of the following molecules do not exist ?

(*a*) CF_6^{2-} (*b*) NeF_2

(*c*) $XeCl_8^{2-}$ (*d*) XeH_6

52. Which of the following molecules do not exist ?

(*a*) PH_5 (*b*) PH_3

(*c*) NH_3 (*d*) SH_6

53. If y axis is the approaching axis then which set of orbitals can not form the π bond between two atom in general -

(*a*) $p_z - p_z$ (*b*) $p_x - p_x$

(*c*) $p_y - p_y$ (*d*) $p_y - p_x$

54. Which of the following overlapping is involved in formation of only σ bond ?

(*a*) s-p overlapping (*b*) s-s overlapping

(*c*) p-d overlapping (*d*) p-p overlapping

55. As per VBT, which of the following overlapping are possible ?

(*a*) $d_{xy} + d_{xy} \xrightarrow{\text{x axis}}$

(*b*) $p_y + p_x \xrightarrow{\text{x axis}}$

(*c*) $d_{xy} + p_{zy} \longrightarrow$

(*d*) $sp^2 - sp^2 \longrightarrow$

56. Find the number of molecule in which direction of back bonding is from central atom to surrounding atom -

(*a*) BBr_3 (*b*) OF_2

(*c*) OCl_2 (*d*) $\overset{\ominus}{C}Cl_3$

57. Find out the correct statements -

(*a*) $\widehat{SiNSi}$ bond angle in $N(SiH_3)_3$ is greater than $\widehat{SiPSi}$ bond angle in $P(SiH_3)_3$

(*b*) B–F bond dissociation energy in $BF(CH_3)_2$ is greater than B–F bond dissociation energy in BF_3

(*c*) In BF_3 back bonding is possible due to this B–F bond has partial double bond character whereas in BF_4^-, back bonding is not possible so B–F bond has 100% single bond character.

(*d*) All hybrid orbitals of O-atom in H_2O lie in the same plane.

58. Which of the following statements are correct ?

(*a*) B–F bond length in BF_4^- is more w.r.t. B–F bond length in BF_3

(*b*) Correct order of lewis acidic strength $SiF_4 > SiCl_4 > SiBr_4 > SiI_4$

(*c*) Correct order of lewis acidic strength $BF_3 > BCl_3 > BBr_3 > BI_3$

(*d*) AlF_3 does not show back bonding

59. Which of the following statements are correct ?

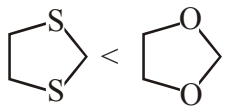
(*a*) there is no scope of axial or equatorial position in octahedral and tetrahedral geometry

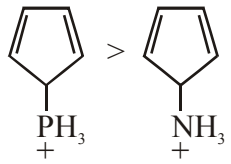
(*b*) $CF_2 = C = CF_2$ molecule has all atoms in one plane

(*c*) the bond order in NO is 2.5 and while that in NO^+ is 3

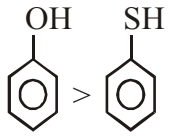
(*d*) X^+ ion is smaller than X^- ion

60. Correct acidic strength order :

(*a*) 

(*b*) 

(*c*) SiH_3OH (Silanol) > CH_3OH (methanol)

(*d*) 

61. Silyl isocyanate is a compound having molecular formula H_3SiNCO. Which of the following bond has significant π bond character -

(*a*) C–O linkage (*b*) N–C linkage

(*c*) Si–N linkage (*d*) Si–H linkage

62. Which of the following statements are correct ?

(*a*) In back bonding of $\overline{C}Cl_3$, e^- movement is from surrounding atom (Cl) to central atom carbon.

(*b*) In back bonding of $:CCl_2$, e^- movement is from surrounding atom (Cl) to central atom carbon.

(*c*) When boric acid is dissolved in water, back bonding is going to be lost in product side.

(*d*) $\overset{+}{C}H_2 - CH_3$ (ethyl carbocation) is more stable than $\overset{+}{C}H_2 - OCH_3$ (methoxy methyl carbocation)

63. I. $O(CH_3)_2 + BF_3 \rightarrow$

II. $O(SiH_3)_2 + BF_3 \rightarrow$

III. $NMe_3 + HCl \rightarrow$

IV. $N(SiH_3)_3 + HCl \rightarrow$

Correct statement :-

(*a*) Reaction I is faster than reaction II

(*b*) Reaction II is faster than reaction I

(*c*) Reaction III is faster than reaction IV

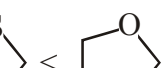
(*d*) Reaction IV is faster than reaction III

64. In which of the following compound, bond angle increases due to back bonding ?

(*a*) BI_3 (*b*) $N(CH_3)_3$

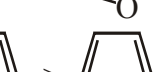
(*c*) $N(SiH_3)_3$ (*d*) $H_3Si–N=C=S$

65. Which structure shown below are correct shape ?

(*a*)  (Bent shape)
Methylisothiocyanate

(*b*) $H_3C–N=C=S$ (Linear shape)
Methylisothiocyanate

(*c*) $H_3Si–N=C=S$ (Linear shape)
Silylisothiocyanate

(*d*)  (Bent shape)
Silylisothiocyante

66. In which of the following molcules during monomer formation, central atom has incomplete octet (less than 8 electrons) :-

(*a*) Al_2Cl_6 (*b*) N_2O_4

(*c*) $(BeCl_2)_n$ (*d*) I_2Cl_6

67. Which molecule under following condition does not have bridging bond :-

(*a*) SO_3 during trimer formation

(*b*) P_2O_5 during dimer formation

(*c*) $BeCl_2$ during polymer formation

(*d*) $Cl_2C = CCl_2$ during polymer formation

68. Which molecule has 3c–4e bond ?

(*a*) Al_2Br_6 (*b*) $(BeH_2)_n$

(*c*) I_2Cl_6 (*d*) Fe_2Cl_6

69. Reaction of diborane with NMe_3 in product formation :-

(*a*) Hybridisation of B does not change

(*b*) Hybridisation of N does not change

(*c*) Hybridisation of B changes

(*d*) Hybridisation of N changes

70. Which molecules are electron defficient ?

(*a*) SO_3 (*b*) $SOCl_2$

(*c*) B_2H_6 (*d*) NH_3

71. Which of the following reactions products formed are correctly written :-

(*a*) $BCl_3 + H_2O \rightarrow B^{3+}(aq) + 3Cl^-(aq)$

(*b*) $POCl_3 + 3H_2O \rightarrow H_3PO_4 + 3HCl$

(*c*) $SF_4 + H_2O \rightarrow H_2SO_3 + HF$

(*d*) $NaCl + H_2O \rightarrow Na^+(aq) + Cl^-(aq)$

72. Which is the correct order of hydrolysis rate :-

(*a*) $NCl_3 > NF_3$

(*b*) $SF_6 > SeF_6 > TeF_6$

(*c*) $CCl_4 > SiCl_4 > GeCl_4$

(*d*) $PCl_3 > AsCl_3 > SbCl_3 > BiCl_3$

73. $A-X \xrightarrow{r.d.s} A^+ + X^-$ $\quad A^+ + Y^- \xrightarrow{r.d.s}$ $A-Y\,(Y=OH)$ .....(I):

$Y^- + A-X \longrightarrow Y-A+X^-$ .....(II) Transition state $\overset{\delta-}{Y}\ldots_f\ldots A\ldots_b\ldots \overset{\delta-}{X}$.

(*a*) I is called dissociative process

(*b*) II is called associative process

(*c*) I is S_N1 mechanism

(*d*) II is S_N2 mechanism

74. Which xenon fluorides when undergo hydrolysis , O_2 gas is evolved :-

(*a*) XeF_2 (*b*) XeF_4

(*c*) XeF_6 (*d*) All

75. Which of the following oxyacids are formed during stepwise hydrolysis of P_4O_{10} :-

(*a*) Tetrameta phosphoric acid

(*b*) Tetrapoly phosphoric acid

(*c*) Pyro phosphoric acid

(*d*) Phosphoric acid

76. $SOCl_2$ when undergoes hydrolysis which of the following statements are correct :-

(*a*) The oxidation state of central atom in oxyacid formed is +4

(*b*) The oxyacid formed is example of dibasic acid

(*c*) The hydrolysis mechanism is example of S_NAE mechanism

(*d*) During hydrolysis, H_2O acts as electrophile and $SOCl_2$ acts as nucleophile

77. Correct number of –OH groups present in product when following compound reacts with water?

(*a*) $PCl_3 \rightarrow \underset{3OH\,group}{Product}$

(*b*) $NCl_3 \rightarrow \underset{1OH\,group}{Product}$

(*c*) $TeF_6 \rightarrow \underset{6OH\,groups}{Product}$

(*d*) $PCl_5 \rightarrow \underset{5OH\,groups}{Product}$

78. Which molecules can form dimer and dimer is planar in nature ?

(*a*) BBr_3 (*b*) $AlCl_3$

(*c*) BeH_2 (*d*) $BeCl_2$

79. Which molecules undergo restricted rotation ?

(*a*) B_2H_6 (*b*) C_2H_6

(*c*) C_2H_4 (*d*) C_4H_{10}

80. Which of the following are correct :-

(*a*) NO_2 at –11°C can form dimer and dimer form is diamagnetic

(*b*) $Cl_2O_6(s)$ ionises to give Cl_2^- and ClO_4^-

(*c*) ClO_2 can not form dimer because odd electron is delocalised

(*d*) (P–O) bond length in P_4O_6 > (P–O) bond length in P_4O_{10}

81. Correct statements :-

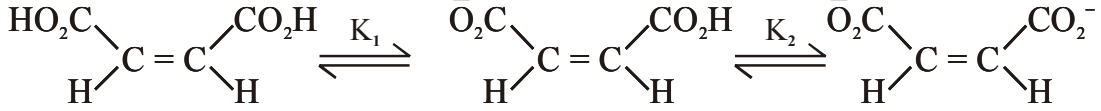
(*a*) NO_2 is paramagnetic and has tendency to form dimer

(*b*) ClO_2 is paramagnetic and has no tendency to form dimer

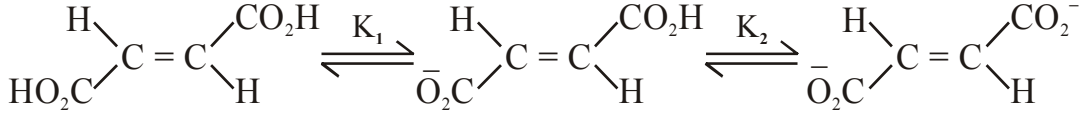
(*c*) ClO_2 is diamagnetic and has no tendency to form dimer

(*d*) NO_2 is brown colour gas but its dimer N_2O_4 is solid in nature

82.



K_1 and K_2 are Ist and IInd dissociation constant of maleic acid :-



K_1' and K_2' are Ist & IInd dissociation constant of fumaric acid :-

(*a*) $(k_1)_{maleic\ acid} > (k_1)_{fumaric\ acid}$ (*b*) $(k_1)_{maleic\ acid} < (k_1)_{fumaric\ acid}$

(*c*) $(k_2)_{maleic\ acid} > (k_2)_{fumaric\ acid}$ (*d*) $(k_2)_{maleic\ acid} < (k_2)_{fumaric\ acid}$

83. Select correct statement :-

(*a*) If molecule has any polar bond then it is always polar

(*b*) Solubility of noble gas increases in water down the group

(*c*) London dispersion forces also contribute in net interaction between nonpolar molecule

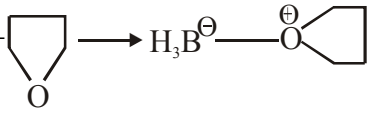
(*d*) Molecular interaction between CF_4 molecule is higher as compared to molecular interaction between NF_3 molecule

84. Which compounds undergo hydrolysis at very high temperature through S_N1 ?

(*a*) SF_6 (*b*) NF_3

(*c*) CCl_4 (*d*) SF_4

85. Which reactions product are correctly written ?

(*a*) $B_2H_6 +$  $\longrightarrow H_3B^{\ominus}-\overset{\oplus}{O}$

(*b*) $B_2H_6 + R_3N \longrightarrow H_3B^{\ominus} - \overset{+}{N}H_3$

(*c*) $B_2H_6 + NH_3 \longrightarrow H_3B^{\ominus} - \overset{+}{N}H_3$

(*d*) All

86. Which of the following compound on heating give NO_2 gas ?

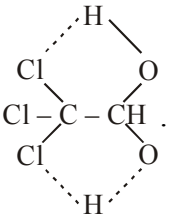
(*a*) $AgNO_3$ (*b*) $LiNO_3$

(*c*) $Be(NO_3)_2$ (*d*) KNO_3

87. Which of the following statements are correct ?

(*a*) OF during dimer formation planarity is lost

(*b*) Pentasulphide S_5^{2-} is bent in shape

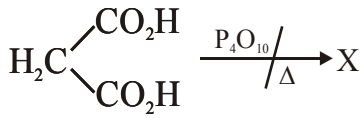
(*c*) Chloral $CCl_3CH = O$ forms stable hydrate because of H bonding. The structure of chloral hydrate is given as follows  .

(*d*) In S_2F_{10}, all S–F bond lengths are identical.

88. Which are correct representation of boranes ?

(*a*) B_nH_{n+4} (*b*) B_nH_{n+6}

(*c*) B_nH_{2n+2} (*d*) None

89. 

Correct statements regarding X :-

(*a*) X is linear in shape

(*b*) X has 3σ and 3π bond

(*c*) all carbons in X have same hybridisation state

(*d*) X is CH_3CO_2H

90. Which of the compounds do have H-bonding ?

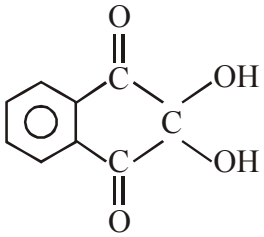
(*a*) NH_3 (*b*) CH_3OCH_3

(*c*) CH_3CH_2OH (*d*) CH_3NHCH_3

91. For which compounds, intramolecular hydrogen bonding is possible :-

(*a*) o-nitrophenol

(*b*) p-nitrophenol

(*c*) 

(*d*) HNO_3

92. H-bonding is responsible for which of the following phenomenon :-

(*a*) Acetylene is dissolved in acetone

(*b*) DDT is soluble in water

(*c*) Formic acid is more acidic than acetic acid

(*d*) H_3PO_4 is more viscous w.r.t. Me_3PO_4

93. Which of the following are correct statements ?

(*a*) the direction of dipole moment in CO is from O to C

(*b*) white phosphorus is less stable than red phosphorus

(*c*) H_2 molecule is more stable than He–H molecule

(*d*) π_b & π^* orbitals obtained from 2p orbital are lying in the same plane

94. Which of the following order are correct regarding electronegativity of elements ?

(*a*) P > S (*b*) P > N

(*c*) Cl > S (*d*) Cl > Br

95. Correct order of stability :-

(*a*) $PbCl_2 > PbCl_4$ (*b*) $CCl_2 > PbCl_2$

(*c*) $SnCl_2 > SnCl_4$ (*d*) $PbCl_4 > PbI_4$

96. All the given molecule have triangular faces. Find molecules in which all the triangular faces are equilateral triangular faces :-

(*a*) $CHCl_3$ (*b*) PCl_5

(*c*) CH_4 (*d*) SF_6

97. During linear combination of atomic orbitals to form molecular orbitals, which of the following conditions must be satisfied :-

(*a*) the combining atomic orbitals must have the same or nearly the same energy

(*b*) the combining atomic orbitals must have the same symmetry about the molecular axis

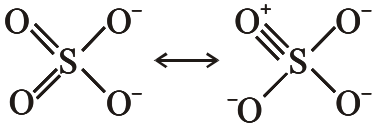
(*c*) the combining atomic orbitals must overlap to the maximum extent

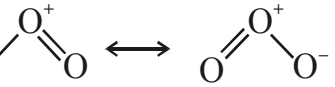
(*d*) the combining atomic orbitals must overlap to the minimum extent

98. For which of the following ion , correct resonating structures are given :-

(*a*) $:\ddot{\underset{\cdot\cdot}{S}}^{-} - C \equiv N \longleftrightarrow :\underset{\cdot\cdot}{S} = C = \overset{\ominus}{\underset{\cdot\cdot}{N}}:$

(*b*) $\overset{\ominus}{N} = C = \overset{\ominus}{N} \longleftrightarrow N \equiv C - N^{2-}$

(*c*) 

(*d*) 

99. Select incorrect statement :-

(*a*) In general no S–H bond is present in oxy acid of sulphur

(*b*) Oxyacids of P containing P–H bonds are reducing in nature

(*c*) Both O_2 and S_2 are diamagnetic in nature

(*d*) General reaction of O_2 with many metals and non metals are endothermic in nature because energy is required to break double bond present in O_2.

100. B_2 molecule will be diamagnetic when :-

(*a*) s-p mixing is not operative

(*b*) s-p mixing is operative and Hund's rule is violated

(*c*) s-p mixing is operative and Hund's rule is followed

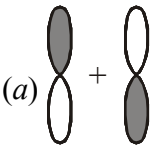
(*d*) None

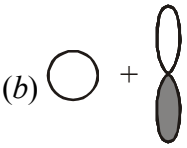
101. Which of the following molecule / ions do not contain unpaired electron ?

(*a*) N_2^+ (*b*) O_2

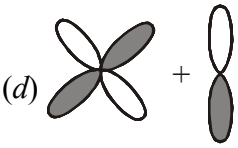
(*c*) O_2^{2-} (*d*) Br_2

102. Which of the following overlapping(s) result antibonding molecular orbital with two nodal plane?

(*a*) 

(*b*) 

(*c*) 

(*d*) 

103. Which of the following process is not correct against the mentioned property ?

(*a*) $N_2^+ \rightarrow N_2$ (magnetic moment increases)

(*b*) $O_2 \rightarrow O_2^+$ (bond order decreases)

(*c*) $Li_2^+ \rightarrow Li_2^-$ (magnetic property changes)

(*d*) $C_2 \rightarrow C_2^+$ (electron is removed from bonding orbital)

104. Which of the following options are incorrect ?

(*a*) dimer of NO_2 contains N–O–N linkage

(*b*) all diatomic halogens are coloured due to HOMO-LUMO electron transition

(*c*) all diatomic halogens are coloured due to LUMO-HOMOelectron transition

(*d*) dimer of NO_2 does not contain N–O–N linkage

105. The correct statements are :-

(*a*) B_2 solid does not exist

(*b*) B_2 have basic building B_{12} icosahedral

(*c*) B_{12} icosahedral is made up of polyhedron having 20 faces and 12 corners

(*d*) B_{12} icosahedral is made up of polyhedron having 10 faces and 5 corners

106. Which of the following compounds when undergo reaction with water give methane gas ?

(*a*) Be_2C (*b*) CaC_2

(*c*) Mg_2C_3 (*d*) Al_4C_3

107. Which of the following compounds when undergo reaction with water give terminal alkyne ?

(*a*) Li_2C_2 (*b*) CaC_2

(*c*) Al_4C_3 (*d*) Mg_2C_3

108. Which compounds when react with water , it gives ammonia as one of the product ?

(*a*) $CaCN_2$ (*b*) AlN

(*c*) Ca_3N_2 (*d*) Li_3N

109. Which compounds consume six moles of water per one mole of compound ?

(*a*) Ca_3N_2 (*b*) P_4O_6

(*c*) BrF_5 (*d*) SiF_4

110. Which of the following statements are incorrect ?

(*a*) maximum covalency of nitrogen is 3

(*b*) in glyoxal, carbon atom is sp^2 hybridised

(*c*) size of d orbital decreases : Si > P > S > Cl

(*d*) maximum covalency of Sulphur is 4

111. How many statements are correct :-

(*a*) In PCl_5 ; axial P–Cl bond length > equatorial P–Cl bond length

(*b*) In PF_4Cl ; axial P–F bond length < equatorial P–Cl bond length

(*c*) PCl_4F has more dipole moment than PCl_3F_2

(*d*) PF_3Cl_2 has more dipole moment than PCl_5

112. Correct statement :-

(*a*) Solid state PCl_5 exists as PCl_4^+ and PCl_6^-

(*b*) Solid state PBr_5 exists as PBr_4^+ and Br^-

(*c*) Solid state N_2O_4 exists as NO^+ and NO_3^-

(*d*) Solid state N_2O_5 exists as NO_2^+ and NO_3^-

113. Which of the following statement are incorrect for PO_4^{3-} ?

(*a*) Numberof identical resonating structures are 3

(*b*) Bond order of P–O bond is 1.25

(*c*) No. of identical P – O bonds are 3

(*d*) Maximum no. of atoms are in one plane is 4

114. Which of the following order are correct ?

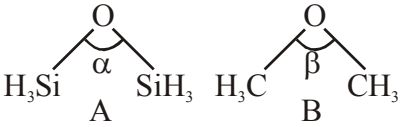
(*a*) CHF > CHCl > CHBr (stability)

(*b*) CHF > CHCl > CHBr (extent of back bonding)

(*c*) $CF_2 > CCl_2 > CBr_2$ (extent of back bonding)

(*d*) $CF_2 > CCl_2 > CBr_2$ (lewis acidity)

115.



Correct option is :-

(*a*) $\alpha > \beta$

(*b*) A is more lewis basic than B

(*c*) $\beta > \alpha$

(*d*) B is more lewis basic than A

116. Which of the following compounds on heating give O_2 gas ?

(*a*) BeC_2O_4 (*b*) $MgCO_3$

(*c*) $NaNO_3$ (*d*) H_2O_2

117. Out of $BeCl_2$, $CaCl_2$, CsCl, KCl :-

(*a*) highest covalent character is observed in $BeCl_2$

(*b*) highest covalent character is observed in $CaCl_2$

(*c*) Least covalent character is observed in KCl

(*d*) Least covalent character is observed in CsCl

118. In $Cr_2O_7^{2-}$ (dichromate ion) :-

(*a*) 8Cr–O bond lengths are identical

(*b*) 6Cr–O bond lengths are identical

(*c*) Cr is in +6 oxidation state

(*d*) Cr is sp^3 hybridised

119. In which all hydrogens are not of same acidic character :-

(*a*) H_3PO_5 (*b*) $H_2S_2O_5$

(*c*) $H_2S_2O_8$ (*d*) H_3PO_4

120. The correct order of boiling point :-

(*a*) $C_2H_6 > C_2F_6$ (*b*) $NH_3 > NF_3$

(*c*) $C_{10}H_{22} > C_{10}F_{22}$ (*d*) $CCl_4 > SiCl_4$

121. Which of the following order are correct regarding solubility in water for following compounds ?

(*a*) KCl > AgCl (*b*) $CaCl_2 > ZnCl_2$

(*c*) $BeSO_4 > BaSO_4$ (*d*) LiI > RbCl

122. Which of the following order are correct regarding size of cation or anion ?

(*a*) $S^{2-} > O^{2-}$ (*b*) $N^{3-} > P^{3-}$

(*c*) $K^+ > Rb^+$ (*d*) $Ba^{2+} > Be^{2+}$

123. Which of the following order are incorrect regarding tendency towards hydrolysis ?

(*a*) $CCl_4 > SiCl_4$

(*b*) $SF_6 > SeF_6$

(*c*) $BiCl_3 > NCl_3$

(*d*) $(CH_3)_3CCl > (CH_3)_2CHCl$

124. Which of the following order are correct regarding stability of compounds of different metal / element in same oxidation state ?

(*a*) B in univalent state > Tl in univalent state

(*b*) Carbon in divalent state > Pb in divalent state

(*c*) Carbon in tetravalent state > Pb in tetravalent state

(*d*) B in trivalent state > Tl in trivalent state

125. In peroxy disulphuric acid $H_2S_2O_8$, which of the following options are correct :-

(*a*) central atom is sp^3 hybridised

(*b*) –O–O– linkage is present

(*c*) S has +7 oxidation state

(*d*) this reagent is used in ELBS oxidation reaction

126. Choose the correct statement regarding ionisation energy :-

(*a*) molecular O_2 < atomic O

(*b*) atomic N < molecular N_2

(*c*) $N_2^+ < N_2$

(*d*) None

127. Regarding colour which of the following options are correct :-

(*a*) O_2 - colourless
S_2 - pale yellow

(*b*) Se_2 - red
Te_2 - black

(*c*) I_2(g)- violet
Br_2(g)- reddish brown

(*d*) NO - colourless
NO_2 - reddish brown

128. Regarding NO which of following options are correct :-

(*a*) it is diamagnetic in gaseous state

(*b*) it combines with O_2 to give paramagnetic NO_2 gas

(*c*) during loss of 1 electron , bond order of the product formed becomes 3

(*d*) its bond order is 2.5

129. Choose the incorrect statement from the following:-

(*a*) HOMO of N_2 molecule is π_bM.O.

(*b*) LUMO of N_2 molecule is π^*M.O.

(*c*) HOMO of N_2 molecule is σ_{2p}M.O.

(*d*) Halogens are colourless

130. Choose correct statement regarding $N_2 \rightarrow N_2^+ + e$:-

(*a*) process is endothermic

(*b*) bond order decreases

(*c*) electron removed from σ_{BMO}

(*d*) electron removed from gerade MO

131. Which of the following pair of species are isostructural but not isoelectronic ?

(*a*) O_3 & NO_2^- (*b*) NF_3 & NH_3

(*c*) CH_4 & CCl_4 (*d*) N_2O & NO_2^+

132. Molecule in which any hybrid orbital(s) of central atom which form bond contains s-character less than 25% :-

(*a*) PCl_5 (*b*) H_2O

(*c*) NH_3 (*d*) NO_3^-

133. Which of the following statement(s) are correct about $Al_2(CH_3)_6$?

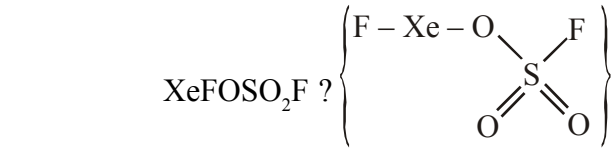
(*a*) number of 2c–2e bonds are 22

(*b*) molecule is non polar

(*c*) maximum number of atoms may lie in one plane is 10

(*d*) total number of 2 vacant orbitals are involved in hybridisation of central atom

134. Which of the following statement are correct for $XeFOSO_2F$?



(*a*) the number of sp^3 hybridised central atom is 3

(*b*) the number of identical S–O bond is 2

(*c*) maximum number of atoms may lie in one plane is 5

(*d*) all atoms are lying in the same plane

135. Which of the following are incorrect order against indicated properties ?

(*a*) AgF > AgCl > AgI : covalent character

(*b*) $NaHCO_3 > KHCO_3 > RbHCO_3$: solubility in water

(*c*) $NaF < MgF_2 < AlF_3$: melting point

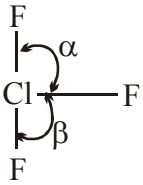
(*d*) $MgC_2O_4 > CaC_2O_4 > BaC_2O_4$: solubility in water

136. Which of the following statements are correct ?

(*a*) compounds of Hg^{2+} ions having an ionic radius of 116 pm are more covalent in character than those of Ca^{2+} ion with almost identical size (114 pm) and same charge

(*b*) ethers behave as bases in the presence of mineral acids

(*c*) carbon has unique ability to form pπ-pπ multiple bonds with itself and with other atoms of small size and high electronegativity.

(*d*)  bond angle α = bond angle β but not precisely 90°.

137. From the following options which are correct for double chain silicate :-

(*a*) average charge on each tetrahedral = –1.5

(*b*) all the tetrahedron have one unshared oxygen / corner

(*c*) all the silicon atoms have +4 oxidation state

(*d*) average shared oxygen / corner per tetrahedron = 2.5

138. Which of the following options are correct ?

(*a*) in alkaline medium, the hydrolysis of $BeCl_2$ produces clear solution consisting of $[Be(OH)_4]^{2-}$ and HCl.

(*b*) in the clear solution of $BiCl_3$ when large quantity of water is added, the white turbidity of BiOCl is obtained

(*c*) SiF_4 undergoes partial hydrolysis

(*d*) the final hydrolysis products of PCl_3 and $POCl_3$ are identical

139. If polarising power is in the order of $M_a^+ > M_b^+ > M_c^+$ and polarisability is in the order of $X^- > Y^- > Z^-$ then select which have more covalent character as compared to $M_b^+Y^-$:-

(*a*) $M_a^+Y^-$ (*b*) $M_b^+X^-$

(*c*) $M_a^+X^-$ (*d*) $M_b^+X^-$

140. Which of the following statements are incorrect ?

(*a*) P–F bond length is longer than that of P–Cl bond length in PF_2Cl_3

(*b*) F atom ocupy in equatorial position of T.b.p structure of PF_2Cl_3

(*c*) In PF_3Cl_2 all axial and all equatorial bond length are identical

(*d*) Fluorine atoms prefers to attach at the axial position than that of equatorial position of PF_2Cl_3

141. Which of the following options are incorrect ?

(*a*) Salicyaldehyde has a higher melting point as compared to its positional isomer because of intra molecular hydrogen bonding

(*b*) Ionic forces are directional in nature

(*c*) In a crystals of I_2, the forces of attraction will be covalent

(*d*) crystalline boric acid forms two dimensional sheet with almost hexagonal symmetry

142. Which of the following statement is incorrect ?

(*a*) the number of bonding electrons in N_2 and N_2^- is same

(*b*) the bond order and bond length of N_2^+ and N_2^- is same

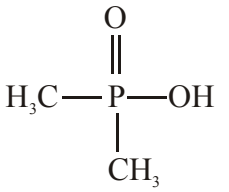
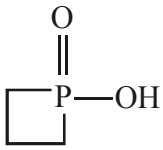
(*c*) among O_2^-, O_2^{2-}, O_2^{2+} ; O_2^{2+} has longest bond length

(*d*) bond order (O–O) $O_2^{2+} > O_2^{+1} > O_2 > O_2^{-1} > O_2^{2-}$

143. Which of the following statement are correct :-

(*a*) the C–Cl distance in CH_3Cl and CF_3Cl are 1.78Å and 1.75Å respectively

(*b*) the C–C single bond distance in methyl acetylene $H_3C - C \equiv CH$ is only 1.46Å compared to 1.54 Å is $CH_3–CH_3$

(*c*)  is less acidic than 

(*d*) SF_6 sublimes at –64°C where graphite sublimes at 3700°C

144. Incorrect statement -

(*a*) POF_3 and NOF_3 both have coordinate bond

(*b*) POF_3 and NOF_3 does not have coordinate bond

(*c*) POF_3 has coordinate bond but NOF_3 does not have coordinate bond

(*d*) POF_3 does not have coordinate bond but NOF_3 has coordinate bond

145. Select the correct statements for sulphuric acid :-

(*a*) it has high boiling point and viscocity

(*b*) there are two types of bond lengths in its bivalent anion

(*c*) pπ-dπ bonding between sulphur and oxygen is observed

(*d*) sulphur has the same hybridisation as that of boron in diborane

146. Which of the following statement are correct ?

(*a*) the percentage of s character in the orbital forming S–S bond and P–P bonds in S_8 and P_4 molecules respectively are same

(*b*) aqueous H_3PO_4 is syrupy

(*c*) SiO_2 crystal may be considered as giant molecule in which eight - membered rings are formed with alternate silicon and oxygen atoms.

(*d*) In SF_4 the bond angles instead of being 90° and 180° are 89° and 177° respectively due to the repulsion between lone pair and bond pairs of electrons

147. Which of the following molecules are nonplanar ?

(*a*) NH_3

(*b*) $N(CH_3)_3$ [trimethyl amine]

(*c*) $N(SiH_3)_3$ (trisilylamine)

(*d*) $P(SiH_3)_3$

148. Select the correct statement(s) :-

(*a*) in ClO_4^-, all Cl – O bonds are identical and there is strong pπ-dπ bonding between chlorine and oxygen atom

(*b*) in P_4S_3 molecules there are a six P – S bonds , three P–P bonds and ten lone pairs of electrons

(*c*) N_2H_4 is pyramidal about each N-atom

(*d*) Br_2 and ICl have same reactivity and same boiling point

149. Which of the following are correct ?

(*a*) thio-ether have less boiling point than ether

(*b*) thiol have more boiling point than alcohol

(*c*) the maximum possible number of hydrogen bonds a water molecule can form is 4

(*d*) Al_2S_3 when undergoes reaction with water the products formed are $Al(OH)_3$ and H_2S

150. Which are correct statements ?

(*a*) Borazine has less intermolecular force of attraction as compared to benzene

(*b*) D_2O has less boiling point than H_2O

(*c*) CuI_2 is unstable even at ordinary temperature

(*d*) $NaClO_4$ is about 1000 times as soluble as $KClO_4$ in water

EXERCISE # III

❑ **Linked Comprehension Type :**

Passage Type:

Passage for Q.1 to Q.3

XeF_6 undergo hydrolysis in 3 stages giving different products in each stage. Here H_2O acts as nucleophile and XeF_6 acts as electrophile. The reaction is as follows :-

$XeF_6 + H_2O \rightarrow P_1 + 2HF$

$P_1 + H_2O \rightarrow P_2 + 2HF$

$P_2 + H_2O \rightarrow P_3 + 2HF$

1. The hybridisation of Xe atom in P_1 :-
(*a*) sp^3 (*b*) sp^3d
(*c*) sp^3d^2 (*d*) sp^3d^3

2. The hybridisation of Xe atom in P_2:-
(*a*) sp^2 (*b*) sp^3
(*c*) sp^3d (*d*) sp^3d^2

3. The hybridisation of Xe atom in P_3 :-
(*a*) sp^2 (*b*) sp^3
(*c*) sp^3d (*d*) sp^3d^2

Passage for Q.4 to Q.6

Interhalogen compound of the type A_mB_n are possible. It can have formula AB ; AB_3 ; AB_5 ; AB_7 where A is halogen of larger size and B is halogen of smaller size and B is more electronegative than A. As the ratio between radii of A,B increases, the number of atoms per molecule increases-

4. Correct geometry and polar character of AB :-
(*a*) AB : linear ; polar
(*b*) AB : linear ; nonpolar
(*c*) AB : bent ; polar
(*d*) AB : bent ; nonpolar

5. Correct geometry and polar character of AB_7 :-
(*a*) AB_7 : octahedral ; polar
(*b*) AB_7 : octahedral ; nonpolar
(*c*) AB_7 : pentagonal bipyramidal ; polar
(*d*) AB_7 : pentagonal bipyramidal ; non polar

6. Correct shape geometry and polar character of AB_3-
(*a*) AB_3 : bent ; nonpolar
(*b*) AB_3 : Trigonal planar ; nonpolar
(*c*) AB_3 : T shaped ; nonpolar
(*d*) AB_3 : T shaped ; polar

Passage for Q.7 to Q.8

$$\underset{1\text{ mole}}{BeF_2} \xrightarrow[(1\text{ mole})]{F^-} A \xrightarrow[(1\text{ mole})]{F^-} B.$$

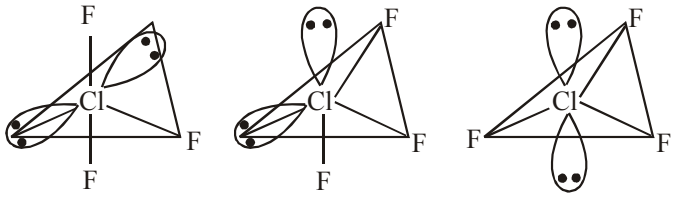
7. In above reaction, hybridisation of central atom in species A is -
(*a*) sp (*b*) sp^2
(*c*) sp^3 (*d*) sp^3d

8. In above reaction, hybridisation of central atom in species B is -
(*a*) sp (*b*) sp^2
(*c*) sp^3 (*d*) sp^3d

Passage for Q.9 to Q.11

When the central atom bears both the bond pairs & lone pairs the structure are devided from regular geometries produced from rule-1 of VSEPR. (Valence shell electron pair repulsion) theory -

9. In ClF_3 , 3-possible structures given as follows -

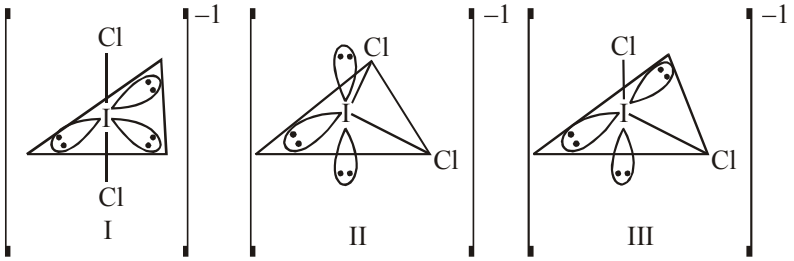


I II III

	l.p.l.p repulsion at 90°	l.p.-b.p repulsion at 90°	b.p.-b.p. repulsion at 90°
(*a*) Str.-I	0	4	2
(*b*) Str.-II	1	3	2
(*c*) Str.-III	0	6	0

(*d*) All are correct

10. In ICl_2^- , 3 possible structures given as follows -

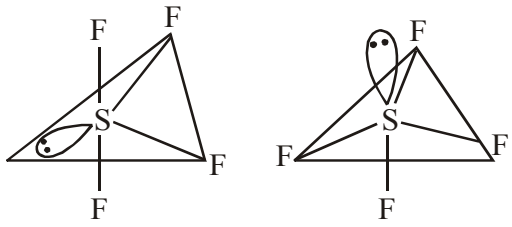


I II III

	l.p.-l.p repulsion at 90°	l.p.-b.p repulsion at 90°	b.p.-b.p.repulsion at 90°
(*a*) Str.-I	0	6	0
(*b*) Str.-II	2	4	0
(*c*) Str.-III	2	3	1

(*d*) All are correct

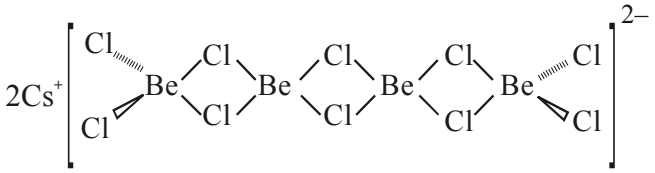
11. In SF_4, 2 possible structures given as follows -



I II

	l.p.-l.p repulsion at 90°	l.p.-b.p repulsion at 90°	b.p.-b.p.repulsion at 90°
(*a*) Str.-I	0	3	3
(*b*) Str.-I	0	2	4
(*c*) Str.-II	0	2	4
(*d*) Str.-II	0	3	3

Passage for Q.12 to Q.14



A segment of polymeric $BeCl_2$ can be given as follows.

12. What is maximum number of atoms present in same plane ?

(*a*) 6 (*b*) 8

(*c*) 10 (*d*) 12

13. What is the number of 2c–2e bonds present ?

(*a*) 12 (*b*) 4

(*c*) 8 (*d*) 6

14. What is the number of 3c–2e bonds present ?

(*a*) 12 (*b*) 4

(*c*) 8 (*d*) 6

Passage for Q.15 to Q.17

Silicate may be regarded as the metal derivative of silicic acid H_4SiO_4. Silicate can be prepared by fuming metal oxide or metal carbonate with sand.

$SiO_2 + Na_2CO_3 \xrightarrow{\text{fused}} Na_2SiO_4, (Na_2SiO_3)_n$ etc.

Silicate are classified according to the nature of linking between the tetrahedral SiO_4^{4-} anions.

15. Hemimorphite having formula $Zn_4(OH)_2 . Si_2O_7 . H_2O$. It is example of :-

(*a*) Orthosilicate

(*b*) Pyrosilicate

(*c*) single chain silicate

(*d*) double chain silicate

16. In Beryl $Be_2Al_2(Si_6O_{18})$, the number of oxygen shared in every tetrahedral :-

(*a*) 2 (*b*) 3

(*c*) 6 (*d*) 4

17. Kaolin, an important clay mineral having molecular formula $Al_2(OH)_4(Si_2O_5)$ is example of :-

(*a*) Single chain silicate

(*b*) 3-D-silicate

(*c*) 2D/Sheet silicate

(*d*) Double chain silicate

Passage for Q.18 to Q.20

$$\underset{\text{paraperiodic acid}}{2H_5IO_6} \xrightarrow[-4H_2O]{100^\circ C} 2P_1 \xrightarrow{200^\circ C} P_2 + H_2O + O_2$$

18. The structure of P_1 is :-

(*a*) trigonal (*b*) tetrahedral

(*c*) octahedral (*d*) bent

19. Hybridisation of iodine atom in P_2 :-

(*a*) sp^2 (*b*) sp^3

(*c*) sp (*d*) sp^3d

20. The shape of paraperiodic acid is :-

(*a*) tetrahedral (*b*) pentagonal bipyramidal

(*c*) octahedral (*d*) angular

Passage for Q.21 to Q.23

Powdered borax $Na_2B_4O_7 . 10H_2O$ is used in borax – bead test to identify different metal ions. For this , it is taken in a Pt wire, heated, the salt swells up and shrinks upon the loop forming a colourless transparent glass - like bead.

21. Correct statement about borax :-

(*a*) each boron atom has one –OH group

(*b*) each boron atom has two –OH group

(*c*) each boron atom has three –OH group

(*d*) each boron atom has four –OH group

22. Borax is actually made of :-

(*a*) two tetrahedra and one triangular unit

(*b*) one tetrahedra and one triangular unit

(*c*) two tetrahedra and two triangular unit

(*d*) None

23. Correct statement regarding borax :-

(*a*) each boron atom has four B–O bonds

(*b*) each boron atom has three B–O bonds

(*c*) two boron atoms has four B–O bonds while other two have three B–O bonds

(*d*) none

Passage for Q.24 to Q.26

The hydrogen bond is generally represented as A–H.....B. Where A is sufficiently electronegative element to cause acidic nature on the hydrogen and B has sufficient electron density to act as a base to this hydrogen.

24. Which hydrogen bonding is strongest :-

(*a*) F–H.....N (*b*) N–H.....O

(*c*) F–H.....O (*d*) F–H.....F

25. Hydrogen bonding takes place in :-

(*a*) KHF_2 (*b*) KH_2PO_4

(*c*) KH_2PO_2 (*d*) both (*a*) and (*b*)

26. Which of the following compound can form hydrogen bonding with each other :-

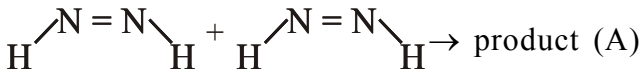
(*a*) NH_4Cl + Water

(*b*) KF + HF

(*c*) CH_3OCH_3 + Water

(*d*) All

Passage for Q.27 to Q.29



→ product (A) N_2 + product (B) (N_2H_4)

27. What kind of hybridisation change is observed for N atom from reactant to product (A):-

(*a*) $sp^2 \rightarrow sp^3$ (*b*) $sp^3 \rightarrow sp$

(*c*) $sp \rightarrow sp^2$ (*d*) $sp^2 \rightarrow sp$

28. What kind of hybridisation change is observed for N atom from reactant to product (B) :-

(*a*) $sp^2 \rightarrow sp^3$ (*b*) $sp^3 \rightarrow sp$

(*c*) $sp \rightarrow sp^2$ (*d*) $sp^2 \rightarrow sp$

29. This reaction is example of :-

(*a*) non-redox reaction

(*b*) disproportionation reaction

(*c*) comproportionation reaction

(*d*) acid base reaction

Passage for Q.30 to Q.31

Polystyrene is a polymer which is used as insulator , manufacture of toys , radio, television cabinet. Its monomeric unit is styrene (CH_2 = CHPh). Polyacrylonitrile is another polymer which is ued as substitute for wool in making commercial fibres. Its momomeric unit is acrylonitrile. (CH_2= CH–CN)

30. The hybridisation of carbon in polystyrene :-

(*a*) sp^2 and sp

(*b*) sp and sp^3

(*c*) sp^3 and sp^2

(*d*) only sp^2

31. The hybridisation of carbon in Polyacrylonitrile :-

(*a*) sp^2 and sp

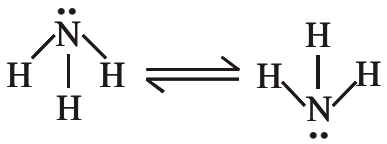
(*b*) sp and sp^3

(*c*) sp^3 and sp^2

(*d*) only sp^2

Passage for Q.32 to Q.33

Ammonia molecule undergoes a type of motion known as inversion ; The N atom oscillate throgh the plane of the three H atoms much as an umbrella turns inside out. This is called umbrella inversion.



32. During umbrella inversion the hybridisation of N in intermediate stage :-

(*a*) sp (*b*) sp^2

(*c*) sp^3 (*d*) sp^3d

33. The potential energy barrier for inversion is :-

(*a*) 6 KJ $mole^{-1}$

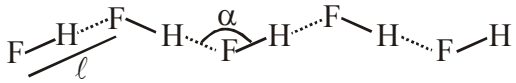
(*b*) 12 KJ $mole^{-1}$

(*c*) 18 KJ $mole^{-1}$

(*d*) 24 KJ $mole^{-1}$

Passage for Q.34 to Q.35

Because of very high electronegativity of F(4.0) , it has the tendency to form hydrogen bonds. The liquid acid and its vapour at low temperature consists of polymeric chain $(HF)_x$. The association of HF molecule is attributed to hydrogen bonding.



34. ℓ and α are respectively :-

(*a*) 1.22°A ; 120°

(*b*) 0.77°A ; 70°

(*c*) 2.55°A ; 140°

(*d*) 3.66°A ; 210°

35. Which of the following option is correct regarding HF ?

(*a*) HF has highest boiling point among all HX

(*b*) HF is most polar among all HX

(*c*) HF is least acidic among all HX

(*d*) All

Passage for Q.36 to Q.38

According to wave mechanics, the atomic orbitals can be expressed by wave functions (ψ's) which represent the amplitude of the electron waves. These are obtained from the solution of Schrodinger wave equation. Molecular orbitals which are one electron wave functions for molecules are difficult to obtain directly from the solution of Schrodinger wave equation. To overcome this problem, an approximate method known as linear combination of atomic orbitals (LCAO) has been adopted.

36. If the atomic orbitals of these atoms are represented by the wave functions Ψ_A and Ψ_A, then which of the following options is correct regarding bonding molecular orbital :-

(*a*) bonding molecular orbitals are formed as $\sigma = \psi_A + \psi_B$

(*b*) antibonding molecular orbitals are formed as $\sigma = \psi_A - \psi_B$

(*c*) both (*a*) and (*b*)

(*d*) None

37. Which of the following option is correct regarding bonding molecular orbital ?

(*a*) In a bonding molecular orbital, electron density is located between the nuclei of the bonded atoms

(*b*) A bonding molecular orbital always possesses lower energy than either of the atomic orbital

(*c*) In the formation of the bonding molecular orbital, the two electron waves of bonding atoms reinforce each other due to constructive interference.

(*d*) All

38. Which of the following option is correct regarding anitbonding molecular orbital ?

(*a*) In a antibonding molecular orbital, most of the electron density is located away from the space between the nuclei.

(*b*) An antibonding molecular orbital always possesses higher energy than either of the atomic orbital

(*c*) In the formation of the antibonding molecular orbital, the two electron waves cancel each other due to destructive interference.

(*d*) All

Passage for Q.39 to Q.41

Type of molecule	Example	Dipole moment μ(D)
AB_2	H_2O	x_1
	H_2S	y_1
	CO_2	z_1
AB_3	NH_3	x_2
	NF_3	y_2
	BF_3	z_2
AB_4	CH_4	x_3
	$CHCl_3$	y_3
	CCl_4	z_3

39. Correct option is :-

(*a*) $x_1 > y_1 > z_1$ (*b*) $x_1 < y_1 < z_1$

(*c*) $x_1 = y_1 = z_1$ (*d*) $x_1 > z_1 > y_1$

40. Correct option is :-

(*a*) $x_2 > y_2 > z_2$ (*b*) $y_3 > x_3 = z_3$

(*c*) $x_2 = y_2 = z_2$ (*d*) both (*a*) & (*b*)

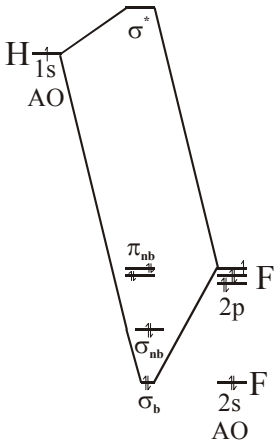
41. Which one has zero dipole moment ?

(*a*) CO_2 (*b*) BF_3

(*c*) CCl_4, CH_4 (*d*) All

Passage for Q.42 to Q.44

M.O. diagram of HF molecule is given below :



42. HOMO of HF is :- (HOMO = highest occupied molecular orbital)

(*a*) σ^* (*b*) σ_b

(*c*) π_{nb} (*d*) σ_{nb}

43. LUMO of HF is :- (LUMO = lowest unoccupied molecular orbital)

(*a*) σ^* (*b*) σ_b

(*c*) π_{nb} (*d*) σ_{nb}

44. HF is :-

(*a*) paramagnetic

(*b*) diamagnetic

(*c*) can not be predicted

(*d*) base

Passage for Q.45 to Q.47

$\alpha\text{-sulphur} \underset{<369K}{\overset{>369K}{\rightleftharpoons}} \beta\text{-sulphur}$

45. α-sulphur is **:-**

(*a*) rhombic sulphur (*b*) monoclinic sulphur

(*c*) plastic sulphur (*d*) colloidal sulphur

46. β-sulphur is **:-**

(*a*) monoclinic sulphur

(*b*) rhombic sulphur

(*c*) plastic sulphur

(*d*) colloidal sulphur

47. Correct statements are :-

(*a*) both α and β variety are soluble in CS_2

(*b*) both α and β variety are insoluble in water

(*c*) α variety is lemon yellow and β variety is needle like transparent crystal

(*d*) all

Passage for Q.48 to Q.50

Interhalogen compounds are represented as XX', XX'_3, XX'_5, XX'_7

when X' is more electronegative element

X is less electronegative element

when they undergo hydrolysis a mixture of hydraacid and oxyacid is formed.

$XX' + n_1H_2O \rightarrow P_1 + P_2$

$XX'_3 + n_2H_2O \rightarrow P_1 + P_3$

$XX'_5 + n_3H_2O \rightarrow P_1 + P_4$

$XX'_7 + n_4H_2O \rightarrow P_1 + P_5$

48. n_1, n_2, n_3, n_4 are respectively

(*a*) 2,3,4,5 (*b*) 0,1,2,3

(*c*) 1,2,3,4 (*d*) 0,2,4,6

49. The common product P_1 is :-

(*a*) HOX' (*b*) HX'

(*c*) HOX (*d*) HX

50. P_2, P_3, P_4, P_5 are respectively :-

(*a*) $XO_0(OH)$; $XO_1(OH)$; $XO_2(OH)$; $XO_3(OH)$

(*b*) $X'O_0(OH)$; $X'O_1(OH)$; $X'O_2(OH)$; $X'O_3(OH)$

(*c*) HOX ; HOX_2 ; HOX_3 ; HOX_4

(*d*) HOX' ; HOX_2' ; HOX_3' ; HOX_4'

Passage for Q.51 to Q.53

Marshal's acid + $H_2O \rightarrow$ X (acid) + Y (acid)

Y (acid) + $H_2O \rightarrow$ X (acid) + Z (unstable compound)

51. The product X, Y are respectively :-

(*a*) H_2SO_3 ; H_2SO_4 (*b*) H_2SO_4 ; H_2SO_5

(*c*) H_2SO_3 ; H_2SO_5 (*d*) H_2SO_5 ; H_2SO_3

52. Unstable compound Z is :-

(*a*) H_2O (*b*) H_2

(*c*) O_2 (*d*) H_2O_2

53. Which compound has peroxide linkage ?

(*a*) X,Y,Z all (*b*) X, Z both

(*c*) X, Y both (*d*) Y, Z both

Passage for Q.54 to Q.56

Carbon exists in two allotropic forms : (i) crystalline form, (ii) amorphous form . The crystalline form of the allotropes of carbon includes (a) Diamond, (b) Graphite. The amorphous form of allotropes of carbon include (a) Charcoal (b) Lampblack (c) Coke (d) Gas carbon.

54. Which of the following options are correct regarding Diamond ?

(*a*) Diamond is chemically inert, it is not attacked by acids and alkalies.

(*b*) It is the hardest substance, specific gravity is 3.5

(*c*) It has carbon with sp^3 hybridisation

(*d*) All

55. Which of the following options are correct regarding Graphite ?

(*a*) Graphite is used as dry lubricant in machine in place of oil

(*b*) It is a good conductor of heat and electricity

(*c*) It is soft and slippery, specific gravity is 2.2

(*d*) All

56. Correct order regarding property between diamond and graphite :-

(*a*) thermal conductivity : diamond > graphite

(*b*) electrical conductivity : diamond < graphite

(*c*) C–C bond length : diamond > graphite

(*d*) All

Passage for Q.57 to Q.59

Nitrogen forms pπ-pπ multiple bonds, nitrogen exists as triply bonded diatomic gaseous molecule. Bond strength is very high which is responsible for inertness at ordinary conditions, while other members of nitrogen family form dπ-pπ bonding :-

57. Thermal and electrical conductivity is highest

(*a*) N (*b*) P

(*c*) As (*d*) Bi

58. Which is most acidic in nature ?

(*a*) Bi_2O_3 (*b*) Bi_2O_4

(*c*) Sb_2O_3 (*d*) Bi_2O_5

59. Maximum covalency of Sb will be :-

(*a*) 0 (*b*) 2

(*c*) 4 (*d*) 6

Passage for Q.60 to Q.62

Chemical bonding between two atoms is necessarily associated with an electrical moment arising out of the difference in electronegativity of two atoms. This means that every bon carries with it an electrical moment called to bond moment'. To compute the dipole moment it is necessary to find out the values of various bond moment. in the following table dipole moment of different bonds are as given.

Bond	$\overrightarrow{H-C}$	$\overrightarrow{C-Cl}$	$\overrightarrow{C=O}$
Bond moments	0.4D	1.5D	2.5D

The group moments of few group as given :

Group	NO_2	OH	CN	CH_3
Direction of dipole	toward N	toward O	toward N	away from CH_3
Dipole moment	4D	1.6D	3.8D	0.4D

60. The bond angle in H_2S is 97° and its dipole moment is 1.5D. The S–H bond distance is 0.15 nm. Therefore approximate percentage ionic character of S–H bond is (neglect the effect of dipole moment of lone pair on sulphur atom in H_2S). (Given cos 97° = – 0.12 and $\sqrt{0.88} = 0.94$)

(*a*) 32% (*b*) 16%

(*c*) 84% (*d*) 10%

61. In CH_3CCl_3 (I), $CHCl_3$ (II) and CH_3Cl (III) the normal tetrahedral bond angle is maintained. Also given $\cos 70.5° = \frac{1}{3}$. Therefore dipole moments of the given compounds are. :-

(*a*) I = 1.9 D, II = 1.9 D, III = 1.7 D

(*b*) I = 1.9 D, II = 1.7 D, III = 1.9 D

(*c*) I = 1.9 D, II = 1.7 D, III = 1.0 D

(*d*) I = 1.9 D, II = 1.1 D, III = 1.9 D

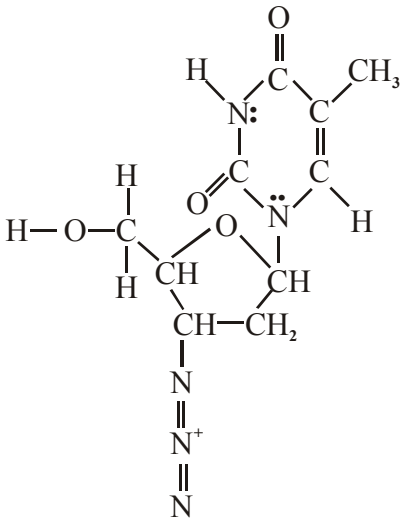
62. In the acetone molecule considering the normal planer structure , the observed dipole moment of acetone molecule is :-

(*a*) 2.9D (*b*) 2.75D

(*c*) 3D (*d*) none of these

Passage for Q.63 to Q.65

The structure of AZT drug (azidothymidine) also called zidovudone, is given below.



It is used to delay development of AIDS in patients infected with HIV (Human immuno defficiency virus)

63. Number of carbon atoms with sp^3 hybridisation

(*a*) 2 (*b*) 4

(*c*) 6 (*d*) 8

64. Number of carbon atoms with sp^2 hybridisation

(*a*) 2 (*b*) 4

(*c*) 6 (*d*) 8

65. Number of nitrogen atoms with sp hybridisation

(*a*) 2 (*b*) 4

(*c*) 6 (*d*) 1

MATRIX MATCH TYPE

66. Match list-I with list-II and select the correct answer :-

Species	**O–N–O angle**
(A) NO_2^+	(P) 180°
(B) NO_2	(Q) 134°
(C) NO_2^-	(R) 120°
(D) NO_3^-	(S) 115°

67. Match list-I with list-II and select the correct answer :-

Species	**HMH/FMF bond angle**
(A) NF_3	(P) 102°
(B) PF_3	(Q) 97.8°
(C) NH_3	(R) 107.3°
(D) PH_3	(S) 93.8°

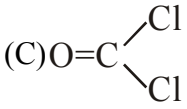
68. Match list-I with list-II and select the correct answer :-

Molecule/Species	**Unpaired electron resides in**
(A) NO_2	(P) vacant d-orbital
(B) ClO_2	(Q) sp^2-orbital
(C) ClO_3	(R) sp^3-orbital
(D) CH_3	(S) vacant p-orbital

69. Match the column :-

Column - I	**Column - II**
Compound	**Characteristic feature**
(A) $POCl_3$	(P) Covalent bond present
(B) XeO_2F_2	(Q) Molecule violets octet rule
(C) CH_3–NC	(R) One lone pair on any atom
(D) CO	(S) π-bond present

70. Match the column :-

Column - I **Compound**	**Column - II** **Characteristic feature**
(A) XeO_4	(P) p_π–p_π bond present
(B) $CH_2 = SF_4$	(Q) p_π–d_π bond present
(C) 	(R) Number of total lone pair present is even
(D) XeO_3F_2	(S) Non polar molecule

71. Match the column :-

Column - I **Compound**	**Column - II** **Hybridisation**
(A) XeO_6^{4-}	(P) sp
(B) IF_7	(Q) sp^2
(C) CO_3^{2-}	(R) sp^3d^3
(D) $Ag(CN)_2^-$	(S) sp^3d^2

72. Match the column :-

Column - I

Atom in a compound

(A) Carbon atom in cyclopentadienyl anion

(B) Oxygen atom in diethyl ether

(C) Carbon atom in singlet carbene

(D) Nitrogen atom in triethyl amine

Column - II

Hybridisation

(P) sp^2 hybridisation

(Q) sp^3 hybridisation

(R) one lone pair of e^- present (localised)

(S) two lone pair of e^- present (localised)

73. Match the column :-

Column - I **Molecule/ Intermediate**	**Column - II** **Shape/Hybridisation of central atom**
(A) NO_2	(P) sp^2
(B) Trifluoro methyl radical	(Q) sp^3
(C) Methyl radical	(R) Trigonal planar
(D) ClO_3	(S) Pyramidal

74. Match the column :-

Column - I **Compound**	**Column - II** **Features**
(A) XeO_4	(P) $p\pi$-$p\pi$ bond present
(B) SO_3	(Q) $p\pi$-$d\pi$ bond present
(C) $COCl_2$	(R) Number of total lone pair is even
(D) $H_2S_2O_7$	(S) sp^2 hybridisation
	(T) sp^3 hybridisation

75. Match the column :-

Column - I **Compound**	**Column - II** **Features**
(A) $\underline{Be}_2Cl_4$	(P) 3c–4$\bar{e}$ bond is present
(B) $\underline{C}_2Cl_6$	(Q) 3c–2$\bar{e}$ bond is present
(C) $\underline{B}_2H_6$	(R) 2c–2e bond is present
(D) $\underline{Al}_2(C_6H_5)_6$	(S) Molecule is planar

76. Match the column :-

Column - I **Compound**	**Column - II** **Features**
(A) BF_3	(P) electron difficient molecule either in monomer or in dimer form
(B) $SiCl_4$	(Q) non-polar in dimeric form
(C) ICl_3	(R) bridging atoms are present in molecular plane in its dimeric form
(D) $BeCl_2$	(S) dimer form does not exist

77. Match the column :-

Column - I **Species**	**Column - II** **Features**
(A) XeF_5^+	(P) Axial bond length is longer than equatorial bond length
(B) IF_4^-	(Q) sp^3d hybridisation of central atom
(C) PCl_5	(R) Non-planar species
(D) ClF_3	(S) Central atom has 2 lone pair of electrons on it
	(T) d_{z^2} orbital is involved in hybridisation

78. Match the column :-

Column - I

Process

(A) Solubility of noble gas is in water

(B) The interaction between chlorobenzene molecule

(C) Interaction between alkane

(D) Dissolution of ionic compound in water

Column - II

Operating interaction involved

(P) Debye forces

(Q) Keesom forces

(R) London forces

(S) Weak forces

79. Match the column :-

Column - I

Process

(A) Clathrate compound of Xe in ice

(B) Liquation of Xe gas

(C) Liquation of HCl gas

(D) Hydration of Na^+

Column - II

Operating interaction involved

(P) Ion-dipole

(Q) Dipole-dipole

(R) Dipole-Induced dipole

(S) London forces

80. Match the column :-

Column - I

Compound

(A) $P(SiH_3)_3$

(B) $N(CH_3)_3$

(C) $N(SiH_3)_3$

(D) SiF_4

Column - II

Features

(P) pyramidal in shape

(Q) no back bonding possible

(R) trigonal planar in shape

(S) $2p_\pi - 3d_\pi$ back bonding possible

(T) tetrahedral in shape

81. Match the column :-

Column - I	**Column - II**
Compound	**Features**
(A) Dimer of acetic acid	(P) 2c–2e bond present
(B) Dimer of borane	(Q) 3c–2e bond present
(C) Dimer of $AlCl_3$	(R) 3c–4e bond present
(D) Dimer of NO_2	(S) H bond present
	(T) Molecule existing

82. Match the column :-

Column - I

Compound

(A) CN_2^{2-}, CO_2

(B) Inorganic benzene, borazene

(C) PCl_3F_2, PF_3Cl_2

(D) BrF_5, XeF_5^+

Column - II

Features

(P) same number of total electrons

(Q) pair of isostructural species

(R) same number of valence electrons

(S) both structures are planar

(T) both cases, central atom has same hybridisation

83. Match the column :-

Column - I	**Column - II**
Species	**Features**
(A) $C_{12}O_9$	(P) M–O–M linkage is present
(B) $Si_2O_7^{6-}$	(Q) open chain silicate
(C) $\gamma - SO_3$ (trimeric form)	(R) cyclic structure
(D) Cl_2O_7	(S) anhydride of $HClO_4$

84. Match the column :-

Column - I	**Column - II**
Species	**Hybridisation of central atom**
(A) $PtCl_4^{2-}$	(P) sp^3
(B) CrO_4^{2-}	(Q) sp^3d^2
(C) XeF_4	(R) d^3s
(D) BF_4^-	(S) dsp^2

85. Match the column :-

Column - I	**Column - II**
Species	**Features**
(A) AlF_3	(P) dipole moment is zero
(B) $I(CN)_2^-$	(Q) overall molecule is linear
(C) Ba_2XeO_6	(R) ionic compound exist as lattice
(D) $H_3Ge - N = C = S$	(S) the central atom has d_z^2 orbital for hybridisation
	(T) at least one of the atom is sp hybridised

86. Match the column :-

Column - I

Species

(A) H_3BO_3 ; H_3PO_4

(B) $CH_2=C=O$; $CH_2=C=CH_2$

(C) LiI, LiF

(D) H_2O, H_2S

Column - II

Features

(P) Ist cpd is planar ; IInd cpd is non planar

(Q) Ist cpd is not proton donor but IInd cpd is proton donor

(R) Ist cpd is covalent but IInd cpd is ionic in nature

(S) For Ist cpd hybridisation of central atom is sp^3 whereas for IInd cpd, hybridisation of central atom in molecule is not defined

87. Match the column :-

Column - I	**Column - II**
Oxyacids of N	**Features**
(A) HNO_4	(P) Monobasic acid
(B) HNO_3	(Q) C.B. has 2 identical R.S.
(C) HNO_2	(R) Compound showing G.I.
(D) $H_2N_2O_2$	(S) Highest oxidation state of central atom
	(T) Peroxy linkage present

88. Match the column :-

Column - I	**Column - II**
Type of π bond	**Molecules**
(A) 2pπ–2pπ	(P) O=C=O
(B) 2pπ–3pπ	(Q) S=C=S
(C) 2pπ–3dπ	(R) $POCl_3$
(D) 3pπ–3dπ	(S) $PSCl_3$
	(T) $SOCl_2$

89. Match the column :-

Column - I	**Column - II**
Oxyacid of chlorine	**Features**
(A) $HClO_4$	(P) weakest acid
(B) $HClO_3$	(Q) strongest acid
(C) $HClO_2$	(R) C.B. has 3 identical R.S.
(D) HOCl	(S) sp^3 hybridisation of central atom
	(T) Formula of anhydride is Cl_2O_7

90. Match the column :-

Column - I

Miscellaneous oxy acid

(A) $HMnO_4$

(B) H_2CrO_4

(C) H_2CO_3

(D) CH_3CO_2H

Column - II

Features

(P) Monobasic acid

(Q) Pink / purple colour

(R) Yellow colour

(S) C–O bond lengths are not identical

(T) Thermally unstable and gives CO_2 gas on heating

91. Match the column :-

Column - I	**Column - II**
Compound/molecule	**Structures**
(A) S_8	(P) Zig-zag structure
(B) H_2O_2	(Q) open book like structure
(C) $(HF)_n$	(R) crown shape
(D) CrO_5	(S) Butterfly structure

92. Match the column :-

Column - I

Compound

(A) NH_4ClO_4

(B) MgC_2O_4

(C) HCOONa (400°C)

(D) $(NH_4)_2CO_3$

Column - II

Products on heating

(P) CO_2 gas is evolved

(Q) H_2 gas is evolved

(R) N_2 gas is evolved

(S) Same gas is evolved which is obtained by heating $(NH_4)_2SO_4$

(T) Intramolecular redox reaction

93. Match the column :-

Column - I

Compounds

(A) AlF_3, SF_4, PF_5

(B) $O(CH_3)_2$, $S(CH_3)_2$, $Se(CH_3)_2$

(C) HCl, HF, HBr

(D) CH_4, CH_3Cl, CH_3OH, CH_3CO_2H

Column - II

Boiling point

(P) Ist compound has highest boiling point

(Q) IIIrd compound has highest boiling point

(R) IInd compound has highest boiling point

(S) IVth compound has highest boiling point

94. Match the column :-

Column - I	**Column - II**
Oxyacids of P	**Features**
(i) H_3PO_4	(P) All Hs' are not ionisable
(ii) H_3PO_3	(Q) Dibasic reducing agent
(iii) H_3PO_2	(R) Monobasic reducing agent
(iv) $H_4P_2O_7$	(S) P–H linkage present
(v) $H_5P_3O_{10}$	(T) P–O–P linkage present
(vi) $H_3P_3O_9$	(U) P–P linkage present
(vii) $H_4P_2O_6$	(V) Cyclic structure
(viii) H_3PO_5	(W) Peroxy linkage present
	(X) Highest oxidation state of P
	(Y) Tetrabasic acid
	(Z) Tribasic acid

95. Match the column :-

Column - I

Oxyacids of S

(i) H_2SO_2 (sulphoxylic acid)

(ii) H_2SO_3

(iii) H_2SO_4

(iv) H_2SO_5 (Caro's acid)

(v) $H_2S_2O_7$ (Oleum)

(vi) $H_2S_2O_8$ (Marshall acid)

(vii) $H_2S_2O_3$ (Thiosulfuric acid)

(viii) $H_2S_2O_2$ (Thiosulfurous acid)

(ix) $H_2S_nO_6$ (Polythionic acid)

(x) $H_2S_nO_4$ (Polythionous acid)

Column - II

Features

(P) S–O–S linkage present

(Q) sp^3 hybridisation of S

(R) Peroxy linkage present

(S) S=S linkage present

(T) S–S linkage present

(U) At least one sulphur atom having oxidation state of (+6)

(V) Oxidation state of S is zero in S–S linkage

(W) Dibasic acid

(X) Sulphur can have –ve oxidation state

(Y) Oxyanion undergoes resonance

96. Match the column :-

Column - I	**Column - II**
Compounds	**Type of bond/ interaction**
(A) Blue vitriol	(P) Ionic bond
(B) Gypsum	(Q) Covalent bond
(C) Pure orthophosphoric acid	(R) Hydrogen bond
(D) Chloral hydrate	(S) Resonance stabilisation

97. Match the column :-

Column - I

Different system

(A) Liquid bromine

(B) Noble gas clathrate

(C) Solution of sodium fluoride in water

(D) Liquid methylamine

Column - II

Type of bond/interaction

(P) hydrogen bond

(Q) ion-dipole force

(R) london dispersion force

(S) dipole induced dipole interaction

98. Match the column :-

Column - I

Molecules

(A) F_2, N_2H_4, H_2O_2, NF_3

(B) XeF_4, SO_2, PCl_3F_2, $PCl_{5(g)}$

(C) H_3BO_3, Graphite, NH_4Cl, Na_2CO_3, SO_3

(D) Inorganic benzene, Benzene,

Column - II

Features

(P) all except one are examples of non polar compounds

(Q) all except one are planar molecules

(R) all except one have at least one atom which is sp^2 hybridised

(S) all except one have less bond energy because ICl_4^-, SO_4^{2-}, NO_3^- of lone pair - lone pair repulsion

99. Match the column :-

Column - I	**Column - II**
Compounds	**Feature/Use**
(A) H_2O	(P) polar solvent
(B) H_2O_2	(Q) non linear molecule
(C) D_2O	(R) more acidic than C_2H_5OH
(D) CH_3OH	(S) used as moderator in nuclear reactions

100. Match the column :-

Column - I

Observed order

(A) $H_2 < CO_2 < H_2O$

(B) $PH_3 < AsH_3 < NH_3 < SbH_3$

(C) $D_2O > H_2O$

(D) $(CH_3)_3N < CH_3NH_2 < (CH_3)_2NH$

Column - II

Property

(P) order of boiling point

(Q) order of density

(R) order of intermolecular forces of attraction

(S) order of basic strength in aqueous medium

EXERCISE # IV

❑ **Integer Type :**

1. Molecules having total eight lone pair present :-

XeO_4 ; $HClO_4$; H_2SO_4 ; N_2O_3 ; $C_3N_3Cl_3$; $COCl_2$; H_2SO_3

2. How many correct bond energy order is given :-

(*a*) H–H > C–H > C–C

(*b*) C–F > C–Cl > C–Br > C–I

(*c*) Cl–Cl > Br–Br > F–F > I–I

(*d*) C–C > Si–Si > Ge–Ge

(*e*) N–N > P–P > As–As > Sb–Sb > Bi–Bi

(*f*) C≡N > C=N > C–N

3. How many molecules /ions are result of dative σ-bond ?

(*a*) $\overset{+}{N}H_4$ (*b*) $H_3\overset{+}{N}-\overset{-}{B}F_3$

(*c*) $I_3^{\ominus}$ (*d*) $BH_4^{\ominus}$

(*e*) SbF_6^- (*f*) H_3O^+

4. How many molecule having negative fractional oxidation state for nitrogen -

N_2O_3 ; N_2O_5 ; Hydrazine ; Hydrazoic acid ; NF_3 ; N_2O ; NH_3

5. How many molecules do not exist ?

CCl_6^{2-} ; CBr_6^{2-} ; SiF_6^{2-} ; AsF_5 ; AsH_5 ; XeF_2 ; $KrCl_2$

6. How many of the following has M–O–M linkage?

(*a*) trimer of SO_3 which is represented as S_3O_9

(*b*) $H_2S_2O_8$

(*c*) Cl_2O_7

(*d*) P_4O_{10}

(*e*) P_4O_6

(*f*) H_2SO_5

(g) $H_2S_2O_7$

7. For how many molecule where all following points are satisfied :

(i) central atom is sp^3 hybridised

(ii) tetrahedral in shape

(iii) π bond is present along with σ bond

CH_4, $SiCl_4$, NH_4^+, BF_4^-, XeO_4, ClO_4^-, SO_4^{2-}, PO_4^{3-}

8. How many molecules / species are example of 16 e^- system with linear inshape -

(*a*) CO_2 (*b*) Nitronium ion

(*c*) Azide ion (*d*) Nitrous oxide

(*e*) Cyanate ion (*f*) Isocyanate ion

(g) Cyanamide (CN_2^{2-}) ion

9. Total number of odd electron system :

NO_2 ; NO : ClO_2 ; OF ; O_3^- ; O_2 ; ClO_3

10. Find the number of sp^3 hybrid orbital in γSO_3 :-

11. How many molecules having molecular formula PCl_nF_m will be polar -

(*a*) m = 0 ; n = 5 (*b*) n = 0 ; m = 5

(*c*) n = 3 ; m = 2 (*d*) m = 3 ; n = 2

(*e*) n = 4 ; m = 1

12. Identify number of molecules in which only two types of bond angles are present

CH_4 ; CH_3Cl ; CH_2Cl_2 ; $CHCl_3$ (Chloroform) ; CCl_4 (Carbon tetrachloride) ; $COCl_2$

13. If number of planes present in CH_4 molecule which contain maximum number of atoms of corresponding molecule is x then find out x – 1.

14. If number of planes present in IF_7 molecule which contain maximum number of atoms of corresponding molecule is y then find out y.

15. Find the number of planes containing maximum number of fluorine atoms (only) in SbF_5.

16. How manmy molecule / species central atom is sp^3 hybridised

BeF_2 ; BF_4^- ; SO_3 ; $AlCl_4^-$; NH_4^+ ; ClO_4^- ; N_3^- ; XeO_4

17. Find the number of molecule in which p – p sideways overlapping is present -

N_2 ; HCl ; Cl_2 ; HF ; S_8 ; F_2 ; HCP

18. Total number of bond angle of 90° in SiF_6^{2-} is

19. Find the number of atomic orbital which forms only σ bond.

s, p_x, p_y, p_z, , d_{xy} , $d_{x^2-y^2}$

20. The number of molecule having perfectly tetrahedral shape among the following are -

NH_3, CCl_4, PO_4^{3-}, $CHCl_3$, BF_4^-

21. Find the ratio of number of lone pairs to number of π bonds in a particular resonating structure of SO_4^{2-} -

22. In which of the following compounds all atoms are present in same plane -

(*a*) I_3^- (*b*) ICl_4^-

(*c*) XeF_4 (*d*) XeF_5^+

(*e*) XeF_5^- (*f*) $C(CN)_4$

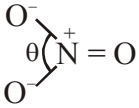
23. In which of the following compound octet of central atom is incomplete or molecule is hypovalent-

(*a*) BF_3 (*b*) ICl

(*c*) ClF_3 (*d*) BeH_2

(*e*) PCl_3 (*f*) $AlCl_3$

24. Identify the total number of molecules (amongest the following) which have bond angle lesser than θ -



CO_2 ; CH_4 ; BF_3 ; $CH_3–O–CH_3$; $SOCl_2$; NH_3 ; H_2O

25. Find the number of chemical species in which bond angle is less than the bond angle in CCl_4-

PH_3 ; H_2S ; OCl_2 ; $O(CH_3)_2$; ClO_2 ; NCl_3

26. Find the molecule in which bond angle is equal to the expected bond angle according to hybridisation of underlined atom -

(*a*) $\underline{P}F_3$ (*b*) $\underline{B}F_3$

(*c*) $\underline{P}Cl_3$ (*d*) $\underline{C}OCl_2$

(*e*) $\underline{N}H_4^+$ (*f*) $\underline{N}Me_3$

27. Find out no. of total lone pair present in trimer of isocyanic acid $(HNCO)_3$.

28. If number of π bonds present in melamine = x and if no. of lone pair present in melamine = y then find out y/x.

29. If number of σ bond present in $C_3N_3(N_3)_3$ cyanauric triazide = x and if number of lone pair present in $C_3N_3(N_3)_3$ is = y & if no. of sp hybridised N present = z then $\frac{y+z}{x}$ is :-

30. Drago rule is applicable for which of the following molecule -

SiH_4 ; PH_3 ; PF_3 ; H_2S ; H_2Te ; AsH_3 ; PH_4^+ ; SbH_3

31. How many structures are cyclic in nature ?

(*a*) S_3O_9 (*b*) $P_3O_9^{3-}$

(*c*) $P_4O_{12}^{4-}$ (*d*) $(PNCl_2)_3$

(*e*) $H_2S_2O_7$ (*f*) $H_2S_2O_8$

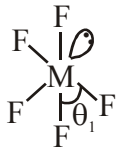
32. Number of S–O–S linkage present in cyclic trimer of SO_3.

33. Number of bond angle which are at 90° w.r.t. each other present in SF_4.

34. Number of bond angle which are at 90° w.r.t. each other present in BrF_5.

35. In which case compound has bond angle which is not exactly equal according to hybridisation?

36.



If $\widehat{FMF}$ bond angle in MF_5 is $\theta = 87°$.

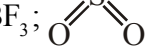
& if $\widehat{FMF}$ bond angle in MF_4 is θ_2

Then find out $\theta_2 - \theta_1$

37. $XeF_4 + PF_5 \longrightarrow XeF_3^+ + PF_6^-$

If total numbers of 90° angle in reactant = m then find out and if total numbers of 9° angles in product = n.

38. In how many of the following species, % s character of all bonds is not identical.

IF_7; CH_4; SF_4; XeF_3^+; OCl_2; ICl_2^-; BF_3; 

39. Cos92° = –0.0.3, What is the % of s-character in hybrid orbital containing lone pair of e⁻s :-

40. Find out number of molecule which do not exist -

XeF_3^-;XeI_3^-; IF_3^{2-}; FeI_3; AI_3; ClI_3^-; PI_5 in T.b.p state.

41. Find the number of molecules which has $3p_\pi - 2p_\pi$ back bonding :

OCl_2 ; :CCl_2 ; BCl_3 ; CCl_3

42. Find the number of molecules in which $2p_\pi - 3d_\pi$ back bonding is present.

OCl_2 ; BF_3 ; $N(SiH_3)_3$; $N(CH_3)_3$; $\overset{\ominus}{C}Cl_3$; $O(SiH_3)_2$; :CCl_2

43. Correct statement regarding B_2H_6 :-

(*a*) Terminal B–H bond length 119 pm and it is 2c–2e bond

(*b*) Bridging B–H bond length 113 pm and it is 3c–2e bond

(*c*) It is non-polar molecule

(*d*) There are only twelve bonding electrons available

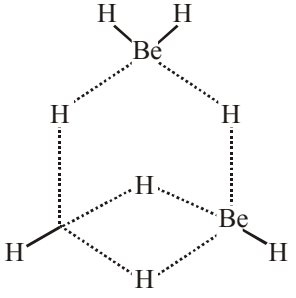
(*e*) B atom in B_2H_6 is approximately sp^3 hybridised

(*f*) It has momentarily complete octet

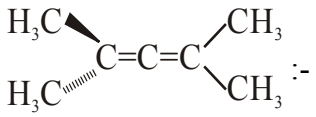
(*g*) The plane containing the two boron atoms and four terminal hydrogen atom is perpendicular to that containing the two bridging hydrogen atoms.

(*h*) The kind of overlap present in bridge bond in B_2H_6 sp^3–s–sp^3

44. In this following molecule the number of bridging bond :-



45. Find the maximum number of atoms may lie in a single plane for the following molecule



:-

46. Maximum number of 2c–2e bonds which are formed by sp^3–sp^3 overlapping in $Al_2(CH_3)_6$:-

47. Maximum number of atoms present in one plane in $Al_2(CH_3)_6$:-

48. How many compounds on reaction with H_2O give product with pH < 7 in aqueous solution ?

MgO ; Na_2O ; SO_3 ; Cl_2O_7 ; P_4O_{10} ; BaO ; N_2O_3 ; SO_2

49. Find out number of molecules which on complete hydrolysis produce sulphuric acid as one of the product :-

SOF_4 ; SF_4 ; $H_2S_2O_8$; $H_2S_2O_7$; SO_2Cl_2 ; S_3O_9

50. Find the number of water molecules required for complete hydrolysis of one molecule of XeF_6 :-

51. Find the number of water molecules which are used for complete hydrolysis of one molecular P_4O_{10} :-

52. How many water molecules are associated with hydrogen bond but not coordinated with metal ion in $CuSO_4.5H_2O$:-

53. Among the following find out the total number of molecules have more % of p-character in E–H bond than that of PH_3 :-

AsH_3 ; SbH_3 ; NH_3 ; H_2O ; B_2H_6

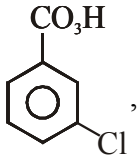
54. Find out the number of molecules which are non-planar :-

$C_2(CN)_4$; P_4 ; S_8 ; H_2O_2 ; F_2O_2 ; CF_4 ; S_2F_{10}

55. For how many molecule C–C bond length is shorter than C–C bond length in graphite :-

(i) acetylene (ii) ethene (iii) benzene (iv) ethane

56. How many molecules have two peroxy linkage :-



, $B_4O_7^{2-}$, $[B_2(O_2)_2(OH)_4]^{2-}$, CrO_5

57. In IF_7 ; what is the total number of bonds which are at 72° ?

58. For C_{70} fullerene find the number of hexagonal face :-

59. For which compound all M–O bonds have bond order 1.5 :-

SO_2 ; CH_3CO_2H ; $CH_3CO_2^-$; NO_2^- ; NO_3^-

60. For $[ABSi_3O_x]$, where A & B have +2 & +4 oxidation state respectively. What is the value of X?

61. Number of S–S linkage in $H_2S_6O_6$:-

62. Find the number of S atom which are at zero oxidation state in $H_2S_6O_6$:-

63. Find the number of species having X–O–X linkage :-

Pyroxene / chain silicate, Perdisulphate ion, Anion of Caro's acid, Pyrosulphate ion, Tetrathionate ion, Thiosulphate ion.

64. How many orbitals are having higher energy compared to σ_{2s} for Li_2 molecule from M.O. given below :-

σ_{1s}^* ; σ_{2s}^* ; σ_{1s} ; π_{2py} ; π_{2py}^* ; σ_{2pz}^* ; π_{2pz}^* ; π_{2pz}

65. How many of the following are paramagnetic :-

He_2^+ ; H_2^+ ; H_2^- ; NO_2 ; NO ; OF

66. How many molecules / ion have bond order less than or equal to two

B_2 ; C_2 ; O_2^{2-} ; O_2^{+1} ; H_2^{+1}

67. Considering MOT find out number of diatomic species which do not have σ bond :-

F_2 ; C_2 ; N_2 ; H_2 ; C_2^{2-}

68. Find the ratio of π electrons in the C_2 molecule with that of B_2 molecule according to MOT :-

69. Find the number of chemical species which are paramagnetic in nature :-

O_2^{2-} ; NO ; ClO_2 ; OF ; B_2

70. Find out the number of species having paramagnetic in nature as well as fractional bond order :-

B_2 ; NO ; OF ; N_2 ; KO_2 ; K_2O_2

71. If sp mixing is not operative then total number of electron in B.M.O. of N_2^+ will be :-

72. Find out total number of species containing N–N/ P–P linkage :-

N_2O ; N_2O_3 (symmetrical) ; N_2O_5 ; $H_2N_2O_2$; $H_4P_2O_6$; P_4O_6 ; P_4O_{10}

73. Find the number of chemical species which are isoelectronic and have same bond order as of CO:-

CN^- ; NO^+ ; N_2 ; C_2^{2-} ; O_2^{2+}

74. Find the number of compounds which can form intermolecular hydrogen bonding but cannot form intramolecular hydrogen bonding :-

Dimer of acetic acid ; Quinol ; Catechol ; $(KHCO_3)_2$; $(NaHCO_3)_n$

75. Number of bond pairs at 90° angle in XeF_5^- is x

Number of bond pairs at 90° angle in XeF_4 is y

The value of y – x :-

76. Select the no. of orbitals which can produce π bond while overlapping with an s-orbital -

(*a*) p_x (*b*) p_y

(*c*) p_z (*d*) d_{xy}

(*e*) d_{yz} (*f*) s

77. Find out total number of σ bond in $P_6O_{18}^{6-}$:-

78. How many statements are correct :-

(*a*) Li_2O has highest melting point among all alkali metal oxide

(*b*) BeO has highest melting point among all alkaline earth metal fluoride

(*c*) LiF_1 has highest melting point among all alkali metal fluoride

(*d*) BeF_2 has highest melting point among all alkaline earth metal fluoride

(*e*) Li_3N has highest melting point among all alkali metal nitride

(*f*) Be_3N_2 has highest melting point among all alkaline earth metal nitride

79. The bond order of the underlined species $NOHSO_4$ is :-

80. The difference in the number of σ and π bonds in trimer of SO_3 is (considering only covalent bond is present) :-

EXERCISE # V(A) JEE-MAIN

1. Which of the following statements is true? [AIEEE–2002]

(1) HFis less polar than HBr

(2) Water does not contain any ions

(3) Chemical bond formation takes place when forces of attraction overcome the forces of repulsion

(4) In covalent bond, transfer of electrons takes place

2. The reason for double helical structure of DNA is operation of: [JEE2003]

(1) dipole–dipole interaction

(2) hydrogen bonding

(3) elcctrostatic attractions

(4) vander Walls forces

3. Which of the following pair of molecules will have permanent dipole moments for both members [AIEEE–2003]

(1) NO_2 and CO_2 (2) NO_2 and O_3

(3) SiF_4 and CO_2 (4) SiF_4 and NO_2

4. The pair of species having identical shapes for molecules of both species is [AIEEE–2003]

(1) XeF_2,CO_2 (2) BF_3,$PC1_3$

(3) PF_5, IF_5 (4) CF_4, SF_4

5. The correct order of bond angles (smallest first) in H_2S, NH_3, BF_3 and SiH_4 is :– [AIEEE–2004]

(1) $H_2S < NH_3 < SiH_4 < BF_3$

(2) $NH_3 < H_2S < SiH_4 < BF_3$

(3) $H_2S < SiH_4 < NH_3 < BF_3$

(4) $H_2S < NH_3 < BF_3 < SiH_4$

6. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements is true for these two species ? [AIEEE–2004]

(1) Bond length in NO^+ is equal to that NO

(2) Bond length in NO is greater than NO^+

(3) Bond length in NO^+ is greater than NO

(4) Bond length is unpredictable

7. The stales of hybridization of boron and oxygen atoms in boric acid (H_3BO_3) are respectively [AIEEE–2004]

(1) sp^3 and sp^2 (2) sp^2 and sp^3

(3) sp^2 and sp^2 (4) sp^3 and sp^3

8. Which one of the following has the regular tetrahedral structure ? [AIEEE–2004]

(1) BF_4^- (2) SF_4

(3) XeF_4 (4) $[Ni(CN)_4]^{2-}$

(Atomic nos.: B = 5, S = 16, Ni = 28, Xe = 54)

9. The maximum number of 90° angles between bond pair–bond pair of electrons is observed – [AIEEE–2004]

(1) dp^2 hybridization (2) sp^3d hybridization

(3) dsp^3 hybridization (4) sp^3d^2 hybridization

10. Beryllium and aluminium exhibit many properties which are similar. But , the two elements differ in :– [AIEEE 2004]

(1) Forming covalent halides

(2) Forming polymeric halides

(3) Forming maximum covalency in compounds

(4) Exhibiting amphoteric nature in their oxides

11. Which one of the following species is diamagnetic in nature ? [AIEEE2005]

(1) He_2^+ (2) H_2

(3) H_2^+ (4) H_2^-

12. Lattice energy of an ionic compound depends upon [AIEEE2005]

(1) charge on the ion only

(2) size of the ion only

(3) packing of the ion only

(4) charge and size of the ion

13. The molecular shapes of SF_4, CF_4 and XeF_4 are– [AIEEE2005]

(1) the same with 2, 0 and 1 lone pair of electrons on the central atom, respectively

(2) the same with 1, 1 and 1 lone pair of electrons on the central atom, respectively

(3) the same with 1, 1 and 2 lone pair of electrons on the central atom, respectively

(4) the same with 1, 0 and 2 lone pair of electrons on the central atom, respectively

14. Of the following sets which one does not contain isoelectronic species. [AIEEE 2005]

(1) PO_4^{3-}, SO_4^{2-}, ClO_4^-

(2) CN^-, N_2, C_2^{2-}

(3) SO_3^{2-}, CO_3^{2-}, N_3^-

(4) BO_3^{3-}, CO_3^{2-}, NO_3^-

15. The number and type of bond between two earbon atom in calcium carbide are: [AIEEE–2005]

(1) one sigma, one pi (2) one sigma, two pi

(3) two sigma, one pi (4) two sigma, two pi

16. Which of the following molecules / ions does not contain unpaired electron ? [AIEEE–2005]

(1) N_2^+ (2) O_2

(3) O_2^{2-} (4) B_2

17. Among the following mixtures , dipole – dipole as the major interaction , is present in : [AIEEE–2006]

(1) KCl and water

(2) benzene and carbon tetrachloride

(3) benzene and ethanol

(4) acetonitrile and acetone

18. A metal , M forms chlorides in its +2 and +4 oxidation states. Which of the following statement about these chlorides is correct ? [AIEEE–2006]

(1) MCl_2 is more ionic than MCl_4

(2) MCl_2 is more easily hydrolysed than MCl_4

(3) MCl_2 is more volatile than MCl_4

(4) MCl_2 is more soluble in anhydrous ethanol than MCl_4

19. In which of the following molecules / ions ae all the bonds not equal : [AIEEE 2006]

(1) XeF_4 (2) BF_4^-

(3) SF_4 (4) SiF_4

20. The decreasing values of bond angles from NH_3 (106°) to SbH_3 (91°) down group–15 of the periodic table is due to – [AIEEE 2006]

(1) decreasing lp – bp repulsion

(2) increasing electronegativity

(3) increasing bp – bp repulsion

(4) increasing p–orbital character in sp^3

21. In which of the following ionization process, the bond order has increased and the magnetic behaviour has changed [AIEEE 2007]

(1) $NO \rightarrow NO^+$ (2) $O_2 \rightarrow O_2^+$

(3) $N_2 \rightarrow N_2^+$ (4) $C_2 \rightarrow C_2^+$

22. Which of the following hydrogen bond is the strongest ? [AIEEE 2007]

(1) F–H.....F (2) O–H.....O

(3) O–H.....F (4) O–H.....N

23. Which of the following species exhibits the diamagnetic behaviour ? [AIEEE 2007]

(1) O_2^+ (2) O_2

(3) NO (4) O_2^{2-}

24. Which one of the following pairs of species have the same bond order [AIEEE 2008]

(1) $CN^-$and NO^+ (2) $CN^-$and CN^+

(3) O_2^- and CN^- (4) NO^+ and CN^+

25. The bond dissociation energy of B–F in BF_3 is 646 kj mol^{-1} whereas that of C–F in CF_4 is 515 kj mol^{-1}. The correct reason for higher B – F bond dissociation energy as compared to that of C–F is :– [AIEEE–2009]

(1) Significant $p\pi - p\pi$ interaction between B and F in BF_3 whereas there is not possibility of such interaction between C and F in CF_4.

(2) Lower degree of $p\pi - p\pi$ interaction between B and F in BF_3 than that between C and F in CF_4

(3) Smaller size of B–atom as compared to that of C–atom

(4) Stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4

26. Using MO theory predict which of the following species has the shortest bond length ? [AIEEE–2009]

(1) O_2^- (2) O_2^{2-}

(3) O_2^{2+} (4) O_2^+

27. The hybridisation of orbitals of N atom in NO_3^-, NO_2^+ and NH_4^+ are respectively:– [ArEEE–2011]

(1) sp, sp^3, sp^2 (2) sp^2, sp^3, sp

(3) sp, sp^2, sp^3 (4) sp^2 , sp, sp^3

28. The structure of IF_7 is :– [AIEEE–2011]

(1) octahedral (2) pentagonal bipyramid

(3) square pyramid (4) trigonal bipyramid

29. Among the following the maximum covalent character is shown by the compound: [AIEEE–2011]

(1) $A1C1_3$ (2) $MgCl_2$

(3) $FeCl_2$ (4) $SnCl_2$

30. Which of the following has maximum number of lone pairs associated with Xe

(1) XeO_3 (2) XeF_4

(3) XeF_6 (4) XeF_2

31. The number of types of bonds between two carbon atoms in calcium carbide is :– [AIEEE–2012]

(1) One sigma, two pi

(2) One sigma, one pi

(3) Two sigma, one pi

(4) Two sigma, two pi

32. The molecule having smallest bond angle is – [AIEEE–2012]

(1) PCl_3 (2) $NC1_3$

(3) $AsCl_3$ (4) $SbCl_3$

33. In which of the following pairs the two species are not isostructural ? [AIEEE–2012]

(1) $A1F_6^{3-}$ and SF_6

(2) CO_3^{2-} and NO_3^-

(3) PCl_4^+ and $SiCl_4$

(4) PF_5 and BrF_5

34. The number of S–S bonds in SO_3, $S_2O_3^{2-}$, $S_2O_6^{2-}$ and $S_2O_8^{2-}$ respectively are :– [JEE–MAINS–2012] (On–line)

(1) 1,0,1,0 (2) 0,1,1,0

(3) 1,0,0,1 (4) 0,1,0,1

35. Dipole moment is shown by :– [JEE–MAINS–2012] (ON-line)

(1) trans–2. 3–dichloro–2–butene

(2) 1, 2–dichlorobenzene

(3) 1,4–diclorobenzene

(4) trans–1,2–dinitroethene

36. Among the following species which two have trigonal bipyramidal shape :–
[JEE–MAINS–2012] (On–line)
(I) NI_3 (II) I_3^-
(III) SO_3^{2-} (IV) NO_3^-
(1) II and III (2) III and IV
(3) I and IV (4) I and III

37. Among the following, the species having the smallest bond is -
[JEE–MAINS–2012] (On–line)
(1) NO (2) NO^+
(3) O_2 (4) NO^-

38. Based on lattice energy and other considerations , which one of the following alkali metal chloride is expected to have the highest melting point :–
[JEE–MAINS–2012] (On–line)
(1) RbCl (2) LiCl
(3) KCl (4) NaCl

39. Which of the following has the square planar structure :– [JEE–MAINS–2012] (On–line)
(1) NH_4^+ (2) CCl_4
(3) XeF_4 (4) BF_4^-

40. The compound of Xenon with zero dipole moment is :– [JEE–MAINS–2012] (On–line)
(1) XeO_3 (2) XeO_2
(3) XeF_4 (4) $XeOF_4$

41. Among the following molecule with the lowest dipole moment is: [JEE–MAINS–2012] (On–line)
(1) $CHCl_3$ (2) CH_2Cl_2
(3) CCl_4 (4) CH_3Cl

42. The formation of molecular complex $BF_3 - NH_3$ results in a change in hybridisation of boron :– [JEE–MAINS–2012]
(1) from sp^3 to sp^3d (2) from sp^2 to dsp^2
(3) from sp^3 to sp^2 (4) from sp^2 to sp^3 (on–line)

43. Which one of the following molecules is expected to exhibit diamagnetic behaviour? [AIEEE–2013]
(1) C_2 (2) N_2
(3) O_2 (4) S_2

44. Which of the following is the wrong statement?
[JEE–M–2013]
(1) ONCl and ONO are not isoelectronic
(2) O_3 molecule is bent
(3) Ozone is violet–black in solid state
(4) Ozone is diamagnetic gas

45. In which of the following pairs of molecules/ions, both the species are not likely to exist ?
[JEE–M–2013]
(1) H_2^+, He_2^{2-} (2) H_2^-, He_2^{2-}
(3) H_2^{2+}, He_2 (4) H_2^-, He_2^{2+}

46. Which of the following exists as covalent crystals in the solid state ? [JEE–M–2013]
(1) Iodine (2) Silicon
(3) Sulphur (4) Phosphorus

47. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of [JEE–M–2013]
(1) $Li_2 < Li_2^+ < Li_2^-$ (2) $Li_2^- < Li_2^+ < Li_2$
(3) $Li_2 < Li_2^- < Li_2^+$ (4) $Li_2^- < Li_2 < Li_2^+$

48. Trigonal bipyramidal geometry is shown by.
[JEE–Mains–2013, Online]
(1) XeO_3F_2 (2) $XeOF_2$
(3) XeO_3 (4) $FXeOSO_3F$

49. In which of the following ionization processes the bond energy has increased and also the magnetic behaviour has changed from paramagnetic to diamagnetic ? [JEE-Main 2013]
(1) $NO \rightarrow NO^+$ (2) $O_2 \rightarrow O_2^+$
(3) $N_2 \rightarrow N_2^+$ (4) $C_2 \rightarrow C_2^+$

50. Which one of the following molecule is polar ?
[JEE.MAINS.2013]
(1) CF_4 (2) SbF_5
(3) IF_5 (4) XeF_4

51. Oxidation state of sulphur in anions SO_3^{2-}, $S_2O_4^{2-}$ and $S_2O_6^{2-}$ increases in the order–
[JEE.MAINS.2013, Online]
(1) $S_2O_6^{2-}$, $S_2O_4^{2-} < SO_3^{2-}$
(2) $SO_3^{2-} < S_2O_4^{2-} < S_2O_6^{2-}$
(3) $S_2O_4^{2-} < SO_3^{2-} < S_2O_6^{2-}$
(4) $S_2O_4^{2-} < S_2O_6^{2-} < SO_3^{2-}$

52. Bond order normally gives idea of stability of a molecular species. All the molecules viz. H_2, Li_2 and B_2 have the same bond order yet they are not equally stable. Their stability order is -
[JEE–MAINS–2013] (On–line)
(1) $Li_2 > H_2 > B_2$ (2) $H_2 > B_2 > Li_2$
(3) $B_2 > H_2 > Li_2$ (4) $Li_2 > B_2 > H_2$

53. The solubility order for alkali metal fluoride in water is– [JEE–MAINS–2013] (On–line)
(1) LiF < NaF < KF < RbF
(2) LiF > NaF > KF > RbF
(3) RbF < KF < NaF < LiF
(4) LiF < RbF < KF < NaF

54. XeO_4 molecule is tetrahedral having :
[JEE–MAINS–2013] (On–line)
(1) Two pπ–dπ bonds
(2) Four pπ–dπ bonds
(3) One pπ–dπ bond
(4) Three pπ–dπ bonds

55. Bond distance in HF is 9.17×10^{-11} m. Dipole moment of HF is 6.104×10^{-30} Cm. The percent ionic character in HF will be :
(electron charge = 1.60×10^{-19} C)
[JEE–MAINS–2013]
(1) 61.0% (2) 38.0%
(3) 35.5% (4) 41.5%

56. The shape of IF_6^- is : [JEE–MAINS–2013]
(1) Trigonally distorted octahedron
(2) Pyramidal
(3) Octahedral
(4) Square antiprism

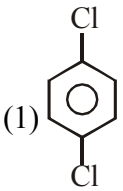
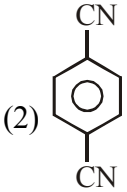
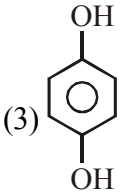
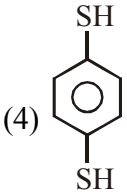
57. Which has trigonal bipyramidal shape ?
[JEE–MAINS–2013], Online
(1) $XeOF_4$ (2) XeO_3
(3) XeO_3F_2 (4) $XeOF_2$

58. The catenation tendency of C, Si and Ge is in the order Ge < Si < C. The bond energies (in kJ mol^{-1}) of C – C, Si –Si and Ge–Ge bonds are respectively :
[JEE–MAINS–2013]–(On–line)
(1) 348, 260, 297 (2) 348, 297, 260
(3) 297, 348, 260 (4) 260, 297, 348

59. In which of the following sets, all the given species are isostructural ? [JEE–MAINS–2013]
(1) BF_3 , NF_3 , PF_3 , AlF_3
(2) $PC1_3$, $A1C1_3$, $BC1_3$, $SbCl_3$ (On–line)
(3) BF_4^-, CCl_4 , NH_4^+ , PCl_4^+
(4) CO_2, NO_2, ClO_2, SiO_2

60. The inter molecular distances in O –O bonds for O_2^+, O_2, O_2^- and O_2^{2-} respectively are :
[JEE–MA INS– 2013], (On–line)
(1) 1.49 Å. 1.21 Å, 1.12 Å, 130 Å
(2) 1.30 Å, 1.49 Å, 1.12 Å, 1.21 Å
(3) 1.12 Å. 1.21 Å, 1.30 Å, 1.49 Å
(4) 1.21 Å, 1.12 Å, 1.49 Å, 1.30 Å

61. Which one of the following properties is not shown by NO ? [JEE–Main–2014]
(1) It combines with oxygen to form nitrogen dioxide
(2) It's bond order is 2.5
(3) It is diamagnetic in gaseous state
(4) It is a neutral oxide

62. For which of the following molecule significant $\mu \neq 0$:- [JEE–Main–2014]
(1) 
(2) 
(3) 
(4) 
(1) Only (3) (2) (3)and (4)
(3) Only (1) (4) (1) Only (2)

63. Among the following oxoacid, thh correct decreasing order of acid strength is– [JEE–M014]
(1) $HClO_4 > HClO_3 > HC1O_2 > HOC1$
(2) $HC1O_2 > HClO_4 > HC1O_3 > HOCl$
(3) $HOCl > HClO_2 > HClO_3 > HC1O_4$
(4) $HClO_4 > HOCl > HClO_2 > HClO_3$

64. The number and type of bonds in C_2^{2-} ion in CaC_2 are– [JEE–MAINS–2014–(On–line)]

(1) Two σ bonds and two π – bonds

(2) Two σ bonds and two π – bonds

(3) One σ bonds and two π – bonds

(4) One σ bond and one π – bond

65. For the compounds

CH_3Cl, CH_3Br, CH_3l and CH_3F,

the correct order of increasing C–halogen bond length is:

(1) $CH_3F < CH_3Br < CH_3C1 < CH_3I$

(2) $CH_3F < CH_3C1 < CH_3Br < CH_3I$

(3) $CH_3C1 < CH_3Br < CH_3F < CH_3I$

(4) $CH_3F < CH_3I < CH_3Br < CH_3C1$

66. Which of the following has unpaired electron(s) ? [JEE–MAINS–2014]

(1) O_2^- (2) N_2^{2+}

(3) O_2^{2-} (4) N_2

67. In allene (C_3H_4), the type(s) of hybridization of the carbon atoms is (are): [JEE–MAINS–2014]

(1) only sp^2 (2) sp^2 and sp

(3) sp and sp^3 (4) sp^2 and sp^3

68. Shapes of certain interhalogen compounds are stated below. Which one of them is not correctly stated? [JEE–MAINS–2014]

(1) IF_7 : Pentagonal bipyramid

(2) BrF_5: Trigonal bipyramid

(3) $IC1_3$: Planar dimeric

(4) BrF_3: Planar T–shaped

69. The correct order of bond dissociation energy among N_2, O_2, O_2^- is shown in which of the following arrangements - [JEE–MAINS–2014 (On–line)]

(l) $N_2 > O_2 > O_2^-$ (2) O_2, O_2^-, N_2

(3) N_2, O_2^-, O_2 (4) O_2^-, O_2, N_2

70. Which of the following molecules has two sigma (σ) and two pi (π) bonds :– [JEE–MAINS–2014, (On–line)]

(1) HCN (2) $C_2H_2Cl_2$

(3) N_2F_2 (4) C_2H_4

71. Which of the following xenon–oxo compounds may not be obtained by hydrolysis of xenon fluoride XeF_6 :– [JEE–MAINS–2014]

(1) XeO_2F_2 (2) XeO_3

(3) XeO_4 (4) $XeOF_4$

72. Which one of the following molecules is paramagnetic - [JEE–MAINS–2014]

(1) NO (2) O_3

(3) N_2 (4) CO

73. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$ the compounds with the greatest and the least ionic character, respectively are: [JEE–MAINS–2014]

(1) RbCl and $MgCl_2$ (2) LiCl and RbCl

(3) $MgCl_2$ and $BeCl_2$ (4) RbCl and $BeCl_2$

74. Example of a three - dimensional silicate is : [JEE–MAINS–2014]

(1) Beryls (2) Zeolites

(3) Feldspars (4) Ultramarines

75. Which one of the following alkaline earth metal sulphates has its hydration enthalpy greater than its lattice entahalpy - [JEE–MAINS–2014]

(1) $BeSO_4$ (2) $SrSO_4$

(3) $CaSO_4$ (4) $BeSO_4$

76. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is " [JEE–MAINS–2015]

(1) London force

(2) Hydrogen bond

(3) ion–ion interaction

(4) ion–dipole interaction

77. Which one has the highest boiling point ? [JEE–MAINS–2015]

(1) Kr (2) Xe

(3) He (4) Ne

78. Which one of the following statements about water is FALSE ? [JEE–MAINS–2016]

(1) Ice formed by heavy water sinks in normal water.

(2) Water is oxidized to oxygen during photosynthesis.

(3) Water can act both as an acid and as a base.

(4) There is extensive intramolecular hydrogen bonding in the condensed phase.

79. The species in which the N atom is in a state of sp hybridization is :– [JEE–MAINS–2016]

(1) NO_2 (2) NO_2^+

(3) NO_2^- (4) NO_3^-

80. The pair in which phosphorous atoms have a formal oxidation state of + 3 is: [JEE–MAINS–2016]

(1) Pyrophosphorous and pyrophosphoric acids

(2) Orthophosphorous and pyrophosphorous acids

(3) Pyrophosphorous and hypophosphoric acids

(4) Orthophosphorous and hypophosphoric acids

81. Which intermolecular force is most responsible in allowing xenon gas to liquefy? [JEE–MAINS–2016 (On–line)]

(1) ionic

(2) Instantaneous dipole– induced dipole

(3) Dipole – dipole

(4) Ion – dipole

83. The group of molecules having identical shape is: [JEE–MAINS–2016]

(1) SF_4, XeF_4, CCl_4

(2) ClF_3, $XeOF_2$, XeF_3^+

(3) $PC1_5$, IF_5, XeO_2F_2

(4) BF_3, $PC1_3$, XeO_3

84. The bond angle H–X–H is the greatest in the compound : [JEE–MAINS–2016 (On–line)]

(1) NH_3 (2) H_2O

(3) PH_3 (4) CH_4

EXERCISE # V(B) (JEE-ADVANCED)

1. The hybridisation of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ are : **[IIT–2000]**

(*a*) sp^2, sp^3 and sp^2 respectively

(*b*) sp, sp^2 and sp^3 respectively

(*c*) sp^2, sp and sp^3 respectively

(*d*) sp^2, sp^3 and sp respectively

2. The correct order of hybridization of the central atom in the following species NH_3, $[PtCl_4]^{2-}$, PCl_5 and BCl_3 is - **[IIT–2001]**

(*a*) dsp^2, sp^3d, sp^2 and sp^3

(*b*) sp^3, dsp^2, sp^3d, sp^2

(*c*) dsp^2, sp^2, sp^3, sp^3d

(*d*) dsp^2, sp^3, sp^2, sp^3d

3. The common features among the species CN^-, CO and NO^+ are - **[IIT–2001]**

(*a*) bond order three and isoelectronic

(*b*) bond order three and weak field ligands

(*c*) bond order two and π-acceptors

(*d*) isoelectronic and weak field ligands

4. Specify the coordination geometry aronnd and hybridisation of N and B atoms in a 1:1 complex of BF_3 and NH_3 - **[IIT 2001]**

(*a*) N: tetrahedral sp^3; B : tetrahedral sp^3

(*b*) N: pyramidal sp^3; B : pyramidal sp^3

(*c*) N: pyramidal sp^3; B : planar sp^2

(*d*) N: pyramidal sp^3; B : tetrahedral sp^3d

5. Specify hybridization of N and B atoms in a 1 : 1 complex of BF_3 and NH_3 - **[JEE 2002]**

(*a*) N: tetrahedral sp^3; B : tetrahedral sp^3

(*b*) N: pyramidal sp^3; B : pyramidal sp^3

(*c*) N: pyramidal sp^3; B : planar sp^2

(*d*) N: pyramidal sp^3; B : tetrahedral sp^3d

6. The nodal plane in the π-bond of ethene is located in **[JEE 2002]**

(*a*) the molecular plane

(*b*) a plane parallel to the molecular plane

(*c*) a plane perpendicular to the molecular plane which bisects, the carbon-carbon bond at right angle

(*d*) a plane perpendicular to the molecular plane which contains the carbon-carbon bond.

7. Which of the following molecular species has unpaired electron(s) ? **[JEE 2003]**

(*a*) N_2 (*b*) F_2

(*c*) O_2^- (*d*) O_2^{2-}

8. Which of the following are isoelectronic and isostructural ?

NO_3^- . CO_3^{2-}, ClO_3^-, SO_3

(*a*) NO_3^-, CO_3^{2-}

(*b*) SO_3, NO_3^-

(*c*) ClO_3^-, CO_3^{2-}

(*d*) CO_3^{2-}, SO_3

9. According to molecular orbital theory which of the following statement about the magnetic character and bond order is correct regarding O_2^+ : **[JEE 2004]**

(*a*) Paramagnetic and Bond order $< O_2$

(*b*) Paramagnetic and Bond order $> O_2$

(*c*) Diamagnetic and Bond order $< O_2$

(*d*) Diamagnetic and Bond order $> O_2$

10. Which species has the maximum number of lone pair of electrons on the central atom?

(*a*) ClO_3^- (*b*) XeF_4

(c) SF_4 (*d*) I_3^- **[JEE 2005]**

11. The percentage of p-character in the orbitals forming P-P bonds in P_4 is **[JEE 2006]**

(*a*) 25 (*b*) 33

(*c*) 50 (*d*) 75

12. Among the following, the paramagnetic compound is **[JEE 2007]**

(*a*) Na_2O_2 (*b*) O_3

(*c*) N_2O (*d*) KO_2

13. The species having bond order different from that in CO is **[JEE 2007]**

(*a*) NO^- (*b*) NO^+

(*c*) CN^- (*d*) N_2

14. The structure of XeO_3 is **[JEE 2007]**

(*a*) linear (*b*) planar

(*c*) pyramidal (*d*) T-shaped

15. Statement-1 : p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid.

Statement-2 : o-Hydroxybenzoic acid has intramolecular hydrogen bonding. **[JEE 2007J**

(*a*) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(*b*) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(*c*) Statement-1 is True, Statement-2 is False.

(*d*) Statement-1 is False, Statement-2 is True.

16. Statement-1 : In water, orthoboric acid behaves as a weak monobasic acid. **[JEE 2007]**

Statement-2 : In water, orthoboric acid acts as a proton donor.

(*a*) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(*b*) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(*c*) Statement-1 is True, Statement-2 is False.

(*d*) Statement-1 is False, Statement-2 is True.

17. Statement-1 : Pb^{+4} compounds are stronger oxidizing agents than Sn^{4+} compounds

Statement-2 : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.

[JEE 2008]

(*a*) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.

(*b*) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.

(*c*) Statement-1 is True, Statement-2 is False.

(*d*) Statement-1 is False, Statement-2 is True.

18. Match each of the diatomic molecules in coloumn I with its property / properties in column - II

Column-I	**Column-II**
(*a*) B_2	(P) paramagnetic
(*b*) N_2	(Q) undergoes oxidation
(*c*) O_2^-	(R) undergoes reduction
(*d*) O_2	(S) Bond order ≥ 2
	(T) Mixing of 's' and 'p' orbitals

19. The nitrogen oxides that contains N–N bonds is are - **[JEE 2009]**

(*a*) N_2O (*b*) N_2O_3

(*c*) N_2O_4 (*d*) N_2O_5

20. In the reaction **[JEE 2009]**

$2X + B_2H_6 \rightarrow [BX_2(X_2)]^+[BH_4]^-$

the amines X is/are -

(*a*) NH_3 (*b*) CH_3NH_2

(*c*) $(CH_3)_2NH$ (*d*) $(CH_3)_3N$

21. The species having pyramidal shape is - **[JEE 2010]**

(*a*) SO_3 (*b*) BrF_3

(*c*) SiO_3^{2-} (*d*) OSF_2

22. Assuming that Hunds rule is violated, the bond order and magnetic nature of the diatomic molecule B_2 is **[JEE 2009]**

(*a*) 1 and diamagnetic

(*b*) 0 and diamagnetic

(*c*) 1 and paramagnetic

(*d*) 0 and paramagnetic

23. In allene (C_3H_4) the type(s) of hybridisation of the carbon atom(s) is/are - **[JEE 2012]**

(*a*) sp and sp^3 (*b*) sp and sp^2

(*c*) only sp^2 (*d*) sp^2 and sp^3

24. Which ordering of compounds is according to the decreasing order of the oxidation state of nitrogen :- **[JEE 2012]**

(*a*) HNO_3 , NO, NH_4Cl, N_2

(*b*) HNO_3 , NO, N_2, NH_4C1

(*c*) HNO_3 , NH_4Cl, NO, N_2

(*d*) NO, HNO_3, NH_4C1, N_2

25. The shape of XeO_2F_2 molecule is : **[JEE 2012]**

(*a*) Trigonal bipyramidal

(*b*) Square planar

(*c*) tetrahedral

(*d*) see-saw

Subjective :

26. The number of water molecules) directly bonded to the metal centre in $CuSO_4.5H_2O$ is :- **[JEE 2012]**

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

28. The value of n in the molecular formula $Be_nAl_2Si_6O_{18}$ is ? **[JEE 2010]**

29. The total number of diprotic acids among the following is ?

H_3PO_4 H_2SO_4 H_3PO_3 H_2CO_3 $H_2S_2O_7$

H_3BO_3 H_3PO_2 H_2CrO_4 H_2SO_3

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

O, Cl, F, N, P, Sn, Tl, Na, Ti **[JEE 2010]**

31. The difference in the oxidation numbers of the two types of sulphur atoms in $Na_2S_4O_6$ - **[JEE 2011]**

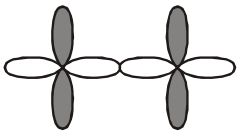
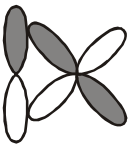
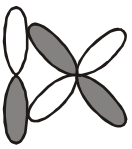
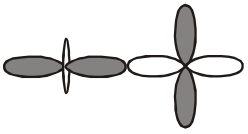
32. The total number of lone-pairs of electrons in melanin is. **[JEE Adv. 2013]**

33. Assuming 2s-2p mixing is NOT operative, the paramagnetic species among the following:-

(*a*) Be_2 (*b*) B_2

(*c*) C_2 (*d*) N_2

34. Match the orbital overlap figures shwon in List - I with the description given in List - II and select the correct answer using the code given below the lists: **[JEE-Adv.2014]**

List - I		**List-II**
(P)		(1) p - d π antibonding
(Q)		(2) d – d σ bonding
(R)		(3) p – d π bonding
(S)		(4) d – d σ antibonding

	P	**Q**	**R**	**S**
(*a*)	2	1	3	4
(*b*)	4	3	1	2
(*c*)	2	3	1	4
(*d*)	4	1	3	2

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

[JEE Adv. 2015]

(Atomic number : S = 16, CI = 17, I = 53 and Xe = 54)

36. The total number of lone pairs of electrons in N_2O_3 is :

37. The correct statement(s) regarding,

(i) HClO, (ii) $HC1O_2$,

(iii) $HC1O_3$ and (iv) $HC1O_4$, is (are)

(*a*) The number of Cl=O bonds in (ii) and (iii) together is two

(*b*) The number of lone pairs of electrons on Cl in (ii) and (iii) together is three

(*c*) The hybridization of Cl in (iv) is sp^3

(*d*) Amongst (i) to (iv), the strongest acid is (i)

38. When O, is adsorbed on a metallic surface, electron transfer occurs from the metal to O_2. The TRUE, statement (s) regarding this adsorption is (are) **[JEE Adv. 2015]**

(*a*) O_2 is physisorbed

(*b*) heat is released

(*c*) occupancy of π_{2p}^* of O_2 is increased

(*d*) bond length of O_2 is increased

■■

ANSWERS

CH-1 CHEMICAL BONDING

EXERCISE # I

1. (*d*)	**2.** (*d*)	**3.** (*c*)	**4.** (*c*)	**5.** (*d*)	**6.** (*b*)	**7.** (*c*)	**8.** (*b*)	**9.** (*d*)	**10.** (*c*)
11. (*d*)	**12.** (*d*)	**13.** (*c*)	**14.** (*c*)	**15.** (*c*)	**16.** (*b*)	**17.** (*a*)	**18.** (*d*)	**19.** (*b*)	**20.** (*d*)
21. (*d*)	**22.** (*a*)	**23.** (*b*)	**24.** (*a*)	**25.** (*c*)	**26.** (*b*)	**27.** (*c*)	**28.** (*a*)	**29.** (*a*)	**30.** (*c*)
31. (*d*)	**32.** (*c*)	**33.** (*c*)	**34.** (*c*)	**35.** (*c*)	**36.** (*d*)	**37.** (*d*)	**38.** (*a*)	**39.** (*c*)	**40.** (*d*)
41. (*b*)	**42.** (*d*)	**43.** (*d*)	**44.** (*b*)	**45.** (*a*)	**46.** (*c*)	**47.** (*a*)	**48.** (*a*)	**49.** (*a*)	**50.** (*c*)
51. (*b*)	**52.** (*b*)	**53.** (*b*)	**54.** (*b*)	**55.** (*c*)	**56.** (*c*)	**57.** (*d*)	**58.** (*d*)	**59.** (*b*)	**60.** (*a*)
61. (*c*)	**62.** (*d*)	**63.** (*c*)	**64.** (*a*)	**65.** (*a*)	**66.** (*a*)	**67.** (*b*)	**68.** (*d*)	**69.** (*a*)	**70.** (*d*)
71. (*d*)	**72.** (*a*)	**73.** (*c*)	**74.** (*d*)	**75.** (*d*)	**76.** (*d*)	**77.** (*a*)	**78.** (*c*)	**79.** (*a*)	**80.** (*d*)
81. (*d*)	**82.** (*c*)	**83.** (*b*)	**84.** (*c*)	**85.** (*c*)	**86.** (*c*)	**87.** (*a*)	**88.** (*c*)	**89.** (*c*)	**90.** (*b*)
91. (*d*)	**92.** (*a*)	**93.** (*d*)	**94.** (*c*)	**95.** (*b*)	**96.** (*c*)	**97.** (*c*)	**98.** (*b*)	**99.** (*d*)	**100.** (*c*)
101. (*d*)	**102.** (*a*)	**103.** (*c*)	**104.** (*c*)	**105.** (*a*)	**106.** (*d*)	**107.** (*b*)	**108.** (*c*)	**109.** (*c*)	**110.** (*c*)
111. (*d*)	**112.** (*b*)	**113.** (*c*)	**114.** (*b*)	**115.** (*c*)	**116.** (*c*)	**117.** (*a*)	**118.** (*d*)	**119.** (*d*)	**120.** (*d*)
121. (*b*)	**122.** (*d*)	**123.** (*c*)	**124.** (*d*)	**125.** (*b*)	**126.** (*b*)	**127.** (*b*)	**128.** (*d*)	**129.** (*d*)	**130.** (*c*)
131. (*a*)	**132.** (*d*)	**133.** (*d*)	**134.** (*c*)	**135.** (*a*)	**136.** (*c*)	**137.** (*a*)	**138.** (*c*)	**139.** (*d*)	**140.** (*d*)
141. (*c*)	**142.** (*a*)	**143.** (*c*)	**144.** (*c*)	**145.** (*c*)	**146.** (*a*)	**147.** (*b*)	**148.** (*d*)	**149.** (*b*)	**150.** (*a*)
151. (*d*)	**152.** (*b*)	**153.** (*d*)	**154.** (*d*)	**155.** (*c*)	**156.** (*a*)	**157.** (*a*)	**158.** (*d*)	**159.** (*d*)	**160.** (*a*)
161. (*d*)	**162.** (*b*)	**163.** (*c*)	**164.** (*c*)	**165.** (*a*)	**166.** (*b*)	**167.** (*d*)	**168.** (*a*)	**169.** (*c*)	**170.** (*b*)
171. (*b*)	**172.** (*c*)	**173.** (*a*)	**174.** (*b*)	**175.** (*b*)	**176.** (*c*)	**177.** (*d*)	**178.** (*c*)	**179.** (*c*)	**180.** (*c*)
181. (*d*)	**182.** (*a*)	**183.** (*c*)	**184.** (*d*)	**185.** (*a*)	**186.** (*c*)	**187.** (*a*)	**188.** (*b*)	**189.** (*d*)	**190.** (*d*)
191. (*d*)	**192.** (*d*)	**193.** (*b*)	**194.** (*a*)	**195.** (*b*)	**196.** (*d*)	**197.** (*a*)	**198.** (*d*)	**199.** (*c*)	**200.** (*b*)

EXERCISE-II

1. (*a*,*b*,*c*,*d*)	**2.** (*a*,*c*,*d*)	**3.** (*a*,*b*,*d*)	**4.** (*a*,*c*,*d*)	**5.** (*b*,*c*,*d*)	**6.** (*a*,*b*,*c*,*d*)
7. (*a*,*b*)	**8.** (*b*,*c*)	**9.** (*a*,*d*)	**10.** (*a*,*b*,*c*)	**11.** (*b*,*d*)	**12.** (*a*,*b*,*d*)
13. (*a*,*d*)	**14.** (*b*,*c*,*d*)	**15.** (*a*,*c*,*d*)	**16.** (*b*,*c*)	**17.** (*a*,*b*,*d*)	**18.** (*a*,*b*,*d*)
19. (*c*,*d*)	**20.** (*a*,*d*)	**21.** (*c*,*d*)	**22.** (*a*,*b*)	**23.** (*b*,*d*)	**24.** (*a*,*c*,*d*)
25. (*b*,*c*)	**26.** (*a*,*c*,*d*)	**27.** (*a*,*c*,*d*)	**28.** (*a*,*d*)	**29.** (*a*,*b*)	**30.** (*b*,*c*)
31. (*a*,*c*,*d*)	**32.** (*b*,*c*)	**33.** (*a*,*b*,*c*)	**34.** (*a*,*b*,*c*,*d*)	**35.** (*a*,*b*,*c*,*d*)	**36.** (*b*,*d*)
37. (*a*,*b*,*c*,*d*)	**38.** (*a*,*b*)	**39.** (*c*,*d*)	**40.** (*a*,*b*)	**41.** (*a*,*d*)	**42.** (*b*,*c*,*d*)
43. (*a*,*c*,*d*)	**44.** (*a*,*b*)	**45.** (*b*,*d*)	**46.** (*b*,*d*)	**47.** (*a*,*c*)	**48.** (*a*,*b*)
49. (*b*,*d*)	**50.** (*b*,*c*)	**51.** (*a*,*b*,*c*,*d*)	**52.** (*a*,*d*)	**53.** (*c*,*d*)	**54.** (*a*,*b*)
55. (*a*,*d*)	**56.** (*c*,*d*,*f*)	**57.** (*a*,*c*)	**58.** (*a*,*b*,*d*)	**59.** (*a*,*c*,*d*)	**60.** (*b*,*c*)
61. (*a*,*b*,*c*)	**62.** (*b*,*c*)	**63.** (*a*,*c*)	**64.** (*c*,*d*)	**65.** (*a*,*c*)	**66.** (*a*,*b*,*c*)
67. (*a*,*b*,*d*)	**68.** (*a*,*c*,*d*)	**69.** (*a*,*b*)	**70.** (*a*,*b*,*c*)	**71.** (*b*,*c*,*d*)	**72.** (*a*,*d*)
73. (*a*,*b*,*c*,*d*)	**74.** (*a*,*b*)	**75.** (*a*,*b*,*c*,*d*)	**76.** (*a*,*b*,*c*)	**77.** (*b*,*c*)	**78.** (*c*,*d*)
79. (*a*,*c*)	**80.** (*a*,*d*)	**81.** (*a*,*b*,*d*)	**82.** (*a*,*d*)	**83.** (*b*,*c*)	**84.** (*a*,*b*,*c*)
85. (*a*,*b*)	**86.** (*a*,*b*,*c*)	**87.** (*a*,*b*,*c*,*d*)	**88.** (*a*,*b*)	**89.** (*a*,*c*)	**90.** (*a*,*c*,*d*)

10.2 ANSWERS

91. (*a*,*c*) **92.** (*a*,*b*,*d*) **93.** (*a*,*b*,*c*,*d*) **94.** (*c*,*d*) **95.** (*a*,*d*) **96.** (*b*,*d*)
97. (*a*,*b*,*c*) **98.** (*a*,*b*,*d*) **99.** (*c*,*d*) **100.** (*a*,*b*) **101.** (*c*,*d*) **102.** (*a*,*d*)
103. (*a*,*b*,*c*) **104.** (*a*,*c*) **105.** (*a*,*b*,*c*) **106.** (*a*,*d*) **107.** (*a*,*b*,*d*) **108.** (*a*,*b*,*c*,*d*)
109. (*a*,*b*) **110.** (*a*,*d*) **111.** (*a*,*b*,*c*,*d*) **112.** (*a*,*b*,*c*,*d*) **113.** (*a*,*c*,*d*) **114.** (*a*,*b*,*c*)
115. (*a*,*d*) **116.** (*c*,*d*) **117.** (*a*,*d*) **118.** (*b*,*c*) **119.** (*a*,*b*) **120.** (*a*,*b*)
121. (*a*,*b*,*c*) **122.** (*a*,*d*) **123.** (*a*,*b*,*c*) **124.** (*c*,*d*) **125.** (*a*,*b*,*d*) **126.** (*a*,*b*)
127. (*a*,*b*,*c*,*d*) **128.** (*b*,*c*,*d*) **129.** (*a*,*d*) **130.** (*a*,*c*,*d*) **131.** (*b*,*c*) **132.** (*a*,*b*,*c*)
133. (*a*,*b*,*c*,*d*) **134.** (*b*,*c*) **135.** (*a*,*d*) **136.** (*a*,*b*,*c*,*d*) **137.** (*a*,*c*,*d*) **138.** (*b*,*c*)
139. (*b*,*c*) **140.** (*a*,*b*,*c*) **141.** (*a*,*b*,*c*) **142.** (*b*,*c*,*d*) **143.** (*a*,*b*,*c*,*d*) **144.** (*a*,*b*,*c*)
145. (*a*,*c*,*d*) **146.** (*a*,*b*,*c*,*d*) **147.** (*a*,*b*,*d*) **148.** (*a*,*b*,*c*) **149.** (*c*,*d*) **150.** (*c*,*d*)

EXERCISE-III : Paragraph Type & Matrix Match Type

1. (*c*) **2.** (*c*) **3.** (*b*) **4.** (*a*) **5.** (*c*) **6.** (*d*) **7.** (*b*) **8.** (*c*) **9.** (*d*) **10.** (*d*)
11. (*b*,*d*) **12.** (*c*) **13.** (*b*) **14.** (*d*) **15.** (*b*) **16.** (*a*) **17.** (*c*) **18.** (*b*) **19.** (*b*) **20.** (*c*)
21. (*a*) **22.** (*c*) **23.** (*c*) **24.** (*d*) **25.** (*d*) **26.** (*d*) **27.** (*d*) **28.** (*a*) **29.** (*b*) **30.** (*c*)
31. (*b*) **32.** (*b*) **33.** (*d*) **34.** (*c*) **35.** (*d*) **36.** (*c*) **37.** (*d*) **38.** (*d*) **39.** (*a*) **40.** (*d*)
41. (*d*) **42.** (*c*) **43.** (*a*) **44.** (*b*) **45.** (*a*) **46.** (*a*) **47.** (*d*) **48.** (*c*) **49.** (*b*) **50.** (*a*)
51. (*b*) **52.** (*d*) **53.** (*d*) **54.** (*d*) **55.** (*d*) **56.** (*d*) **57.** (*d*) **58.** (*d*) **59.** (*d*) **60.** (*b*)
61. (*d*) **62.** (*a*) **63.** (*c*) **64.** (*b*) **65.** (*d*)

66. (A)-P ; (B)-Q ; (C)-S ; (D)-R
67. (A)-P ; (B)-Q ; (C)-R ; (D)-S
68. (A)-Q ; (B)-P ; (C)-R ; (D)-S
69. (A)-P, Q, R,S ; (B)-P,Q,R,S ; (C)-P,R,S ; (D)-P,R,S
70. (A)-Q, R, S ; (B)-Q,R ; (C)-P,R ; (D)-Q,R,S
71. (A)-S ; (B)-R ; (C)-Q; (D)-P
72. (A)-P ; (B)-Q,S ; (C)-P,R ; (D)-Q,R
73. (A)-P ; (B)-Q,S ; (C)-P,R ; (D)-Q,S
74. (A)-Q,R,T ; (B)-P,Q,R,S ; (C)-P,R,S ; (D)-Q,R,T
75. (A)-P,R,S ; (B)-R ; (C)-Q,R ; (D)-Q,R
76. (A)-P,S ; (B)-S ; (C)-Q,R ; (D)-P,Q,R
77. (A)-R, T ; (B)-Q,S,T ; (C)-P,R,T; (D)-P,S,T
78. (A)-P,S ; (B)-Q,S ; (C)-R,S; (D)-S
79. (A)-R ; (B)-S ; (C)-Q ; (D)-P
80. (A)-P ; (B)-P,Q ; (C)-R,S ; (D)-S,T
81. (A)-P,S,T ; (B)-P,Q,T ; (C)-P,R,T ; (D)-P,T
82. (A)-P,Q,R,S,T ; (B)-P,Q,R,S,T ; (C)-Q,R,T ; (D)-Q,R,T
83. (A)-P,R ; (B)-P,Q ; (C)-P,R ; (D)-P,S
84. (A)-S ; (B)-R ; (C)-Q ; (D)-P
85. (A)-R ; (B)-P,Q,S,T ; (C)-P,R,S ; (D) -T
86. (A)-P, Q ; (B)-P ; (C)-R ; (D)-S
87. (A)-P, S, T ; (B)-P,S ; (C)-P,Q ; (D)-R
88. (A)-P ; (B)-Q ; (C)-R,T ; (D)-S
89. (A)-Q, S, T ; (B)-R,S ; (C)-S ; (D)-P,S
90. (A)-P,Q ; (B)-R ; (C)-S,T ; (D)-P,S
91. (A)-R ; (B)-Q ; (C)-P ; (D)-S
92. (A)-R,T ; (B)-P,T ; (C)-Q,T ; (D)-P,S
93. (A)-P ; (B)-Q ; (C)-R ; (D)-S

94. (i) -X, Z (ii) -P,Q,S (iii) -P,R,S (iv) -T,X,Y
(v) -T,X (vi) -T,V,X,Z (vii) -U,Y (viii) -W,X,Z

95. (i) -Q, W (ii) -Q,W,Y (iii) -Q,U,W,Y (iv) -Q,R,U,W,Y
(v) -P,Q,U,W,Y (vi) -Q,R,U,W,Y (vii) -Q,S,U,W,Y (viii) -Q,S,W,X,Y
(ix) -Q,T,V,W,Y (x) -Q,T,V,W,Y

96. (A)-P,Q,R,S ; (B)- P,Q,R,S; (C)-Q,R,S ; (D)-Q,R **97.** (A)-R ; (B)-R,S ; (C)-P,Q,R ; (D)-P,R

98. (A)-S ; (B)-P ; (C)-R ; (D)-Q **99.** (A)-P, Q, R ; (B)-Q,R ; (C)-P,Q,R,S ; (D)-P,Q,R

100. (A)-P ; (B)-Q ; (C)-R ; (D)-S

EXERCISE-IV : Integer Type

1. (5)	**2.** (5)	**3.** (6)	**4.** (1)	**5.** (3)	**6.** (5)	**7.** (4)	**8.** (7)	**9.** (7)	**10.** (6)
11. (2)	**12.** (3)	**13.** (9)	**14.** (1)	**15.** (6)	**16.** (5)	**17.** (2)	**18.** 12 or 3	**19.** (1)	**20.** (3)
21. (5)	**22.** (5)	**23.** (3)	**24.** (5)	**25.** (3)	**26.** (2)	**27.** (9)	**28.** (2)	**29.** (1)	**30.** (5)
31. (4)	**32.** (3)	**33.** (0)	**34.** (0)	**35.** (2)	**36.** (3)	**37.** (1)	**38.** (3)	**39.** (0)	**40.** (7)
41. (2)	**42.** (4)	**43.** (8)	**44.** (4)	**45.** (7)	**46.** (4)	**47.** (8)	**48.** (5)	**49.** (5)	**50.** (3)
51. (6)	**52.** (1)	**53.** (2)	**54.** (6)	**55.** (3)	**56.** (2)	**57.** (5)	**58.** 7, 25	**59.** (3)	**60.** (9)
61. (5)	**62.** (4)	**63.** (2)	**64.** (6)	**65.** (6)	**66.** (4)	**67.** (1)	**68.** (2)	**69.** (4)	**70.** (3)
71. (9)	**72.** (4)	**73.** (5)	**74.** (4)	**75.** (4)	**76.** (0)	**77.** 24 or 6	**78.** (6)	**79.** (3)	**80.** (6)

EXERCISE-V(A) : (JEE-MAIN)

1. (3)	**2.** (2)	**3.** (2)	**4.** (1)	**5.** (1)	**6.** (2)	**7.** (3)	**8.** (1)	**9.** (4)	**10.** (3)
11. (2)	**12.** (4)	**13.** (4)	**14.** (3)	**15.** (2)	**16.** (3)	**17.** (4)	**18.** (1)	**19.** (3)	**20.** (4)
21. (1)	**22.** (1)	**23.** (4)	**24.** (1)	**25.** (1)	**26.** (3)	**27.** (4)	**28.** (2)	**29.** (1)	**30.** (4)
31. (1)	**32.** (4)	**33.** (4)	**34.** (2)	**35.** (2)	**36.** (Bonus)	**37.** (2)	**38.** (4)	**39.** (3)	**40.** (3)
41. (3)	**42.** (4)	**43.** (2)	**44.** (1)	**45.** (3)	**46.** (2)	**47.** (2)	**48.** (1)	**49.** (1)	**50.** (3)
51. (3)	**52.** (2)	**53.** (1)	**54.** (2)	**55.** (4)	**56.** (1)	**57.** (3)	**58.** (2)	**59.** (3)	**60.** (3)
61. (3)	**62.** (2)	**63.** (1)	**64.** (3)	**65.** (2)	**66.** (1)	**67.** (2)	**68.** (2)	**69.** (1)	**70.** (1)
71. (3)	**72.** (1)	**73.** (4)	**74.** (2,3,4)	**75.** (4)	**76.** (2,4)	**77.** (2)	**78.** (4)	**79.** (2)	**80.** (2)
81. (2)	**82.** (2)	**83.** (2)	**84.** (4)						

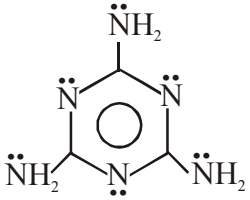
EXERCISE-V(B) : (JEE-ADVANCED)

1. (*b*)	**2.** (*b*)	**3.** (*a*)	**4.** (*a*)	**5.** (*a*)	**6.** (*a*)	**7.** (*c*)	**8.** (*a*)	**9.** (*b*)	**10.** (*d*)
11. (*d*)	**12.** (*d*)	**13.** (*a*)	**14.** (*c*)	**15.** (*c*)	**16.** (*c*)	**17.** (*c*)			

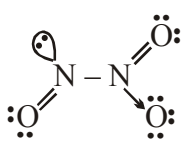
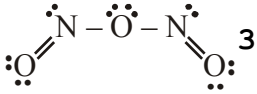
18. (A)-P,Q,R,T ; (B)-Q,R,S,T ;(C)-P,Q,R ;(D)-P,Q,R,S

19. (*a*,*b*,*c*) **20.** (*b*,*c*) **21.** (*d*) **22.** (*a*) **23.** (*b*) **24.** (*b*) **25.** (*d*) **26.** (4) **27.** (0) **28.** (3)

29. (6) : H_2SO_4 ; H_3PO_4 ;H_2CO_3 ;$H_2S_2O_7$;H_2CrO_4 ;H_2SO_3

30. (2) ; F, Na **31.** (5) **32.** (6) ;  **33.** (*c*) **34.** (*c*)

35. (D) ; $BeCl_2$, N_3^- , N_2O , NO_2^+

36. (8) ;   **37.** (*b*,*c*)**38.** (*b*,*c*,*d*)