3 CHAPTER

BASIC CHEMICAL BONDING

EXERCISE-1

[SINGLE CORRECT CHOICE TYPE]

INTRODUCTION

Q.1 What will be the correct formula if A and B are involved to form ionic compound. The electronic configuration of A and B are as follows:

A : [Ar] $3d^{10}$ $4s^2$ **B : [Ne] $3s^2$ $3p^4$**

(A) A_2B (B) AB (C) AB_2 (D) A_2B_3

Q.2 The atomic number of two elements A and B are 17 and 20 respectively. The formula of ionic compound made by A and B is (where the cation is conventionally written first)

(A) AB (B) A_2B (C) AB_2 (D) BA_2

Q.3 Which of the following pair(s) represent(s) the isoelectronic species ?

(I) CH_4 and NH_4^+ (II) SO_2 and NO_3^- (III) NO and $CN^{\ominus}$ (IV) SO_2 and NH_3

(A) I & II (B) II, III, IV (C) I, II, III, IV (D) II & III

Q.4 Which of the following ionic compound has highest lattice energy?

(A) NaF (B) NaCl (C) AlF_3 (D) Al_2O_3

Q.5 Which of the following statements is correct regarding HCN and HNC?

(A) Both produce same ions on ionisation

(B) Both have equal tendency to release proton

(C) Both have same central atom.

(D) Both are not linear

Q.6 The total number of valence electrons in 4.2 g of N_3^- ion are

(A) 2.2 N_A (B) 4.2 N_A (C) 1.6 N_A (D) 3.2 N_A

Q.7 In which of the following species the bonds are non-directional.

(A) NCl_3 (B) RbCl (C) $BeCl_2$ (D) BCl_3

Q.8 Which has the highest lattice energy?

(A) LiF (B) LiCl (C) NaCl (D) MgO

Q.9 Which set of species is molecule at room temperature?

(A) NaCl, CO_2 (B) HCl, SiO_2 (C) HCl, CO_2 (D) NaCl, SiO_2

Q.10 Bond energy of which of the following interaction is less than 8 kJ/mole.

(A) $Cu^{2+}(aq)$ and NH_3 (B) Xe and H_2O (C) Na^+ and $[BF_4]^-$ (D) C_2H_5OH and HF

Q.11 Variable covalency is exhibited by which pair of atoms , when formal charge on atom is zero.

(A) P and S (B) N and O (C) N and P (D) F and Cl

Q.12 Consider three hypothetical ionic compounds AB, A_2B and A_2B_3 , where in all the compounds B is in –2 oxidation state and A has a variable oxidation state. What is the correct order of lattice energy for these compounds ?

(A) $A_2B > AB > A_2B_3$ (B) $A_2B_3 > AB > A_2B$

(C) $AB > A_2B > A_2B_3$ (D) $A_2B_3 > A_2B > AB$

Q.13 Read the following information about ionic compound -

(I) For formation of ionic compound ionisation potential of metal should be high.

(II) Ionic bond has non-directional nature.

(III) For completion of octet ionic bond can represent as a coordinate bond.

(IV) Ionic compound does not conduct electricity in solid state but conduct electricity in molten state.

(V) During the solubility of ionic compound if lattice energy < Hydration energy then compound is soluble in water.

The number of statements which are **correct** is :

(A) two (B) three

(C) one (D) All five statement are correct

Q.14 The number of excited state of centre atom to the formation of , IF_7 , PCl_5, SO_2Cl_2 and NH_3 are x, y, z and w respectively, the correct order of :

(A) x > z > y > w (B) x = z = y = w (C) x > z = y < w (D) x < z < y < w

Q.15 The succeessive ionization enthalpies of an element (M) are 899, 1757 and 14850 kJ mol^{-1}. Formula of its chloride is :

(A) MCl (B) MCl_2 (C) MCl_3 (D) MCl_4

Q.16 A compound contains three elements A, B and C, if the oxidation number of A = +2, B = +5 and C = –2, the possible formula of the compound is

(A) $A_3(B_4C)_2$ (B) $A_3(BC_4)_2$ (C) $A_2(BC_3)_2$ (D) ABC_2

LEWIS OCTET RULE

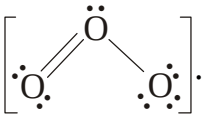
Q.17 What is the formal charge on nitrogen in NO_3^-?

(A) + 3 (B) +1 (C) –1 (D) + 4

Q.18 Sum of formal charge of all atom of given species is

(A) real charge on given species (B) imiginary charge charge on given species

(C) oxidation state of central atom (D) oxidation state of surrounding atom

Q.19 The formal charges on three 'O' atoms in O_3 molecule are  .

(A) 0, 0, 0 (B) 0, 0, –1 (C) 0, 0, +1 (D) 0, +1, –1

Q.20 Find out the molecule/ species which is not electron defficient.

(A) $AlCl_3$ (B) BeH_2 (C) BH_4^- (D) BF_3

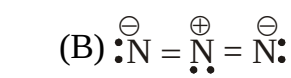
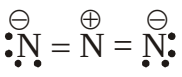
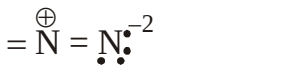
Q.21 The number of π-bonds and σ-bonds in the octet structure of SO_3 is

(A) $3\sigma, 3\pi$ (B) $3\sigma, 2\pi$ (C) $3\sigma, 1\pi$ (D) None of these

Q.22 Which of following molecule/specie is having maximum number of lone pairs in Lewis - dot structure.

(A) BH_4^- (B) BF_4^- (C) CN^- (D) $COCl_2$

Q.23 Which of the following is correct Lewis Dot structure for N_3^-.

(A)  (B)  (C)  (D) 

Q.24 Which of the following molecule has co-ordinate bond in it's Lewis structure.

(A) CO_3^{2-} (B) SO_3 (C) NO_2^- (D) HCN

Q.25 Which of the following ion has inert gas configuration and having complete octet.

(A) B^{+3} (B) Al^{+3} (C) Ga^{+3} (D) All of these

Q.26 Which of the following does not exist?

(A) SF_4 (B) OF_6 (C) OF_2 (D) SF_6

Q.27 The compound which does not exist, is

(A) NCl_3 (B) NCl_5 (C) PCl_5 (D) PH_3

Q.28 Which of the following doesn't obeys Lewis octet rule?

(A) CO (B) NO_3^- (C) O_3 (D) NO

Q.29 Which of the following has incomplete octet?

(A) NH_3 (B) BF_3 (C) $SiCl_4$ (D) CO_2

Q.30 Which of the following molecule does not exist?

(A) PF_5 (B) NOF_3 (C) FCl_3 (D) NO_2Cl

VBT (OVERLAPPING THEORY)

Q.31 Which of the approaching axis is not appropriate to form π-bond by two p_y-orbitals.

(A) y-axis (B) x-axis (C) z-axis (D) No suitable axis

Q.32 Which of the following elements does not form stable diatomic molecules?

(A) Iodine (B) Phosphorus (C) Nitrogen (D) Oxygen

Q.33 Which of the following combination will not form π-bond?

(A) p – p overlapping (B) s – p overlapping (C) d – d overlapping (D) d – p overlapping

Q.34 Choose the correct order of bond strength by overlapping of atomic orbitals

(A) 1s-1s > 1s-2s > 1s-2p (B) 2s-2s > 2s-2p > 2p-2p

(C) 2s-2p > 2s-2s > 2p-2p (D) 1s-1s > 1s-2p > 1s-2s

Q.35 The possible orientations in space for a d-orbital is

(A) 7 (B) 3 (C) 1 (D) 5

Q.36 Which of the following orbital is having longest lobe.

(A) 3p (B) 3d (C) 2p (D) 4d

Q.37 Choose the incorrect option for bond strength.

(A) $2p_\pi - 2p_\pi > 2p_\pi - 3p_\pi$ (B) $2p_\pi - 3p_\pi > 2p_\pi - 3d_\pi$

(C) 1s– 2p > 2s – 2p (D) 2s– 2p > 3s – 3p

Q.38 If x-axis is the internuclear axis, π-bond is formed by overlap between :

(A) p_y and d_{xy} (B) p_x and d_{xy} (C) p_x and $d_{x^2-y^2}$ (D) None of these

Q.39 Which of the following is maximum thermal stable compound?

(A) HF (B) HCl (C) HBr (D) HI

Q.40 Which of the molecule has p – p overlapping?

(A) Cl_2 (B) HCl (C) H_2O (D) NH_3

Q.41 The strength order of π bond is

(A) 2p–2p > 2p–3d > 2p–3p > 3p–3p (B) 2p–2p < 2p–3d < 2p–3p < 3p–3p

(C) 2p–2p < 2p–3d < 2p–3p > 3p–3p (D) 2p–2p < 2p–3d > 2p–3p < 3p–3p

Q.42 d_{z^2} orbital is combination of :

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

Q.43 If internuclear axis is y then π - bond is form by -

(A) $p_x + p_x$ (B) $s + p_x$ (C) $p_y + p_y$ (D) $p_x + p_y$

Q.44 Which is correct order of bond strength ?

(A) 1s – 1s > 2p – 2p (B) $2p_\pi - 2p_\pi < 2p_\pi - 3d_\pi$

(C) $2p_\pi - 3p_\pi > 2p_\pi - 3d_\pi$ (D) 2s – 2s > 2p – 2p

Q.45 Assuming the bond direction to be z-axis, which of the overlapping of atomic orbitals of two atom (A) and (B) will result in bonding?

(I) s-orbital of A and p_x orbital of B (II) s-orbital of A and p_z orbital of B

(III) p_y-orbital of A and p_z orbital of B (IV) s-orbitals of both (A) and (B)

(A) I and IV (B) I and II (C) III and IV (D) II and IV

Q.46 In which of the following pair of elements the π -bond formation tendency is maximum.

(A) S and O (B) Si and O (C) P and O (D) Cl and O

Q.47 Which of the following set of orbital overlap can not form π- bond.

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

Q.48 Which one of the following bonds has the highest bond energy :

(A) C – C (B) Si – Si (C) Ge – Ge (D) Sn – Sn

Q.49 Two p_z orbitals from two atoms can form a σ-bond when they approach along.

(A) x-axis (B) z-axis (C) y-axis (D) None

Q.50 Number of σ and π bonds present in : $CH_3 - CH = CH - C \equiv CH$

(A) 10σ, 3π (B) 10σ, 2π (C) 9σ, 2π (D) 8σ, 3π

HYBRIDISATION

Q.51 What is the hybridisation of anionic part of solid Cl_2O_6 molecule.

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

Q.52 How many bond angles of 90° are present in trigonal bipyramidal shape of PCl_5?

(A) 9 (B) 6 (C) 4 (D) None of these

Q.53 The number of 90° angle in SF_6 are :

(A) 4 (B) 8 (C) 12 (D) 16

Q.54 Choose the correct option for following statements :

(I) sp^3 hybrid orbitals are at 90° to one another

(II) sp^3d^2 adjacent hybrid orbitals are at 90° to one another

(III) sp^2 hybrid orbitals are at 120° to one another

(IV) Bond order of N–O bond in NO_3^- is $1\frac{1}{3}$

(A) T F T F (B) T T F F (C) F T T T (D) F T F T

Q.55 Which of the following compound having number of pπ-pπ bond is equal to pπ-dπ bonds?

(A) SO_2 (B) SO_3 (C) O_3 (D) $POCl_3$

Q.56 What is the state of hybridisation of anionic part of solid N_2O_5

(A) sp (B) sp^2 (C) sp^3 (D) Not applicable

Q.57 The pair of compounds having similar geometry.

(A) BF_3, NF_3 (B) BeF_2, H_2O (C) BCl_3, PCl_3 (D) BF_3, CH_3^+

Q.58 TeF_5^-, XeF_2, I_3^+, XeF_4, PCl_3

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

(A) Square pyramidal (B) Square planar

(C) Trigonal planar (D) Linear

Q.59 Which of the following species does not exist?

(A) XeF_3^- (B) XeF_4 (C) XeF_5^- (D) XeF_6

Q.60 Find the species / molecule is having maximum number of lone pair on the central atom.

(A) $ClOF_4^-$ (B) $ClOF_2^+$ (C) BH_4^- (D) $XeOF_2$

Q.61 What is the hybridisation of C-atoms bonded by the triple bond in benzyne.

(A) sp (B) sp^2 (C) sp^3 (D) Can't be predicted

Q.62 The hybridisation of central atom of cationic and anionic part of Cl_2O_6 (solid) respectively.

(A) sp^2, sp^2 (B) sp^3, sp^2 (C) sp^2, sp^3 (D) sp, sp^2

Q.63 The number of π bonds and σ-bonds in case of lewis structure of SO_4^{2-}.

(A) 4σ, 2π (B) 4σ, 1π (C) 4σ, zero π (D) 4σ, 4π

Q.64 The orbital involved in case of sp^3d^2 hybridisation is

(A) $s + p_x + p_y + d_{xy} + p_z + d_{z^2}$ (B) $s + p_x + p_y + d_{z^2} + p_z + d_{yz}$

(C) $s + p_x + p_y + p_z + d_{z^2} + d_{x^2-y^2}$ (D) $s + p_x + p_y + p_z + d_{yz} + d_{xz}$

Q.65 Which of the following molecule / species is having minimum number of lone pair on its central atom.

(A) BrF_3 (B) BrF_4^- (C) XeF_5^+ (D) I_3^-

Q.66 If pure 'p' orbitals are involved in molecule formation, then the shape of H_3O^+ will be

(A) Pyramidal (B) Tetrahedral (C) Angular (D) Planar

Q.67 The species which is not tetrahedral in shape is

(A) ICl_4^- (B) BF_4^- (C) AlH_4^- (D) $\overset{\oplus}{N}F_4$

Q.68 Which of the following pair of species is not isostructural ?

(A) KrF_2, ICl_2^- (B) SO_3, SO_3^{2-} (C) CO_3^{2-}, BO_3^{3-} (D) SiO_4^{4-}, IO_4^-

Q.69 Find the pair of species having same shape but different hybridisation.

(A) SO_3, CO_3^{2-} (B) NO_2^-, ClO_2^- (C) $BeCl_2$, HCN (D) XeF_2, $SnCl_2$

Q.70 The hybridisation of all carbon atom in benzene is

(A) sp^2 (B) sp^3 (C) sp^2 and sp^3 (D) sp^2 and sp

Q.71 d_{z^2} orbital is present in which of the following hybridisation.

(A) sp^3d (Square pyramidal) (B) sp^3

(C) sp^3d^2 (D) sp^3d^4 (square anti prismatic)

Q.72 Which of the following molecule has two π-bonds in it's structure.

(A) $N_3^{\ominus}$ (B) SCN^- (C) C_3^{4-} (D) All are correct

Q.73 What is the hybridisation of Xe in cationic part of solid XeF_6.

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

Q.74 Which of the following d-orbital takes part in sp^3d hybridisation?

(A) d_{xy} (B) d_{yz} (C) d_{z^2} (D) d_{zx}

Q.75 Shape of NH_4^+ and BF_4^- are :

(A) Tetrahedral & Tetrahedral (B) Pyramidal & Tetrahedral

(C) Square planar & Tetrahedral (D) Tetrahederal & Trigonal planar

Q.76 Which of the following has total 5 lone pair in molecule?

(A) CO_2 (B) SO_2 (C) ClF_3 (D) $[XeF_5]^-$

Q.77 Which of the following is T-shaped?

(A) PCl_3 (B) BCl_3 (C) NH_3 (D) ClF_3

Q.78 Which of the following is linear?

(A) CO_2 (B) $BeCl_2$ (C) NO_2^+ (D) All of these

CO-ORDINATE BOND

Q.79 Which of the following molecule when combines with water, then H_2O molecule does not attack at central atom?

(A) PCl_3 (B) NCl_3 (C) ClF_3 (D) CO_2

Q.80 For which of the following combination, Lewis-acid base interaction does not occur:

(A) $H_3BO_3 + H_2O$ (B) $CO_2 + H_2O$ (C) $KI + I_2$ (D) $SF_6 + H_2O$

Q.81 Which one is least basic among the following trihalide?

(A) NF_3 (B) NCl_3 (C) NBr_3 (D) NI_3

Q.82 Which of them follows octet rule and also act as Lewis acid?

(A) BCl_3 (B) XeF_2 (C) SiF_4 (D) PCl_5

Q.83 Which of following molecule can show Lewis acidity.

(I) CO_2 (II) Br_2 (III) $SnCl_2$ (IV) HF (V) NMe_3

(A) III, IV (B) I, II, III (C) I, III, IV (D) II, III, V

Q.84 Which of the following species will be the strongest Lewis acid.

(A) Fe^0 (B) Fe^{+3} (C) Fe^{2+} (D) Fe^{+1}

Q.85 $F_3B + :NH_3 \longrightarrow F_3B \leftarrow :NH_3$

What will be the hybridisation of B and N respectively?

(A) sp^3 , sp^3 (B) sp^2 , sp^3 (C) sp^2 , sp^2 (D) sp^2 , sp^2

Q.86 The maximum no of atoms in a plane for the compound formed by reaction of SbF_5 with SO_2 is :

(A) 8 (B) 6 (C) 7 (D) 9

Q.87 SbF_5 reacts with XeF_4 to form an adduct. The shapes of cation and anion in the adduct are respectively.

(A) Square planar, trigonal bipyramidal (B) T-shaped, octahedral

(C) Square pyramidal, octahedral (D) Square planar, octahedral

Q.88 MF (M^+ = alkali metal cation) + $XeF_4 \longrightarrow$ 'A'

The state of hybridisation of the central atom in 'A' and shape of the species are respectively.

(A) sp^3d, TBP (B) sp^3d^3, distorted Octahedral

(C) sp^3d^3 , Pentagonal Planar (D) No compound formed at all

Q.89 $IF_7 + BF_3 \rightarrow [X]$

What is the shape of cationic and anionic part in ionic compound [X] respectively?

(A) Trigonal bipyramidal and Octrahedral

(B) Trigonal bipyramidal & Tetrahedral

(C) Octahedral & Tetrahedral

(D) Pentagonal bipyramidal & Tetrahedral

BOND PARAMETERS & BENT'S RULE

Q.90 For which of the following molecule s-character is found to be maximum in lone pair present at central atom.

(A) NH_3 (B) H_2O (C) SF_2 (D) AsH_3

Q.91 It has been observed that % 's' character in Sb–H bond in SbH_3 is 0.5%. Predict the % 's' character in the orbital occupied by the lone pair is

(A) 99.5 % (B) 99.0 % (C) 98.5 % (D) 98.0 %

Q.92 The orbitals occupy more space will have more "s" character and accordingly which is incorrect statement.

(A) l.p. will go to the axial position of PBP (pentagonal bipyramidal) geometry.

(B) l.p.will go to the equitorial position of TBP (trigonal bipyramidal) geometry.

(C) Axial bond lengths of PBP geometry is longer than equatorial.

(D) Equatorial bond lengths of TBP geometry are shorter than axial.

Q.93 Calculate the % p character in the orbital occupied by the lone pairs in water molecule.

[Given : $\square$ HOH is 104.5° and Cos (104.5°) = – 0.25]

(A) 80% (B) 20% (C) 70 % (D) 75%

Q.94 As the s-character of hybrid orbitals increases

(A) Bond angle decreases (B) Bond angle increases

(C) Bond strength decreases (D) Bond length increases

Q.95 Select the correct order of bond angle of the following species.

ClO_3^- , BrO_3^-, IO_3^-

(A) $BrO_3^- > IO_3^- > ClO_3^-$ (B) $ClO_3^- > BrO_3^- > IO_3^-$

(C) $IO_3^- > BrO_3^- > ClO_3^-$ (D) $IO_3^- < BrO_3^- > ClO_3^-$

Q.96 The bond order of X–O bond in HPO_3^{2-} and ClO_4^- are respectively.

(A) 1.25 and 1.75 (B) 1.33 and 1.25 (C) 1.33 and 1.33 (D) 1.33 and 1.75

Q.97 Find out the relation between (adjacent angle) $\widehat{FClF}$ and $\widehat{FBrF}$ bond angle in ClF_3 and BrF_3 molecule respectively.

(A) $\widehat{FClF} = \widehat{FBrF}$ (B) $\widehat{FClF} > \widehat{FBrF}$

(C) $\widehat{FClF} < \widehat{FBrF}$ (D) Can't predicted.

Q.98 The compound is having shortest S–O bond length is

(A) SO_3F^- (B) SO_4^{2-} (C) SOF_4 (D) $SOCl_2$

Q.99 Which of the following statement is not correct regarding SF_2Cl_2 molecule?

(A) Two axial bond lengths are longer compared to two equitorial bond lengths.

(B) Two S–F bond lengths are identical.

(C) Two S–Cl bond lengths are identical.

(D) Lone pair is not changing its position.

Q.100 The total right angled $\angle$ ClPCl are present in PCl_5, PCl_4^+, PCl_6^- _ , _ , _ respectively.

(A) 0, 1, 4 (B) 6, 0, 4 (C) 2, 4, 0 (D) 6, 0, 12

Q.101 If hybridisation is absent in NH_3 and pure orbitals involved in bonding then select the incorrect statement.

(A) All bonds have equal strength (B) Shape of NH_3 will be pyramidal

(C) All $\angle$HNH angles are 90° (D) All $\angle$HNH angles are 107°

Q.102 Which of the following has 90° bond angle in its structure?

(A) IF_7 (B) SF_6 (C) PCl_5 (D) All

Q.103 The correct order of $\angle$ OPX bond angle is (X = F, Cl, Br):

(A) $POF_3 > POCl_3 > POBr_3$ (B) $POF_3 < POCl_3 < POBr_3$

(C) $POF_3 = POCl_3 = POBr_3$ (D) $POCl_3 > POF_3 > POBr_3$

Q.104 The correct order of bond length (C – O) is

(A) $CO_2 < CO < CO_3^{2-}$ (B) $CO_3^{2-} < CO < CO_2$

(C) $CO < CO_2 < CO_3^{2-}$ (D) $CO < CO_3^{2-} < CO_2$

Q.105 Which of the following has maximum bond angle?

(A) NF_3 (B) NCl_3 (C) PCl_3 (D) OF_2

Q.106 Which of the following has the shortest N–H bond length?

(A) $H_2N - NH_2$ (B) H–N = N–H (C) NH_3 (D) CH_3—NH_2

Q.107 Which of the following has minimum bond angle about oxygen?

(A) OF_2 (B) OCl_2 (C) $(CH_3)_2O$ (D) H_2O

Q.108 Which of the following molecules or ions has different bond lengths?

(A) XeF_4 (B) BF_4^- (C) SF_4 (D) SiF_4

Q.109 The correct order of bond angle is

(A) $PF_3 < PCl_3 < PI_3 < PBr_3$ (B) $PF_3 < PCl_3 < PBr_3 < PI_3$

(C) $PF_3 > PCl_3 > PBr_3 > PI_3$ (D) $PCl_3 > PF_3 > PBr_3 > PI_3$

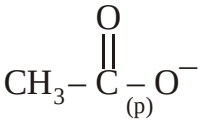
Q.110 Which of the following has all equal bond angles?

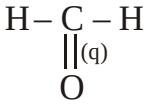
(A) CH_3Cl (B) CH_2F_2 (C) NH_3 (D) NH_2–OH

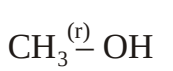
Q.111 In which of the following O–N–O bond angle is highest?

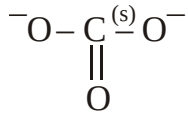
(A) NO_2^+ (B) NO_3^- (C) NO_2^- (D) None

Q.112 **Correct** order of bond length of p, q, r, s in following compound is









(A) $p < s < q < r$ (B) $s < p < q < r$ (C) $r < q < s < r$ (D) $q < p < s < r$

Q.113 Which of the following tri-atomic planar species have bond angle greater than 104° and less than bond angle in perfectly tetrahedral species?

(A) OCl_2 (B) NH_3 (C) OF_2 (D) OH_2

Q.114 Choose the correct statement regarding the I–I bond length in free I_3^-.

(A) shorter than I-I distance in I_2 (B) Two I–I distances are different.

(C) Two I–I distances are same. (D) Resonance predict the bond length.

Q.115 The bond length of the S–O bond is maximum in which of the following compound.

$SOBr_2$, $SOCl_2$, SOF_2

(A) $SOCl_2$ (B) $SOBr_2$ (C) SOF_2 (D) All have same length

Q.116 In which of following cases C–C bond length will be highest.

(A) CH_3–CF_3 (B) FCH_2–CH_2F (C) F_2CH–CHF_2 (D) CF_3–CF_3

Q.117 Which of the following statements is/are incorrect for following species:

BO_3^{3-}, CO_3^{2-}, NO_3^-

(A) They are isoelectronic and isostructural.

(B) They have same bond angle.

(C) The extent of π-bonding is in the order of $CO_3^{2-} < NO_3^- < BO_3^{3-}$.

(D) Bond angles are same in every cases.

Q.118 The correct order in which d_{O-O} increases

(A) $H_2O_2 < O_2 < O_3$ (B) $O_2 < O_3 < H_2O_2$

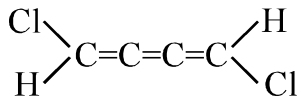
(C) $H_2O_2 < O_3 < O_2$ (D) $O_2 < H_2O_2 < O_3$

Q.119 In which of the following option, all bond lengths are not equal.

(A) BF_3 (B) NF_3 (C) XeF_4 (D) ClF_3

POLAR AND PLANAR (DIPOLE MOMENT)

Q.120 Choose the correct option for the following molecule in view of chemical bonding



(A) non-planar (B) $\mu \neq 0$ (C) A & B both (D) $\mu = 0$

Q.121 What may be the geometry of molecule if AX_3 molecule has non-zero dipole moment.

(A) Trigonal planar (B) Bent T-shape (C) Pyramidal (D) Both (B) and (C)

Q.122 Find the molecule which is planar and polar.

(A) $B_3N_3H_6$ (B) $F_2C = C = C = CF_2$

(C) BrF_2Cl (D) $F_2C = C = CF_2$

Q.123 How many maximum number of atoms are present in single plane of $Al(CH_3)_3$ molecule.

(A) 7 (B) 4 (C) 10 (D) 6

Q.124 The polar and planar compound is :

(A) SF_4 (B) BF_2Cl (C) CH_2F_2 (D) O_2F_2

Q.125 Select the property which do(es) not follow the following order for NX_3 (X = halogen).

$NF_3 < NCl_3 < NBr_3 < NI_3$

(A) XNX bond angle (B) NX bond length

(C) N–X bond polarity (D) All of these

Q.126 Which of the following molecule is planar?

(A) $F_2C = C = C = C = CF_2$ (B) $H_2C = C = CH_2$

(C) C_2H_2 (D) All of these

Q.127 Amongst NO_3^-, AsO_3^{3-}, CO_3^{2-}, ClO_3^-, SO_3^{2-} and BO_3^{3-}, the non-planar species are

(A) $CO_3^{2-}, SO_3^{2-}, BO_3^{3-}$ (B) $AsO_3^{3-}, ClO_3^-, SO_3^{2-}$

(C) NO_3^-, CO_3^{2-}, BO_3^{3-} (D) $SO_3^{2-}, NO_3^-, BO_3^{3-}$

Q.128 The nodal plane in the π-bond of ethene is located in

(A) the molecular plane

(B) a plane parallel to the molecular plane

(C) a plane perpendicular to the molecular plane which bisects the carbon-carbon σ bond at right angle.

(D) a plane perpendicular to the molecular plane which contains the carbon-carbon bond.

Q.129 Which of the following pair of molecule have same shape but different in polarity (Polar or nonpolar)

(A) H_2O & NH_3 (B) $SnCl_2$ & SO_2 (C) CO_2 & N_2O (D) SO_2 & SO_3

Q.130 In which of the following pairs of compounds, the first one is more polar than the second one?

(A) SO_3, SO_2 (B) NF_3, NH_3 (C) CH_3Cl, CH_3F (D) PF_2Cl_3, PF_3Cl_2

Q.131 The molecule which is planar.

(A) SF_4 (B) BrF_5 (C) ICl_4^- (D) NH_4^+

Q.132 Which of the following is non polar and pentagonal planar species?

(A) XeF_6 (B) $XeOF_4$ (C) XeF_5^- (D) XeF_4

Q.133 Which of the following statements is incorrect for the dipole moment measurement of the compound.

(A) It helps to predict the percentage ionic character in a bond.

(B) It helps to predict the shape of the molecule.

(C) It helps to predict the particular cis trans isomer.

(D) It help to predict the bond energies of all bonds within the molecule.

Q.134 Which of the following molecule / ion has zero dipole moment.

(A) ClF_3 (B) $ICl_2^{\ominus}$ (C) SF_4 (D) None of these

Q.135 If the measured dipole moment for the molecule is zero then for which of given formula the shape and hybridization of the species can be predicted.

(A) AX_3 (B) AX_4 (C) AX_5 (D) AX_2

Q.136 The **correct** order of dipole moment is :

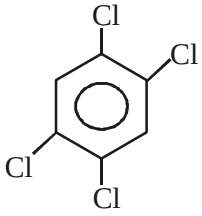
(A) $CH_3Cl < CH_3F < CH_3Br < CH_3I$ (B) $CH_3Cl > CH_3F > CH_3Br > CH_3I$

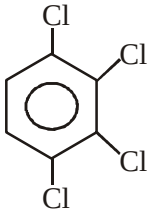
(C) $CH_3F > CH_3Cl > CH_3Br > CH_3I$ (D) $CH_3F < CH_3Cl < CH_3Br < CH_3I$

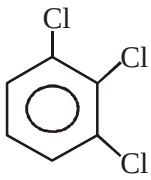
Q.137 Which of the following has non-zero dipole moment?

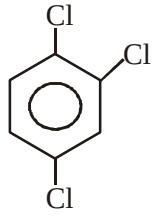
(A) CCl_4 (B) C_2H_6 (C) CO_2 (D) SO_2

Q.138 Which of the given compound has highest dipole moment ?

(A) 

(B) 

(C) 

(D) 

Q.139 Which of the following molecule have nonzero dipole moment?

(A) $P(CH_3)_3(CF_3)_2$ (B) PF_3Cl_2 (C) BF_3, (D) CCl_4

Q.140 If IF_x^n, types species are planar and nonpolar, then which of the following match is correct (where x is number of F atoms and n is charge on 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

EXERCISE-2

[MULTIPLE CORRECT CHOICE TYPE]

Q.1 Which of the following are isoelectronic pairs.

(A) H_2, HD (B) CO, N_2 (C) HCl, H_2S (D) D_2O, Ne

Q.2 Which pair(s) can form XY type compound?

(A) Al, P (B) Mg, N (C) Ca, O (D) Na, F

Q.3 Which bonds are directional?

(A) ionic (B) covalent (C) Dative (D) All of these

Q.4 Correct statement(s) regarding ionic compound is/are:

(A) High melting points and non-directional bonds.

(B) Shows structural isomerism.

(C) Directional bonds and low-boiling points.

(D) High solubilities in polar solvents.

Q.5 Which of the following is / are not possible?

(A) NOF_3 (B) NF_5 (C) OF_4 (D) $SnCl_3^-$

Q.6 Which of the following molecule is / are electron deficient.

(A) $BeCl_2$ (B) CH_2Cl_2 (C) BH_3 (D) NH_2Cl

Q.7 Assuming pure 2s and 2p orbitals of carbon are used in forming CH_4 molecule, which of the following statement are true?

(A) Three C–H bonds will be at 90°.

(B) Three C–H bond will be stronger than 4^{th} C–H bond.

(C) The angle of C–H bond formed by s–s overlapping will be uncertain with respect to other three bonds.

(D) No prediction regarding the shape of the molecule.

Q.8 Which of the following overlapping is involved in formation of only σ-bond.

(A) s – p overlapping (B) p – d overlapping

(C) s – s overlapping (D) p – p overlapping

Q.9 Which of the following statement is correct

(A) xz plane is the nodal plane for p_y orbital.

(B) xy and xz planes are nodal planes for d_{xz} orbital.

(C) nodal planes for $d_{x^2-y^2}$ are at 45° inclined with the x-axis and perpendicular to xz-plane.

(D) nodal planes of π-bonds of $B_3N_3H_6$ are at molecular plane.

Q.10 If z-axis be the internuclear axis, σ-bond would be formed by the overlap between:

(A) s and p_z (B) p_z and p_z (C) p_y and p_y (D) d_{z^2} and d_{z^2}

Q.11 Select **correct** statements regarding σ and π bonds.

(A) σ -bond lies on the line joining the nuclei of bonded atoms.

(B) π -electron cloud lies on either side to the line joining the nuclei of bonded atoms.

(C) $(2p_\pi - 3d_\pi)$ π-bond is stronger than $(2p_\pi - 3p_\pi)$ π-bond.

(D) σ-bond has primary effect to decide direction of covalent bond, while π-bond has no primary effect in direction of bond.

Q.12 Which of the following pair of compound have same hybridisation but different shape of the molecule

(A) BeH_2, XeF_2 (B) SO_2, SO_3 (C) CO_2, $SnCl_2$ (D) XeF_2, SeF_4

Q.13 Which of following shape can not be derived from sp^3d^2 hybridisation of the molecule having single central atom.

(A) Octahedral (B) Trigonal pyramidal

(C) Square planar (D) Linear

Q.14 What are the following types of bond present in $CuSO_4.5H_2O$.

(A) H-bond (B) Electrovalent bond

(C) Covalent bond (D) Co-ordinate covalent bond

Q.15 Which of following pair of species is having different hybridisation but same shape.

(A) $BeCl_2$ and CO_2 (B) CO_2 and SO_2 (C) SO_2 and I_3^+ (D) ICl_2^- and BeH_2

Q.16 The bent-shape of the molecule may develop from which of the following hybridisation(s).

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

Q.17 The hybridisation of Xe–atom in XeO_6^{4-} is same as

(A) Xe in XeF_6 (B) Te in TeO_6^{6-} (C) P in PF_6^- (D) Si in SiF_6^{2-}

Q.18 The shape of H_2S_2 is identical to that of

(A) S_2Cl_2 (B) O_2F_2 (C) C_2F_2 (D) H_2O_2

Q.19 Which pair of compounds is not isostructural but possesses same number of lone pairs on the central atom?

(A) SF_4 and SO_3^{2-} (B) CO_2 and SO_2 (C) XeF_2 and BeH_2 (D) ClF_3 and XeF_4

Q.20 From octahedral electron geometry of the central atom which of the following shape of the molecule / species may be possible.

(A) Square pyramidal (B) Linear

(C) Square planar (D) Bent

Q.21 Which of the following molecule does not have cyclic structure.

(A) S_3O_9 (B) $B_3O_6^{3-}$ (C) $H_2S_4O_6$ (D) $H_5P_3O_{10}$

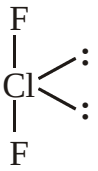
Q.22 In which of following cases, the hybridisation of the central atom for the cationic part in their solid is identical.

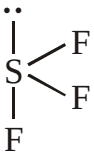
(A) $PCl_5(s)$ (B) $PBr_5(s)$ (C) $N_2O_5(s)$ (D) $XeF_6(s)$

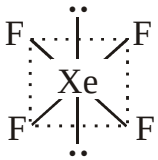
Q.23 Which of the following has tetrahedral shape?

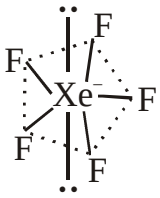
(A) $KMnO_4$ (B) K_2CrO_4 (C) $KClO_4$ (D) NH_3

Q.24 Which of the following electronic arrangement(s) is/are stable?

(A) 

(B) 

(C) 

(D) 

Q.25 Which of the following have a three dimensional network structure ?

(A) SiO_2 (B) Diamond (C) P_4 (white) (D) CCl_4

Q.26 Which of the following statement(s) is/ are correct regarding hybrid orbitals?

(A) The number of hybrid orbitals is equal to the number of the atomic orbitals that get hybridised.

(B) Hybrid orbitals are equivalent in energy and shape

(C) The hybrid orbitals are more effective in forming stable bonds than the pure atomic orbitals.

(D) Promotion of electron is essential condition prior to hybridisation

Q.27 Which of the following orbitals involved in hybridisation of IF_7?

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

Q.28 The compounds or ions which do not exist, are

(A) OF_4 (B) HFO_4 (C) NCl_5 (D) PBr_6^-

Q.29 Which of the following has sp^3d^2 hybridisation?

(A) $[IF_6]^+$ (B) SF_6 (C) $[PCl_6]^-$ (D) $H_2S_2O_3$

Q.30 Which of the following statements is/are **not correct** for following compounds.

(I) $SCl_2(OCH_3)_2$ and (II) $SF_2(OCH_3)_2$

(A) $-OCH_3$ groups in both cases occupy the same position.

(B) Cl-atoms occupy equitorial position in case of (I) and F-atoms occupy equitorial position in case of (II).

(C) Cl-atoms occupy axial position in case of (I) and F-atoms occupy equitorial position in case of (II)

(D) Cl and F-atom occupy either axial or equitorial position in case of (I) and (II) respectively.

Q.31 Halogens form compounds among themselves with the formula XX', XX & XX'_7 (where X is the heavier halogen) which of the following pair(s) represent(s) correct geometry with polar and non-polar nature (theoretically)

(A) XX' — Linear — Polar (B) XX — Linear — Polar

(C) XX' — Linear — Non-polar (D) XX'_7 — Pentagonal bipyramidal — Non-polar

Q.32 Which of the following statement is correct in the context of the allene molecule C_3H_4.

(A) The central carbon is sp hybridized.

(B) the terminal carbon atoms are sp^2 hybridized.

(C) The planes containing the CH_2 groups are mutually perpendicular to permit the formation of two separate π bonds.

(D) Central atom is sp^2 hybridized.

Q.33 Select the molecule have non equivalent hybrid orbitals around central atom .

(A) SOF_2 (B) PCl_3 (C) SiF_4 (D) CH_2Cl_2

Q.34 The compounds having 8 or more bond angles equal to 90°, are :

(A) XeO_6^{4-} (B) IF_7 (C) BrF_5 (D) XeF_6

Q.35 Select the compounds which have polyatomic anion in their solid state/liquid state ?

(A) PCl_5 (B) XeF_6 (C) BrF_3 (D) N_2O_5

Q.36 Which of the following has/have open book structure?

(A) O_2F_2 (B) O_2H_2 (C) S_2F_2 (D) S_2Cl_2

Q.37 Which of the following compounds have sp^2 hybridised in anionic species?

(A) $N_2O_3(s)$ (B) $N_2O_4(s)$ (C) $N_2O_5(s)$ (D) $PCl_5(s)$

Q.38 In which of the following molecular species, d-orbital with no nodal plane is involved in the hybridisation of central atom.

(A) XeF_5^- (B) IF_6^+ (C) TeF_5^- (D) SeF_5^-

Q.39 Select **correct** statement(s) with respect to geometry of hybrid orbitals.

(A) sp^3 and d^3s have identical shape.

(B) sp_z has linear geometry along z-axis.

(C) different geometry may be formed from sp^3d.

(D) If p_z orbital is replaced by $d_{x^2-y^2}$ in sp^3 hybridization, non-planar geometry changes to planar geometry.

Q.40 Shape of NH_3 is very similar to

(A) SeO_3^{2-} (B) $\dot{C}H_3$ (C) H_3O^+ (D) CCl_3^-

Q.41 The species having linear structure is / are:

(A) $SnCl_2$ (B) NCO^- (C) CS_2 (D) S_5^{2-}

Q.42 Which of the following statement is / are correct.

(A) $(s + p_y)$ produces sp hybrid orbitals which are lying in yz-plane.

(B) $(s + p_y)$ produces sp hybrid orbitals which are lying in xz-plane.

(C) $(s + p_x + p_z)$ produces sp^2 hybrid orbitals are lying in xz-plane.

(D) $(s + p_y)$ produces sp hybrid orbitals which are lying in y-axis.

Q.43 Which of the following molecular are having $p\pi-d\pi$ bonds?

(A) SO_2 (B) SO_3 (C) P_4O_{10} (D) $B_3N_3H_6$

Q.44 In which of the following species, all bond pairs are formed by hybridized orbitals

(A) PH_4^+ (B) SbH_3 (C) GeH_4 (D) C_2H_4

Q.45 Which of the following species are formed by Lewis acid base interaction.

(A) CH_4 (B) $NaBF_4$ (C) PCl_4^+ (D) $Al(OH)_4^-$

Q.46 NH_4NO_3 contains :

(A) Ionic bond (B) Covalent bond (C) Coordinate bond (D) Back bond

Q.47 There is change of hybridisation when:

(A) NH_3 combines with H^+ (B) AlH_3 combines with H^-

(C) NH_3 forms NH_2^- (D) SiF_4 forms SiF_6^{2-}

Q.48 Select the correct order ?

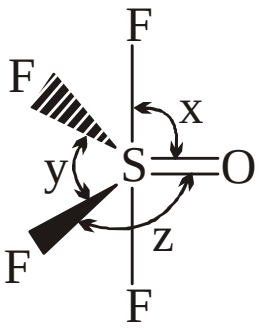
(A) $NH_3 > NI_3 > NF_3 \Rightarrow$ Decreasing order of Lewis basic character

(B) $HI > HBr > HCl > HF \Rightarrow$ Decreasing order of thermal stability

(C) $PCl_5 > CCl_4 \Rightarrow$ Decreasing order of Lewis acid character

(D) $F_2 > Cl_2 > Br_2 > I_2 \Rightarrow$ Decreasing order of bond dissociation energy

Q.49 The incorrect order of bond angle in the following molecule is/are



(A) y = z > x (B) z > y > x (C) y > x > z (D) x > y > z

Q.50 Which of the following statements is not correct for SiF_6^{2-} and ClF_6^+.

(A) They are isoelectronic

(B) They are isostructural

(C) All possible $\angle FSiF$ and $\angle FClF$ angles are identical.

(D) d_{Si-F} and d_{Cl-F} (bond lengths) are identical.

Q.51 Which of the following is / are **incorrect.**

(A) Graphite is good conductor of electricity than diamond.

(B) $XeF_3^{\ominus}$ does not exist

(C) In SF_6, the S–F bond length is greater in axial than that in equatorial.

(D) NO & CO are acidic oxide.

Q.52 Which of the following has/have different bond angles ?

(A) CF_4 (B) PCl_5 (C) NF_3 (D) SF_4

Q.53 Which of the following has more than four 90° bond angle among following?

(A) PCl_5 (B) SF_6 (C) SF_4 (D) CH_4

Q.54 Choose the correct angle order.

(A) $H\hat{P}H$ in PH_4^+ is equal to $H\hat{C}H$ in CH_4

(B) $H\hat{N}H$ in NH_3 < $H\hat{P}H$ in PH_3

(C) $H\hat{N}H$ in NH_3 < $H\hat{P}H$ in PH_4^+

(D) $O\hat{S}O$ in SO_4^{2-} < $O\hat{N}O$ in NO_3^-

Q.55 Which of the following statements are **not correct**?

(A) All C–O bonds in CO_3^{2-} are equal but not in H_2CO_3.

(B) All C–O bonds in HCO_2^- are equal but not in HCO_2H

(C) C–O bond length in HCO_2^- is longer than C–O bond length in CO_3^{2-}.

(D) C–O bond length in HCO_2^- and C–O bond length in CO_3^{2-} are equal.

Q.56 In the structure of H_2CSF_4, which of the following statement is/are correct?

(A) Two C–H bonds are in the same plane of axial S–F bonds.

(B) Two C–H bonds are in the same plane of equitorial S–F bonds.

(C) Total six atoms are in the same plane.

(D) Equitorial S–F bonds are perpendicular to plane of π–bond.

Q.57 Which statement(s) is/are correct regarding the d_{I-I} in I_3^-?

(A) both are identical
(B) both are different
(C) It depends upon the cation attached.
(D) It can't be predicted from its formula.

Q.58 The correct statements about the structures of H_2O_2, O_2F_2 and OF_2 is/are :

(A) H_2O_2, O_2F_2, OF_2 are polar compounds
(B) d_{O-O} of $H_2O_2 > d_{O-O}$ of O_2F_2
(C) d_{O-F} of $OF_2 > d_{O-F}$ of O_2F_2
(D) No peroxide linkage in O_2F_2

Q.59 Choose the **incorrect** statement.

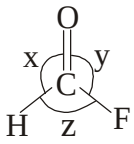
(A) All S – F bond lengths are identical in SF_4.
(B) All Cl – F bond length are identical in ClF_3.
(C) All $\angle$ FClF angles are identical in ClF_3.
(D) All possible angle in BF_2Cl are 120°.

Q.60 Choose the correct properties for the following molecules.

(I) CH_2F_2 (II) CHF_3 (III) CH_3F

(A) C–F bond length order : $CH_3F > CH_2F_2 > CHF_3$
(B) C–H bond length order : $CH_3F > CH_2F_2 > CHF_3$
(C) Shape is not perfect tetrahedral for given compounds.
(D) Dipole moment is non zero for given compounds.

Q.61 Which of the following relationship is correct for the following figure.



(A) x = y = z (B) x = y > z (C) x > 120° (D) z < 120°

Q.62 Select the correct statement(s) for following molecules.

(I) $PF_2(CH_3)_3$ (II) $PF_2(CF_3)_3$

(A) Both have trigonal bipyramidal structure
(B) Both have same dipole moment
(C) P–F bond length is longer in $PF_2(CH_3)_3$ than the $PF_2(CF_3)_3$
(D) P–F bond length is longer in $PF_2(CF_3)_3$ than the $PF_2(CH_3)_3$

Q.63 Select the correct option(s) regarding $PMeF_2Cl_2$.(–Me is $-CH_3$)

(A) P–Cl bond length is longer than P–F bond length.

(B) Both fluorine atoms occupy axial position.

(C) P-Me bond has more s-character than P-Cl bond.

(D) Both chlorine atoms occupy axial position.

Q.64 Which of the following are correct statement(s).

(A) Bond angle order (X–S–X) is $OSF_2 < OSCl_2 < OSBr_2$

(B) (O–O) bond length in O_2^{2-} is more than O_2F_2

(C) d_{C-Cl} bond length in $CH_3Cl > CF_3Cl$

(D) 4 $P-\hat{P}-P$ angles are equal to 90° in P_4 molecule.

Q.65 Choose the incorrect order of bond angle?

(A) $H_2S < H_2O < NH_3$ (B) $NO_2 > NO_2^- > NO_2^{\oplus}$

(C) $OF_2 < OH_2 < O(CH_3)_2$ (D) $BF_3 < BCl_3 < BBr_3$

Q.66 In compound $PX_n Y_{5-n}$; X & Y are monovalent surrounding atoms and order of electronegativity is X > Y then according to given information correct statement is / are:

(A) If n= 3 then bond angle between central atom and less electronegativity atom is greater than 120°.

(B) If n = 0, then all five bond lengths are not equal.

(C) if n =1, then axial plane can have two same substituent and equatorial plane can have three same substituent.

(D) If n = 4 then axial plane can have three same substituent and equatorial plane can have two same substituent.

Q.67 Which of the following pair of species having individual equivalent bond lengths?

(A) SF_6 & CCl_4 (B) CH_3Cl & PCl_5 (C) IF_7 & PCl_5 (D) BF_3 & CF_4

Q.68 Correct order regarding bond angle in the following species?

(A) $NH_4^+ > NH_3 > NH_2^-$ ($H\hat{N}H$ bond angle)

(B) $NO_2^+ > NO_3^- > NO_2^-$ ($O\hat{N}O$ bond angle)

(C) $OCl_2 > OF_2 > OH_2$ ($X\hat{O}X$) (X = terminal atom)

(D) $BCl_3 > PCl_3 > NCl_3$ ($Cl\hat{X}Cl$) (X = central atom)

Q.69 Select the **correct** statement(s):

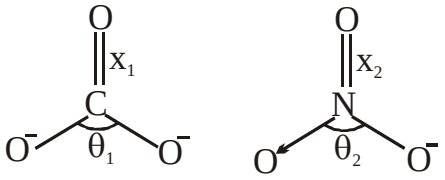
(A) $CH_3 - C - CH_3$ angle in $(CH_3)_2C = CH_2$ is smaller and the $CH_3 - C = CH_2$ angle is larger than the trigonal 120°.

(B) O – I – F angle is less than 90° (89°) in IOF_4^-.

(C) In $SeOCl_2$, Cl – Se – Cl angle is less than the Cl – Se – O angle

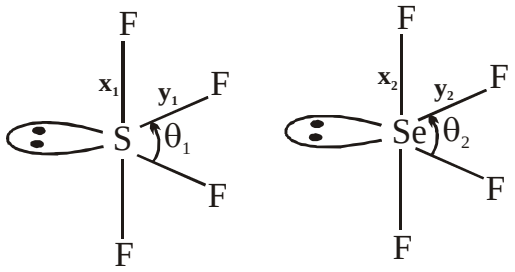
(D) $POCl_3$ is tetrahedral with a double bond between P and O. There is no lone pair on central atom.

Q.70 Correct order(s) for following molecular species is/are :(x_1 and x_2 are bond length)



(A) $x_1 > x_2$ (B) $x_2 > x_1$ (C) $\theta_1 > \theta_2$ (D) $\theta_1 = \theta_2$

Q.71 Correct order(s) for following structure is/are:



(A) $x_1 < x_2$ (B) $y_1 < y_2$ (C) $x_2 > y_2 > x_1$ (D) $\theta_1 > \theta_2$

Q.72 Which of the following is incorrect bond angle?

(A) $NH_3 > H_2O$ (B) $SO_3 > SO_2$ (C) $CCl_4 > CCl_3^-$ (D) $CO_2 < CCl_4$

Q.73 Consider skeleton of following two species :

where θ_1, θ_2 and θ_3 are $O - \hat{Cl} - O$ bond angles and x, y and z are 'Cl – O' bond lengths then which of the following order is incorrect.

(A) $\theta_2 > \theta_1$ (B) $x > y$ (C) $\theta_2 < \theta_3$ (D) $z > y$

Q.74 SO_2 has the similar geometry as

(A) XeF_2 (B) F_2O (C) $BeCl_2(g)$ (D) $SnCl_2$

Q.75 Which of following statements are correct for HCN molecule.

(A) Two π-bonds are perpendicular to each other.

(B) Lone pair lying in the orbital which is perpendicular to both π-bonds.

(C) The dipole moment value is non zero.

(D) The direction of dipole moment is from N to H atom.

Q.76 Find the **correct** order of dipole moment ?

(A) HF > HCl (B) $CH_3F > CH_3Cl$ (C) $CH_2Cl_2 > CHCl_3$ (D) $NF_3 > NH_3$

Q.77 If PF_2Cl_3 has zero dipole moment, the correct statement(s) is / are

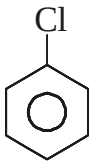
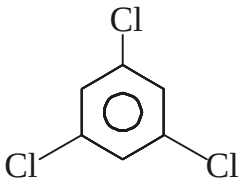
(A) The two F atoms are at 180° with respect to each other.

(B) Maximum 4 atoms are present in the same plane.

(C) P–Cl bond is longer than P–F bond

(D) The d-orbital of 'P' involved in the formation of PF_2Cl_3 is d_{z^2}

Q.78 Which of the following option is / are correct?

(A)  &  (Equal dipole moment)

(B) H_2O & HF (Inter molecular Hbonding)

(C) PCl_5(s) & PBr_5 (s) (Cation of both the compound have same hybridisation)

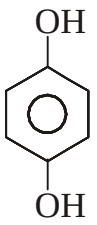
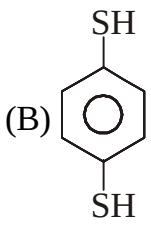
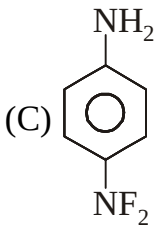
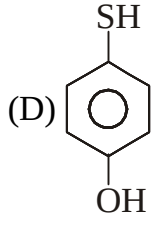
(D) N_2O & CO_2 (Both are acidic oxide)

Q.79 SO_2 and SO_3 are different in :

(A) Hybridisation (B) Compound polarity

(C) Number of pπ-pπ bond (D) Structure

Q.80 Which of the following has non-zero dipole moment?

(A)  (B)  (C)  (D) 

Q.81 Which of the following has zero dipole moment value?

(A) PCl_3F_2 (B) $P(CH_3)_3F_2$ (C) PCl_5 (D) PF_3Cl_2

Q.82 Select the correct statements regarding molecules of CF_4 and $F_2C = C = CF_2$

(A) Both are polar (B) Both are planar

(C) Both are non-polar (D) Both are non-planar

Q.83 The dipole moment of AX_3, BX_3 and CY_3 are 4.97×10^{-30} , 0.60×10^{-30} and 0.00 columb meter respectively, then the shape of molecules may be

(A) Pyramidal, T-shape, Trigonal planar (B) Pyramidal, pyramidal, T-shape

(C) Pyramidal, pyramidal, Trigonal planar (D) Pyramidal , pyramidal , linear

Q.84 Which of the following compounds are planar as well as non polar.

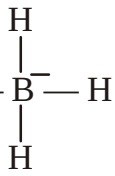
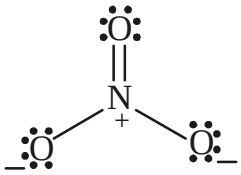
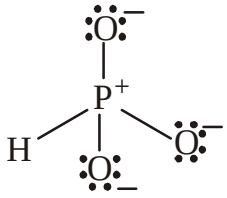
(A) XeF_4 (B) XeF_2 (C) $XeF_5^{\ominus}$ (D) XeF_5^{+}

[PARAGRAPH TYPE]

Paragraph for question nos. 85 to 87

Lewis theory does not guide regarding the shape of the molecule and initially it was thought that pure atomic orbitals are forming bond and next hybridisation theory is adopted to explain the several facts properly.

Q.85 Which of the Lewis structure is **not correctly** drawn.

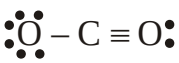
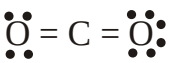
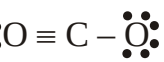
(A)  (B)  (C)  (D) 

Q.86 Which of the following set of molecules/ ions does not exist?

(A) NCl_5, PCl_5 , BiF_5 (B) PBr_6^{-}, $SiCl_6^{2-}$, XeF_4

(C) NCl_5, OF_4, SF_8 (D) H_2S, PH_3, TlI

Q.87 Which of the following Lewis dot structure of CO_2 is incorrect ?

(A)  (B)  (C)  (D) None of these

Paragraph for question nos. 88 & 89

In above diagram A has five valence electrons and **B,C** and **D** have six valence electrons each. According to the L.D.S. **A** has **x** formal charge, **B** has **y** and **C** has **z** formal charge. The above mentioned compound / ion follows Lewis octet theory. Give the answer of following question.

Q.88 Identify the formal charge of A,B and C respectively.

(A) –2, 0,+1 (B) +1, 0, +1 (C) –2, 0, +2 (D) +1, 0, –1

Q.89 Choose the incorrect options?

(A) B,C,D belong to chalcogen family.

(B) Molecule does not have equal bond length

(C) Central atom A has sp^2 hybridisation

(D) The sum of formal charge is zero in this molecle.

Paragraph for question nos. 90 & 91

Initially it was thought that pure atomic orbitals are involved in covalent bond formation and various kind of overlap are there for σ and π-bond formation.

Q.90 Which of the following set of overlap can not provide π-bond formation.

(A) 3d and 2p (B) 2p and 3p (C) 2p and 2p (D) 3p and 1s

Q.91 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

Paragraph for question nos. 92 to 94

Different types of bonds are formed in the chemical compounds. These bond have different strength and bond energies associated with them. These bonds are formed with atoms in different environments.

Q.92 Which of the following bond has highest bond energy?

(A) σ-bond (B) π-bond (C) Hydrogen bond (D) Metallic bond

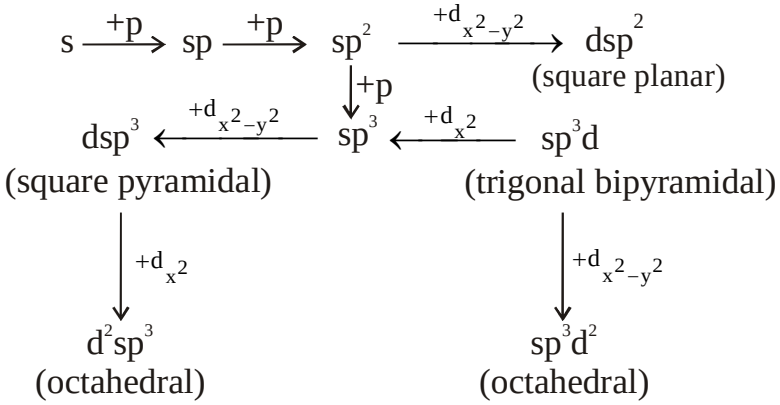
Q.93 Shape of the molecule is decided by

(A) σ-bond (B) π-bond
(C) both σ and π-bond (D) Never σ Nor π-bond

Q.94 Which of the following hydrides is thermally least stable?
(A) H_2O (B) H_2Te (C) H_2S (D) H_2Se

Paragraph for question nos. 95 & 96

The process of inter mixing of pure atomic orbitals to produce a set of new orbitals having equal energy is called hybridized orbitals and phenomenon is called hybridization.
Total number of hybrid orbitals is equal to number of σ bond + number of lone pairs



If central atoms is from d block having d^0 configuration or in higher oxidation state then it show d^3s hybridization.

Q.95 In which of the following compound vaccant orbital(s) participate In hybridisaticn during its formation
(A) BF_3 (B) Be_2Cl_4 (C) SF_4 (D) Si_2H_6

Q.96 Type of orbtial of S-atom involved in π-bond formation in SOF_4 molecule is
(A) p_x (B) d_{zx} (C) d_{yz} (D) d_{xy}

Paragraph for question nos. 97 & 98

Bond formation between two atoms is then envisaged (imagine) as the progressive overlapping of an atomic orbital from each of the participating atoms the greater the overlap achieved, the stronger the bond so formed.

Q.97 In which of the following pair both have similarity in hybridisation?
(A) PCl_3, PCl_4^+ (B) PCl_4^+, PCl_5 (C) PCl_5, PCl_6^- (D) PCl_4^+, PCl_6^-

Q.98 According to Lewis dot structure, the number of σ -bond(s) and π-bond(s) in SO_3 molecule respectively are :
(A) 2 and 3 (B) 3 and 3 (C) 3 and 1 (D) 3 and 2

Paragraph for question nos. 99 to 101

Among the hydrides of nitrogen family, NH_3 can easily donate its lone pair and forms number of compounds and complexes.

Q.99 When NH_3 reacts with BF_3, then an addition compound is formed. Which of the following statement is **incorrect** regarding the addition compound.

(A) Hybridisation of N-atom changes (B) Hybridisation of B-atom changes

(C) Shape of NH_3 changes (D) Shape of BF_3 changes

Q.100 Which of the following hydride contains least bond angle.

(A) PH_3 (B) SbH_3 (C) NH_3 (D) AsH_3

Q.101 The correct increasing order of H – N – H bond angle in NH_2^-, NH_3 and NH_4^+ is

(A) $NH_2^- > NH_3 > NH_4^+$ (B) $NH_2^- < NH_3 < NH_4^+$

(C) $NH_3 > NH_4^+ > NH_2^-$ (D) $NH_3 < NH_4^+ < NH_2^-$

Paragraph for question nos. 102 & 103

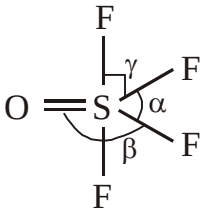
All species tend to attain or adopt the electronic geometry in which overall repulsion is minimum. If all the sites (positions) are equivalent (e.g. octahedral), lone pairs prefer to be trans (anti) to each other, else lone pairs choose the largest site (e.g. equilateral position in trigonal bipyramidal). In trigonal bipyramidal geometry, axial position (a) is more crowded than equatorial position (e) which results in elongation of axial bond as compared to equatoraial bond, therebyincreasing the axial bond length. This holds valid if the substituents are same. Also bonding pairs to more electronegative substituents occupy less space than those to more electropositive or less electronegative substituents. Double bond occupy more space than single bond.

Q.102 Choose the correct statement regarding ClF_3 .

(A) $Cl - F_a$ is shorter than $Cl - F_e$ (B) All $Cl - F$ bonds are of equal length

(C) $\angle F_a - Cl - F_a$ is exactly equal to 180^o (D) $Cl - F_a$ is longer than $Cl - F_e$

Q.103 Consider the molecule given below,



Which of the following is correct order of bond angle?

(A) $\alpha > \beta > \gamma$ (B) $\beta > \gamma > \alpha$ (C) $\alpha > \gamma > \beta$ (D) $\beta > \alpha > \gamma$

Paragraph for question nos. 104 & 105

The more ionic character (i.e. poorer covalency) in a bond (due to the more electronegative substituent to the central atom) leads to the utilisation of hybrid orbitals containing more pweharacter (i.e.less s-character) of the central atom. In other words, the multiple bond encourages the central atom to utilise its hybrid orbitals which contain more sweharacter.

The percentage of s- or p-character between two adjacent and equivalent hybrid orbitals can determined from the knowledge of the corresponding bond angle (θ) as follows:

Q.104 If x_1, x_2 and x_3 are S – S bond lengths in $S_2O_4^{2-}$, $S_2O_5^{2-}$ and $S_2O_6^{2-}$ respectively, then correct order for S – S bond length is :

(A) $x_3 > x_2 > x_1$ (B) $x_1 > x_2 > x_3$ (C) $x_3 > x_1 > x_3$ (D) $x_1 > x_3 > x_2$

Q.105 The percentage of p-character (approx) in hybrid orbital having the lone pair at central atom in SF_4 molecule will be (given F – $\hat{S}$ – F equatorial bond angle is 102° and cos 102° = – 0.21)

(A) 65.5 (B) 34.5 (C) 50.5 (D) 82.2

Paragraph for question nos. 106 to 108

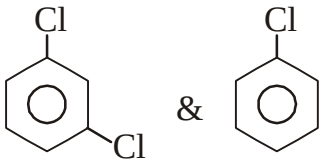
Polar covalent molecules exhibit dipole moment. Dipole moment is equal to the product of charge separation, q and the bond length d for the bond. Unit of dipole moment is Debye. One Debye is equal to 10^{-18} esu cm.

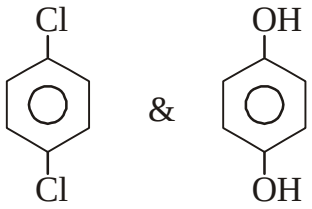
Dipole moment is a vector quantity. It has both magnitude and direction. Hence, dipole moment of a molecule depends upon the relative orientation of the bond dipoles, but not on the polarity of bonds alone. A symmetrical structure shows zero dipole moment. Thus, dipole moment helps to predict the geometry of a molecules. Dipole moment values can be used to distinguish between *cis*- and *trans*-isomers; *ortho*-, *meta*- and *para*-forms of a substance, etc.

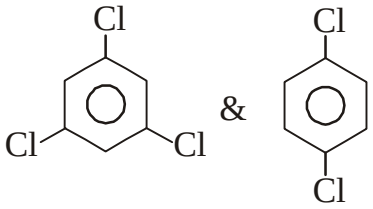
Q.106 Among the following, which is a type of non-planar as well as non-polar compound.

(A) $H_2C= C = CH_2$ (B) ClF_3 (C) XeF_4 (D) PF_3Cl_2

Q.107 Which of the following pair of species having same dipole moment value?

(A)  &

(B)  &

(C)  &

(D) Both (A) & (C)

Q.108 The dipole moment value of H–X molecule is 1.2 Debye. If the internuclear distance between H–X is 0.8 Å then the % ionic character in H–X molecules is:

(A) 31.3 % (B) 50% (C) 14% (D) 25%

Paragraph for question nos. 109 to 111

The formal charge is the difference between the number of valence electrons in an isolated (i.e. free) atoms and the number of electrons assigned to that atom in a Lewis structure.

For a molecule the net dipole moment is the vector addition of bond moment and lone pair moment.

Q.109 In $SnCl_3^{\ominus}$ ion calculate the formal charge on Sn.

(A) +1 (B) –1 (C) zero (D) –2

Q.110 In which of the following molecule has polar as well as non polar bond

(A) HCN (B) PCl_5 (C) H_2O_2 (D) All are correct

Q.111 Select the correct statement.

(A) NH_3 has higher bond dipole than that of NF_3

(B) CCl_4 is polar molecule

(C) SF_4 is polar molecule

(D) IF_7 is polar molecule

[MATCH LIST TYPE]

Q.112 **List-I (Molecule)** **List-II (Number of d-orbital(s) used in bond formation)**

(P) SOF_4 (1) 1

(Q) XeO_3F_2 (2) 2

(R) XeO_3 (3) 3

(S) $POCl_3$ (4) 4

Codes :

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

Q.113 **List-I** **List-II**

(P) XeO_3 (1) Planar and lone pair is present on central atom

(Q) CF_4 (2) Planar and lone pair is not present on central atom

(R) XeF_2 (3) Non-planar and lone pair is not present on central atoms

(S) CO_2 (4) Non-planar and lone pair is present on central atom

Codes :

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

[MATCH THE COLUMN]

Q.114 **Column-I** **Column-II**

(A) 2 lone pair (P) XeF_5^-

(B) Zero dipole moment (Q) NF_3

(C) Planar (R) ICl_3

(D) All adjacent bond angles are equal (S) XeF_4

Q.115

Column -I (Type of orbital)		**Column-II (Orbitals involved in hybridisation)**	
(A)	d_{z^2} -orbital	(P)	sp^3 (Tetrahedral)
(B)	s - orbital	(Q)	sp^3d^2 (Octahedral)
(C)	$d_{x^2-y^2}$ - orbital	(R)	sp^3d (TBP)
(D)	p_y - orbital	(S)	dsp^2 (square planar)

Q.116

Column I		**Column II**	
(A)	XeO_3	(P)	Pyramidal geometry
(B)	$XeF_5^{\ominus}$	(Q)	Non planar molecule
(C)	XeO_2F_2	(R)	One lone pair is present on Xe
		(S)	d_{Z^2} orbital is involved in hybridisation.

[INTEGER TYPE]

Q.117 Find the number of hypervalent compounds.
BF_3, SF_4, NCl_3, PCl_5, SiF_4, BrF_5 , XeF_2, $BeCl_2$

Q.118 Find the number of σ-bonds and π bonds in the Lewis structure of PO_4^{3-}.
[If the answers are 2 and 5 then represent as 0025]

Q.119 How many of the following overlaps of orbitals at right angle to the internuclear z-axis would lead to the formation of π-bond.
$d_{xy} - d_{yz}$, $p_x - p_x$, $p_y - p_y$, $d_{yz} - d_{yz}$, $d_{xz} - d_{xz}$, $s - p_x$, $p_z - p_z$

Q.120 The ratio of lone pairs on the surrounding atoms to that of central atom of XeO_2F_2 is _____.

Q.121 How many molecules have two lone pairs on the central atom?
H_2O, SF_4, I_3^-, XeF_5^-, XeO_3, $XeOF_4$, PCl_3, NCl_3, ClF_3, XeF_2, NO_2^-, CO_3^{2-}

Q.122 Calculate pπ–dπ bonds present in SO_4^{2-}, NO_3^- and trimer of SO_3.
[If number of pπ–dπ bonds are 1, 0, 5 respectively, write it as 0105.]

Q.123 Find the number of the has sp^3 hybridised atoms / ion in their cationic / anionic part.
Note : Consider all given compounds in their solid / liquid state.
PCl_5 , Cl_2O_6, PBr_5 , XeF_6 , I_2Cl_6, N_2O_5, N_2O_4, N_2O_3
[If your answer is 2, write it as 0002.]

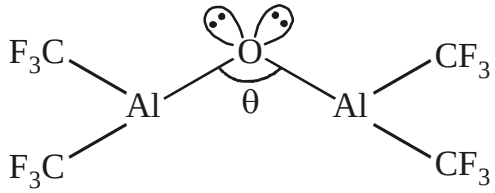
Q.124 Find the total number of species having bent shape

I_3^-, NO_2^+, H_2S, OCl_2, XeF_2, SO_2, NOCl

Q.125 Find the number of species where $d_{x^2-y^2}$ orbital participate in hybridisation.

XeF_6	SF_6	IF_7	XeO_3
PCl_5	PF_5		

Q.126 In following structure calculate percentage 's' character in lone pair occupy by oxygen atom.



Given : $\cos\theta = -0.99$

[Note : If your answer is 38% then write your answer in OMR sheet is 3 but if your answer 0.38% then write your answer in OMR sheet is 3.]

Q.127 Find the number of $\widehat{FSF}$ angle which are less than 90° in SF_4 according to V.S.E.P.R. theory.

Q.128 Find the number of species which do not exist.

XeF_3^-, PbI_4, $SnCl_2$, SCl_6, SH_2, SH_6, XeH_4, PH_3, $NaBF_4$, NF_5, NOF_3, POF_3

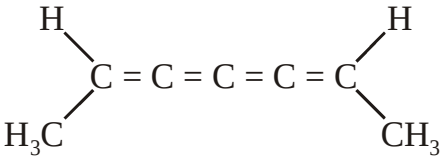
[If your answer is 3, write it as 0003]

Q.129 Which of the following has only σ bonded molecule.

PCl_5, PF_5, $POCl_3$, $XeOF_4$, XeF_2, XeF_4, NCl_3, IF_7, SO_2Cl_2, $SOCl_2$, SO_2, SO_3

[If your answer is 11 so write 0011.]

Q.130 How many maximum Nodal plane of π-bonds are present in one plane in following structure.



Q.131 How many compound which has pπ-dπ bonds -

CO_3^{2-}, ClO_4^- , SO_3, SO_4^{2-}, P_4O_{10}, NO_3^-, HCN, $[I(CN)_2]^-$, PO_4^{3-}

Q.132 Find out total number species in which at least two nonaxial d-orbitals are used in bond formation.

SO_2^{2-}, ClO_3^-, XeO_6^{4-}, XeO_3F_2, $XeOF_4$, $IO_2F_2^-$, SOF_4, $S_3O_6^{2-}$, $S_2O_3^{2-}$

Q.133 $SiF_4 + 2HF \rightarrow H_2SiF_6$

Find out the value of expression $|x - y|$ for the above reaction.

where

x = Total number of Si – F bonds in H_2SiF_6 that are longer than Si–F bonds present in SiF_4.

y = Total number of ionizable hydrogen ion(s) in H_2SiF_6.

Q.134 How many total adjacent bond angles are present in IF_7?

[If your answer is 13, write it as 0013.]

Q.135 Find the number of species having more than 4 bond angle.

CH_4, CCl_4, $CHCl_3$, XeF_6, XeF_4, CO_2, SO_2, $SOCl_2$, $POCl_3$

Q.136 Find the maximum number of identical bond angles in CH_2F_2.

Q.137 Total number of molecules having only one type of bond angle.

PF_3, CF_4, XeF_4, PF_5, BeF_2, SF_6, IF_7

Q.138 How many compounds have zero dipole moment?

PCl_3F_2, PF_3Cl_2, OCl_2, OH_2, CCl_4, SF_4, SF_6, C_2H_4, NCl_3

If your answer is 2, write the answer as 0002.

Q.139 Find the number of non polar molecule having all polar bonds.

CCl_4, PCl_5, SF_6, IF_7, IF_5, PCl_4F, SF_4, NO_2, BF_3

Q.140 Find the number of planar molecule.

(i) BF_3 (ii) BCl_3 (iii) CO_3^{2-} (iv) SO_3 (v) NH_3 (vi) NCl_3

(vii) PCl_3 (viii) PF_3

Q.141 How many number of tetra atomic species are planar and polar with central atom sp^3d hybridised?

$PCl_4^{\oplus}$, ClF_3, XeF_2, SOF_2, SF_4, $[I_2CN]^{\ominus}$, $ICl_2^{\ominus}$

Q.142 The molecules / ions which are planar as well as polar :

$SnCl_2$, I_3^+, NH_2^-, IF_3, BF_3, H_2O, CO_3^{2-}, I_3^-, SF_2, XeF_2, NO_2^-, XeF_4, ICl_4^-, NH_2^+

[ANSWER KEY]

EXERCISE-1

Q.1	B	Q.2	D	Q.3	A	Q.4	D	Q.5	A
Q.6	C	Q.7	B	Q.8	D	Q.9	C	Q.10	B
Q.11	A	Q.12	B	Q.13	B	Q.14	A	Q.15	B
Q.16	B	Q.17	B	Q.18	A	Q.19	D	Q.20	C
Q.21	C	Q.22	B	Q.23	C	Q.24	B	Q.25	B
Q.26	B	Q.27	B	Q.28	D	Q.29	B	Q.30	C
Q.31	A	Q.32	B	Q.33	B	Q.34	D	Q.35	D
Q.36	D	Q.37	B	Q.38	A	Q.39	A	Q.40	A
Q.41	A	Q.42	B	Q.43	A	Q.44	A	Q.45	D
Q.46	D	Q.47	A	Q.48	A	Q.49	B	Q.50	A
Q.51	B	Q.52	B	Q.53	C	Q.54	C	Q.55	A
Q.56	B	Q.57	D	Q.58	C	Q.59	A	Q.60	D
Q.61	B	Q.62	C	Q.63	C	Q.64	C	Q.65	C
Q.66	A	Q.67	A	Q.68	B	Q.69	B	Q.70	A
Q.71	C	Q.72	D	Q.73	C	Q.74	C	Q.75	A
Q.76	B	Q.77	D	Q.78	D	Q.79	B	Q.80	D
Q.81	A	Q.82	C	Q.83	B	Q.84	B	Q.85	A
Q.86	C	Q.87	B	Q.88	C	Q.89	C	Q.90	D
Q.91	C	Q.92	C	Q.93	C	Q.94	B	Q.95	B
Q.96	D	Q.97	B	Q.98	C	Q.99	A	Q.100	D
Q.101	D	Q.102	D	Q.103	A	Q.104	C	Q.105	B
Q.106	B	Q.107	A	Q.108	C	Q.109	B	Q.110	C
Q.111	A	Q.112	D	Q.113	D	Q.114	C	Q.115	B
Q.116	B	Q.117	C	Q.118	B	Q.119	D	Q.120	D
Q.121	D	Q.122	C	Q.123	A	Q.124	B	Q.125	C
Q.126	C	Q.127	B	Q.128	A	Q.129	C	Q.130	C
Q.131	C	Q.132	C	Q.133	D	Q.134	B	Q.135	A
Q.136	B	Q.137	D	Q.138	C	Q.139	B	Q.140	C

EXERCISE-2

Q.1	ABCD	Q.2	ACD	Q.3	BC	Q.4	AD	Q.5	BC
Q.6	AC	Q.7	ABCD	Q.8	AC	Q.9	AD	Q.10	ABD
Q.11	ABCD	Q.12	BD	Q.13	BD	Q.14	ABCD	Q.15	CD
Q.16	BD	Q.17	BCD	Q.18	ABD	Q.19	AD	Q.20	AC
Q.21	CD	Q.22	AB	Q.23	ABC	Q.24	ACD	Q.25	AB
Q.26	ABC	Q.27	ABCD	Q.28	ABCD	Q.29	ABC	Q.30	ABCD
Q.31	AD	Q.32	ABC	Q.33	ABD	Q.34	AB	Q.35	ACD
Q.36	ABCD	Q.37	ABC	Q.38	ABCD	Q.39	ABCD	Q.40	ACD
Q.41	BC	Q.42	ACD	Q.43	ABC	Q.44	AC	Q.45	BD
Q.46	ABC	Q.47	BD	Q.48	AC	Q.49	ACD	Q.50	CD
Q.51	CD	Q.52	BD	Q.53	AB	Q.54	ACD	Q.55	CD
Q.56	AC	Q.57	CD	Q.58	ABD	Q.59	ABCD	Q.60	ABCD
Q.61	CD	Q.62	ABC	Q.63	ABC	Q.64	ABC	Q.65	BD
Q.66	ABCD	Q.67	AD	Q.68	AB	Q.69	ABCD	Q.70	AD
Q.71	ABCD	Q.72	CD	Q.73	C	Q.74	BD	Q.75	ABC
Q.76	AC	Q.77	ABCD	Q.78	BC	Q.79	BD	Q.80	ABCD
Q.81	ABC	Q.82	CD	Q.83	AC	Q.84	ABC	Q.85	C
Q.86	C	Q.87	B	Q.88	D	Q.89	D	Q.90	D
Q.91	C	Q.92	A	Q.93	A	Q.94	B	Q.95	B
Q.96	D	Q.97	A	Q.98	C	Q.99	A	Q.100	B
Q.101	B	Q.102	D	Q.103	D	Q.104	B	Q.105	B
Q.106	A	Q.107	D	Q.108	A	Q.109	B	Q.110	C
Q.111	C	Q.112	B	Q.113	B				

Q.114 (A) P, R, S; (B) P, S; (C) P, R, S; (D) P, Q, R, S

Q.115 (A) Q,R (B) P,Q,R,S (C) Q,S (D) P,Q,R,S

Q.116 (A) P,Q,R (B) S (C) Q,R,S

		Q.117	4	Q.118	0040	Q.119	4	Q.120	10
Q.121	3	Q.122	0206	Q.123	0004	Q.124	4	Q.125	3
Q.126	2	Q.127	4	Q.128	0006	Q.129	0006	Q.130	2
Q.131	5	Q.132	5	Q.133	4	Q.134	0015	Q.135	5
Q.136	4	Q.137	3	Q.138	0004	Q.139	5	Q.140	4
Q.141	2	Q.142	8						