

EXERCISE - O

SINGLE CORRECT TYPE QUESTIONS

Introduction, Ionic Bond and lattice Enthalpy

1. When two atoms combine to form a molecule :
(A) Energy is released (B) Energy is absorbed
(C) Energy is neither released nor absorbed (D) Energy may either released or absorbed
CCB091
2. Which of the following is not an example of strong bond ?
(A) Ionic Bond (B) Covalent Bond (C) Hydrogen Bond (D) Metallic Bond
CCB092
3. Element A has 3 electrons in the outermost orbit and element B has 6 electrons in the outermost orbit. The formula of the compound formed with A and B would be :
(A) A_2B_3 (B) A_2B_6 (C) A_2B (D) A_3B_2
CCB094
4. Lattice enthalpy is the change in energy that occurs when of an ionic solid is separated into isolated ions in the gas phase.
(A) One mole (B) One gram (C) Two mole (D) All of these
CCB095
5. Ionic bond formation involves :
(A) Elimination of protons (B) Sharing of electrons
(C) Overlapping orbitals (D) Formation of octets
CCB096
6. Which of the following compounds will show the highest lattice energy ?
(A) KF (B) NaF (C) CsF (D) RbF
CCB097
7. The lattice energy of the lithium compounds is in the following order :
(A) $LiF > LiCl > LiBr > LiI$ (B) $LiCl > LiF > LiBr > LiI$
(C) $LiBr > LiCl > LiF > LiI$ (D) $LiI > LiBr > LiCl > LiF$
CCB098
8. The electronegativity of Cesium is 0.7 and that of Fluorine is 4.0. The bond formed between the two is :
(A) Covalent (B) Electrovalent / Ionic
(C) Coordinate (D) Metallic
CCB099
9. Ionic compounds in general possess both :
(A) High melting point and non – directional bonds
(B) High melting point and low boiling points
(C) Directional bonds and low boiling point
(D) High solubility in polar and non – polar solvents
CCB100

10. Element X is strongly electropositive and Y is strongly electronegative and both are univalent. The compound formed would be :
 (A) $X^{\oplus}Y^{\ominus}$ (B) $X - Y$ (C) $X^{\ominus}Y^{\oplus}$ (D) $X \rightarrow Y$ CCB101
11. The order of increasing lattice energy of the following compounds, is :
 (A) $NaCl < CaO < NaBr < BaO$ (B) $NaBr < NaCl < BaO < CaO$
 (C) $NaCl > NaBr < BaO < CaO$ (D) $NaBr < NaCl < CaO < BaO$ CCB103
12. Ionic bond is formed between :
 (A) Two electropositive elements
 (B) Two electronegative elements
 (C) Electropositive & electronegative elements
 (D) All of these CCB105
13. Three elements A,B,C have electronegative values of 3.0, 0.9 & 2.1 respectively. An ionic bond is most likely to form between :
 (A) A & B (B) B & C (C) C & A (D) None of these CCB106
14. Lattice energy of an ionic compound is preferably :
 (A) Low (B) High (C) Both (D) None of these CCB109
15. Which of the following have lowest lattice enthalpy ?
 (A) LiCl (B) NaCl (C) KCl (D) RbCl CCB110
16. The electronic configuration of four elements L, P, Q and R are given in brackets
 $L(1s^2, 2s^2 2p^4)$; $Q(1s^2, 2s^2 2p^6, 3s^2 3p^5)$
 $P(1s^2, 2s^2 2p^6, 3s^1)$; $R(1s^2, 2s^2 2p^6, 3s^2)$
 The formulae of ionic compounds that can be formed between these elements are
 (A) L_2P , RL , PQ and R_2Q (B) LP , RL , PQ and RQ
 (C) P_2L , RL , PQ and RQ_2 (D) LP , R_2L , P_2Q and RQ CCB111
17. An ionic bond $A^{\oplus}B^{\ominus}$ is most likely to be formed when :
 (A) the ionization energy of A is high and the electron gain enthalpy of B is low
 (B) the ionization energy of A is low and the electron gain enthalpy of B is high
 (C) the ionization energy of A and the electron gain enthalpy of B both are high
 (D) the ionization energy of A and the electron gain enthalpy of B both are low CCB122

Covalent Bond, Coordinate Bond

18. Which of the following is an ionic compound ?
 (A) CH_4 (B) H_2O (C) $CaCl_2$ (D) NH_3 CCB113
19. In a triple bond there is sharing of :
 (A) 3-electrons (B) 4-electrons (C) Several electrons (D) 6-electrons CCB114

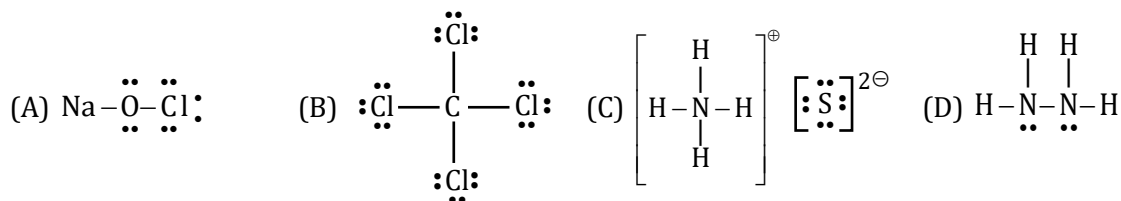
20. Covalent bond is formed by :
 (A) Combination of ions (B) Combination of half filled orbitals
 (C) Exchange of electrons by atom (D) None of above
 CCB116
21. In allene structure ($\text{H}_2\text{C}=\text{C}=\text{CH}_2$) three carbon atoms are joined by :
 (A) Three sigma bonds and three pi bonds (B) Two sigma bonds and one pi bond
 (C) Two sigma bonds and two pi bonds (D) Three pi bonds only
 CCB119
22. Number of σ and π bonds present in $\text{CH}_3 - \text{CH} = \text{CH} - \text{C} \equiv \text{CH}$ are :
 (A) $10\sigma, 3\pi$ (B) $10\sigma, 2\pi$ (C) $9\sigma, 2\pi$ (D) $8\sigma, 3\pi$
 CCB120
23. The compound which contains ionic as well as covalent bonds is
 (A) $\text{C}_2\text{H}_4\text{Cl}_2$ (B) CH_3I (C) KCN (D) H_2O_2
 CCB121
24. In co-ordinate bond, the acceptor atoms must essentially contain in its valence shell an orbital :
 (A) With paired electron (B) With single electron
 (C) With no electron (D) With three electrons
 CCB123
25. The pair of compounds which can form a co-ordinate bond is :
 (A) $(\text{C}_2\text{H}_5)_3\text{B}$ and $(\text{CH}_3)_3\text{N}$ (B) HCl and HBr
 (C) BF_3 and NH_3 (D) (A) & (C) both
 CCB124
26. The types of bond present in N_2O_4 are
 (A) only covalent (B) only ionic (C) ionic and covalent (D) covalent & coordinate
 CCB125
27. Which of the following molecule does not have coordinate bonds?
 (A) CH_3-NC (B) CO (C) O_3 (D) CO_3^{2-}
 CCB126

Lewis Dot Structure and bond order

28. The total number of lone pairs in a chlorine molecule is :
 (A) Six (B) Three (C) Four (D) Seven
 CCB118
29. The number of electrons involved in the bond formation of N_2 molecule
 (A) 2 (B) 4 (C) 6 (D) 10
 CCB127
30. The bond that exists between NH_3 and BF_3 is called
 (A) Electrovalent (B) Covalent (C) Coordinate (D) Hydrogen
 CCB130
31. Which has a coordinate bond (draw LDS)
 (A) SO_3^{2-} (B) CH_4 (C) CO_2 (D) NH_3
 CCB131

32. The compound containing co-ordinate bond is
(A) O_3 (B) SO_3 (C) H_2SO_4 (D) All of these
CCB132
33. The number of dative bonds in nitric acid molecule is :
(A) 0 (B) 1 (C) 2 (D) 4
CCB133
34. Indicate the nature of bonding in CCl_4 and CaH_2
(A) Covalent in CCl_4 and electrovalent in CaH_2
(B) Electrovalent in both CCl_4 and CaH_2
(C) Covalent in both CCl_4 and CaH_2
(D) Electrovalent in CCl_4 and covalent in CaH_2
CCB134
35. Which species does not exists :
(A) AlF_6^{3-} (B) BF_4^+ (C) BeF_4^{2-} (D) CCl_6^{2-}
CCB137
36. According to LDS, dative bond is present in :
(A) SO_3 (B) NH_3 (C) K_2CO_3 (D) BF_3
CCB138
37. Which of the following species follows octet rule :
(A) IBr_5 (B) N^{3-} (C) SF_4 (D) Pb^{4+}
CCB139
38. Which one of the following element will never complete its octet ?
(A) Na (B) F (C) S (D) H
CCB140
39. The octet rule is not valid for the molecule :
(A) CO_2 (B) NH_3 (C) SF_2 (D) $AlCl_3$
CCB142
40. Which of the following pair has electron deficient compounds ?
(A) BCl_3 , $AlCl_3$ (B) C_2H_6 , PCl_6^+ (C) SF_2 , Cl_2O (D) BF_4^+ , ICl
CCB143
41. Which is not an exception to octet rule ?
(A) BF_3 (B) $SnCl_4$ (C) BeI_2 (D) ClO_2
CCB144
42. An oxide of chlorine which is an odd electron molecule is :
(A) ClO_3 (B) Cl_2O_6 (C) Cl_2O_7 (D) Cl_2O
CCB145
43. Which of the following is an example of hypovalent species ?
(A) $BeCl_2$ (B) PCl_5 (C) CO_2 (D) SF_6
CCB146
44. Which of the following species are hypervalent?
(1) PCl_5 , (2) BF_3 , (3) XeF_2 , (4) CO_3^{2-}
(A) 1, 2, 3 (B) 1, 3 (C) 3, 4 (D) 1, 2
CCB147

45. Which of the following Lewis dot diagrams is(are) incorrect ?



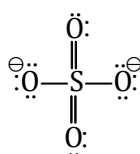
CCB148

46. The weakest Cl - O bond found in:

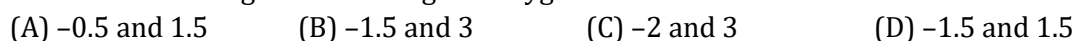


CCB149

47. One of the resonating structure of $\text{SO}_4^{2\ominus}$ is :



Which set of average formal charge on oxygen and bond order is correct ?



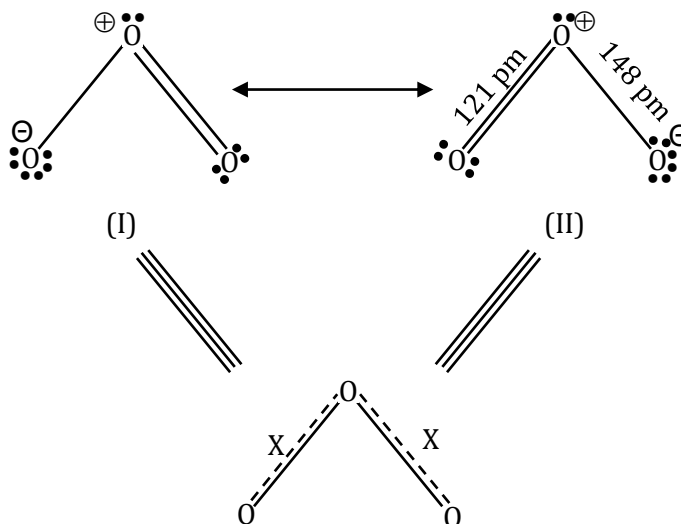
CCB150

48. The resonance is shown by :

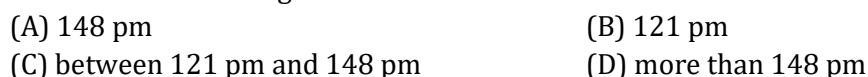


CCB151

49. O_3 (ozone) molecule can be equally represented by the structures I and II shown below :

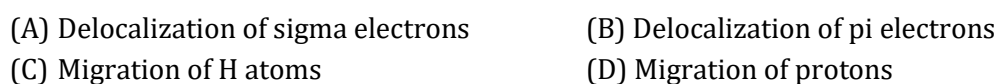


Which of the following value of x is correct ?



CCB152

50. Resonance is due to



CCB153

51. Point out incorrect statement about resonance
 (A) Resonance structures should have equal energy
 (B) In resonance structures, the constituent atoms should be in the same position
 (C) In resonance structures, there should not be the same number of electron pairs
 (D) Resonance structures should differ only in the location of electrons around the constituent atoms

CCB154

Valence bond theory

52. Variable covalency is exhibited by :
 (A) P and S (B) N and O (C) N and P (D) F and Cl
53. In which of the excitation state of Chlorine, ClF_3 is formed ?
 (A) In ground state (B) In third excitation state
 (C) In first excitation state (D) In second excitation state
54. Which compound of xenon is not possible ?
 (A) XeF_2 (B) XeF_4 (C) XeF_5 (D) XeF_6
55. Nitrogen does not form NF_5 because :
 (A) Nitrogen is member of V group (B) It contains no empty d-orbital
 (C) The bond energy of $\text{N} \equiv \text{N}$ is very high (D) Fluorine is highly electronegative
56. Which of the following compound is formed in the second excitation state of sulphur atom ?
 (A) SF_4 (B) SF_6 (C) SF_2 (D) None
57. p-p overlapping will be observed in the molecules of :
 (A) Hydrogen (B) Hydrogen bromide
 (C) Hydrogen chloride (D) Chlorine
58. A sigma bond is formed by the overlapping of :
 (A) s-s orbital alone
 (B) s and p orbitals alone
 (C) s-s, s-p or p-p orbitals along internuclear axis
 (D) p-p orbital along the sides
59. The strongest covalent bond is formed by the overlap of (If considering the same shell) :
 (A) s and p orbitals (B) s and s orbitals
 (C) p and d orbitals (D) p and p collateral orbitals
60. The maximum number of bond and π - bond that can be formed between two non-metals are respectively :
 (A) 4, 3 (B) 3, 2 (C) 2, 3 (D) 3, 1

CCB165

61. The ratio of number of σ bond to π bond in N_2 and CO molecules are :
 (A) 2.0, 2.0 (B) $2, \frac{1}{2}$ (C) $\frac{1}{2}, \frac{1}{2}$ (D) $\frac{1}{2}, 2$ CCB166
62. No. of σ and π bonds in $C_2(CN)_4$ are respectively :
 (A) $9\sigma, 9\pi$ (B) $8\sigma, 7\pi$ (C) $1\sigma, 1\pi$ (D) $9\sigma, 8\pi$ CCB167
63. If x - axis is the approaching axis between two atoms, then which of the set of orbitals can form π -bond between two atoms in general ?
 (A) $s + p_x$ (B) $p_y + p_y$ (C) $p_x + p_x$ (D) $p_y + p_z$ CCB168
64. Which of the set of orbitals can form ' δ ' bond between two atoms ?
 (A) $d_{yz} + d_{yz}$ along y - axis. (B) $d_{yz} + d_{yz}$ along z - axis.
 (C) $d_{yz} + d_{yz}$ along x - axis. (D) $d_{xz} + d_{xz}$ along x - axis. CCB169
65. Which of the following statements is not correct ?
 (A) Double bonds is shorter than a single bond
 (B) σ - bond is weaker than a π bond
 (C) Double bond is stronger than a single bond
 (D) Covalent bond is stronger than a hydrogen bond CCB170
66. Nitrogen forms N_2 but phosphorus do not forms P_2 , but it exists as P_4 . The reason for this is :
 (A) Triple bond is present between phosphorus atoms
 (B) $p\pi - p\pi$ bonding is weak
 (C) $p\pi - p\pi$ bonding is strong
 (D) Multiple bond is formed easily CCB171
67. The correct order of decreasing bond energy is :
 (A) $O-O > S-S > Se-Se$ (B) $C-C > Si-Si > Ge-Ge$
 (C) $F-F > O-O > N-N$ (D) $F-F > Cl-Cl > Br-Br$ CCB172
68. The strength of bonds by $2s - 2s$, $2p - 2p$ and $2p - 2s$ overlapping has the order :
 (A) $2s - 2s > 2p - 2p > 2s - 2p$ (B) $2s - 2s > 2p - 2s > 2p - 2p$
 (C) $2p - 2p > 2s - 2p > 2s - 2s$ (D) $2p - 2p > 2s - 2s > 2p - 2s$ CCB173
69. Which of the following bond is strongest ?
 (A) $1s - 1s$ (B) $2p - 2p$ (C) $2s - 2p$ (D) $1s - 2p$ CCB174
70. Consider the following statements :
 I. A sigma (σ) bond is formed when two s-orbitals overlap
 II. A pi (π) bond is formed when two p-orbitals axially overlap
 III. A σ - bond is weaker than π - bond
 Which of the above statements is/are correct ?
 (A) I and II (B) II and III (C) I alone (D) II alone CCB175

71. Maximum bond energy is in :
 (A) F_2 (B) N_2 (C) O_2 (D) equal CCB176
72. Select the **CORRECT** statement if internuclear axis is y-axis :-
 (A) d_{xy} and d_{xy} orbital of two atoms form π -bond
 (B) p_z and p_z orbital of two atoms form σ -bond
 (C) $d_{x^2-y^2}$ and $d_{x^2-y^2}$ orbital of two atoms form π -bond
 (D) p_y and d_{zx} orbital of two atoms form π -bond CCB177
73. The number of sigma and pi bonds in 1-butene-3-yne are
 (A) 5 sigma and 5 pi (B) 7 sigma and 3 pi (C) 8 sigma and 2 pi (D) 6 sigma and 4 pi CCB178
74. Which of the following has $p\pi-d\pi$ bonding
 (A) $NO_3^\ominus$ (B) $CO_3^{2\ominus}$ (C) $BO_3^{3\ominus}$ (D) $SO_3^{2\ominus}$ CCB179
75. Number of sigma bonds in P_4O_{10} is
 (A) 6 (B) 7 (C) 17 (D) 16 CCB180

Hybridisation & VSEPR theory

76. Which of the following are arranged in increasing order of length of the hybrid orbitals ?
 (A) $sp < sp^2 < sp^3$ (B) $sp^3 < sp^2 < sp$ (C) $sp^2 < sp^3 < sp$ (D) $sp^2 < sp < sp^3$ CCB183
77. If % s character of hybrid orbitals increases, then :
 (A) Bond length $\downarrow$ (B) Bond strength $\uparrow$ (C) Bond Angle $\downarrow$ (D) EN $\uparrow$
 (A) A, B C are true (B) A, C, D are true (C) A, B, D are true (D) B, C, D are true CCB184
78. In following hydrocarbon which one has 75% p – character and 25% s – character :
 (A) C_2H_4 (B) C_2H_2 (C) CH_4 (D) All of the above CCB185
79. Which of the following is incorrect about hybridization ?
 (A) The concept of hybridization is not applied to isolated atoms.
 (B) Hybridization is the mixing of at least two non-equivalent atomic orbitals.
 (C) The number of hybrid orbitals generated is more than the number of pure atomic orbitals that participate in the hybridization process.
 (D) Number of hybrid orbitals formed is same as that of number of orbitals participate in mixing. CCB186
80. The type of hybrid orbitals used by chlorine atom in $ClO^\ominus$, $ClO_2^\ominus$, $ClO_3^\ominus$ and $ClO_4^\ominus$ is/are :
 (A) sp , sp^2 , sp^3 and sp^3d (B) sp and sp^3
 (C) Only sp^3 (D) Only sp CCB187
81. In the series, ethane, ethylene and acetylene, the carbon-hydrogen bond length is :
 (A) Equal in all the three (B) Largest in ethane
 (C) Smallest in ethylene (D) Largest in acetylene CCB188

82. The hybridization of phosphorus in POCl_3 is the same as :
 (A) P in PCl_3 (B) S in SF_4 (C) Cl in ClF_3 (D) B in BCl_3 CCB189
83. The order of increasing adjacent bond angle in the molecules BeCl_2 , BCl_3 , CCl_4 and SF_6 is :
 (A) $\text{SF}_6 < \text{CCl}_4 < \text{BCl}_3 < \text{BeCl}_2$ (B) $\text{BeCl}_2 < \text{BCl}_3 < \text{CCl}_4 < \text{SF}_6$
 (C) $\text{SF}_6 < \text{CCl}_4 < \text{BeCl}_2 < \text{BCl}_3$ (D) $\text{BCl}_3 < \text{BeCl}_2 < \text{SF}_6 < \text{CCl}_4$ CCB190
84. The hybridization state of the central atom in HgCl_2 is :
 (A) sp (B) sp^2 (C) sp^3 (D) dsp^2 CCB191
85. Which of the following compounds has four bond pair and one lone pair ?
 (A) NH_4^+ (B) ICl_4^+ (C) SF_4 (D) XeF_4 CCB192
86. Which of the following elements can not exhibit sp^3d hybridisation state in its compound ?
 (a) C (b) P (c) Cl (d) B
 Correct answer is :
 (A) a, c (B) a, d (C) b, c (D) b, d CCB193
87. XeO_4 molecule is tetrahedral having :
 (A) Two $\text{p}\pi - \text{d}\pi$ bonds (B) Four $\text{p}\pi - \text{d}\pi$ bonds
 (C) One $\text{p}\pi - \text{d}\pi$ bond (D) Three $\text{p}\pi - \text{d}\pi$ bonds CCB194
88. SeF_6 is sp^3d^2 hybridised and octahedral in shape, which d – orbitals are involved in hybridisation ?
 (A) $\text{d}_{x^2-y^2}$, d_{xy} (B) $\text{d}_{x^2-y^2}$, d_{z^2} (C) d_{xy} , d_{yz} (D) d_{z^2} , d_{xy} CCB195
89. IF_7 is sp^3d^3 hybridised and pentagonal bipyramid in shape, which d – orbitals are involved in hybridisation ?
 (A) d_{xy} , d_{yz} , d_{xz} (B) $\text{d}_{x^2-y^2}$, d_{z^2} , d_{xy} (C) $\text{d}_{x^2-y^2}$, d_{yz} , d_{xz} (D) $\text{d}_{x^2-y^2}$, d_{z^2} , d_{yz} CCB196
90. In the context of carbon, which of the following is arranged in the correct order of electronegativity :
 (A) $\text{sp} > \text{sp}^2 > \text{sp}^3$ (B) $\text{sp}^3 > \text{sp}^2 > \text{sp}$ (C) $\text{sp}^2 > \text{sp} > \text{sp}^3$ (D) $\text{sp}^3 < \text{sp} < \text{sp}^2$ CCB197
91. Choose the correct option regarding hybridisation of underlined atom :
 (A) $\text{XeF}_2 \rightarrow \text{sp}$ (B) $\text{XeF}_4 \rightarrow \text{sp}^3$ (C) $\text{POCl}_3 \rightarrow \text{sp}^3$ (D) $\text{IF}_5 \rightarrow \text{sp}^3\text{d}$ CCB198
92. The AsF_5 molecule is trigonal bipyramidal. The hybrid orbitals used by the As atoms for bonding are :
 (A) $\text{d}_{x^2-y^2}$, d_{z^2} , s, p_x , p_y (B) d_{xy} , s, p_x , p_y , p_z (C) s, p_x , p_y , p_z , d_{z^2} (D) $\text{d}_{x^2-y^2}$, s, p_x , p_y CCB199
93. Which of the following orders of repulsive interactions is correct ?
 (A) $\text{lp} - \text{lp} > \text{lp} - \text{bp} > \text{bp} - \text{bp}$ (B) $\text{bp} - \text{bp} > \text{lp} - \text{bp} > \text{lp} - \text{lp}$
 (C) $\text{bp} - \text{bp} > \text{lp} - \text{lp} > \text{lp} - \text{bp}$ (D) $\text{lp} - \text{lp} > \text{bp} - \text{bp} > \text{lp} - \text{bp}$ CCB206

94. The Shape of SF_4 is :
 (A) Tetrahedral (B) trigonal bipyramidal
 (C) See – Saw (D) Octahedral
 CCB207
95. Choose correct matching :
 (A) $\text{SO}_2 \rightarrow$ Linear (B) $\text{BF}_3 \rightarrow$ trigonal planar
 (C) $\text{PCl}_5 \rightarrow$ octahedral (D) $\text{SF}_6 \rightarrow$ tetrahedral
 CCB208
96. The shape of ClO_3^- ion according to Valence Shell Electron Pair Repulsion (VSEPR) theory will be :
 (A) Triangular planar (B) Pyramidal
 (C) Tetrahedral (D) Square planar
 CCB209
97. The geometry of XeO_3F_2 is :
 (A) Triangular planar (B) Trigonal bipyramidal
 (C) Square planar (D) Tetrahedral
 CCB210
98. Which of the set of species have same hybridisation state but different shapes ?
 (A) NO_2^+ , NO_3^- , NO_2^- (B) ClO_4^- , SF_4 , XeF_4 (C) NH_4^+ , H_3O^+ , OF_2 (D) SO_4^{2-} , PO_4^{3-} , NH_4^+
 CCB211
99. The bond angle in H_2O molecule is less than that of NH_3 molecule because :
 (A) The hybridisation of O in H_2O and N in NH_3 is different
 (B) The atomic radii of N and O are different
 (C) There is one lone pair of electrons on O and two lone pairs of electrons on N
 (D) There are two lone pairs of electrons on O and one lone pair of electrons on N
 CCB212
100. Which of the following species are expected to be planar ?
 (a) NH_3 (b) NH_3^{2+} (c) CH_3^+ (d) PCl_3
 The correct answer is :
 (A) b and c (B) c and d (C) b and d (D) a and d
 CCB214
101. Calculate the maximum number of atoms lying in a plane for NH_4^+ :
 (A) 4 (B) 5 (C) 3 (D) 2
 CCB215
102. Amongst NO_3^- , AsO_3^{3-} , CO_3^{2-} , ClO_3^- , SO_3^{2-} and BO_3^{3-} , In which set all species are non planar :
 (A) CO_3^{2-} , SO_3^{2-} and BO_3^{3-} (B) AsO_3^{3-} , ClO_3^- and SO_3^{2-}
 (C) NO_3^- , CO_3^{2-} and BO_3^{3-} (D) SO_3^{2-} , NO_3^- and BO_3^{3-}
 CCB216
103. The formal charges on the three O-atoms in O_3 molecule are :
 (A) 0, 0, 0 (B) 0, 0, -1 (C) 0, 0, +1 (D) 0, +1, -1
 CCB217

104. Which of the following has a geometry different from the other three species (having the same geometry)?

- (A) $\text{BF}_4^\ominus$ (B) $\text{SO}_4^{2\ominus}$ (C) XeF_4 (D) $\text{PH}_4^\oplus$

CCB218

105. The structure of XeF_6 in vapour phase is

- (A) pentagonal bipyramidal (B) trigonal bipyramidal
(C) capped octahedron (D) square bipyramidal

CCB219

106. In the protonation of H_2O , change occurs in :

- (A) Hybridisation state of oxygen (B) Shape of molecule
(C) Hybridisation and shape both (D) None

CCB220

107. Hybridisation is a theoretical concept, as state of hybridisation cannot be detected even by spectroscopically; unlike intermediates or transition state in various reactions. but it corrects the predictions which are based simple on overlapping of pure atomic orbitals. VSEPR theory predicts precisely shape and bond angle in a given molecule.

In which pair of molecules bond angles are not same:

- (A) CCl_4 & SiCl_4 (B) $\text{NH}_4^\oplus$ & $\text{NF}_4^\oplus$ (C) $\text{ClF}_6^\oplus$ & SF_6 (D) None

CCB221

108. The bond angle at oxygen and hybridization of oxygen in ether (CH_3OCH_3) is :

- (A) $106^\circ 51'$, sp^3 (B) $104^\circ 31'$, sp^3 (C) 110° , sp^3 (D) $109^\circ 28'$, sp^3

CCB245

Bond Parameters & solid state hybridisation

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

- (A) 60° (B) $109^\circ 28'$ (C) 0° (D) 90°

CCB235

110. C-H bond distance is the longest in:

- (A) C_2H_2 (B) C_2H_4 (C) C_2H_6 (D) $\text{C}_2\text{H}_2\text{Br}_2$

CCB244

111. Which of the following has been arranged in order of decreasing bond length ?

- (A) $\text{P-O} > \text{Cl-O} > \text{S-O}$ (B) $\text{P-O} > \text{S-O} > \text{Cl-O}$
(C) $\text{S-O} > \text{Cl-O} > \text{P-O}$ (D) $\text{Cl-O} > \text{S-O} > \text{P-O}$

CCB246

112. Select the **CORRECT** set of statements :

As the s-character of a hybrid orbital decreases

- (I) The bond angle decreases (II) The bond strength increases
(III) The bond length increases (IV) Size of orbital increases
(A) (I), (III) and (IV) (B) (II), (III) and (IV) (C) (I) and (II) (D) All are CORRECT

CCB247

113. What is the hybridisation state of Cl in cationic part of solid Cl_2O_6 ?

- (A) sp^3 (B) sp (C) sp^2 (D) sp^3d

CCB251

Bent Rule and Drago's Rule

114. Choose the INCORRECT statements :

- (A) $d_{P-F}(\text{axial}) > d_{P-F}(\text{equatorial})$ in PF_3Cl_2
 (B) $d_{P-F} > d_{P-Cl}$ in PF_2Cl_3
 (C) $d_{P-Cl}(\text{PF}_2\text{Cl}_3) > d_{P-Cl}(\text{PF}_3\text{Cl}_2)$
 (D) All d_{P-Cl} (in PF_2Cl_3) are identical while all d_{P-F} (in PF_3Cl_2) are not identical

CCB236

115. Order of C – H bond lengths :

- (A) $d_{C-H}(\text{CH}_4)$ (B) $d_{C-H}(\text{CH}_3\text{F})$ (C) $d_{C-H}(\text{CH}_2\text{F}_2)$ (D) $d_{C-H}(\text{CHF}_3)$
 (A) $A > B > C > D$ (B) $D > C > B > A$ (C) $A > D > B > C$ (D) $D > A > B > C$

CCB237

116. If the %s character in one Sb-H bond in SbH_3 is 1.0%. What is %p character in the orbital occupied by its lone pair ?

- (A) 99.0 (B) 97 (C) 90 (D) None

CCB239

117. Among the following, the CORRECT statement is :

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

CCB240

118. In which of the following molecule C—C bond length will be highest ?

- (A) $\text{CF}_3 - \text{CF}_3$ (B) $\text{F}_2\text{CH} - \text{CHF}_2$ (C) $\text{FCH}_2 - \text{CH}_2\text{F}$ (D) $\text{CH}_3 - \text{CF}_3$

CCB248

119. Which of the following order is CORRECT for increasing p-character in orbital used for bonding by central atom

- (A) $\text{SiH}_4 > \text{CH}_4$ (B) $\text{H}_2\text{S} > \text{H}_2\text{O}$ (C) $\text{PH}_4^+ > \text{PH}_3$ (D) $\text{NH}_3 > \text{PH}_3$

CCB250

120. The species in which the central atom uses sp^2 hybrid orbitals in its bonding is

- (A) PH_3 (B) NH_3 (C) H_3C^+ (D) SbH_3

CCB252

Odd electron molecules & molecule do not exist

121. In which of the following processes, the magnetic behaviour of the species is changed ?

- (A) $2\text{CH}_3 \rightarrow \text{C}_2\text{H}_6$ (B) $2\text{NO}_2 \rightarrow \text{N}_2\text{O}_4$
 (C) $2\text{ClO}_3 \rightarrow \text{Cl}_2\text{O}_6$ (D) All of these

CCB241

122. Which of the following odd e^- species is planar ?
 (A) $\dot{C}H_3$ (B) $\dot{C}lO_3$ (C) $\dot{C}F_3$ (D) None of these
 CCB242
123. Which of the following molecules do not exist ?
 (A) BF_6^{3-} (B) NCl_3 (C) NOF_3 (D) XeF_5^+
 CCB259
124. Select non existing species :
 (A) PH_3 (B) PH_4^+ (C) $[PF_6]^-$ (D) None of these
 CCB260
125. Select non existing species
 (A) PF_5 (B) SF_6 (C) PH_5 (D) SF_4
 CCB261
126. Among the fluorides below, the one which does not exist is -
 (A) XeF_4 (B) BeF_4 (C) SF_4 (D) CF_4
 CCB262
127. Which of the following compound exist -
 (A) XeH_2 (B) ClF_7 (C) PH_5 (D) ICl_3
 CCB263

Assertion & Reason Question : (128 & 129)

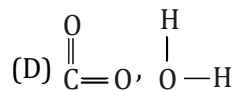
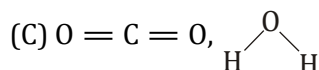
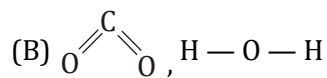
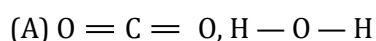
These questions contains, Statement-I (assertion) and Statement-II (reason).

- (A) Statement-I is True, Statement-II is True ; Statement-II is a correct explanation for Statement-I
 (B) Statement-I is True, Statement-II is True ; Statement-II is NOT a correct explanation for Statement-I
 (C) Statement-I is True, Statement-II is False.
 (D) Statement-I is False, Statement-II is True.
128. Statement-I : SF_6 exists but SH_6 does not.
 Statement-II : $d\pi - p\pi$ bonding cannot take place in SH_6
 CCB290
129. Statement-I : Although PF_5 , PCl_5 and PBr_5 are known, the penta halide of nitrogen have not been observed.
 Statement-II : Phosphorus has lower electronegativity than nitrogen.
 CCB291

Dipole moment

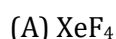
130. The dipole moment of NH_3 is :
 (A) Less than dipole moment of NCl_3 (B) Higher than dipole moment of NCl_3
 (C) Equal to the dipole moment of NCl_3 (D) None of these
 CCB264

131. Experiment shows that H_2O has a dipole moment where as CO_2 has not. Point out the structures which illustrate these facts ?



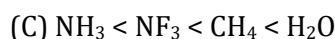
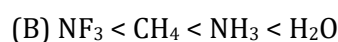
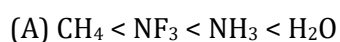
CCB265

132. Species having zero dipole moment :



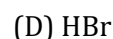
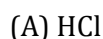
CCB266

133. The correct order of dipole moment is :



CCB267

134. Which of the following has the highest value of dipole moment ?



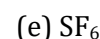
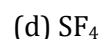
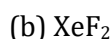
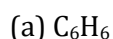
CCB268

135. The experimental value of the dipole moment of HCl is 1.03 D. The length of the $\text{H} - \text{Cl}$ bond is 1.275 Å. The percentage of ionic character in HCl is nearly :

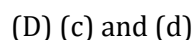
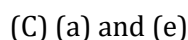
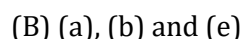
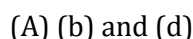


CCB269

136. Which of the following species are polar ?

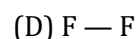
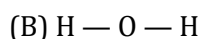
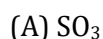


Correct answer is :



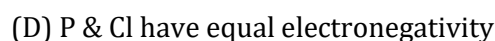
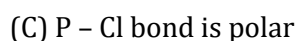
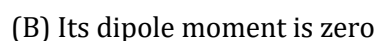
CCB270

137. An example of a polar covalent molecule is :



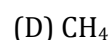
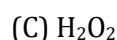
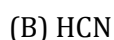
CCB271

138. PCl_5 is non polar because :



CCB272

139. Which contains both polar and non-polar bonds ?



CCB273

140. Find out the incorrect order of the dipole moment among the following pair of compound :

- (A) $\text{NH}_3 > \text{NF}_3$
(B) *p*-dichloro benzene > *o*-dichloro benzene
(C) $\text{CH}_3\text{Cl} > \text{CH}_2\text{Cl}_2$
(D) $\text{SiF}_4 < \text{SF}_4$

CCB274

141. In which of the following both are nonpolar ?

- (A) XeF_4, O_3 (B) $\text{XeF}_5^\ominus, \text{N}_2\text{O}_4$
(C) $\text{SF}_4, \text{XeF}_2$ (D) $\text{BrF}_3, \text{SCl}_2$

CCB275

142. Which of the following molecules is nonpolar ?

- (i) PbCl_4 (ii) BF_3 (iii) SnCl_2 (iv) CS_2
(A) (i), (ii), (iii) (B) (i), (ii), (iii), (iv)
(C) (i), (ii), (iv) (D) (ii), (iii), (iv)

CCB276

143. Which of the following has the highest dipole moment ?

- (A) *o*-Dichlorobenzene (B) *m*-Dichlorobenzene
(C) *p*-Dichlorobenzene (D) All have equal values

CCB277

144. Both CO_2 and H_2O contain polar covalent bonds but CO_2 is nonpolar while H_2O is polar because :

- (A) H atom is smaller than C atom
(B) CO_2 is a linear molecule while H_2O is an angular molecule
(C) O – H bond is more polar than C – H bond
(D) CO_2 contains multiple bonds while H_2O has only single bonds

CCB278

145. If IF_x^n , types species are planar and non-polar, then which of the following match is correct-
(where X is number of F atoms and n is charge an species)

- (A) $x = 2$ and $n = +1$ (B) $x = 3$ and $n = 0$ (C) $x = 2$ and $n = -1$ (D) $x = 5$ and $n = 0$

CCB279

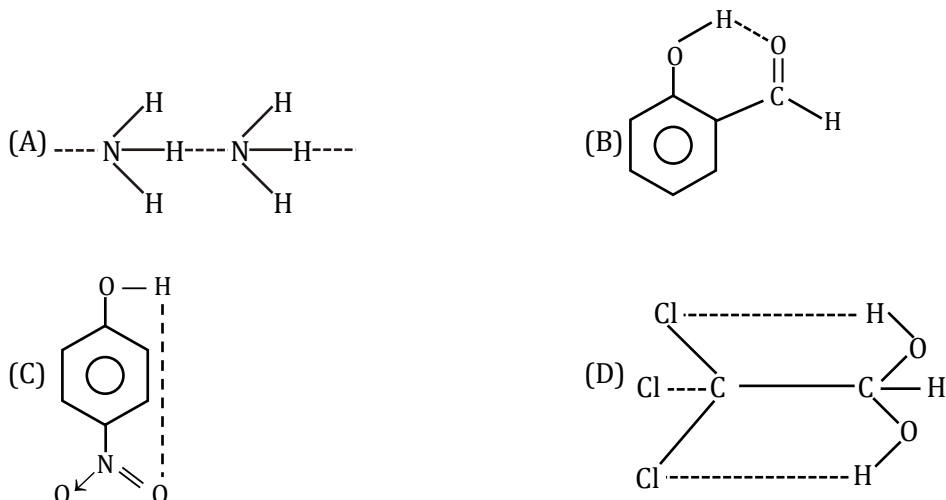
146. BF_3 and NF_3 both molecules are covalent, but BF_3 is non-polar and NF_3 is polar. Its reason is

- (A) In uncombined state boron is metal and nitrogen is gas
(B) B–F bond has no dipole moment whereas N–F bond has dipole moment
(C) The size of boron atom is smaller than nitrogen
(D) BF_3 is planar whereas NF_3 is pyramidal

CCB280

Hydrogen bonding

147. In which of the following molecule e, the shown hydrogen bond is not possible ?



CCB295

148. Maximum number of H-Bond is shown by :

- (A) H_2O (B) H_2Se (C) H_2S (D) HF

CCB296

149. The crystal lattice of ice is mostly formed by :

- (A) Ionic forces (B) Covalent bonds
(C) Inter molecular H-bonds (D) Covalent as well as H-bonds

CCB297

150. KF combines with HF to form KHF_2 . The compound contains the species :

- (A) K^+ , F^- and H^+ (B) K^+ , F^- and HF
(C) K^+ and $[\text{HF}_2]^-$ (D) $[\text{KHF}]^+$ and F_2

CCB298

151. The correct order of volatility is :

- (A) $\text{NH}_3 < \text{H}_2\text{O}$ (B) p - nitro phenol < o - nitro phenol
(C) $\text{CH}_3\text{OH} > \text{CH}_3 - \text{O} - \text{CH}_3$ (D) $\text{HF} > \text{HCl}$

CCB299

152. Which of the following hydrides has the lowest boiling point ?

- (A) H_2O (B) H_2S (C) H_2Se (D) H_2Te

CCB300

153. Correct order of volatility is :

- (A) $\text{HF} > \text{HCl} > \text{HBr} > \text{HI}$ (B) $\text{HCl} > \text{HBr} > \text{HI} > \text{HF}$
(C) $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$ (D) $\text{HBr} < \text{HCl} < \text{HI} < \text{HF}$

CCB301

154. Statement-1 : p-Hydroxybenzoic acid has a lower boiling point than o-hydroxybenzoic acid.

Statement-2 : o-Hydroxybenzoic acid has intramolecular hydrogen bonding.

- (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.

CCB302

- 155.** Statement-1 : Dipole moment of H_2O is more than that of OF_2 .
 Statement-2 : In H_2O , the resultant bond dipole moment of O – H bond and the resultant lone pair dipole moment are in opposite direction.
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.

CCB303

- 156.** Ethanol has a higher boiling point than dimethyl ether though they have the same molecular weight. This is due to :
 (A) resonance (B) coordinate bonding
 (C) hydrogen bonding (D) ionic bonding

CCB305

- 157.** Which of the following compounds would have significant intermolecular hydrogen bonding ?
 HF , CH_3OH , N_2O_4 , CH_4
 (A) HF , N_2O_4 (B) HF , CH_4 , CH_3OH (C) HF , CH_3OH (D) CH_3OH , CH_4

CCB306

- 158.** For H_2O_2 , H_2S , H_2O and HF , the correct order of decreasing strength of hydrogen bonding is :
 (A) $\text{H}_2\text{O} > \text{HF} > \text{H}_2\text{O}_2 > \text{H}_2\text{S}$ (B) $\text{HF} > \text{H}_2\text{O}_2 > \text{H}_2\text{O} > \text{H}_2\text{S}$
 (C) $\text{HF} > \text{H}_2\text{O} > \text{H}_2\text{O}_2 > \text{H}_2\text{S}$ (D) $\text{H}_2\text{O}_2 > \text{H}_2\text{O} > \text{HF} > \text{H}_2\text{S}$

CCB307

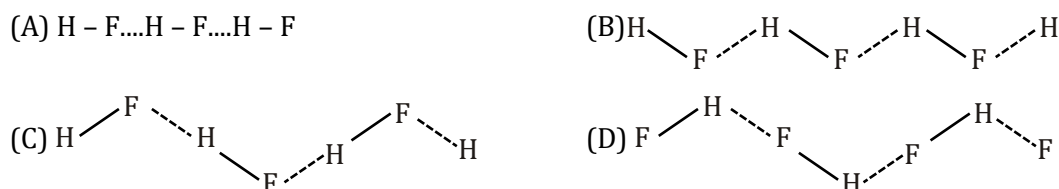
- 159.** Which one of the following does not have intermolecular H-bonding?
 (A) H_2O (B) *o*-nitro phenol (C) HF (D) CH_3COOH

CCB308

- 160.** The order of strength of hydrogen bonds is:
 (A) $\text{NH}\cdots\text{N} > \text{OH}\cdots\text{O} > \text{FH}\cdots\text{F}$ (B) $\text{NH}\cdots\text{N} < \text{OH}\cdots\text{O} < \text{FH}\cdots\text{F}$
 (C) $\text{NH}\cdots\text{N} > \text{OH}\cdots\text{O} < \text{FH}\cdots\text{F}$ (D) $\text{NH}\cdots\text{N} < \text{OH}\cdots\text{O} > \text{FH}\cdots\text{F}$

CCB309

- 161.** The H bond in solid HF can be best represented as:



CCB310

- 162.** In the following which has highest boiling point
 (A) HI (B) HF (C) HBr (D) HCl

CCB311

- 163.** In which of the following compounds does hydrogen bonding occur
 (A) SiH_4 (B) LiH (C) HI (D) NH_3

CCB312

164. Acetic acid exists as dimer in benzene due to
 (A) Condensation reaction (B) Hydrogen bonding
 (C) Presence of carboxyl group (D) Presence of hydrogen atom at α – carbon
 CCB313

165. The high density of water compared to ice is due to
 (A) Hydrogen bonding interactions
 (B) Dipole-dipole interactions
 (C) Dipole-induced dipole interactions
 (D) Instantaneous dipole-induced dipole interactions
 CCB314

Weak forces

166. Which is the weakest among the following types of bonds ?
 (A) Debye force (B) Metallic bond
 (C) Dipole-dipole bond (D) Hydrogen bond
 CCB319

167. Which is the incorrect match for the energy distance function for following interaction ?
 (A) Debye force : r^6
 (B) Ion-induced dipole interaction : r^2
 (C) London force : r^6
 (D) Keesom force : r^3
 CCB320

168. Iodine molecules are held in solid lattice by :
 (A) London forces (B) Dipole-dipole attraction
 (C) Covalent bonds (D) Coulombic force
 CCB321

169. Which of the following inert gas liquefied easily as compare to others ?
 (A) Kr (B) He (C) Ne (D) Ar
 CCB322

170. The relative strength of interionic/intermolecular forces in decreasing order is :
 (A) Ion-dipole > Ion-ion > Dipole-dipole (B) Dipole-dipole > Ion-dipole > Ion-ion
 (C) Ion-dipole > Dipole-dipole > Ion-ion (D) Ion-ion > Ion-dipole > Dipole-dipole
 CCB323

171. Which of the following boiling point order is correct ?
 (A) $\text{He} > \text{T}_2 > \text{D}_2$ (B) $\text{He} < \text{T}_2 < \text{D}_2$ (C) $\text{T}_2 > \text{He} > \text{D}_2$ (D) $\text{He} < \text{D}_2 < \text{T}_2$
 CCB324

172. Identify the incorrect order of boiling point in the following pairs :
 (A) $\text{B(OH)}_3 < \text{B(OCH}_3)_3$ (B) $\text{NF}_3 < \text{N(CH}_3)_3$
 (C) $\text{BF}_3 < \text{B(CH}_3)_3$ (D) $\text{C}_2\text{H}_6 < \text{C}_2\text{F}_6$
 CCB325

173. In which molecule the Vander Waals force (London dispersion force) is likely to be the most important in determining the melting point and boiling point ?
 (A) Br_2 (B) CO (C) H_2S (D) HCl
 CCB326

174. Select the CORRECT statement :
(A) Boiling point of NF_3 is greater than NMe_3
(B) Greater the dipole moment in molecule, greater will be the dipole-dipole interaction between the molecules.
(C) London dispersion force increases with decreasing number of electrons
(D) Boiling point of hydrides of carbon family decreases down the group. CCB327
175. In solid argon, the atoms are held together by
(A) Ionic bonds (B) Hydrogen bonds
(C) Vander Waals forces (D) Hydrophobic forces CCB329
176. Which has weakest bond
(A) Diamond (B) NaCl (C) KCl (D) Ice CCB330
177. Which of the following exhibits the weakest intermolecular forces
(A) He (B) HCl (C) NH_3 (D) H_2O CCB331
178. Among the following the weakest one is
(A) Metallic bond (B) Ionic bond
(C) Vander Waal's force (D) Covalent bond CCB332
179. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is :
(A) London force (B) Hydrogen bond
(C) Ion-ion interaction (D) Ion-dipole interaction CCB333
180. Which one has the highest boiling point ?
(A) Kr (B) Xe (C) He (D) Ne CCB334

Assertion & Reason Question : (181 & 182)

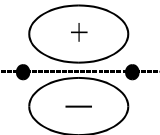
These questions contain, Statement-I (assertion) and Statement-II (reason).

181. Statement-1 : The melting point of noble gases increases as its atomic mass increases.
Statement-2 : Instantaneous dipole induced dipole attraction increases with increase in atomic mass of noble gases.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true. CCB338

182. Statement-1 : CCl_4 has lower boiling point than that of SiCl_4 .
 Statement-2 : The magnitude of negative charge developed at chlorine atoms in SiCl_4 is more in comparison to negative charge developed at chlorine atoms in CCl_4 .
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.

CCB339

Molecular orbital theory (MOT)

183. According to VBT, Oxygen, O_2 is :
 (A) Paramagnetic (B) Diamagnetic (C) Both (D) None
184. Which molecular orbital is formed by positive overlap of atomic orbitals ?
 (A) Bonding molecular orbital (B) Antibonding molecular orbital
 (C) Both (D) None
185. The number of molecular orbitals obtained :
 (A) Is equal to number of atomic orbitals getting intermixed
 (B) Is less than number of atomic orbitals getting intermixed
 (C) Is greater than number of atomic orbitals getting intermixed
 (D) Cannot predict
186. Which of the following does not exist ?
 (A) B_2 (B) C_2 (C) He_2 (D) N_2
187. Which of the following combination of orbitals is CORRECT ?
- (A)  $\rightarrow$ 
- (B)  $\rightarrow$ 
- (C)  $\rightarrow$ 
- (D)  $\rightarrow$ 
188. If the z-axis is taken as the internuclear axis, then which of the following combinations of atomic orbitals is a nonbonding combination ?
 (A) s and p_y (B) p_x and s (C) p_x and p_y (D) All of these

CCB344

CCB345

189. Statement-1 : Super oxide ion is paramagnetic whereas peroxide ion is diamagnetic.
Statement-2 : Super oxide ion has one unpaired electron whereas peroxide ion has no unpaired electron.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

CCB346

190. Statement-1: H_2 molecule is more stable than He-H molecule.
Statement-2: The antibonding electron in He-H molecule decreases the bond order and there by the stability.
(A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
(B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1.
(C) Statement-1 is true, statement-2 is false.
(D) Statement-1 is false, statement-2 is true.

CCB347

191. Among KO_2 , $AlO_2^\ominus$, BaO_2 and $NO_2^\ominus$ unpaired electron is present in :
(A) KO_2 only (B) $NO_2^\ominus$ and BaO_2
(C) KO_2 and $AlO_2^\ominus$ (D) BaO_2 only

CCB348

192. Select the CORRECT option about stability :
(A) $NO_2^\ominus > NO_2^\oplus$ (B) $NO_2^\oplus > NO_2^\ominus$
(C) $NO_2^\oplus = NO_2^\ominus$ (D) Not predictable

CCB349

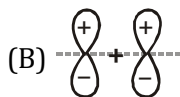
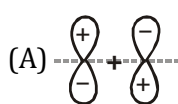
193. In the formation of $NO_2^\oplus$, the electron is removed from :
(A) σ -orbital (B) π -orbital (C) σ^* -orbital (D) π^* -orbital

CCB350

194. During the formation of a molecular orbital from atomic orbitals, probability of electron density is
(A) minimum in the nodal plane (B) maximum in the nodal plane
(C) zero in the nodal plane (D) zero on the surface of the lobe

CCB351

195. Which of the following overlapping indicates formation of bonding molecular orbitals having gerade symmetry ?



(D) All of these

CCB352

196. The bond order is maximum in
(A) O_2 (B) $O_2^{1\ominus}$ (C) $O_2^{1\oplus}$ (D) $O_2^{2\ominus}$

CCB353

197. Which one is paramagnetic from the following
 (A) $O_2^\ominus$ (B) NO (C) Both (A) and (B) (D) $CN^\ominus$ CCB354
198. The molecular electronic configuration of $H_2^\ominus$ ion is
 (A) $(\sigma_{1s})^2$ (B) $(\sigma_{1s})^2(\sigma_{1s}^*)^2$ (C) $(\sigma_{1s})^2(\sigma_{1s}^*)^1$ (D) $(\sigma_{1s})^3$ CCB355
199. The paramagnetic nature of oxygen molecule is best explained on the basis of
 (A) Valence bond theory (B) Resonance
 (C) Molecular orbital theory (D) Hybridization CCB356
200. Which one of the following species is diamagnetic in nature
 (A) $He_2^\oplus$ (B) H_2 (C) $H_2^\oplus$ (D) $H_2^\ominus$ CCB357
201. Which of the following molecular orbitals has two different nodal planes
 (A) σ_{2s} (B) π_{2p_y} (C) $\pi_{2p_y}^*$ (D) $\sigma_{2p_x}^*$ CCB358
202. Out of the following which has smallest bond length
 (A) O_2 (B) $O_2^\oplus$ (C) $O_2^\ominus$ (D) $O_2^{2\ominus}$ CCB364
203. Pick out the incorrect statement ?
 (A) N_2 has greater dissociation energy than $NO_2^\oplus$
 (B) O_2 has lower dissociation energy than $O_2^\oplus$
 (C) Bond length in $NO_2^\oplus$ is less than N_2
 (D) Bond length in $NO^\oplus$ is less than in NO CCB365
204. Which of the following is true ?
 (A) With increasing Bond order, Bond length decreases & Bond energy increases
 (B) With increasing Bond order, Bond length increases & Bond energy decreases
 (C) With increasing Bond order, Bond length decreases & Bond energy decreases
 (D) With increasing Bond order, Bond length increases & Bond energy increases CCB366
205. Which of the following group of molecules have 2.5 bond order ?
 (A) $N_2^{2\ominus}$, $O_2^{2\ominus}$, CO (B) $N_2^\oplus$, $O_2^\oplus$, NO
 (C) $C_2^{2\ominus}$, N_2 , O_2 (D) $CN^\ominus$, $NO^\oplus$, $O_2^{2\oplus}$ CCB367
206. Which of the following species will have the minimum bond energy ?
 (A) N_2 (B) $N_2^\ominus$ (C) $N_2^\oplus$ (D) $N_2^{2\ominus}$ CCB368

207. When N_2 is ionised to N_2^+ bond length & if O_2 is ionised to O_2^+ bond length
Select the CORRECT option to fill the blank space respectively :
(A) Increases and decreases (B) Decreases and increases
(C) Increases and increases (D) Decreases and decreases
CCB369
208. Which of the following order of ionisation energy is correct ?
(A) $F_2 > F$ (B) $F_2 < F$ (C) $F_2 = F$ (D) Cannot predict
CCB370
209. Choose Correct order of ionisation energy ?
(A) $O_2 > O$ (B) $O_2 < O$ (C) $O_2 = O$ (D) Cannot predict
CCB371
210. LUMO in N_2 is :
(A) π_{2px}^* (B) σ_{2pz}^* (C) π_{2px} (D) σ_{2pz}
CCB372
211. HOMO in O_2 is :
(A) π_{2px}^* (B) σ_{2pz}^* (C) π_{2px} (D) σ_{2pz}
CCB373
212. Most stable species is :
(A) O_2^{1+} (B) O_2^{10} (C) O_2^{2+} (D) All equal
CCB374
213. The highest bond length is present in :
(A) B_2 (B) B_2^{2+} (C) B_2^{1+} (D) All equal
CCB375
214. The bond energy order of He_2^+ and HeH^+ is
(A) $He_2^+ > HeH^+$ (B) $HeH^+ = He_2^+$ (C) $HeH^+ > He_2^+$ (D) Can't be predicted
CCB376
215. A simplified application of MO theory to the hypothetical molecule 'OF' would give its bond order as :
(A) 2 (B) 1.5 (C) 1.0 (D) 0.5
CCB377
216. Number of anti bonding electrons in N_2 is :
(A) 4 (B) 10 (C) 12 (D) 14
CCB378

Hydration energy

217. The hydration of ionic compounds involves :
(A) Evolution of heat (B) Weakening of attractive forces
(C) Dissociation into ions (D) All
CCB387
218. The hydration energy of Mg^{2+} is greater than the hydration energy of :
(A) Al^{3+} (B) Mg^{3+} (C) Na^+ (D) Be^{2+}
CCB388

219. Which of the compound is least soluble in water ?
 (A) AgF (B) AgCl (C) AgBr (D) AgI
 CCB389
220. Ionic conductance of hydrated $M^{\oplus}$ ions are in the order :
 (A) $Li^{\oplus}(aq) > Na^{\oplus}(aq) > K^{\oplus}(aq) > Rb^{\oplus}(aq) > Cs^{\oplus}(aq)$
 (B) $Li^{\oplus}(aq) > Na^{\oplus}(aq) < K^{\oplus}(aq) < Rb^{\oplus}(aq) < Cs^{\oplus}(aq)$
 (C) $Li^{\oplus}(aq) > Na^{\oplus}(aq) > K^{\oplus}(aq) > Rb^{\oplus}(aq) < Cs^{\oplus}(aq)$
 (D) $Li^{\oplus}(aq) < Na^{\oplus}(aq) < K^{\oplus}(aq) < Rb^{\oplus}(aq) < Cs^{\oplus}(aq)$
 CCB390
221. The ionic mobility of alkali metal ions in aqueous solution is maximum for
 (A) $Li^{\oplus}$ (B) $Na^{\oplus}$ (C) $K^{\oplus}$ (D) $Rb^{\oplus}$
 CCB391
222. Sodium sulphate is soluble in water whereas barium sulphate is sparingly soluble because :
 (a) The hydration energy of Na_2SO_4 is less than its lattice energy
 (b) The hydration energy of Na_2SO_4 is more than its lattice energy
 (c) The lattice energy of $BaSO_4$ is more than its hydration energy
 (d) The lattice energy has no role to play in solubility
 (A) a & b (B) b & c (C) c & d (D) b & d
 CCB392
223. Choose the compound from each of the following pairs that has the more solubility in water :-
 (a) $BeSO_4$, $BaSO_4$ (b) $LiOH$, $CsOH$ (c) $AgCl$, AgI
 (A) $BeSO_4$, $CsOH$, AgI (B) $BeSO_4$, $CsOH$, $AgCl$ (C) $BaSO_4$, $LiOH$, $AgCl$ (D) $BaSO_4$, $LiOH$, AgI
 CCB393
224. **Statement-1** : Among alkali metal cations, $Li^{\oplus}(aq.)$ has highest electrical conductance.
Statement-2 : $Li^{\oplus}(aq.)$ is largest alkali metal cation because of greater degree of hydration.
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.
 CCB394
225. **Statement-1** : $Al(OH)_3$ is amphoteric in nature.
Statement-2 : $Al-O$ and $O-H$ bonds can be broken with equal ease in $Al(OH)_3$.
 (A) Statement-1 is true, statement-2 is true and statement-2 is correct explanation for statement-1.
 (B) Statement-1 is true, statement-2 is true and statement-2 is NOT the correct explanation for statement-1
 (C) Statement-1 is true, statement-2 is false.
 (D) Statement-1 is false, statement-2 is true.
 CCB395
226. Which of the following metal ion will have maximum hydrated radius :
 (A) $Be^{2\oplus}$ (B) $Mg^{2\oplus}$ (C) $Ca^{2\oplus}$ (D) $Sr^{2\oplus}$
 CCB396

Fagan's rule and Ionic compounds

227. Amongst LiCl, RbCl, BeCl₂ and MgCl₂ the compounds with the greatest and the least ionic character, respectively are :
(A) LiCl and RbCl (B) RbCl and BeCl₂
(C) RbCl and MgCl₂ (D) MgCl₂ and BeCl₂
CCB397
228. Compound with maximum ionic character is formed from :
(A) Na and Cl (B) Cs and F (C) Cs and I (D) Na and F
CCB398
229. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizing power of the cationic species, K⁺, Ca²⁺, Mg²⁺, Be²⁺ ?
(A) Be²⁺ < K⁺ < Ca²⁺ < Mg²⁺ (B) K⁺ < Ca²⁺ < Mg²⁺ < Be²⁺
(C) Ca²⁺ < Mg²⁺ < Be²⁺ < K⁺ (D) Mg²⁺ < Be²⁺ < K⁺ < Ca²⁺
CCB399
230. CCl₄ is more covalent than LiCl because :
(A) There is more polarization of Cl in CCl₄ (B) There is more polarization of Cl in LiCl
(C) CCl₄ has more weight (D) None of above
CCB400
231. On the basis of concept of ionic potential (ϕ), the tendency to form covalent bond in a group :
(A) Increases (B) Decreases
(C) Remains unchanged (D) Shows erratic change
CCB401
232. Select correct order out of given options :
(A) BeCO₃ < BaCO₃ : Covalent character (B) BeO > SrO : lattice energy
(C) Be²⁺ < Li⁺ : Hydration energy (D) Be²⁺ (aq.) > Li⁺ (aq.) : Ionic mobility
CCB402
233. Which of the following set of characteristics lead to the increase in solubility of ionic substances?
(A) High dipole moment, strong attraction by an ion towards solvent and large solvation energy
(B) Low dipole moment, weak attraction by an ion towards solvent and high solvation energy
(C) High dipole moment, strong attraction by an ion towards solvent and low solvation energy
(D) High dipole moment, weak attraction by an ion towards solvent and large solvation energy
CCB403
234. The solubility of anhydrous AlCl₃ and hydrated AlCl₃ in diethyl ether are S₁ and S₂ respectively. Then
(A) S₁ = S₂ (B) S₁ > S₂ (C) S₁ < S₂ (D) S₁ < S₂ but not S₁ = S₂
CCB404
235. Which of the following has highest melting point
(A) BeCl₂ (B) MgCl₂ (C) CaCl₂ (D) BaCl₂
CCB405

236. Which of the following statements is not true for ionic compounds
 (A) High melting point (B) Least lattice energy
 (C) Least solubility in organic compounds (D) Soluble in water
 CCB406
237. Which compound is highest covalent
 (A) LiCl (B) LiF (C) LiBr (D) LiI
 CCB407
238. Polarization is the distortion of the shape of an anion by an adjacently placed cation. Which of the following statements is correct
 (A) Maximum polarization is brought about by a cation of high charge
 (B) Minimum polarization is brought about by a cation of low radius
 (C) A large cation is likely to bring about a large degree of polarization
 (D) A small anion is likely to undergo a large degree of polarization
 CCB408
239. In which of the following molecule is the covalent bond most polar
 (A) HI (B) HBr (C) HCl (D) H₂
 CCB409
240. Which of the following possesses highest melting point
 (A) Chlorobenzene (B) *o*-dichlorobenzene
 (C) *m*-dichlorobenzene (D) *p*-dichlorobenzene
 CCB410
241. Which of the following has a high polarising power
 (A) Mg²⁺ (B) Al³⁺ (C) Na⁺ (D) Ca²⁺
 CCB411
242. Maximum covalent character is associated with the compound
 (A) NaI (B) MgI₂ (C) AlCl₃ (D) AlI₃
 CCB412
243. According to Fajan's rule, covalent bond is favoured by
 (A) Large cation and small anion (B) Large cation and large anion
 (C) Small cation and large anion (D) Small cation and small anion
 CCB413

MULTIPLE CORRECT TYPE QUESTIONS

Lewis Dot Structure and bond order

244. Which of the following compounds contain ionic, covalent and co-ordinate bonds?
 (A) NH₄Cl (B) KCN (C) NaBF₄ (D) NaOH
 CCB135
245. Select the correct statement -
 (A) C-O bond length of CO molecule is higher than the C-O bond length of CO₂
 (B) C-O bond length of CO molecule is lower than the C-O bond length of CO₂
 (C) N-O bond length of NO₃[⊖] ion is higher than the N-O bond length of NO₂[⊖]
 (D) N-O bond length of NO₃[⊖] ion is lower than the N-O bond length of NO₂[⊖]
 CCB155

Hybridisation & VSEPR theory

246. Which of the following statement(s) is / are not correct?

- (A) Hybridization is the mixing of atomic orbitals of large energy difference.
 (B) sp^2 -hybrid orbitals are formed from two p - atomic orbitals and one s - atomic orbital
 (C) sp^3d^2 -hybrid orbitals are all at 90° to one another
 (D) sp^3 -hybrid orbitals are directed towards the corners of a regular tetrahedron

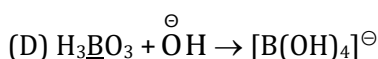
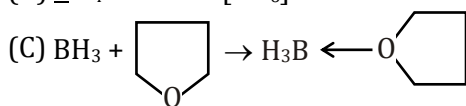
CCB201

247. CO_3^{2-} anion has which of the following characteristics

- (A) Bonds of unequal length
 (B) sp^2 hybridization of C atom
 (C) Resonance stabilization
 (D) Same bond angles

CCB202

248. In which of the following process(s) hybridisation of underlined atom does not change ?



CCB223

249. Which of the following species are linear ?

- (A) $ICl_2^\ominus$ (B) $I_3^\ominus$ (C) $N_3^\ominus$ (D) $ClO_2^\oplus$

CCB226

250. Which of the following molecules have bent shape.

Where A is central atom, B is surrounding atom and E is lone pair -

- (A) AB_2E_2 (B) AB_2E (C) AB_3E (D) AB_2

CCB227

251. Which of the following 'd' orbital(s) participate in the hybridisation for Xe in the cationic part of $XeF_6(s)$:-

- (A) d_{xy} (B) $d_{x^2-y^2}$ (C) d_{z^2} (D) d_{y^2}

CCB283

Bond Parameters & solid state hybridisation

252. INCORRECT order of bond angle is :

- (A) $OCl_2 > SF_2$ (B) $H_2O > OF_2$ (C) $SO_4^{2-} > CF_4$ (D) $NF_3 > NH_3$

CCB224

253. Select the CORRECT statement(s) :

- (A) Bond angle order : $CH_4 > CF_4$
 (B) Bond length order : $d_{N-O}(NO_2^\ominus) < d_{N-O}(NO_3^\ominus)$
 (C) Bond order of S - O : $SO_4^{2-} > SO_3^{2-}$
 (D) Bond angle order : $NH_3 < PH_3$

CCB225

Bent Rule and Drago's Rule

254. In which of the following, the theory of hybridisation does not help to predict the bond angle ?
 (A) PH_3 (B) SbH_3 (C) SiH_4 (D) H_2S

CCB282

Odd electron molecules & molecule do not exist

255. Choose the correct options for NO_2 :

- (A) It is odd electron specie (B) N–O bond order = 1.5
 (C) Paramagnetic specie (D) Isoelectronic with CO_2

CCB254

256. The number of specie(s) which are not perfectly planar.

- (A) $\dot{\text{C}}\text{H}_3$ (B) $\dot{\text{C}}\text{F}_3$ (C) CHF_3 (D) CH_2F_2

CCB255

257. Which of the following molecules do not exist ?

- (A) Br_2O (B) SF_6 (C) NCl_5 (D) OF_4

CCB284

258. Which of the following do not exists ?

- (A) SH_6 (B) HFO_4 (C) SiCl_6^{2-} (D) HClO_3

CCB285

259. Which of the following molecule exist-

- (A) SF_6 (B) IH_3 (C) SH_2 (D) PCl_5

CCB286

260. Which of the following molecules does not exist and non-existence reason is same as that of SH_6

- (A) OF_4 (B) SH_4 (C) PBr_6^- (D) XeH_4

CCB287

Dipole moment

261. Which of the following compounds possesses zero dipole moment?

- (A) Water (B) Benzene
 (C) Carbon tetrachloride (D) Boron trifluoride

CCB288

262. Which of the following statements is/are true?

- (A) Covalent bonds are directional
 (B) Ionic bonds are nondirectional
 (C) A polar bond is formed between two atoms which have the same electronegativity value.
 (D) The presence of polar bonds in a polyatomic molecule suggests that it has zero dipole moment

CCB289

Hydrogen bonding

263. Which of the following statements are correct ?

- (A) The crystal lattice of ice is formed by covalent as well as hydrogen bonds
 (B) The density of water increases when heated from 0°C to 4°C
 (C) Above 4°C the thermal agitation of water molecules increases. Therefore, intermolecular distance increases and water starts expanding
 (D) The density of water decreases from 0°C to a maximum at 4°C

CCB315

264. The correct order/s of boiling point is/are :

- (A) $\text{H}_2\text{O} > \text{CH}_3\text{OH}$ (B) $\text{H}_3\text{PO}_4 > \text{Me}_3\text{PO}_4$
(C) $\text{NH}_3 < \text{H}_2\text{O}$ (D) $\text{H}_2\text{O} > \text{HF}$

CCB316

265. In which of the following chemical species hydrogen bonding takes places -

- (A) $\text{Na}_2\text{HPO}_3(\text{s})$ (B) $\text{K}_2\text{HPO}_4(\text{s})$ (C) $\text{KHCO}_3(\text{s})$ (D) $\text{NaHCO}_3(\text{s})$

CCB317

Weak forces

266. Which of the following factors are responsible for origination of Vander Waals forces ?

- (A) Instantaneous dipole-induced dipole interaction
(B) Dipole-induced dipole interaction
(C) Dipole-dipole interaction
(D) Size of molecule

CCB335

267. Which of the following are true ?

- (A) Vander Waals forces are responsible for the formation of molecular crystals
(B) Branching lowers the boiling points of isomeric organic compounds due to decrease in Vander Waals forces of attraction
(C) In graphite, Vander Waals forces act between the carbon layers
(D) In diamond, Vander Waals forces act between the carbon layers

CCB336

268. London forces depends upon :

- (A) Molecular weight (B) Number of polarisable electrons
(C) Molecular size (D) None of these

CCB337

Molecular orbital theory (MOT)

269. Which of the following overlapping results non bonding molecular orbital (if overlapping axis is x-axis) ?

- (A) s of A & p_y of B (B) p_z of A & p_z of B
(C) p_y of A & p_z of B (D) d_{xy} of A & s of B

CCB359

270. Which of the following statements are true for these given species : N_2 , CO, $\text{CN}^\ominus$ and $\text{NO}^\oplus$.

- (A) All species are paramagnetic (B) The species are isoelectronic
(C) All the species have dipole moment (D) All the species are linear

CCB360

271. Which of the following have unpaired electron(s)

- (A) $\text{O}_2^\oplus$ (B) $\text{O}_2^\ominus$ (C) NO (D) $\text{H}_2^\oplus$

CCB361

272. Which of the following is/are paramagnetic ?

- (A) B_2 (B) O_2 (C) N_2 (D) He_2

CCB362

273. Which of the following is/are correct ?

- (A) During $N_2^{\oplus}$ formation, one electron is removed from the bonding molecular orbitals
- (B) During $O_2^{\oplus}$ formation, one electron is removed from the antibonding molecular orbitals
- (C) During $O_2^{\ominus}$ formation, one electron is added to the bonding molecular orbitals
- (D) During $N_2^{\ominus}$ formation, one electron is added to the bonding molecular orbitals

CCB363

274. Which of the following have identical bond order ?

- (A) $O_2^{2\oplus}$
- (B) $NO^{\oplus}$
- (C) $CN^{\ominus}$
- (D) $CN^{\oplus}$

CCB379

275. Which of the following statement is/are correct

- (A) The peroxide ion has a bond order of 1 while the oxygen molecule has a bond order of 2
- (B) The peroxide ion has a weaker bond than the dioxygen molecule has.
- (C) The peroxide ion as well as the dioxygen molecules are paramagnetic
- (D) The bond length of the peroxide ion is greater than that of the dioxygen molecule

CCB380

276. Which of the following species have a bond order of 3 ?

- (A) CO
- (B) $CN^{\ominus}$
- (C) $NO^{\oplus}$
- (D) $O_2^{\oplus}$

CCB381

Fagan's rule and Ionic compounds

277. Choose the correct order(s) for the given properties.

- (A) $MgSO_4 < SrSO_4 < BaSO_4$: Thermal stability order
- (B) $BeC_2O_4 < CaC_2O_4 < BaC_2O_4$: Solubility in water
- (C) $LiCl > NaCl > KCl$: Melting point order
- (D) $BeF_2 > CaF_2 > SrF_2$: Covalent character order

CCB414

278. Most ionic compounds have :

- (A) high melting points and low boiling points
- (B) high melting points and nondirectional bonds
- (C) high solubilities in polar solvents and low solubilities in nonpolar solvents
- (D) three-dimensional network structures, and are good conductors of electricity in the molten state

CCB415

279. Choose the correct order for the given properties.

- (A) $NaF < MgF_2 < AlF_3$: covalent character order.
- (B) $NaF < MgF_2 < AlF_3$: melting point order
- (C) $NaF < MgF_2 < AlF_3$: lattice energy order
- (D) $NaF > MgF_2 > AlF_3$: order of polarising power of cation.

CCB416

COMPREHENSION TYPE QUESTIONS

Dipole moment**Paragraph for Questions: 280 & 281**

Bond angle and bond polarity are important parameters associated for bonding in molecule.

280. Which of the following bond angle order is incorrect.

- (A) $\text{NH}_3 > \text{PH}_3$ (B) $\text{BF}_3 < \text{BH}_3$
 (C) $\text{O}(\text{CH}_3)_2 < \text{O}(\text{C}_2\text{H}_5)_2$ (D) $\text{CO}_3^{2-} < \text{CO}_2$

CCB292

281. Which of the following molecule is polar and non-planar

- (A) CH_2Cl_2 (B) PCl_5 (C) SO_2 (D) XeF_4

CCB293

Molecular orbital theory (MOT)**Paragraph for Questions 282 & 283**

Molecular orbital theory is based on linear combination of atomic orbitals (LCAO). According to LCAO when respective atomic orbitals of the atoms interact, they undergoes constructive and destructive interference giving two types of molecular orbital i.e. bonding and antibonding molecular orbitals respectively.

282. Which of the following specie is paramagnetic ?

- (A) $\text{NO}^\ominus$ (B) $\text{O}_2^{2\ominus}$ (C) $\text{CN}^\ominus$ (D) CO

CCB382

283. Bond order of Be_2 is :

- (A) 1 (B) 2 (C) 3 (D) 0

CCB383

MATRIX MATCH TYPE QUESTION

Hybridisation & VSEPR theory

284. Select the correct matching :

List IA : XeF_4 B : XeF_6 C : XeO_3 D : XeOF_2 **List II**

1. Pyramidal

2. T-shape

3. Distorted octahedral

4. Square planar

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

CCB213

285. Match the column

Column-I (molecules)	Column-II (correct about molecule)
(A) PCl_5 ($\theta = 120^\circ$), ($\theta' = 90^\circ$)	(P) Number of the given bond angle (θ or θ') is = One
(B) NH_3 ($\theta = 107^\circ$)	(Q) Number of the given bond angle (θ or θ') is = Three
(C) SiH_4 ($\theta = 109^\circ 28'$)	(R) Number of the given bond angle (θ or θ') is = Six
(D) SO_2 ($\theta = 116^\circ$)	(S) d-orbital(s) is/are involved in hybridisation of central atom
	(T) Lone pair at underlined atom is present
(A) (A)P,T; (B)Q,T; (C)R; (D)Q,R,S	(B) (A)Q,R,S; (B)Q,T; (C)R; (D)P,T
(C) (A)Q,R,S; (B)R; (C)Q,T; (D)P,T	(D) (A)R; (B)Q,T; (C)Q,R,S; (D)P,T

CCB222

Bent Rule and Drago's Rule

286. Match the column :

Column-I (Molecules)	Column-I (Characteristics)
(1) CH_4	(P) Molecule is having perfect tetrahedral shape
(2) CH_2F_2	(Q) C-F bond has maximum p-character
(3) CHF_3	(R) C-H bond has maximum s-character
(4) CF_4	(S) Molecule is having maximum number of equal angles
	(T) Molecule has lowest bond angle
(A) (1) $\rightarrow$ T,S ; (2) $\rightarrow$ Q,P ; (3) $\rightarrow$ R ; (4) $\rightarrow$ Q,S	
(B) (1) $\rightarrow$ P,T ; (2) $\rightarrow$ Q,T ; (3) $\rightarrow$ Q ; (4) $\rightarrow$ S,R	
(C) (1) $\rightarrow$ P,S ; (2) $\rightarrow$ Q,T ; (3) $\rightarrow$ R ; (4) $\rightarrow$ P,S	
(D) (1) $\rightarrow$ S,Q ; (2) $\rightarrow$ R,T ; (3) $\rightarrow$ T ; (4) $\rightarrow$ P,Q	

CCB238

Odd electron molecules & molecule do not exist

287. Match list I with list II and select the correct answer :

List-I (Molecule / Species)	List-II (Unpaired electron resides in)
(P) NO_2	(1) d-orbital
(Q) ClO_2	(2) sp^2 - orbital
(R) ClO_3	(3) sp^3 - orbital
(S) CH_3	(4) p-orbital

Code :

P	Q	R	S
(A) 2	4	1	3
(B) 2	1	3	4
(C) 1	4	2	3
(D) 3	1	2	4

CCB243

288. Match list I with list II and select the correct answer:

List-I (species)(P) $\text{NO}_2^{\oplus}$ (Q) NO_2 (R) $\text{NO}_2^{\ominus}$ (S) $\text{NO}_3^{\ominus}$

	P	Q	R	S
(A)	5	4	3	2
(C)	1	2	4	3

List-II (O-N-O angle)(1) 180° (2) 134° (3) 120° (4) 115° (5) 109°

	P	Q	R	S
(B)	5	2	4	3
(D)	1	4	3	2

CCB253

Dipole moment

289. Match the column

Column-I(A) $\text{I}(\text{CN})_2^{\ominus}$ (B) $\text{CO}_3^{2\ominus}$ (C) XeO_2F_2 (D) SOF_4

(A) (A) Q,S (B) P,R (C) Q,S (D) P,R,S

(C) (A) P,R,S (B) P,R (C) Q,S (D) Q,S

Column-II(P) Having $p\pi-p\pi$ bond & $\mu_D = 0$ (Q) Having $p\pi-d\pi$ bond & $\mu_D \neq 0$

(R) Planar

(S) Central atom is sp^3d

(B) (A) P,R,S (B) Q,S (C) P,R (D) Q,S

(D) (A) Q,S (B) P,R (C) P,R,S (D) Q,S

CCB281

Hydrogen bonding

290. **Column-I**

(1) 2 lone pair on central atom

(2) Zero dipole moment

(3) Planar

(4) All adjacent bond angles are equal

(A) (1) P, Q; (2) P, R, S; (3) P, R, S; (4) P, Q, R

(C) (1) R, S; (2) P, Q, S; (3) P, R, S; (4) P, Q, S

Column-II(P) $\text{XeF}_5^{\ominus}$ (Q) NF_3 (R) C_2H_4 (S) XeF_4

(B) (1) P, S; (2) P, R, S; (3) P, R, S; (4) P, Q, S

(D) (1) R, S; (2) P, R, S; (3) P, R, S; (4) P, Q, R

CCB304

Weak forces

291. Match list I with list II and select the correct answer:

List-I**(Process)**

(P) Clathrate compound of Xe in ice

(Q) Liquefaction of Xe gas

(R) Liquefaction of HCl gas

(S) Hydration of $\text{Na}^{\oplus}$ **Code :**

	P	Q	R	S
(A)	1	3	4	2
(C)	3	4	2	1

List-II**(Operating interaction involved)**

(1) Ion - Dipole

(2) Dipole - Dipole

(3) Dipole - Induced dipole

(4) London forces

	P	Q	R	S
(B)	3	4	1	2
(D)	1	3	2	4

CCB328

TABLE TYPE QUESTION

Molecular orbital theory (MOT)

Direction for Q.292 to Q.294 by appropriately matching the information given in the three columns of the following table

Molecular Orbital	Number of nodal plane	Symmetry of Molecular Orbital
(1) σ_s	(P) 3	(I) BMO, gerade
(2) π_p	(Q) 2	(II) ABMO, ungerade
(3) σ_{pz}^*	(R) 1	(III) BMO, ungerade
(4) δ^*	(S) 0	(IV) ABMO, gerade

292. Which of the following matching is **INCORRECT**.

- (A) (1), S, I (B) (2), R, I (C) (3), R, II (D) (4), P, II

CCB384

293. How many orbitals are occupied with set (1)(S)(I) in F_2

- (A) 0 (B) 1 (C) 2 (D) 3

CCB385

294. If z axis is the molecular axis then **CORRECT** matching for $d_{xy} + d_{xy}$ orbital is 4, P, II for the subtraction of wave function.

Which of the following matching is **CORRECT** for the addition of wave function for same combination of orbitals.

- (A) P, IV (B) P, III (C) Q, II (D) Q, I

CCB386

EXERCISE - S

Introduction, Ionic Bond and lattice Enthalpy

1. In solid NaCl one Na^+ is surrounded by six Cl^- ions find out total number of directional bonds formed by each Na^+ with Cl^- ions.

CCB112

Lewis Dot Structure and Bond order

2. In SO_3^{2-} , the total number of bond pairs and lone pairs are :

CCB136

3. How many of the following compounds are exception to the octet rule ?
 H_2SO_4 , BeCl_2 , ClO_2 , H_2O , H_2 , CCl_4 , HF , NH_3 , BF_3

CCB156

4. Draw the Lewis dot structure of the given compounds and find how many compounds contain lone pair(s) on central atom ?

- | | | | |
|---------------------------|-------------------------|--------------------------|----------------------------|
| 1. $\text{CCl}_3^\ominus$ | 2. CCl_4 | 3. $\text{NO}_2^\ominus$ | 4. $\text{NO}_3^\ominus$ |
| 5. CO | 6. CO_2 | 7. $\text{SCN}^\ominus$ | 8. $\text{SnCl}_3^\ominus$ |
| 9. $\text{BH}_4^\ominus$ | 10. BeF_4^{2-} | 11. SO_3 | 12. H_3O^+ |
| 13. CO_3^{2-} | | | |

CCB157

Valence Bond theory

5. Which of the given set of orbitals form ' σ ' bond between two atoms along y-axis ?
 $s + p_x$, $s + p_y$, $p_y + p_y$, $p_x + p_y$, $p_y + p_z$, $p_x + p_z$

CCB181

6. Using 's' and 'p' orbitals how many maximum bonds can be formed between two atoms ?

CCB182

Hybridisation & VSEPR theory

7. In which of the given species central atom is sp^3 hybridized ?
 SF_4 , POCl_3 , H_2O , XeO_3 , PCl_5 , OF_2 , SO_3^{2-} , XeO_3F_2 , XeF_4

CCB203

8. Find the number of $\text{p}\pi - \text{p}\pi$ bond in $\text{IO}_3^\ominus$:

CCB204

9. Find out total number of $\text{p}\pi - \text{d}\pi$ bonds present in SO_2 molecule :

CCB205

10. How many compounds have distorted shape ?
 CH_4 , CHCl_3 , CH_2Cl_2 , SF_6 , BF_2Cl

CCB228

11. Among the given species, how many species have maximum '3' atoms lying in a plane ?
 BeCl_2 , SnCl_2 , SF_2 , XeO_3F_2 , IF_7

CCB229

12. Among the given species how many species have sum of maximum number of atoms lying in a plane and number of such planes equal to '7' ?
 $\text{SnCl}_2, \text{SF}_2, \text{NH}_4^+, \text{IF}_7, \text{XeO}_3\text{F}_2, \text{BrF}_3$

CCB230

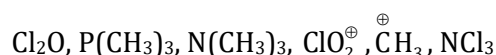
13. Find the maximum number of atoms lying in a plane in AsF_5 :

CCB231

14. Calculate the maximum number of atoms lying in one plane of PCl_3F_2 .

CCB233

15. Among the following total number of planar molecules is / are :



CCB234

Bond parameters & Solid state hybridisation

16. Find the total number of following molecule(s) which have all bond lengths are same :
 $\text{XeF}_4, \text{SF}_4, \text{SH}_2, \text{NO}_3^-, \text{SiF}_4, \text{ClF}_3, \text{PF}_2\text{Cl}_3, \text{XeO}_3\text{F}_2$

CCB232

17. What is the bond angle difference between anionic part of solid Iodine molecule and anionic part of $\text{N}_2\text{O}_5(\text{s})$

CCB256

Bent rule and Drago's rule

18. How many number of atomic orbitals are required, so that their mixing produces hybrid orbitals each having % of s-character nearly equal to 17%.

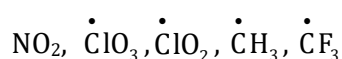
CCB258

19. Which of the following species have axial bond length greater than equatorial bond length :
 $\text{PCl}_5, \text{IF}_7, \text{SF}_6, \text{CCl}_4$

CCB433

Odd electron molecules & molecule do not exist

20. Find the number of species which have tendency to dimerize :



CCB257

Dipole moment

21. A diatomic molecule has a dipole moment of 1.2 D. If bond length is $1.0 \text{ \AA}$, what percentage of an electronic charge exists on each atom.
 [Add the digits untill you are getting single digit. e.g. If the answer is 537, then $5 + 3 + 7 = 15$] again $1 + 5 = 6$ and 6 is to be written as answer.

CCB294

22. Among the given molecules, number of molecules having some net polarity ($\mu \neq 0$)
 $\text{XeF}_4, \text{SO}_2, \text{SF}_4, \text{CH}_2\text{Cl}_2, \text{NF}_3, \text{BF}_3$

CCB417

23. Molecule AB has a bond length of $1.6 \text{ \AA}$ and a dipole moment of 0.40 D. The fractional charge on each atom (absolute magnitude) is q, value of $100q$ to nearest integer is.....
 ($e_0 = 4.8 \times 10^{-10} \text{ esu}$) :-

CCB418

Hydrogen bonding

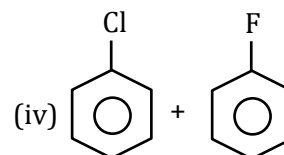
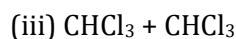
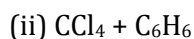
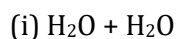
24. Number of species from the following which shows hydrogen bonding.

Chloral, HF, H₂O₂, HPO₃²⁻, HNO₃, H₃BO₃, NaHCO₃, HF₂⁻

CCB318

Weak forces

25. Dipole-Dipole interaction is present in how many of the given species ?



CCB419

Molecular orbital theory (MOT)

26. If s and p-orbital mixing is operative for all species given, then how many following species is/are paramagnetic in nature?

O₂⁻, N₂, C₂, CN⁻, B₂, O₂²⁺

CCB420

27. Total number of species in which highest occupied molecular orbital has gerade type symmetry.

B₂, N₂, C₂, N₂²⁺, O₂, O₂²⁻, N₂²⁻

CCB421

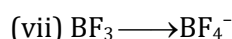
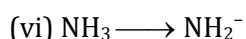
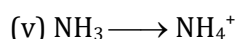
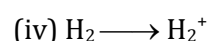
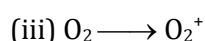
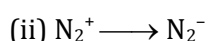
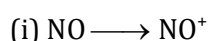
28. How many of the following molecule(s) or ion(s) is/are having bond order less than or equal to two?

B₂, C₂, O₂²⁻, O₂⁺, H₂⁺, N₂⁺, O₂⁻, H₂

CCB422

Miscellaneous

29. In how many conversions, the bond length increases ?



CCB423

30. Find the number of Chemical species which are paramagnetic in nature.

O₂²⁻, NO, ClO₂, OF, B₂

CCB424

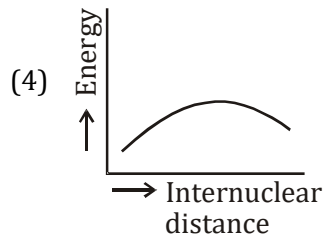
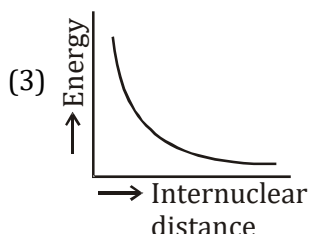
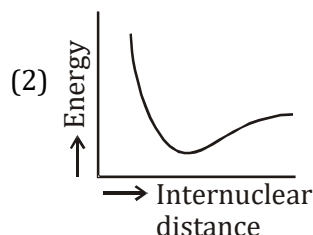
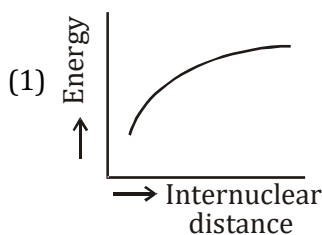
EXERCISE - JEE (Main) PYQ

1. The structure of PCl_5 in the solid state is : [JEE (Main) 2020]

- (1) Square pyramidal
- (2) Tetrahedral $[\text{PCl}_4]^+$ and octahedral $[\text{PCl}_6]^-$
- (3) Square planar $[\text{PCl}_4]^+$ and octahedral $[\text{PCl}_6]^-$
- (4) Trigonal bipyramidal

CCB038

2. The potential energy curve for the H_2 molecule as a function of internuclear distance is : [JEE (Main) 2020]



CCB039

3. The compound that has the largest H-M-H bond angle ($M = \text{N, O, S, C}$), is : [JEE (Main) 2020]
- (1) H_2O
 - (2) CH_4
 - (3) NH_3
 - (4) H_2S

CCB040

4. Match the type of interaction in Column A with the distance dependence of their interaction energy in Column B : [JEE (Main) 2020]

A

- (I) Ion - ion
- (II) Dipole - dipole
- (III) London dispersion

B

- (a) $\frac{1}{r}$
- (b) $\frac{1}{r^2}$
- (c) $\frac{1}{r^3}$
- (d) $\frac{1}{r^6}$

Code:-

- | | |
|----------------------------------|----------------------------------|
| (1) (I)-(a), (II)-(b), (III)-(c) | (2) (I)-(a), (II)-(c), (III)-(d) |
| (3) (I)-(a), (II)-(b), (III)-(d) | (4) (I)-(b), (II)-(d), (III)-(c) |

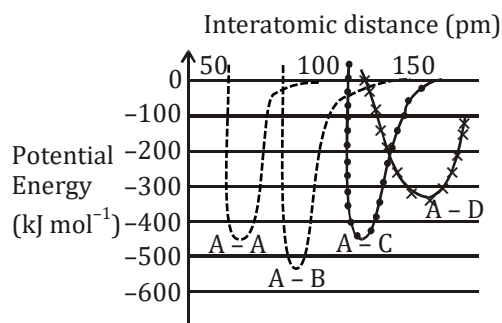
CCB041

5. If the boiling point of H_2O is 373 K, the boiling point of H_2S will be : [JEE (Main) 2020]
- (1) Greater than 300 K but less than 373 K
 - (2) Less than 300 K
 - (3) Equal to 373 K
 - (4) More than 373 K

CCB042

6. The intermolecular potential energy for the molecules A, B, C and D given below suggests that :

[JEE (Main) 2020]



- (1) D is more electronegative than other atoms
- (2) A-D has the shortest bond length
- (3) A-B has the stiffest bond
- (4) A-A has the largest bond enthalpy

CCB043

7. If AB_4 molecule is a polar molecule, a possible geometry of AB_4 is :

[JEE (Main) 2020]

- (1) Square pyramidal
- (2) Tetrahedral
- (3) Square planar
- (4) Rectangular planar

CCB044

8. The shape/structure of $[XeF_5]^-$ and XeO_3F_2 , respectively, are :

[JEE (Main) 2020]

- (1) Pentagonal planar and trigonal bipyramidal
- (2) Trigonal bipyramidal and pentagonal planar
- (3) Octahedral and square pyramidal
- (4) Trigonal bipyramidal and trigonal bipyramidal

CCB045

9. Which one of the following species **doesn't** have a magnetic moment of 1.73 BM, (spin only value) ?

[JEE (Main) 2021]

- (1) O_2^+
- (2) CuI
- (3) $[Cu(NH_3)_4]Cl_2$
- (4) O_2^-

CCB046

10. The hybridisations of the atomic orbitals of nitrogen in NO_2^- , NO_2^+ and NH_4^+ respectively are.

[JEE (Main) 2021]

- (1) sp^3 , sp^2 and sp
- (2) sp , sp^2 and sp^3
- (3) sp^3 , sp and sp^2
- (4) sp^2 , sp and sp^3

CCB047

11. Match List - I with List - II.

List - I
(Compound)

List - II
(Shape)

(A) BrF_5

(I) bent

(B) $[CrF_6]^{3-}$

(II) square pyramidal

(C) O_3

(III) trigonal bipyramidal

(D) PCl_5

(IV) octahedral

Choose the **correct** answer from the options given below :

[JEE (Main) 2022]

- (1) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
- (2) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
- (3) (A) - (II), (B) - (IV), (C) - (I), (D) - (III)
- (4) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)

CCB048

12. Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion A : Zero orbital overlap is an out of phase overlap.

Reason : It results due to different orientation/ direction of approach of orbitals.

In the light of the above statements. Choose the **correct** answer from the options given below

[JEE (Main) 2022]

- (1) Both A and R are true and R is the correct explanation of A
 (2) Both A and R are true but R is NOT the correct explanation of A
 (3) A is true but R is false
 (4) A is false but R is true

CCB049

13. Sum of π -bonds present in peroxodisulphuric acid and pyrosulphuric acid is [JEE (Main) 2023]

CCB050

14. What is the number of unpaired electron(s) in the highest occupied molecular orbital of the following species : N_2 ; N_2^+ ; O_2 ; O_2^+ ? [JEE (Main) 2023]

- (1) 0, 1, 2, 1 (2) 2, 1, 2, 1 (3) 0, 1, 0, 1 (4) 2, 1, 0, 1

CCB425

15. Match List I with List II

LIST-I (molecules/ions)		LIST-II (No. of lone pairs of e^- on central atom)	
(A)	IF_7	I.	Three
(B)	ICl_4^-	II.	One
(C)	XeF_6	III.	Two
(D)	XeF_2	IV.	Zero

Choose the **correct** answer from the options given below:

[JEE (Main) 2023]

- (1) A – II, B – III, C – IV, D – I (2) A – IV, B – III, C – II, D – I
 (3) A – II, B – I, C – IV, D – III (4) A – IV, B – I, C – II, D – III

CCB426

16. Amongst the following, the number of species having the linear shape is ____.

XeF_2 , I_3^+ , C_3O_2 , I_3^- , CO_2 , SO_2 , $BeCl$ and $BCl_2^\ominus$

[JEE (Main) 2023]

CCB427

17. The number of following factors which affect the percent covalent character of the ionic bond is ____

- (a) Polarising power of cation (b) Extent of distortion of anion
 (c) Polarisability of the anion (d) Polarising power of anion

[JEE (Main) 2023]

CCB428

18. Match List-I with List-II :

List-I Species	List-II Geometry/Shape
A. H_3O^+	I. Tetrahedral
B. Acetylide anion	II. Linear
C. NH_4^+	III. Pyramidal
D. ClO_2^-	IV. Bent

Choose the correct answer from the options given below :

[JEE (Main) 2023]

- (1) A-III, B-II, C-I, D-IV (2) A-III, B-I, C-II, D-IV
 (3) A-III, B-IV, C-I, D-II (4) A-III, B-IV, C-II, D-I

CCB429

19. The bond order and magnetic property of acetylide ion are same as that of [JEE (Main) 2023]
(1) NO^+ (2) O_2^+ (3) O_2^- (4) N_2^+

CCB430

20. In which of the following processes, the bond order increases and paramagnetic character changes to diamagnetic one? [JEE (Main) 2023]
(1) $\text{O}_2 \rightarrow \text{O}_2^{2-}$ (2) $\text{NO} \rightarrow \text{NO}^+$ (3) $\text{N}_2 \rightarrow \text{N}_2^+$ (4) $\text{O}_2 \rightarrow \text{O}_2^+$

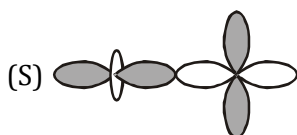
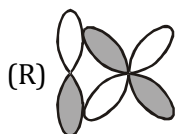
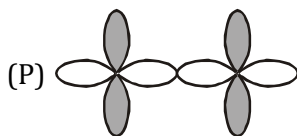
CCB431

EXERCISE - JEE (Advanced) PYQ

1. The number of water molecule(s) directly bonded to the metal centre in $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ is :
[JEE (Advanced) 2009]
CCB071
2. Based on VSEPR theory, the number of 90 degree F–Br–F angles in BrF_5 is :
[JEE (Advanced) 2010]
CCB072
3. Among the following, the number of elements showing only one non-zero oxidation state in their compounds :
O, Cl, F, N,
Sn, Tl, Na, Ti
[JEE (Advanced) 2010]
CCB073
4. In allene (C_3H_4), the type(s) of hybridisation of the carbon atoms is (are) :
[JEE (Advanced) 2012]
(A) sp and sp^3 (B) sp and sp^2 (C) Only sp^2 (D) sp^2 and sp^3
CCB074
5. Which ordering of compounds is according to the decreasing order of the oxidation state of Nitrogen ?
[JEE (Advanced) 2012]
(A) HNO_3 , NO , NH_4Cl , N_2 (B) HNO_3 , NO , N_2 , NH_4Cl
(C) HNO_3 , NH_4Cl , NO , N_2 (D) NO , HNO_3 , NH_4Cl , N_2
CCB075
6. The shape of XeO_2F_2 molecule is :
[JEE (Advanced) 2012]
(A) Trigonal bipyramidal (B) Square planar
(C) Tetrahedral (D) See-saw
CCB076
7. The total number of lone-pairs of electrons in Melamine is :
[JEE (Advanced) 2013]
CCB077
8. Assuming $2s$ - $2p$ mixing is NOT operative, the paramagnetic species among the following is :
[JEE (Advanced) 2014]
(A) Be_2 (B) B_2
(C) C_2 (D) N_2
CCB078

9. Match the orbital overlap figures shown in List-I with the description given in List-II and select the correct answer using the code given below the lists : [JEE (Advanced) 2014]

List-I



List-II

(1) p – d π antibonding

(2) d – d σ bonding

(3) p – d π bonding

(4) d – d σ antibonding

(A) P-2, Q-1, R-3, S-4

(B) P-4, Q-3, R-1, S-2

(C) P-2, Q-3, R-1, S-4

(D) P-4, Q-1, R-3, S-2

CCB079

10. Among the triatomic molecules/ions, BeCl_2 , $\text{N}_3^\ominus$, N_2O , $\text{NO}_2^\oplus$, O_3 , SCl_2 , $\text{ICl}_2^\ominus$, $\text{I}_3^\ominus$ 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 :
(Atomic number : S = 16, Cl = 17, I = 53 and Xe = 54) [JEE (Advanced) 2015]

CCB080

11. The total number of lone pairs of electrons in N_2O_3 is : [JEE (Advanced) 2015]

CCB081

12. The correct statement(s) regarding, (i) HClO , (ii) HClO_2 , (iii) HClO_3 and (iv) HClO_4 , is(are) : [JEE (Advanced) 2015]

- (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)

CCB082

13. The compound(s) with TWO lone pairs of electrons on the central atom is(are) : [JEE (Advanced) 2016]

(A) BrF_5

(B) ClF_3

(C) XeF_4

(D) SF_4

CCB083

14. According to Molecular Orbital Theory :

- (A) $\text{C}_2^{2\ominus}$ is expected to be diamagnetic
(B) $\text{O}_2^{2\oplus}$ is expected to have a longer bond length than O_2
(C) $\text{N}_2^\oplus$ and $\text{N}_2^\ominus$ have the same bond order
(D) $\text{He}_2^\oplus$ has the same energy as two isolated He atoms [JEE (Advanced) 2016]

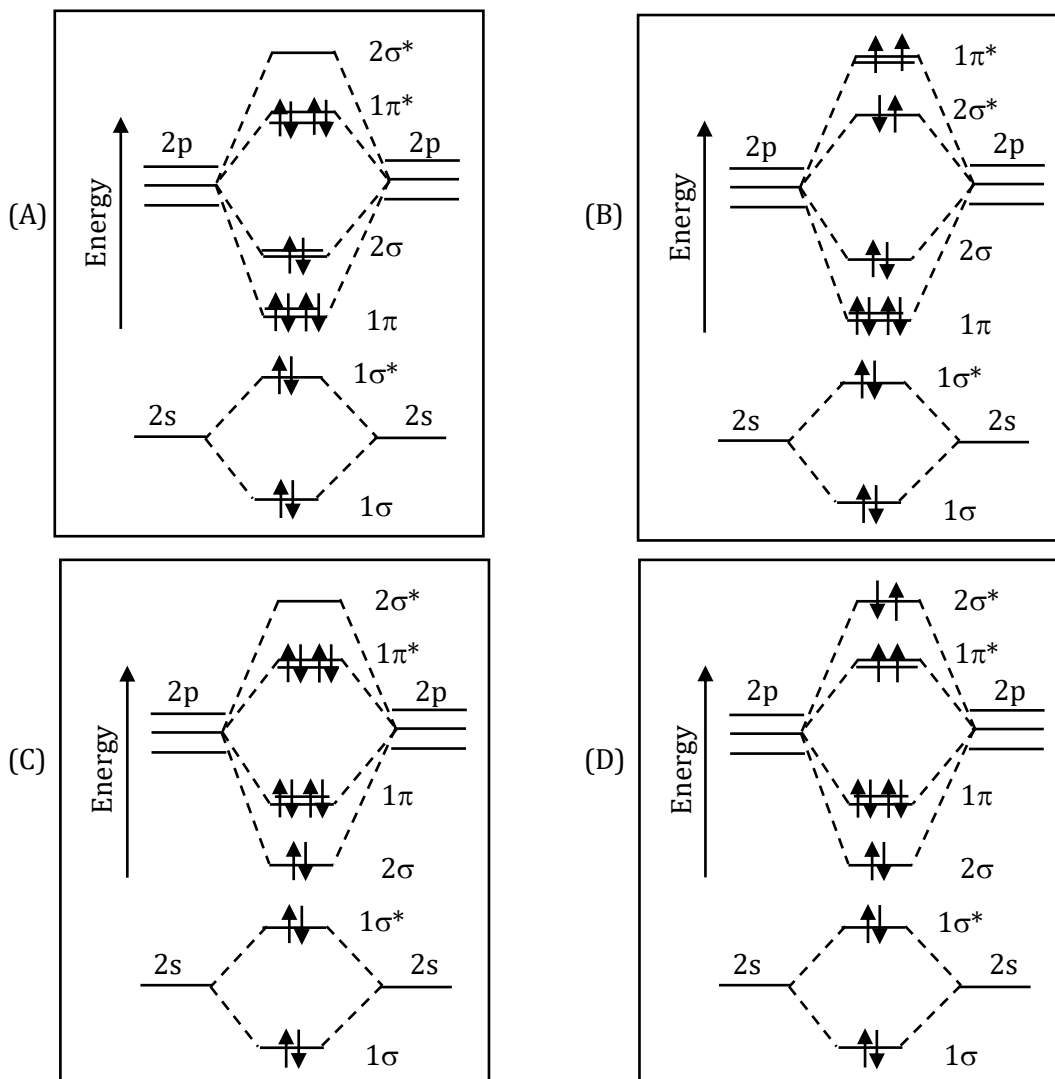
CCB084

15. Among H_2 , He_2^+ , Li_2 , Be_2 , B_2 , C_2 , N_2 , O_2^+ , and F_2 , the number of diamagnetic species is :
[Atomic number : H = 1, He = 2, Li = 3, Be = 4, B = 5, C = 6, N = 7, O = 8, F = 9]
[JEE (Advanced) 2017]
CCB085
16. The sum of the number of lone pairs of electrons on each central atom in the following species is :
[TeBr_6] $^{2-}$, [BrF_2] $^+$, SNF_3 and [XeF_3] $^-$
[Atomic number : N = 7, F = 9, S = 16, Br = 35, Te = 52, Xe = 54]
[JEE (Advanced) 2017]
CCB086
17. Each of the following options contains a set of four molecules. Identify the option(s) where all four molecules possess permanent dipole moment at room temperature :
(A) BeCl_2 , CO_2 , BCl_3 , CHCl_3 (B) SO_2 , $\text{C}_6\text{H}_5\text{Cl}$, H_2Se , BrF_5
(C) BF_3 , O_3 , SF_6 , XeF_6 (D) NO_2 , NH_3 , POCl_3 , CH_3Cl
[JEE (Advanced) 2019]
CCB087
18. Among B_2H_6 , $\text{B}_3\text{N}_3\text{H}_6$, N_2O , N_2O_4 , $\text{H}_2\text{S}_2\text{O}_3$ and $\text{H}_2\text{S}_2\text{O}_8$, the total number of molecules containing covalent bond between two atoms of the same kind is :
[JEE (Advanced) 2019]
CCB088
19. Consider the following compounds in the liquid form :
 O_2 , HF , H_2O , NH_3 , H_2O_2 , CCl_4 , CHCl_3 , C_6H_6 , $\text{C}_6\text{H}_5\text{Cl}$
When a charged comb is brought near their flowing stream, how many of them show deflection as per the following figure ?

[JEE (Advanced) 2020]
CCB089
20. For diatomic molecules, the correct statement(s) about the molecular orbitals formed by the overlap of two $2p_z$ orbitals is(are)
[JEE (Advanced) 2022]
(A) σ orbital has a total of two nodal planes.
(B) σ^* orbital has one node in the xz -plane containing the molecular axis.
(C) π orbital has one node in the plane which is perpendicular to the molecular axis and goes through the center of the molecule.
(D) π^* orbital has one node in the xy -plane containing the molecular axis.
CCB090

21. The correct molecular orbital diagram for F_2 molecule in the ground state is

[JEE (Advanced) 2023]



CCB432

22. Among $[I_3]^\oplus$, $[SiO_4]^{4\ominus}$, SO_2Cl_2 , XeF_2 , SF_4 , ClF_3 , $Ni(CO)_4$, XeO_2F_2 , $[PtCl_4]^{2\ominus}$, XeF_4 , and $SOCl_2$, the total number of species having sp^3 hybridised central atom is ____.

[JEE (Advanced) 2023]

CCB434

JEE (Main) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-A

- This section contains **TWENTY** questions.
- Each question has **FOUR** options (1), (2), (3) and (4). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +4, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1 in all other cases

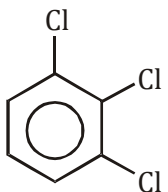
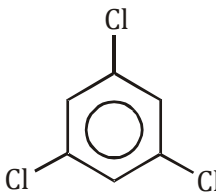
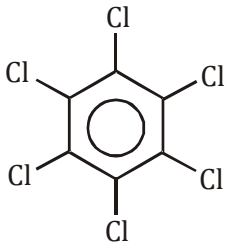
- Correct order of covalent character of alkaline earth metal chloride in :
(1) $\text{BeCl}_2 < \text{MgCl}_2 < \text{CaCl}_2 < \text{SrCl}_2$ (2) $\text{BeCl}_2 < \text{CaCl}_2 < \text{SrCl}_2 < \text{MgCl}_2$
(3) $\text{BeCl}_2 > \text{MgCl}_2 > \text{CaCl}_2 > \text{SrCl}_2$ (4) $\text{SrCl}_2 > \text{BeCl}_2 > \text{CaCl}_2 > \text{MgCl}_2$ CCB001
- Hydrated radius of $\text{M}^{\oplus}$ ions in decreasing order :
(1) $\text{Li}^{\oplus}(\text{aq}) > \text{Na}^{\oplus}(\text{aq}) > \text{K}^{\oplus}(\text{aq}) > \text{Rb}^{\oplus}(\text{aq}) > \text{Cs}^{\oplus}(\text{aq})$
(2) $\text{Li}^{\oplus}(\text{aq}) > \text{Na}^{\oplus}(\text{aq}) < \text{K}^{\oplus}(\text{aq}) < \text{Rb}^{\oplus}(\text{aq}) < \text{Cs}^{\oplus}(\text{aq})$
(3) $\text{Li}^{\oplus}(\text{aq}) > \text{Na}^{\oplus}(\text{aq}) > \text{K}^{\oplus}(\text{aq}) > \text{Rb}^{\oplus}(\text{aq}) < \text{Cs}^{\oplus}(\text{aq})$
(4) $\text{Li}^{\oplus}(\text{aq}) < \text{Na}^{\oplus}(\text{aq}) < \text{K}^{\oplus}(\text{aq}) < \text{Rb}^{\oplus}(\text{aq}) < \text{Cs}^{\oplus}(\text{aq})$ CCB002
- Which of the following π bond will have maximum strength ?
(1) $3p\pi - 3p\pi$ (2) $2p\pi - 3p\pi$ (3) $2p\pi - 2p\pi$ (4) $2p\pi - 3d\pi$ CCB003
- The d- orbitals involved in sp^3d hybridisation (trigonal bipyramidal) is :
(1) $d_{x^2-y^2}$ (2) d_{z^2} (3) d_{xy} (4) d_{xz} CCB004
- The shape of $\text{IF}_4^{\oplus}$ will be :
(1) Square planar (2) Tetrahedral
(3) Pentagonal bipyramidal (4) See-saw shape CCB005
- The bonds present in N_2O_5 are :
(1) Only ionic (2) Covalent & coordinate
(3) Only covalent (4) Covalent & ionic CCB006
- Increasing order of bond length in NO , $\text{NO}^{\oplus}$ and $\text{NO}^{\ominus}$ is :
(1) $\text{NO} > \text{NO}^{\ominus} > \text{NO}^{\oplus}$ (2) $\text{NO}^{\oplus} < \text{NO} < \text{NO}^{\ominus}$
(3) $\text{NO} < \text{NO}^{\oplus} < \text{NO}^{\ominus}$ (4) $\text{NO} < \text{NO}^{\oplus} = \text{NO}^{\ominus}$ CCB007
- The correct order of increasing C — O bond length of CO , $\text{CO}_3^{2\ominus}$, CO_2 is :
(1) $\text{CO}_3^{2\ominus} < \text{CO}_2 < \text{CO}$ (2) $\text{CO}_2 < \text{CO}_3^{2\ominus} < \text{CO}$ (3) $\text{CO} < \text{CO}_3^{2\ominus} < \text{CO}_2$ (4) $\text{CO} < \text{CO}_2 < \text{CO}_3^{2\ominus}$ CCB008

9. Which of the following species will have the minimum bond energy :
 (1) N_2 (2) $N_2^{\ominus}$ (3) $N_2^{\oplus}$ (4) $N_2^{2\ominus}$ CCB009
10. The hydrogen bond is strongest in :
 (1) $O-H \cdots S$ (2) $S-H \cdots O$ (3) $F-H \cdots F$ (4) $O-H \cdots O$ CCB010
11. In solid Argon the atoms are held together :
 (1) By ionic bonds (2) By hydrogen bonds
 (3) By Vander Waal forces (4) None of these CCB011
12. BeF_2 has zero dipole moment whereas H_2O has a dipole moment because :
 (1) Water is linear (2) H_2O is bent
 (3) F is more electronegative than O (4) Hydrogen bonding is present in H_2O CCB012
13. The critical temperature of water is higher than that of O_2 because the H_2O molecule has :
 (1) fewer electrons than O_2 (2) two ionic bonds
 (3) V-shape (4) dipole moment CCB013
14. Hybridisation related to NO_2 molecule is -
 (1) sp^3 (2) sp (3) sp^3d (4) sp^2 CCB014
15. The polarizability of the following ions is/are in the order of
 (1) $I^{\ominus} > Br^{\ominus} > Cl^{\ominus} > F^{\ominus}$ (2) $I^{\ominus} > Br^{\ominus} > F^{\ominus} > Cl^{\ominus}$
 (3) $I^{\ominus} < Br^{\ominus} < Cl^{\ominus} < F^{\ominus}$ (4) $I^{\ominus} < Br^{\ominus} < F^{\ominus} < Cl^{\ominus}$ CCB015
16. Which of the following has fractional bond order :
 (1) $O_2^{2\oplus}$ (2) $O_2^{\ominus}$ (3) $F_2^{2\ominus}$ (4) $H_2^{\ominus}$ CCB016
17. PCl_5 exists but NCl_5 does not because :
 (1) Nitrogen has no vacant $2d$ -orbitals (2) is unstable
 (3) Nitrogen atom is much smaller than P (4) Nitrogen is highly inert CCB017
18. There is no $2s$ - $2p$ mixing in the
 (1) f_2 molecule (2) B_2 molecule (3) N_2 molecule (4) C_2 molecule CCB018
19. Two ice cubes are pressed over each other and unite to form one cube. Which force is responsible for holding them together :
 (1) Vander Waal's forces (2) Covalent attraction
 (3) Hydrogen bond formation (4) Dipole-dipole attraction CCB019
20. Which of the following compound does not exist ?
 (1) PF_3 (2) PCl_5 (3) SF_6 (4) Si_6 CCB020

SECTION-B

- This section contains **TEN** Questions. Attempt any five Questions. First five Questions Attempt will be considered for marking.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places; e.g. 6.25, 7.00, -0.33, -.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +4, if ONLY the correct numerical value is entered as answer.
 Zero Marks : 0 in all other cases.

- Find the number of molecules in which $d_{\pi} - p_{\pi}$ bond(s) is/are present :
 $\text{ClO}_3^{\ominus}$, $\text{PO}_4^{3\ominus}$, SO_3 , $\text{NO}_3^{\ominus}$ CCB021
- What is the number of lone pairs on central atom of $\text{ICl}_4^{\ominus}$? CCB022
- How many compounds have distorted shape ?
 CH_4 , CHCl_3 , CH_2Cl_2 , SF_6 , BF_2Cl CCB023
- For a species of type MX_4 :
 (a) If shape is square planar
 (i) Total number of 90° angles = x
 (ii) Total number of 180° angles = y
 (b) If shape is tetrahedral
 (i) Total number $109^\circ 28'$ angles = z
 What will be the value of $x + y - z$? CCB024
- What is the total number of $p_{\pi} - p_{\pi}$ bonds present in $\text{SO}_4^{2\ominus}$? CCB025
- Find number of planer species out of :
 SF_2 , SF_4 , SF_6 , SO_2 , SO_3 CCB026

- Find the number of molecules having dipole moment less than the dipole moment of  CCB027
- 




8. Find the number of angles less than 120° in PH_2F_3 . CCB028
9. The total number of bonding and antibonding electrons in $\text{O}_2^\oplus$ are "....." and "....." respectively.
[If the answer is 14 and 7, then represent as 147] CCB029
10. Find the ratio of π -electrons in the C_2 -molecule with that of B_2 molecule according to M.O.T. CCB030

JEE (Advanced) Practice Paper

This paper is for yourself practice and assessment the discussion of this paper is optional though you can see PDF solutions or video solutions or solutions in hardcopy whichever is provided.

SECTION-I

- This section contains **ONE** questions of matching type.
- This section contains **One** table (having 3 columns and 4 rows)
- Based on table, there are **THREE** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1 in all other cases.

Answer Q.1, Q.2 and Q.3 by appropriately matching the information given in the three columns of the following table.

Column - I	Column - II	Column - III
(P) d_{yz}	(1) p_y	(i) 1 lobe - 1 lobe overlap
(Q) s	(2) p_x	(ii) 2 lobe - 2 lobe overlap
(R) d_{xz}	(3) d_{yz}	(iii) 4 lobe - 4 lobe overlap
(S) p_z	(4) s	(iv) Zero overlap

1. Which of the following combination results in π -bond formation if internuclear axis is z-axis
 (A) (P), (1), (ii) (B) (P), (4), (i) (C) (R), (4), (iv) (D) (R), (3), (ii)
CCB051
2. Which of the following combination results in σ -bond formation if internuclear axis is z-axis
 (A) (P), (1), (ii) (B) (Q), (3), (ii) (C) (Q), (4), (i) (D) (R), (2), (ii)
CCB052
3. Which of the following combination results in δ -bond formation if internuclear axis is x-axis
 (A) (P), (1), (i) (B) (P), (3), (iii) (C) (R), (3), (iv) (D) (P), (2), (ii)
CCB053

SECTION-II

- This section contains **FIVE** questions.
- Each question has **FOUR** options for correct answer(s). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct option(s).
- For each question, choose the correct option(s) to answer the question.
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4, if only (all) the correct option(s) is (are) chosen.
Partial Marks : +3, if all the four options are correct but **ONLY** three options are chosen.
Partial Marks : +2, if three or more options are correct but **ONLY** two options are chosen, both of which are correct options.
Partial Marks : +1, if two or more options are correct but **ONLY** one option is chosen and it is a correct option.
Zero Marks : 0, if none of the options is chosen (i.e. the question is unanswered).
Negative Marks : -2, in all other cases.

For Example : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

4. Molecule(s) having both polar and non polar bonds is / are
(A) O_2F_2 (B) S_2Cl_2 (C) N_2H_4 (D) S_2F_{10} CCB054
5. Which of the following molecule is/are planar -
(A) CH_2Cl_2 (B) XeF_4 (C) SO_3 (D) NF_3 CCB055
6. The compounds having Keesom, Debye and London forces are :
(A) H_2O_2 (B) H_2O (C) Xe (D) ICl CCB056
7. Select the **CORRECT** statement about following species :
 H_3BO_3 , H_2O_2 , $H-F$
(A) $H_3BO_3(s)$ has a planar structure and becomes less soluble in cold water due to formation of infinite intermolecular hydrogen bonding
(B) H_2O_2 is nonplanar and lesser hydrogen bond strength than H_2O
(C) The boiling point of HF is less than that of H_2O
(D) " HF " can form its acidic salt with KF as a product of KHF_2 CCB057
8. Which of the following is correct order of the bond angles ?
(A) $NH_3 > NF_3$ (B) $PH_3 > PF_3$ (C) $H_2O > OF_2$ (D) $H_2O > Cl_2O$ CCB058

SECTION-III

- This section contains **THREE** questions.
- Each question has matching lists.** The codes for the lists have choices (A), (B), (C) and (D) out of which **ONLY ONE is correct**.
- For each question, marks will be awarded in one of the following categories :
Full Marks : +3, if only the bubble corresponding to the correct option is darkened.
Zero Marks : 0, if none of the bubbles is darkened.
Negative Marks : -1, in all other cases

9.

List-I		List-II	
(P)	C_2	(1)	Same bond order as that of $CN^\ominus$
(Q)	B_2	(2)	sp mixing is possible
(R)	O_2	(3)	Ions obtain by adding and removing one electron, shows same magnetic nature.
(S)	N_2	(4)	Ionisation energy is lower as compare to corresponding atomic form

The **CORRECT** option is

- (A) $P \rightarrow 2, 3, 4$; $Q \rightarrow 2, 3, 4$; $R \rightarrow 3$; $S \rightarrow 1, 3, 4, 2$ (B) $P \rightarrow 1, 2, 3$; $Q \rightarrow 1, 2, 3$; $R \rightarrow 4$; $S \rightarrow 3, 2$
(C) $P \rightarrow 2, 3$; $Q \rightarrow 2, 3$; $R \rightarrow 2, 4$; $S \rightarrow 1, 2, 3$ (D) $P \rightarrow 2$; $Q \rightarrow 2, 3$; $R \rightarrow 3, 4$; $S \rightarrow 1, 2$

CCB059

10. Match the lists based on the information given in the paragraph.

List-I		List-II	
(P)	ClF ₃	(1)	Tetrahedral
(Q)	CF ₄	(2)	See-saw
(R)	SF ₄	(3)	T-Shape
(S)	NF ₃	(4)	Trigonal pyramidal

Select CORRECT code for shape of molecule :

- (A) P → 3; Q → 1; R → 2; S → 4
 (B) P → 3; Q → 1; R → 4; S → 2
 (C) P → 1; Q → 3; R → 2; S → 4
 (D) P → 3; Q → 2; R → 1; S → 4

CCB060

- 11.

List-I		List-II	
(P)	XeF ₄	(1)	sp ³ d hybridised with 2 lone pair on central atom
(Q)	BrF ₅	(2)	sp ³ d ² hybridised with 2 lone pair on central atom
(R)	ClF ₃	(3)	sp ³ hybridised with 1 lone pair on central atom
(S)	SO ₃ ²⁻	(4)	sp ³ d ² hybridised with 1 lone pair on central atom

Code :

- | | | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|----------|
| P | Q | R | S | P | Q | R | S |
| (A) 1 | 2 | 3 | 4 | (B) 2 | 4 | 1 | 3 |
| (C) 2 | 4 | 3 | 1 | (D) 3 | 1 | 4 | 2 |

CCB061

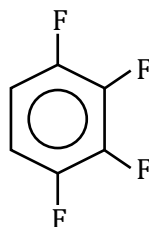
SECTION-IV

- This section contains **TWO** paragraphs.
- Based on each paragraph, there are **TWO** questions.
- Each question has **FOUR** options (A), (B), (C) and (D) **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :
 Full Marks : +3, if only the bubble corresponding to the correct answer is darkened.
 Zero Marks : 0, in all other cases.

Paragraph for Questions 12 and 13

Dipole moment of a molecule is a vector sum of all the individual bond moments. Mathematically it is $\mu = q \times d$, where q is magnitude of particle charges and d is the distance between centre of opposite charges. Its main application includes, determination of polarity of bond, symmetry of molecule and in calculation of % ionic character.

12. The net dipole moment produced in the molecule if each C-F bond has dipole equal to μ , is :



- (A) 2μ (B) $\sqrt{2}\mu$ (C) 4μ (D) $\sqrt{3}\mu$

CCB062

13. In HI molecule if observed dipole moment is 1.2 Debye and also the interionic distance between atoms (d_{HI}) is 1 Å. The percentage covalent character in HI bond will be :

- (A) 25% (B) 75% (C) 50% (D) 12.5%

CCB063

Paragraph for Questions 14 and 15

During the formation of a covalent bond each participating atom usually acquires electronic configuration to that of nearest noble gas, and the shared electron pair remains localized between the bonded nuclei. Besides these shared electrons there are certain electron pairs which remain localized on C.A. or on substituent or both and are called non-bonding or lone pair electrons.

14. Which of the following species does / do not follow octet rule:
 (A) Hypovalent (B) Hypervalent
 (C) Odd electron molecules (D) All

CCB064

15. In SO_3^{2-} the total number of lone pairs and bond pairs are respectively
 (A) 18 and 4 (B) 9 and 8 (C) 9 and 4 (D) 7 and 4

CCB065

SECTION-V

- This section contains **FOUR** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the second decimal place; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct).
- Answer to each question will be evaluated according to the following marking scheme:
 Full Marks : +3, if ONLY the correct numerical value is entered as answer.
 Zero Marks : 0, in all other cases.

16. Consider y-axis as internuclear axis, how many of following will lead to π -bond formation :
 (i) $p_y - p_y$ (ii) $p_x - p_x$ (iii) $p_z - p_z$ (iv) $d_{xy} - d_{xy}$
 (v) $d_{yz} - d_{yz}$ (vi) $p_x - d_{xy}$ (vii) $d_{xy} - p_z$ (viii) $d_{xz} - d_{xz}$

CCB066

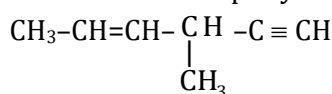
17. Find the no. of species having fractional bond order :
 $\text{N}_2^{\oplus}, \text{N}_2^{\ominus}, \text{O}_2, \text{O}_2^{\oplus}, \text{F}_2, \text{B}_2^{\oplus}, \text{C}_2^{\oplus}, \text{CN}^{\ominus}, \text{NO}^{\oplus}$

CCB067

18. Find the number of molecules having intramolecular hydrogen bonding in the following :
 ice, o-boric acid, o-nitrophenol, o-chlorophenol, chloral hydrate, o-salicylaldehyde

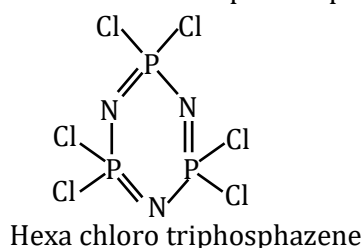
CCB068

19. Total number of sp^3 hybridised atom(s) in given hydrocarbon.



CCB069

20. Find the ratio of sp^3 and sp^2 hybridised atoms which are present in ring in following molecule :



CCB070

ANSWER KEY

EXERCISE - O

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A	C	A	A	D	B	A	B	A	A
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	B	C	A	B	D	C	B	C	D	B
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	C	A	C	C	D	D	D	A	C	C
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	A	D	B	A	D	A	B	D	D	A
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	B	A	A	B	A	C	A	D	C	B
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	C	A	C	C	B	B	D	C	A	B
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	C	A	B	C	B	B	B	C	A	C
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	B	A	B	D	D	A	C	C	C	C
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	B	A	A	A	C	B	B	B	B	A
Que.	91	92	93	94	95	96	97	98	99	100
Ans.	C	C	A	C	B	B	B	C	D	A
Que.	101	102	103	104	105	106	107	108	109	110
Ans.	C	B	D	C	C	B	D	C	C	C
Que.	111	112	113	114	115	116	117	118	119	120
Ans.	B	A	C	B	A	D	C	C	B	C
Que.	121	122	123	124	125	126	127	128	129	130
Ans.	D	A	A	D	C	B	D	C	B	B
Que.	131	132	133	134	135	136	137	138	139	140
Ans.	C	A	A	B	C	D	B	B	C	B
Que.	141	142	143	144	145	146	147	148	149	150
Ans.	B	C	A	B	C	D	C	A	D	C
Que.	151	152	153	154	155	156	157	158	159	160
Ans.	B	B	B	D	C	C	C	C	B	B
Que.	161	162	163	164	165	166	167	168	169	170
Ans.	C	B	D	B	A	A	B	A	A	D
Que.	171	172	173	174	175	176	177	178	179	180
Ans.	D	A	A	B	C	D	A	C	B	B

Que.	181	182	183	184	185	186	187	188	189	190
Ans.	A	D	B	A	A	C	C	D	A	A
Que.	191	192	193	194	195	196	197	198	199	200
Ans.	A	B	A	C	C	C	C	C	C	B
Que.	201	202	203	204	205	206	207	208	209	210
Ans.	C	B	C	A	B	D	A	B	B	A
Que.	211	212	213	214	215	216	217	218	219	220
Ans.	A	A	C	C	B	A	D	C	D	D
Que.	221	222	223	224	225	226	227	228	229	230
Ans.	D	B	B	D	C	A	B	B	B	A
Que.	231	232	233	234	235	236	237	238	239	240
Ans.	B	B	A	B	D	B	D	A	C	D
Que.	241	242	243	244	245	246	247	248	249	250
Ans.	B	D	C	AC	BC	AC	BCD	AC	ABC	AB
Que.	251	252	253	254	255	256	257	258	259	260
Ans.	BC	CD	BC	ABD	ABC	BCD	CD	ABC	ACD	BD
Que.	261	262	263	264	265	266	267	268	269	270
Ans.	BCD	AB	ABC	ABCD	BCD	ABC	ABC	ABC	ACD	BD
Que.	271	272	273	274	275	276	277	278	279	280
Ans.	ABCD	AB	AB	ABC	ABD	ABC	AD	BCD	ABC	B
Que.	281	282	283	284	285	286	287	288	289	290
Ans.	A	A	D	A	B	C	B	C	C	B
Que.	291	292	293	294						
Ans.	C	B	C	D						

EXERCISE - S

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	0	13	4	5	2	3	5	0	1	3
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	3	1	4	4	3	4	60	6	1	4
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	7	4	5	6	3	2	4	6	4	4

EXERCISE - JEE (Main) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	2	2	2	2	2	3	1	1	2	4
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	3	1	8	1	2	5	3	1	1	2

EXERCISE - JEE (Advanced) PYQ

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	4	0	2	B	B	D	6	C	C	4
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	8	BC	BC	AC	5 or 6	6	BD	4	6	AD
Que.	21	22								
Ans.	C	5								

JEE (Main) Practice Paper

Section-A	Q.	1	2	3	4	5	6	7	8	9	10
	A.	3	1	3	2	4	2	2	4	4	3
	Q.	11	12	13	14	15	16	17	18	19	20
	A.	3	2	4	4	1	4	1	1	3	4
Section-B	Q.	1	2	3	4	5	6	7	8	9	10
	A.	3	2	3	0	0	3	3	8	105	2

JEE (Advanced) Practice Paper

Section-I	Q.	1	2	3			
	A.	A	C	B			
Section-II	Q.	4	5	6	7	8	
	A.	ABCD	BC	ABD	ABCD	AC	
Section-III	Q.	9	10	11			
	A.	D	A	B			
Section-IV	Q.	12	13	14	15		
	A.	D	B	D	C		
Section-V	Q.	16	17	18	19	20	
	A.	5	5	4	3	1	