Exercise-1

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Introduction to Bonding, Octet rule and Ionic bond

A-1. An ionic bond $A^+ B^-$ is most likely to be formed when :
(1) The ionization energy of A is high and the electron affinity of B is low
(2*) The ionization energy of A is low and the electron affinity of B is high
(3) The ionization energy of A and the electron affinity of B is high
(4) The ionization energy of A and the electron affinity of B is low

A-2. Which forms a crystal of NaCl ?
(1) NaCl molecules (2*) Na^+ and Cl^- ions (3) Na and Cl atoms (4) None of these

A-3. Which of the following pair of elements form a compound with maximum ionic character ?
(1) Na and F (2*) Cs and F (3) Na and Br (4) Cs and I

A-4. Two element have electronegativity of 1.2 and 3.0. Bond formed between them would be :
(1*) ionic (2) polar covalent (3) co-ordinate (4) metallic

A-5. Which one of the following pairs of elements is most likely to form an ionic compound?
(1) B and Cl_2 (2*) K and O_2 (3) O_2 and Cl_2 (4) Al and I_2

A-6. Among Na^+, Mg^{2+} and Al^{3+}, the correct order of ease of formation of ionic compounds is :
(1) $Al^{3+} > Mg^{2+} > Na^+$ (2*) $Na^+ > Mg^{2+} > Al^{3+}$ (3) $Mg^{2+} > Al^{3+} > Na^+$ (4) $Al^{3+} > Na^+ > Mg^{2+}$

A-7. Which of the following shows the highest lattice energy ?
(1) RbF (2) CsF (3*) NaF (4) KF

A-8. Which of the following have low lattice energy ?
(1) Cs – F (2) Cs – Cl (3) Cs – Br (4*) Cs – I

Section (B) : Fajan's rule

B-1. According to Fajan's rule covalent character is favoured by :
(1) large cation and small anion (2*) small cation and large anion
(3) large cation and large anion (4) small cation and small anion

B-2. Which one of the following combination of ion will have highest polarisation ?
(1) Pb^{2+}, Br^- (2*) Pb^{4+}, Br^- (3) Fe^{2+}, Br^- (4) Fe^{3+}, Br^-

B-3. Correct order of covalent character of alkaline earth metal chloride in
(1) $BeCl_2 < MgCl_2 < CaCl_2 < SrCl_2$ (2) $BeCl_2 < CaCl_2 < SrCl_2 < MgCl_2$
(3*) $BeCl_2 > MgCl_2 > CaCl_2 > SrCl_2$ (4) $SrCl_2 > BeCl_2 > CaCl_2 > MgCl_2$

B-4. Which of the following is in order of increasing covalent character ?
(1) $CCl_4 < BeCl_2 < BCl_3 < LiCl$ (2) $LiCl < CCl_4 < BeCl_2 < BCl_3$
(3*) $LiCl < BeCl_2 < BCl_3 < CCl_4$ (4) $LiCl < BeCl_2 < CCl_4 < BCl_3$

B-5. Least melting point is shown by the compound :
(1) $PbCl_2$ (2*) $SnCl_4$ (3) NaCl (4) $AlCl_3$

B-6. Which is most ionic according to Fajan's rule?:

(1*) AlF_3 (2) Al_2O_3 (3) AlN (4) Al_4C_3

B-7. Which compound among the following has least ionic character?
(1) $AlCl_3$ (2*) AlI_3 (3) MgI_2 (4) CsI

B-8. In which of the following compound the cation has pseudo inert gas configuration?
(1) NaCl (2) $AlCl_3$ (3*) CuCl (4) $CaCl_2$

Section (C) : Covalent Bond and Coordinate Bond

C-1. The maximum covalency of representative elements (having zero formal charge) is equal to (excluding 1st and 2nd period) :
(1) the number of unpaired p-electrons
(2) the number of paired d-electrons
(3) the number of unpaired s and p-electrons
(4*) the actual number of s and p-electrons in the outermost shell.

C-2. Which of the following contains both electrovalent and covalent bonds ?
(1) $MgCl_2$ (2) H_2O (3*) NH_4Cl (4) none

C-3. The types of bond present in N_2O_5 are :
(1) only covalent (2) only ionic (3) ionic and covalent (4*) covalent & coordinate

C-4. Example of super octet molecule is :
(1) SF_6 (2) PCl_5 (3) IF_7 (4*) All of these

C-5. The number of electrons involved in the bond formation in N_2 molecule is :
(1) 2 (2) 4 (3) 10 (4*) 6

C-6. The octet rule is not obeyed in :
(1) CO_2 (2) BCl_3 (3) PCl_5 (4*) (2) and (3) both

C-7. For the formation of covalent bond the difference in the value of electronegativity should be :
(1) 1.7 (2) More than 1.7 (3) 1.7 or more (4*) equal to or less than 1.7

C-8. The covalency of nitrogen in HNO_3 is :
(1) 0 (2) 3 (3*) 4 (4) 5

C-9. Which one of the following molecules has a co-ordinate as well as covalent bond ?
(1*) NH_4Cl (2) $AlCl_3$ (3) NaCl (4) Cl_2

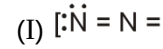
C-10. Which of the following species are hypervalent ?
1. ClO_4^-, 2. BF_3, 3. SO_4^{2-}, 4. CO_3^{2-}
(1) 1, 2, 3 (2*) 1, 3 (3) 3, 4 (4) 1, 2

Section (D) : Formal charge and Resonance

D-1. What are the formal charges on central sulphur and each terminal oxygen atoms in SO_2?

D-2. Resonating structures have different :
(1) atomic arrangements (2*) electronic arrangements
(3) functional groups (4) alkyl groups

D-3. Which among the following resonance structures of N_3^- satisfies the octet rule but is ruled out as a resonance structure?

(I)  (II)  (III)  (IV) 

(1*) IV only (2) I and IV only (3) I only (4) II and III only

D-4. Which one in the following is not the resonating structure of CO_2 :

(1*) O ≡ C = O (2) O = C = O (3) $^{-}O - C \equiv O^{+}$ (4) $^{+}O \equiv C - O^{-}$

D-5._ Average bond order of C–C bond in C_6H_6 is

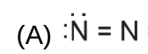
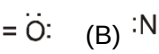
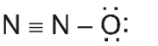
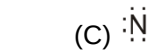
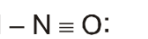
C_6H_6 esa C–C ca/k dk vkSlr ca/k Øe gS %

(1) 1 (2) 2 (3*) 1.5 (4) 1.33

D-6._ Among the species ,which has the weakest carbon- oxygen bond :

(1) CO_2 (2) CH_3COO^{-} (3) *CO* (4*) CO_3^{2-}

D-7._ Which one (s) of the following structures cannot represent resonance forms for N_2O (diamagnetic)? **[Schaum's series]**

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

(1) A and C (2) C , E and D (3*) D and E (4) C and D.

Section (E) : Valence bond theory

E-1. VBT is given by :

(1*) Heitler & london (2) Pauling & Slater (3) Hund & Muliken (4) Huckel & Hund

E-2. Number and type of bonds between two carbon atoms in CaC_2 are :

(1) one sigma (σ) and one pi (π) bond (2*) one σ and two π bonds

(3) one σ and one and a half π bond (4) one σ bond

E-3. The total number of σ and π bonds in $C_2(CN)_4$ are :

(1*) 9 σ and 9 π (2) 9 σ and 18π (3) 18 σ and 9π (4) 18 σ and 18π

E-4. Acetylene consists of :

(1*) both sigma and pi bonds (2) sigma bond only

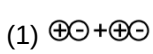
(3) pi bond only (4) none of these

E-5. Number of bonds in SO_2 are :

(1) two σ and two π (2) two σ and one π

(3*) two σ, two π and one lone pair (4) none of these

E-6._ Effective overlapping will be shown by :

(1)  (2)  (3*) (4) All the above

E-7._ Indicate the wrong statement according to Valence bond theory :

(1) A sigma bond is stronger then π - bond

(2*) p-orbitals always have only sidewise overlapping

(3) s-orbitals never form π - bonds

(4) There can be only one sigma bond between two atoms

Section (F) : VSEPR Theory

F-1. In which of the following molecules number of lone pairs and bond pairs on central atom are not equal ?

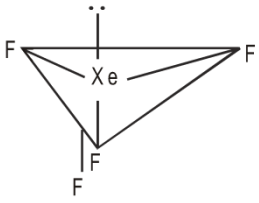
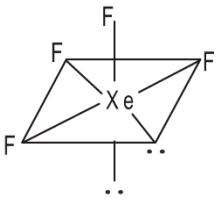
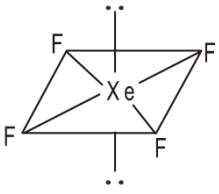
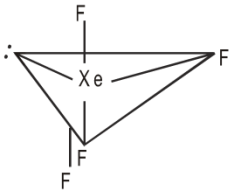
(1) H_2O (2*) I_3^- (3) O_2F_2 (4) SCl_2

F-2. Which one of the following species is not linear ?
(1) CO_2 (2*) ClO_2 (3) I_3^- (4) NO_2^+

F-3. Match list I with List II and select the correct answer using the codes given below the lists.

	List I (Compound)	**List II (Shape)**
(a)	CS_2	1. Bent
(b)	SO_2	2. Linear
(c)	BF_3	3. Trigonal planer
(d)	NH_3	4. Tetrahedral
		5. Trigonal pyramidal

F-4. Which is the right structure of XeF_4 ?

(1)  (2)  (3*)  (4) 

F-5. The ion which is not tetrahedral in shape is :
(1) BF_4^- (2) NH_4^+ (3) XeO_4 (4*) ICl_4^-

F-6. The molecule/ion which has trigonal pyramidal shape is :
(1*) PCl_3 (2) SO_3 (3) CO_3^{2-} (4) NO_3^-

F-7. Which of the following pairs of compound has linear structure ?
(1) Cl_2O, H_2O (2) SO_2, NO_2 (3) OF_2, H_2O_2 (4*) $BeCl_2$, CO_2

F-8. CO_2 is isostructure with :
(I) $HgCl_2$ (II) $SnCl_2$ (III) NO_2 (IV) C_2H_2
The correct answer is :
(1*) I, IV (2) I, II (3) II, III (4) I, II, III

F-9. The pair having similar geometry is :
(1) BF_3, NH_3 (2*) BF_3, AlF_3 (3) BeF_2, H_2O
(4) BCl_3, PCl_3

Section (G) : Hybridisation and Bond angle

G-1. Which of the following has been arranged in increasing order of % p-character?
(1*) $sp < sp^2 < sp^3$ (2) $sp^3 < sp^2 < sp$ (3) $sp^2 < sp^3 < sp$ (4) $sp^2 < sp < sp^3$

G-2. Choose the molecules in which hybridisation occurs in the ground state ?
(a) BCl_3 (b) NH_3 (c) PCl_3 (d) BeF_2

G-3. In C—C bond C_2H_6 undergoes heterolytic fission, the hybridisation of two resulting carbon atoms is :
(1) sp^2 both (2) sp^3 both (3*) sp^2, sp^3 (4) sp, sp^2

G-4. The hybridization in PF_3 is :
(1*) sp^3 (2) sp^2 (3) dsp^3 (4) d^2sp^3

G-5. Which of the following compounds have bond angle as nearly 90º ?
(1) CH_4 (2) CO_2 (3) H_2O (4*) SF_6

G-6 sp^2 – hybridisation is shown by :
(1) $BeCl_2$ (2*)) BF_3 (3) NH_3 (4) XeF_2

G-7. The hybridisation of carbon in diamond, graphite and acetylene is (respectively) –
(1*) sp^3, sp^2, sp (2) sp^3, sp, sp^2 (3) sp^2, sp^3, sp (4) sp, sp^3, sp^2

G-8. The hybridization of the central atom in ICl_2^+ is -
(1) dsp^2 (2) sp (3) sp^2 (4*) sp^3

G-9. Each carbon in carbon suboxide is :
(1) sp^2 - hybridized (2) sp^3-hybridized
(3*) sp-hybridized (4) sp^2-hybridized but linked with one co-ordinate bond

G-10. In which of the following pairs hybridisation of the central atom is different ?
(1) ClF_3 , ClF_3O (2) ClF_3O, ClF_3O_2 (3*) $[ClF_2O]^+$, $[ClF_4O]^-$ (4) $[ClF_4O]^-$, $[XeOF_4]$

G-11. OF_2 is :
(1) Linear molecule and sp hybridised (2) Tetrahedral molecule and sp^3 hybridised
(3*) Bent molecule and sp^3 hybridised (4) None of these

G-12. Which has the smallest bond angle (X – S – X) in the given molecules?
(1*) OSF_2 (2) $OSCl_2$ (3) $OSBr_2$ (4) OSI_2 .

G-13. Consider the following iodides :

	PI_3	AsI_3	SbI_3
	102°	100.2°	99°

The bond angle is maximum in PI_3, which is :
(1) due to small size of phosphorus (2*) due to more bp–bp repulsion in PI_3
(3) due to less electronegativity of P (4) none of these

G-14. Arrange the following in the increasing order of deviation from normal tetrahedral angle :
(1) $P_4 < PH_3 < H_2O$ (2) $PH_3 < H_2O < P_4$ (3) $P_4 < H_2O < PH_3$ (4*) $H_2O < PH_3 < P_4$

G-15. The bond angle H – N – H in NH_3, NH_4^+ and NH_2^- decreases in the order as :
(1) $NH_2^- > NH_3 > NH_4^+$ (2*) $NH_4^+ > NH_3 > NH_2^-$ (3) $NH_3 > NH_2^- > NH_4^+$ (4) $NH_3 > NH_4^+ > NH_2^-$

G-16. The angle between two covalent bond is maximum in :
(1) H_2O (2*) CO_2 (3) NH_3 (4) CH_4

G-17. Which is having highest bond angle :
(1) PCl_3 (2) PBr_3 (3) PF_3 (4*) PI_3

Section (H) : Electron deficient bond and Back bonding

H-1._ Electron deficient molecule among the following is : **[Made by BKS Sir_2015]**
(1) I_2Cl_6 (2*) B_2H_6 (3) Al_2Cl_6 (4) All of these

H-2._ For B_2H_6
S_1 : Each boron is sp^3 hybridised
S_2 : from terminal 'H' & two 'B' atom are in same plane but two bridge hydrogen in different plane
S_3 : It has 4 σ bond & 2 bridge bond

S_4 : 8 σ bonds are present in it
(1) T T F F (2*) T T T F (3) F F T F (4) F T F T

H-3._ Identify the species containing Banana bonds
(1*) $(BeH_2)_n$ (2) BF_3 (3) $(AlCl_3)_2$ (4) $(BeCl_2)_n$

H-4._ Which is not true about B_2H_6
(1) Both 'B' atoms are sp^3 hybridised (2*) Boron atom is in ground state
(3) Two hydrogens occupy special positions (4) There are two, three centre two electron bonds

H-5._ For BF_3 molecule which of the following is true ?
(1) B-atom is sp^2 hybridised.
(2) There is a pπ–pπ back bonding in this molecule.
(3) Observed B–F bond length is found to be less than the expected bond length.
(4*) All of these

H-6._ Respective order of strength of back-bonding in boron trihalides is :
(1) $BF_3 < BCl_3 < BBr_3$ (2) $BF_3 > BBr_3 > BCl_3$
(3*) $BF_3 > BCl_3 > BBr_3$ (4) $BF_3 < BBr_3 < BCl_3$

H-7._ For BF_3 molecule which of the following will not be true
(1) It has less bond length than BF_4^-
(2) It has less bond length than the compound $[NH_3 \rightarrow BF_3]$
(3*) It's bond strength is increased because of pπ–dπ back bonding
(4) It forms BF_4^- when hydrolysed in water.

H-8. Which is the true statement about $(SiH_3)_3N$?
(1*) It is trigonal planar. (2) It is trigonal pyramidal.
(3) It is stronger lewis base than that of $(CH_3)_3N$. (4) It has a total of 9 sigma bonds.

Section (I) : Molecular Orbital Theory (MOT)

I-1. When two atomic orbitals combine they form :
(1*) two moleculear orbital (2) one molecular orbital
(3) three molecular orbital (4) four molecular orbital

I-2. During the formation of a molecular orbital from atomic orbitals of the same atom, probability of electron density is :
(1) non zero in the nodal plane (2) maximum in the nodal plane
(3*) zero in the nodal plane (4) zero on the surface of the lobe

I-3. Which one of the following can not exist on the basis of molecular orbital theory ?
(1) H_2^+ (2) He_2^+ (3) C_2 (4*) He_2

I-4. Which of the following has fractional bond order ?
(1) B_2 (2) O_2^{2-} (3) F_2 (4*) H_2^-

I-5. In which of the following set, the values of bond orders will be 2.5 ?
(1*) O_2^+, NO, NO^{2+}, CN (2) CN, NO^{2+}, CN^-, F_2 (3) O_2^+ , NO^{2+}, O_2^{2+}, CN^- (4) O_2^{2-}, O_2^-, O_2^+, O_2

I-6. Among the following species, which has the minimum bond length ?
(1) B_2 (2*) C_2 (3) F_2 (4) O_2^-

I-7. Number of antibonding electrons in N_2 is :
(1*) 4 (2) 10 (3) 12 (4) 14

I-8. Pick out the incorrect statement.
(1) N_2 has greater dissociation energy than N_2^+ (2) O_2 has lower dissociation energy than O_2^+
(3*) Bond length in N_2^+ is less than N_2 (4) Bond length in NO^+ is less than in NO.

I-9. Which of the following pairs have identical values of bond order ?
(1*) N_2^+ and O_2^+ (2) F_2 and Ne_2 (3) O_2 and B_2 (4) C_2 and N_2

I-10. A simplified application of MO theory to the hypothetical 'molecule' OF would give its bond order as :
(1) 2 (2*) 1.5 (3) 1.0 (4) 0.5

I-11. Which of the following species is paramagnetic ?
(1*) NO^- (2) O_2^{2-} (3) CN^- (4) CO

I-12. The following molecules/species have been arranged in the order of their increasing bond orders Identify the correct order.
(I) O_2 ; (II) O_2^- ; (III) O_2^{2-} ; (IV) O_2^+
(1*) I I I < I I < I < IV (2) IV < I I I < I I < I (3) I I I < I I < IV < I (4) I I < I I I < I < IV

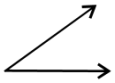
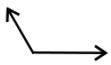
I-13. Which the following molecules / species have identical bond order and same magnetic properties ?
(I) O_2^+ ; (II) NO ; (III) N_2^+
(1) (I) , (II) only (2) (I) and I I I only (3*) (I) ,(I I) and (I I I) (4) (I I) and (I I I) only

I-14. Negative bond order means :
(1*) molecule is unstable (2) molecule is stable
(3) molecule is neutral (4) none of them

Section (J) : Dipole Moment

J-1. Which hydrogen is most polar ?
(1) LiH (2) CsH (3*) HF (4) HI

J-2. The most polar bond is :
(1) C – H (2) N – H (3) S – H (4*) O – H

J-3. Which has maximum dipole moment ?
(1*)  (2)  (3)  (4)

J-4. Of the following molecules, the one, which has permanent dipole moment, is : **[CB]**
(1) SiF_4 (2) BF_3 (3*) PF_3 (4) PF_5

J-5. Which of the following has the least dipole moment ?
(1) NF_3 (2*) SO_3 (3) XeO_3 (4) NH_3

J-6. Among the following compounds the one that is polar and has central atom with sp^3 hybridisation is :
(1) H_2CO_3 (2) SiF_4 (3) BF_3 (4*) $HClO_2$

J-7. The dipole moment of the given molecules are such that :
(1) $BF_3 > NF_3 > NH_3$ (2) $NF_3 > BF_3 > NH_3$ (3*) $NH_3 > NF_3 > BF_3$ (4) $NH_3 > BF_3 > NF_3$

J-8. The correct order of dipole moment is :

(1*) $CH_4 < NF_3 < NH_3 < H_2O$ (2) $NF_3 < CH_4 < NH_3 < H_2O$
(3) $NH_3 < NF_3 < CH_4 < H_2O$ (4) $H_2O < NH_3 < NF_3 < CH_4$

J-9. Carbon tetrachloride has no dipole moment because of :
(1) its planar structure (2*) its regular tetrahedral structure
(3) similar sizes of carbon and chlorine (4) similar electron affinities of carbon and chlorine

J-10. The molecules which has zero dipole moment is :
(1) ClO_2 (2) PCl_3 (3*) XeF_4 (4) $CHCl_3$

J-11. The dipole moment of HCl is 1.03 D. If H–Cl bond distance is 1.275 Å, what is the percentage of ionic character in the H–Cl bond -
(1) 60% (2) 39% (3) 29% (4*) 17%

Section (K) : Hydrogen bonding

K-1. Pure phosphoric acid is very viscous because :
(1) it is a strong acid (2) it is tribasic acid (3) it is hygroscopic
(4*) it has PO_4^{3-} groups which are bonded by many hydrogen bonds

K-2. Which of the following is least volatile ?
(1*) HF (2) HCl (3) HBr (4) HI

K-3. Which one of the following does not have intermolecular H-bonding ?
(1) H_2O (2*) o-nitro phenol (3) HF (4) CH_3COOH

K-4. Which of the following exhibits H-bonding ?
(1) CH_4 (2) H_2Se (3*) N_2H_4 (4) H_2S

K-5. H–bonding is not present in :
(1) NH_3 (2) H_2O (3*) H_2S (4) HF

K-6. Hydrogen bonding would not affect the boiling point of :
(1*) HI (2) NH_3 (3) CH_3OH (4) H_2O

K-7. Which of the following compound has maximum number of H-bonds per mole ?
(1) HF (2) PH_3 (3*) H_2O (4) OF_2

K-8. Water (H_2O) is liquid while hydrogen sulphide (H_2S) is a gas because :
(1) water has higher molecular weight
(2) hydrogen sulphide is weak acid
(3*) water molecular associate through hydrogen bonding
(4) sulphur has high electronegativity than oxygen

Section (L) : Intermolecular forces

L-1. Which of the following has the highest boiling point?
(1) H_2 (2) Ne (3*) Xe (4) CH_4

L-2. Among the following molecules the dipole-dipole attraction does not play most important role in determing the melting and boiling point is :
(1) ICl (2*) Br_2 (3) H_2S (4) CO

L-3. At ordinary temperature and pressure, among halogens chlorine is a gas, bromine is a Liquid and iodine is a solid. This is because :
(1) The specific heat is in the order $Cl_2 > Br_2 > I_2$
(2*) Intermolecular forces among molecule of chlorine are the weakest and those in iodine the strongest
(3) The order of density is $I_2 > Br_2 > Cl_2$
(4) The order of stability is $I_2 > Br_2 > Cl_2$

L-4. Which of the following models best describes the bonding within a layer of the graphite structure ?
(1) metallic bonding (2) ionic bonding
(3*) non-metallic covalent bonding (4) v

L-5. Among the following, v are maximum in :
(1) HBr (2) LiBr (3) LiCl (4*) AgBr

L-6. Which of the following bonds/forces is weakest ?
(1) Covalent bond (2) Ionic bond (3) Metallic bond (4*) London force

L-7. In which molecule is the London dispersion force likely to be most important in determining boiling point?
(1) H_2O (2*) Br_2 (3) SO_2 (4) ClF_3

Section (M) : Metallic bond

M-1._ Iron is harder than sodium because :
(1) iron atoms are smaller. (2) iron atoms are more closely packed.
(3) metallic bonds are stronger in sodium. (4*) metallic bonds are stronger in iron.

M-2._ The enhanced force of cohesion in metals is due to :
(1) The covalent linkages between atoms
(2) The electrovalent linkages between atoms
(3) The lack of exchange of valency electrons
(4*) The delocalization of valence electron between metallic kernels.

Exercise-2

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

1. When two atoms combine to form a molecule :
(1*) energy is released (2) energy is obserbed
(3) energy is neither released nor absorbed (4) energy may either released or absorbed

2. Which condition favours the bond formation ?
(1) Maximum attraction and maximum potential energy
(2) Minimum attraction and minimum potential energy
(3*) Minimum potential energy and maximum attraction
(4) None of the above

3. Most favourable conditions for electrovalent bonding are :
(1*) low ionisation potential of one atom and high electron affinity of the other atom
(2) high electron affinity and high ionisation potential of both the atoms

(3) low electron affinity and low ionisation potential of both the atoms
(4) high ionisation potential of one atom and low electron affinity of the outer atom.

4. Which one of the following bonds is least covalent ?
(1*) S-F in SF_2 (2) S-F in SF_4 (3) S-F in SF_6 (4) S-S in S_8

5. The correct order of increasing covalent character of the following is :
(1) $SiCl_4 > AlCl_3 < CaCl_3 < KCl$ (2*) $KCl < CaCl_2 < AlCl_3 < SiCl_4$
(3) $AlCl_3 < CaCl_2 < KCl < SiCl_4$ (4) None of these

6. Select the most ionic and most covalent compounds respectively from the following.
CrO_5, Mn_2O_7, PbO, P_4O_{10}, SnO_2
(1) CrO_5, Mn_2O_7 (2*) PbO, Mn_2O_7 (3) CrO_5, P_4O_{10} (4) SnO_2, CrO_5

7. To which of the following species is the octet rule applicable ?
(1) BrF_5 (2) SF_6 (3) IF_7 (4*) CO_2

8. Which statement(s) is incorrect ?
(1) Polarising power refers to cation.
(2) Polarisability refers to anion.
(3) Small cation is more efficient to polarise anion.
(4*) Molecules in which cation having pseudo inert gas configuration are more Ionic.

9. In which of the following will have highest hydration ?
(1) Rb (2) Cs (3*) Na (4) K

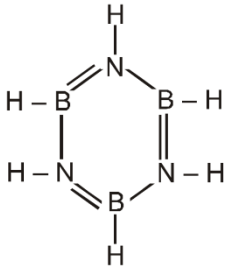
10. If a molecule X_2 has a triple bond, then X will have the electronic configuration :
(1) $1s^2\ 2s^2\ 2p^5$ (2*) $1s^2\ 2s^2\ 2p^3$ (3) $1s^2\ 2s^1$ (4) $1s^2\ 2s^2\ 2p^1$

11. Which of the following does not contain coordinate bond ?
(1) BH_4^- (2) NH_4^+ (3*) CO_3^{2-} (4) H_3O^+

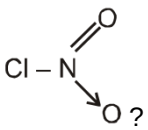
12. The species which is diamagnetic is :
(1) NO (2) NO_2 (3) ClO_2 (4*) N_2O_4

13. N_2O is isoelectronic with CO_2 and N_3^-, which is the structure of N_2O ?
(1)  (2) N–O–N (3)  (4*) N ≡ N → 

14. What are the formal charges on B and N respectively in the given structure?



(1*) –1, + 1, (2) + 1, – 1 (3) – 2, + 2 (4) 0, 0

15. What is the formal charge on N in  ?
(1*) + 1 (2) – 1 (3) 0 (4) + 2

16. In PO_4^{3-} ion, the formal charge on each oxygen atom and P– O bonds order respectively are **[DMT 2004]**
(1*) – 0.75, 1.25 (2) –0.75, 1.0 (3) – 0.75, 0.6 (4) – 3, 1.25

17. For hydrazoic acid , which of the following resonating structure will be least stable ?

$$\underset{(I)}{H - N = N^{+} = N^{-}} \longleftrightarrow \underset{(II)}{H - N^{+} - N^{+} = N^{2-}} \longleftrightarrow \underset{(III)}{H - N^{-} - N^{+} \equiv N}$$

(1) I (2*) I I (3) I I F (4) Both (I) and (III)

18. The correct order of bond length is
(1) C–C < C=C < C≡C (2*) C≡C<C=C<C–C (3) C=C<C≡C<C–C (4) C=C<C–C<C≡C

19. Which of the following overlaps is **<u>incorrect</u>** [assuming z-axis to be the internuclear axis] ?
(a) 2 py + 2 py → π 2 py (b) 2 pz + 2 pz → σ 2pz
(c) 2 px + 2 px → π 2 px (d) 1 s + 2 py → π (1 s-2 py)
(1) 'a' & 'b' (2) 'b' & 'd' (3*) only 'd' (4) None of these

20. Which of the following statements is correct about the π-bond ?
(1) π-bond is formed when a sigma bond is not formed.
(2) Generally π-bond are formed from hybrid orbitals.
(3) π- bond may be formed by the overlapping of s-atomic orbitals.
(4*) π-bond results from lateral overlap of p-atomic orbitals.

21. p-p overlapping will be observed in the molecule of :
(1) H_2 (2) HBr (3) HCl (4*) Cl_2

22. Identify the correct match.

(i) XeF_2	(a) Central atom has sp^3 hybridisation and bent geometry.
(ii) N_3^-	(b) Central atom has sp^3d^2 hybridisation and octahedral.
(iii) PCl_5 (s) anion	(c) Central atom has sp hybridisation and linear geometry.
(iv) I_2Cl_6 (ℓ) cation	(d) Central atom has sp^3d hybridisation and linear geometry.

(1) (i – a), (ii – b), (iii – c), (iv – d) (2) (i – d), (ii – b), (iii – d), (iv – c)
(3) (i – b), (ii – c), (iii – a), (iv – d) (4*) (i – d), (ii – c), (iii – b), (iv – a)

23. In a change from $PCl_3 \rightarrow PCl_5$, the hybrid state of P changes from :
(1) sp^2 to sp^3 (2) sp^3 to sp^2 (3*) sp^3 to sp^3d (4) sp^3 to dsp^2

24. The type of hybrid orbitals used by chlorine atom in ClO^-, ClO_2^-, ClO_3^- and ClO_4^- is / are :
(1) sp, sp^2, sp^3 and sp^3d (2) sp and sp^3 (3*) only sp^3 (4) only sp

25. Correct statement regarding this reaction :

$$BF_3 + NH_3 \longrightarrow [F_3B \leftarrow NH_3]$$

(1) hybridisation of only N changes (2*) hybridisation of only B changes
(3) hybridisation of N and B both change (4) none of these.

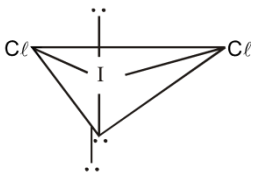
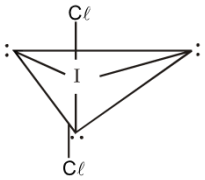
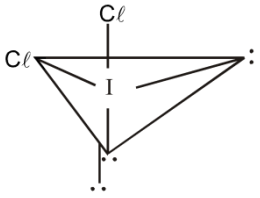
26. The hybridisation of central atoms in N_3^-, NOCl and N_2O are respectively :
(1*) sp , sp^2 , sp (2) sp , sp , sp^3 (3) sp^2 , sp , sp (4) sp^2 , sp^2 , sp

27. The shape of O_2F_2 is similar to :
(1) C_2F_2 (2*) H_2O_2 (3) H_2F_2 (4) C_2H_2

28. Which of the following molecules is trigonal bipyramidal?

(1) BF_3 (2) CH_4 (3*) PCl_5 (4) SF_6

29. The structure of $IC\ell_2^+$ would be :

(1)  (2)  (3)  (4*) None of these

30. The structure of $IO_2F_2^-$ is analogous to :

(1) SF_4 (2) XeO_2F_2 (3) F_2SeO_2 (4*) (1) and (2) both

31. The bond angle in H_2O is nearly 105° whereas bond angle in H_2S is nearly 92°. This is because :

(1*) Electronegativity of oxygen is greater than that of sulphur

(2) Oxygen is a gas whereas sulphur is solid

(3) Sulphur contains d-orbitals whereas oxygen does not

(4) The number of lone pairs present on oxygen and sulphur is not equal

32. In XeF_2, XeF_4 and XeF_6 (g) the number of lone pairs on Xe respectively are :

(1) 2, 3, 1 (2) 1, 2, 3 (3) 4, 1, 2 (4*) 3, 2, 1

33. Incorrect order about bond angle is/are :

(1) $H_2O > H_2S > H_2Se > H_2Te$ (2) $C_2H_2 > C_2H_4 > CH_4 > NH_3$

(3*) $SF_6 < NH_3 < H_2O < OF_2$ (4) $ClO_2 > H_2O > H_2S > SF_6$

34. The ONO angle is maximum in :

(1) HNO_3 (2*) NO_2^+ (3) HNO_2 (4) NO_2

35. Which of the following is electron deficient compounds ?

(1) $NaBH_4$ (2*) B_2H_6 (3) Al_2Cl_6 (4) $LiAlH_4$

36. Which of the following statement is incorrect ?

(1) During N_2^+ formation, one electron is removed from the bonding molecular orbital of N_2.

(2) During O_2^+ formation, one electron is removed from the antibonding molecular orbital of O_2.

(3*) During O_2^- formation, one electron is added to the bonding molecular orbitals of O_2.

(4) During CN^- formation, one electron is added to the bonding molecular orbitals of CN.

37. According to Molecular orbital theory which of the following is correct ?

(1) LUMO level for C_2 molecule is σ_{2p_x} orbital (2) In C_2 molecules both the bonds are π bonds

(3) In C_2^{2-} ion there is one σ and two π bonds (4*) All the above are correct

38. Which of the following species will have the minimum bond energy?

(1) N_2 (2) N_2^- (3) N_2^+ (4*) N_2^{2-}

39. The sequence that correctly describes the relative bond strengths partaining to oxygen molecule and its cation or anion is

40. Which of the following statements is correct about N_2 molecule ?

(1) It has a bond order of 3

(2) The number of unpaired electrons present in it is zero and hence it is diamagnetic

(3) The order of filling of MOs is π(2px) = π(2py), σ(2pz)

(4*) All the above three statements are correct

41. The bond order of HeH^+ is :
(1) 3/2 (2*) 1 (3) 1/2 (4) 2

42. Which of the following statements is true?
(1) The dipole moment of NF_3 is zero (2*) The dipole moment of NF_3 is less than NH_3
(3) The dipole moment of NF_3 is more than NH_3 (4) The dipole moment of NH_3 is zero

43. Which of the following orders are correct about the magnitude of dipole moments ?
(i) $NH_3 > NF_3$ (ii) $I_2Cl_6 > B_2H_6$ (iii) $Me_3N\text{-}BF_3 > Me_3N\text{-}SO_2$ (iv) $SiH_3OCH_3 > (SiH_3)_2O$
(1) (i) & (iv) only (2) (i), (ii) and (iv) only (3*) (i), (iii) and (iv) only (4) (iii) only

44. Which of the following would be expected to have a dipole moment of zero on the basis of symmetry?
(1) $SOCl_2$ (2) OF_2 (3*) SeF_6 (4) ClF_5

45. The dipole moment of HBr is 2.6×10^{-30} cm and the interatomic spacing is 1.41 Å. The percentage of ionic character in HBr is :
(1) 10.5 (2*) 11.5 (3) 12.5 (4) 13.5

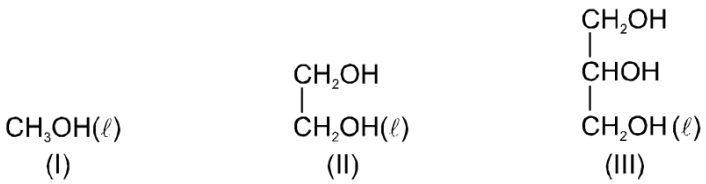
46. Which statement is true ? **[RPMT 2002]**
(1) The B.P. of diethyl ether and C_2H_5OH is equal. (2*) Diethyl ether have dipole moment.
(3) Diethyl ether is highly soluble in water. (4) Diethyl ether is Lewis acid.

47. H_2O boils at higher temperature than H_2S, because it is capable of forming :
(1) ionic bonds (2) covalent bonds (3*) hydrogen bonds (4) metallic bonds

48. Weakest hydrogen bond is :
(1) O–H - - - N (2*) N – H - - - N (3) F – H - - - F (4) All are equally strong

49. Which one among the following does not have the hydrogen bond ?
(1) HSO_5^- (2) C_6H_5OH (3) H_2SO_4 (4*) H_2S

50. The correct order of the viscosity in the following compounds in liquid state is :



(1) I > II > III (2*) III > II > I (3) II > III > I (4) I > III > II

51. The boiling point of p-nitrophenol is higher than that of o-nitrophenol because :
(1) NO_2 group at p-position behaves in a different way from that at o-position
(2) intramolecular hydrogen bonding exists in p-nitrophenol
(3*) there is intermolecular hydrogen bonding in p-nitrophenol
(4) p-nitrophenol has a higher molecular weight than o-nitrophenol

52. Density of ice is less than that of water because of :
(1) presence of Van der Wall interaction.
(2) crystal modification of ice.
(3*) open porous cage like structure of ice due to H-bonding.
(4) different physical states of these.

53. NH_3 has a much higher boiling point than PH_3 because :
(1*) NH_3 forms hydrogen bond.
(2) NH_3 has a larger molecular weight.
(3) NH_3 undergoes umbrella inversion.
(4) NH_3 contains ionic bonds where are PH_3 contains covalent bond.

54. Which of the following compounds would have significant intermolecular hydrogen bonding ?
HF, CH_3OH, N_2O_4, CH_4
(1) HF, N_2O_4 (2) HF, CH_4, CH_3OH (3*) HF, CH_3OH (4) CH_3OH, CH_4

55. Which of the following does not have intramolecular hydrogen bond ?
(1) persulphate ion (2) chloral hydrate (3) o-nitrophenol (4*) fumeric acid

56. The decreasing order of the boiling points of the following hydrides is
(i) NH_3 , (ii) PH_3, (iii) AsH_3 (iv) SbH_3 , (v) H_2O
fuEu gkbM+kbM ds DoFkukad dk vojksgh Øe fuEu gSA
(i) NH_3 , (ii) PH_3, (iii) AsH_3 (iv) SbH_3 , (v) H_2O
(1*) (v) > (iv) > (i) > (iii) > (ii) (2) (v) > (i) > (ii) > (iii) > (iv)
(3) (ii) > (iv) > (iii) > (i) > (v) (4) (iv) > (iii) > (i) > (ii) > (v)

57. The boiling point of ICI is nearly 40°C higher than that of Br_2 although the two substance have the same relative molecular mass. This is because :
(1) ICI is ionic compound .
(2) I–Cl bond is stronger than Br–Br bond.
(3*) ICI is polar covalent molecule while Br_2 is non polar.
(4) Ionization energy of iodine is less than that of Br.

58. The nature of intermolecular forces among benzene (C_6H_6) molecules is :
(1) dipole dipole attraction (2*) london dispersion forces (3) ion dipole attraction (4) hydrogen bonding

59. Which of the following is false ?
(1) V are responsible for the formation of molecular crystals.
(2) Branching lowers the boiling points of isomeric organic compounds due to reduction in the van der Waals force of attraction.
(3) In graphite, v act between the carbon layers.
(4*) Boiling point of NH_3 is greater than SbH_3.

60. Match the species given in column-I with the type of hybridisation given in column-II.

Column-I	**Column-II**
(A) $IO_2F_2^-$	(p) sp^3d
(B) F_2SeO	(q) sp^3
(C) SO_2	(r) sp^2
(D) XeF_5^+	(s) sp^3d^2

	A	B	C	D
(1*)	p	q	r	s
(2)	p	q	s	r
(3)	p	s	r	p
(4)	q	p	r	s

61. **Assertion :** NF_3 has little tendency to act as a donor molecule.
Reason : The highly electronegative F atoms attract electrons and these moments partly cancel the moment from the lone pair.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion

(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

62. **Assertion :** Molecules having different hybridisation can have same shape.
Reason : The shape of a molecule does not depend on the hybridisation but it depends on the energy factor.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

63. **Assertion :** Aluminium chloride in acidified aqueous solution forms octahedral $[Al(H_2O)_6]_3^+$ ion.
Reason : In $[Al(H_2O)_6]^{3+}$ complex ion, the 3d orbitals of Al are involved and the hybridisation state of Al is sp^3d^2.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

64. **Assertion :** NO_3^- and PO_3^- have similar formula type but differ structurally i.e. they have different type of hybridisation.
Reason : NO_3^- ion exists as free ion. On the other hand PO_3^- exists as cyclic or linear polymeric structure.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

65. **Assertion :** The increasing order of acidic character of CO_2, N_2O_5 , SiO_2 and SO_3 is $SO_3 > N_2O_5 > CO_2 > SiO_2$
Reason : As electronegativity difference (E–O) decreases acidic character of the oxide increases.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3*) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

66. **Assertion :** In graphite, on increasing the temperature the conductivity decreases along the layers of carbon atoms.
Reason : Graphite cleaves easily, because the force of attraction between the layers is weak van der Waal's force.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

67. **Assertion :** Molecular species like SF_6, PF_5 , I_3^- and XeF_2 violate the octet rule.
Reason : Compounds with an expanded octet are called hypervalent compounds.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

68. **Assertion :** π is stronger while σ is a weak bond.

Reason : Atoms rotate freely about π bond.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4*) Both are assertion and reason are incorrect

69. **Assertion :** Carbon has unique ability to form pπ–pπ multiple bonds with itself and with other atoms of small size and high electronegativity.
Reason : Heavier elements of group 14th do not form pπ–pπ multiple bonds with itself because their atomic orbitals are too large and diffuse to have effective overlapping.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

70. **Assertion :** Bond energy has order like C–C < C=C < C≡C.
Reason : Bond energy increase with increase in bond order.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

71. **Assertion :** Nitrogen molecule is paramagnetic.
Reason : N_2 molecule have unpaired electron.
(1) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4*) Both are assertion and reason are incorrect

72. **Assertion :** $[SiC\ell_6]^{2-}$ does not exist.
Reason : Interaction between lone pairs of chloride ions and Si^{4+} is not very strong and six large chloride ions can not be accommodated around Si^{4+} due to limitation of its size.
(1*) Both assertion and reason are correct, and the reason is the correct explanation for the assertion
(2) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion
(3) The assertion is incorrect, but the reason is correct
(4) Both are assertion and reason are incorrect

Exercise-3

PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

1. Which of the following compounds has the smallest bond angle in its molecule ? **[AIEEE-2003, 3/225]** **[AIEEE-2003, 3/225]**
(1) SO_2 (2) H_2O (3*) H_2S (4) NH_3

2. An ether is more volatile than an alcohol having the same molecular formula. This is due to: **[AIEEE-2003, 3/225]**
(1) dipolar character of ethers. (2) alcohols having resonance structures.
(3) inter-molecular hydrogen bonding in ethers. (4*) inter-molecular hydrogen bonding in alcohols.

3. The pair of species having identical shapes for molecules of both species is : **[AIEEE-2003, 3/225]**
(1) CF_4, SF_4 (2*) XeF_2, CO_2 (3) BF_3, PCl_3 (4) PF_5, IF_5.

4. Which of the following pair of molecules will have permanent dipole moments for both members? **[AIEEE-2003, 3/225]**

(1) SiF_4 and NO_2 (2) NO_2 and CO_2 (3*) NO_2 and O_3 (4) SiF_4 and CO_2

5. The correct order of bond angles (smallest first) in H_2S, NH_3, BF_3 and SiH_4 is : **[AIEEE-2004, 3/225]**

(1) $H_2S < SiH_4 < NH_3 < BF_3$ (2) $NH_3 < H_2S < SiH_4 < BF_3$

(3*) $H_2S < NH_3 < SiH_4 < BF_3$ (4) $H_2S < NH_3 < BF_3 < SiH_4$

6. The bond order in NO is 2.5 while that in NO^+ is 3. Which of the following statements is true for these two species? **[AIEEE-2004, 3/225]**

(1) bond length in NO^+ is greater than in NO (2*) bond length in NO is greater than in NO^+

(3) bond length in NO^+ is equal to that in NO (4) bond length is unpredictable

7. The states of hybridization of boron and oxygen atoms in boric acid (H_3BO_3) are respectively : **[AIEEE-2004, 3/225]**

(1*) sp^2 and sp^2 (2) sp^2 and sp^3 (3) sp^3 and sp^2 (4) sp^3 and sp^3

8. Which one of the following has the regular tetrahedral structure ? **[AIEEE-2004, 3/225]**

(1) XeF_4 (2) SF_4 (3*) BF_4^- (4) $[Ni(CN)_4]^{2-}$

(Atomic number : B = 5, S = 16, Ni = 28, Xe = 54)

9. Which one of the following does not have sp^2 hybridized carbon? **[AIEEE-2004, 3/225]**

(1) acetone (2) acetic acid (3*) acetonitrile (4) acetamide

10. Lattice energy of an ionic compound depends upon : **[AIEEE-2005, 3/225]**

(1) charge on the ions only (2) size of the ions only

(3) packing of ions only (4*) charge on the ion and size of the ion

11. Based on lattice energy and other considerations, which one of the following alkali metal chlorides is expected to have the highest melting point ? **[AIEEE-2005, 3/225]**

(1) LiCl (2*) NaCl (3) KCl (4) RbCl

12. The molecular shapes of SF_4, CF_4 and XeF_4 are : **[AIEEE-2005, 3/225]**

(1) The same with 2, 0 and 1 lone pairs of electrons on the central atom, respectively.

(2) The same with 1, 1 and 1 lone pair of electrons on the central atoms, respectively.

(3) Different with 0, 1 and 2 lone pairs of electrons on the central atom, respectively.

(4*) Different with 1, 0 and 2 lone pairs of electrons on the central atom, respectively.

13. Which one of the following species is diamagnetic in nature ? **[AIEEE-2005, 1½/225]**

(1) He_2^+ (2*) H_2 (3) H_2^+ (4) H_2^-.

14. The number and type of bonds between two carbon atoms in calcium carbide are : **[AIEEE-2005, 3/225]**

(1) one sigma, one pi (2*) one sigma, two pi (3) two sigma, one pi (4) two sigma, two pi

15. Which of the following molecules/ions does not contain unpaired electrons? **[AIEEE-2006, 3/165]**

(1*) O_2^{2-} (2) B_2 (3) N_2^+ (4) O_2

16. A metal, M forms chlorides in + 2 and + 4 oxidation states. Which of the following statements about these chlorides is correct ? **[AIEEE-2006, 3/165]**

(1) MCl_2 is more volatile than MCl_4 (2) MCl_2 is more soluble in anhydrous ethanol than MCl_4

(3*) MCl_2 is more ionic than MCl_4 (4) MCl_2 is more easily hydrolysed than MCl_4

17. In which of the following molecules/ions are all the bonds not equal? **[AIEEE-2006, 3/165]**
(1*) SF_4 (2) SiF_4 (3) XeF_4 (4) BF_4^-

18. Which of the following hydrogen bonds is the strongest ? **[AIEEE-2007, 3/120]**
(1) O – H ... O (2) O – H ... F (3) F – H ... H (4*) F – H ... F

19. 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 these cationic species, K^+, Ca^{2+}, Mg^{2+}, Be^{2+}? **[AIEEE-2007, 3/120]**
(1*) $K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$ (2) $Ca^2 < Mg^{2+} < Be^{2+} < K^+$
(3) $Mg^{2+} < Be^{2+} < K^+ < Ca^{2+}$ (4) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$

20. In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed ? **[AIEEE-2007, 3/120]**
(1) $O_2 \longrightarrow O_2^+$ (2) $N_2 \longrightarrow N_2^+$ (3) $C_2 \longrightarrow C_2^+$ (4*) $NO \longrightarrow NO^+$

21. Which one of the following pairs of species have the same bond order? **[AIEEE-2008, 3/105]**
(1) CN^- and CN^+ (2) O_2^- and CN^- (3) NO^+ and CN^+ (4*) CN^- and NO^+

22. The bond dissociation energy of B – F in BF_3 is 646 kJ mol^{-1} whereas that of C – F in CF_4 is 515 kJ mol^{-1}. The correct reason for higher B – F bond dissociation energy as compared to that of C – F is : [AIEEE-2009, 4/144]
(1) stronger σ bond between B and F in BF_3 as compared to that between C and F in CF_4.
(2*) significant pπ - pπ interaction between B and F in BF_3 whereas there is no possibility of such interaction between C and F in CF_4.
(3) lower degree of pπ - pπ interaction between B and F in BF_3 than that between C and F in CF_4.
(4) smaller size of B - atom as compared to that of C - atom.

23. Using MO theory predict which of the following species has the shortest bond length ? **[AIEEE-2009, 4/144]**
[AIEEE-2009, 4/144]
(1) O_2^+ (2) O_2^- (3) O_2^{2-} (4*) O_2^{2+}

24. Among the following the maximum covalent character is shown by the compound : **[AIEEE-2011, 4/120]**
(1) $FeCl_2$ (2) $SnCl_2$ (3*) $AlCl_3$ (4) $MgCl_2$

25. The hybridisation of orbitals of N atom in NO_3^-, NO_2^+ and NH_4^+ are respectively : **[AIEEE-2011, 4/120]**
(1) sp, sp^2, sp^3 (2*) sp^2, sp, sp^3 (3) sp, sp^3, sp^2 (4) sp^2, sp^3, sp

26. The structure of IF_7 is : **[AIEEE-2011, 4/120]**
(1) square pyramid (2) trigonal bipyramid (3) octahedral (4*) pentagonal bipyramid

27. The number of types of bonds between two carbon atoms in calcium carbide is: **[AIEEE-2011, 4/120]**
(1) One sigma, one pi (2) Two sigma, one pi
(3) Two sigma, two pi (4*) One sigma, two pi

28. Which of the following has maximum number of lone pairs associated with Xe ? **[AIEEE-2011, 4/120]**
(1) XeF_4 (2) XeF_6 (3*) XeF_2 (4) XeO_3

29. The molecule having smallest bond angle is : **[AIEEE-2012, 4/120]**

(1) NCl_3 (2) $AsCl_3$ (3*) $SbCl_3$ (4) PCl_3

30. In which of the following pairs the two species are not isostructural ? **[AIEEE-2012, 4/120]**
(1) CO_3^{2-} and NO_3^- (2) PCl_4^+ and $SiCl_4$ (3*) PF_5 and BrF_5 (4) AlF_6^{3-} and SF_6

31. Which one of the following molecules is expected to exhibit diamagnetic behaviour? **[JEE(Main) 2013, 4/120]**
(1*) C_2 (2*) N_2 (3) O_2 (4) S_2

32. In which of the following pairs of molecules/ions, both the species are not likely to exist ? **[JEE(Main) 2013, 4/120]**
(1) H_2^+, He_2^{2-} (2) H_2^-, He_2^{2-} (3*) H_2^{2+}, He_2 (4) H_2^-, He_2^{2+}

33. Which of the following exists as covalent crystals in the solid state ? **[JEE(Main) 2013, 4/120]**
(1) Iodine (2*) Silicon (3) Sulphur (4) Phosphorus

34. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of : **[JEE(Main) 2013, 4/120]**

35. Among the following oxoacids, the correct decreasing order of acid strength is : **[JEE(Main)-2014, 4/120]**
(1) $HOCl > HClO_2 > HClO_3 > HClO_4$ (2) $HClO_4 > HOCl > HClO_2 > HClO_3$
(3*) $HClO_4 > HClO_3 > HClO_2 > HOCl$ (4) $HClO_2 > HClO_4 > HClO_3 > HOCl$

36. The correct statement for the molecule, CsI_3 is : **[JEE(Main)-2014, 4/120]**
(1) it is a covalent molecule. (2*) it contains Cs^+ and I_3^-
(3) it contains Cs^{3+} and I^- ions. (4) it contains Cs^+, I^- and lattice I_2 molecule.

37. The intermolecular interaction that is dependent on the inverse cube of distance between the molecules is:
(1) ion-ion interaction (2) ion-dipole interaction **[JEE(Main)-2015, 4/120]**
(3) London force (4*) hydrogen bond

38. Which one has the highest boiling point ? **[JEE(Main)-2015, 4/120]**
(1) He (2) Ne (3) Kr (4*) Xe

39. The species in which the N atom is in a state of sp hybridization is : **[JEE(Main)-2016, 4/120]**
(1) NO_2^- (2) NO_3^- (3) NO_2 (4*) NO_2^+

40. Which one of the following statements about water is **FALSE** ? **[JEE(Main)-2016, 4/120]**
(1) Water can act both as an acid and as a base.
(2*) There is extensive intramolecular hydrogen bonding in the condensed phase.
(3) Ice formed by heavy water sinks in normal water.
(4) Water is oxidized to oxygen during photosynthesis.

41. In the following reactions, ZnO is respectively acting as a/an : **[JEE(Main)-2017, 4/120]**
(a) $ZnO + Na_2O \longrightarrow Na_2ZnO_2$
(b) $ZnO + CO_2 \longrightarrow ZnCO_3$

42. Which of the following species is not paramagnetic? **[JEE(Main)-2017, 4/120]**
(1*) CO (2) O_2 (3) B_2 (4) NO

ONLINE QUESTION

1. Which of the following has unpaired electron(s) ? **[JEE(Main) 2014 Online (09-04-14), 4/120]**
(1) N_2 (2*) O_2^- (3) N_2^{2+} (4) O_2^{2-}

2. The number and type of bonds in C_2^{2-} ion in CaC_2 are : **[JEE(Main) 2014 Online (09-04-14), 4/120]**
(1) One σ-bond and one π-bond (2*) One σ-bond and two π-bonds
(3) Two σ-bonds and two π-bonds (4) Two σ-bonds and one π-bonds

3. The correct order of bond dissociation energy among N_2, O_2, O_2^- is shown in which of the following arrangements? **[JEE(Main) 2014 Online (11-04-14), 4/120]**
(1) $N_2 > O_2^- > O_2$ (2) $O_2^- > O_2 > N_2$ (3*) $N_2 > O_2 > O_2^-$ (4) $O_2 > O_2^- > N_2$

4. Which one of the following does not have a pyramidal shape?
[JEE(Main) 2014 Online (11-04-14), 4/120]
(1) $(CH_3)_3N$ (2*) $(SiH_3)_3N$ (3) $P(CH_3)_3$ (4) $P(SiH_3)_3$

5. Which one of the following molecules is paramagnetic ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**
(1) N_2 (2*) NO (3) CO (4) O_3

6. Amongst LiCl, RbCl, $BeCl_2$ and $MgCl_2$ the compounds with the greatest and the least ionic character respectively are : **[JEE(Main) 2014 Online (19-04-14), 4/120]**
(1) LiCl and RbCl (2*) RbCl and $BeCl_2$ (3) $MgCl_2$ and $BeCl_2$ (4) RbCl and $MgCl_2$

7. After understanding the assertion and reason, choose the correct option.
Assertion : In the bonding molecular orbital (MO) of H_2, electron density is increased between the nuclei.
Reason : The bonding MO is $\psi_A + \psi_B$, which shows destructive interference of the combining electron waves.
[JEE(Main) 2015 Online (10-04-15), 4/120]
(1*) Assertion is correct, reason is incorrect.
(2) Assertion is incorrect, reason is correct.
(3) Assertion and reason are correct, but reason is not the correct explanation for the assertion.
(4) Assertion and reason are correct and reason is the correct and reason is the correct explanation for the assertion.

8. The geometry of $XeOF_4$ by by VSEPR theory is : **[JEE(Main) 2015 Online (10-04-15), 4/120]**
(1) pentagonal planar (2) octahedral (3*) square pyramidal (4) trigonal bipyramidal

9. Which of the alkaline earth metal halides given below is essentially covalent in nature ?
[JEE(Main) 2015 Online (11-04-15), 4/120]
(1) $SrCl_2$ (2) $CaCl_2$ (3*) $BaCl_2$ (4) $MgCl_2$

10. Which of the following compound has a P–P bond ? **[JEE(Main) 2015 Online (11-04-15), 4/120]**
(1) $H_4P_2O_5$ (2) $(HPO_3)_3$ (3*) $H_4P_2O_6$ (4) $H_4P_2O_7$

11. Choose the incorrect formula out of the four compounds for an element X below :
(1) X_2O_3 (2*) X_2Cl_3 (3) $X_2(SO_4)_3$ (4) XPO_4

12. Molecular AB has a bond length of 1.61 Å and a dipole moment of 0.38 D. The fractional charge on each atom (absolute magnitude) is : ($e_0 = 4.802 \times 10^{-10}$ esu) **[JEE(Main) 2015 Online (11-04-15), 4/120]**
(1) 0.5 (2*) 0.05 (3) 0 (4) 1.0

13. The group of molecules having identical shape is : **[JEE(Main) 2016 Online (09-04-16), 4/120]**

(1) PCl_5, IF_5, XeO_2F_2 (2) BF_3, PCl_3, XeO_3 (3*) ClF_3, $XeOF_2$, XeF_3^+ (4) SF_4, XeF_4, CCl_4

14. Which intermolecular force is most responsible in allowing xenon gas to liquefy?
[JEE(Main) 2016 Online (09-04-16), 4/120]

(1*) Instantaneous dipole-induced dipole (2) Ionic
(3) Ion-dipole (4) Dipole-dipole

15. **Assertion:** Among the carbon allotropes, diamond is an insulator, Whereas, graphite is a good conductor of electricity.
Reason: Hybridization of carbon in diamond and graphite are sp^3 and sp^2, respectively.
[JEE(Main) 2016 Online (10-04-16), 4/120]

(1*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion.
(2) Assertion is incorrect statement, but the reason is correct.
(3) Both assertion and reason are correct, and the reason is the correct explanation for the assertion.
(4) Both assertion and reason are incorrect.
(1*) Both assertion and reason are correct, but the reason is not the correct explanation for the assertion.
(2) Assertion is incorrect statement, but the reason is correct.
(3) Both assertion and reason are correct, and the reason is the correct explanation for the assertion.
(4) Both assertion and reason are incorrect.

16. The bond angle H–X–H is the greatest in the compound : **[JEE(Main) 2016 Online (10-04-16), 4/120]**
;kSfxd ftlesa lsrq cUk H–X–H cUk vf/kdre gS **[JEE(Main) 2016 Online (10-04-16), 4/120]**

(1) NH_3 (2) PH_3 (3*) CH_4 (4) H_2O

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

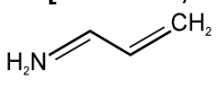
*** Marked Questions may have more than one correct option.**

1. Which of the following are isoelectronic and isostructural ?
NO_3^- , CO_3^{2-} , ClO_3^- , SO_3 . **[JEE–2003, 3/84]**

(A*) NO_3^- , CO_3^{2-} (B) SO_3 , NO_3^- (C) ClO_3^- , CO_3^{2-} (D) CO_3^{2-} , SO_3 .

2. Among the following the molecule with the highest dipole moment is : **[JEE–2003, 3/84]**
(A*) CH_3Cl (B) CH_3Cl_2 (C) $CHCl_3$ (D) CCl_4

3. Which of the following represent the given mode of hybridisation $sp^2 – sp^2 – sp – sp$ from left to right.
[JEE–2003, 3/84]

(A*) $H_2C=CH–C\equiv N$ (B) $HC\equiv C–C\equiv CH$ (C) $H_2C=C=C=CH_2$ (D) 

4. The number of lone pair(s) of electrons in $XeOF_4$ is : **[JEE–2004, 3/84]**
(A) 3 (B) 2 (C*) 1 (D) 4

5. Amongst the following the acid having –O–O– bond is : **[JEE–2004, 3/84]**
(A) $H_2S_2O_3$ (B) $H_2S_2O_5$ (C) $H_2S_2O_6$ (D*) $H_2S_2O_8$

6. According to molecular orbital theory, which one of the following statements about the molecular species O_2^+ is correct ? **[JEE–2004, 3/84]**

(A) It is paramagnetic and has less bond order than O_2

(B*) It is paramagnetic and more bond order than O_2

(C) It is diamagnetic and has less bond order than O_2

(D) It is diamagnetic and has more bond order than O_2

7. In which of the following the maximum number of lone pairs is present on the central atom ? **[JEE–2005, 3/84]**

(A) $[ClO_3]^-$ (B) XeF_4 (C) SF_4 (D*) I_3^-

8. Which of the following silicate is formed when three oxygen atoms of $[SiO_4]^{4-}$ tetrahedral units are shared ? **[JEE–2005, 3/84]**

(A*) Sheet silicate (B) Pyrosilicate

(C) Three dimensional silicate (D) Linear chain silicate

9. The species having bond order different from that in CO is : **[JEE–2007, 3/162]**

(A*) NO^- (B) NO^+ (C) CN^- (D) N_2

10. Among the following, the paramagnetic compound is : **[JEE–2007, 3/162]**

(A) Na_2O_2 (B) O_3 (C) N_2O (D*) KO_2

11. The percentage of p-character in the orbitals forming P – P bonds in P_4 is : **[JEE–2007, 3/162]**

(A) 25 (B) 33 (C) 50 (D*) 75

12. **Statement-1 :** Boron always forms covalent bond, **because**

Statement-2 : The small size of B^{3+} favours formation of covalent bond. **[JEE–2007, 3/162]**

(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.

13. **Statement-1 :** Band gap in germanium is small, **because**

Statement-2 : The energy spread of each germanium atomic energy level is infinitesimally small. **[JEE–2007, 3/162]**

(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

14. Assuming that Hund's rule is violated, the bond order and magnetic nature of the diatomic molecule B_2 is:

(A*) 1 and diamagnetic (B) 0 and diamagnetic **[JEE–2010, 5/163]**

(C) 1 and paramagnetic (D) 0 and paramagnetic

15. The shape of XeO_2F_2 molecule is **[JEE–2012, 3/136]**

(A) trigonal bipyramidal (B) square plannar

(C) tetrahedral (D*) see-saw

16. Assuming *2s-2p* mixing is **NOT** operative, the paramagnetic species among the following is : **[JEE(Advanced) 2014, 3/120]**

(A) Be_2 (B) B_2 (C*) C_2 (D) N_2

17. 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, 3/120]**

	List-I		List-II
P.		1.	*p–d* π antibonding
Q.		2.	*d–d* σ bonding
R.		3.	*p–d* π bonding
S.		4.	*d–d* σ antibonding

Code :

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

Additional Problems For Self Practice (APSP)

PART - I : PRACTICE TEST PAPER

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.
2. The Test Booklet consists of **30** questions. The maximum marks are **120.**
3. Each question is allotted **4 (four)** marks for correct response.
4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. **¼ (one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

---

1. If the electronic configuration of an element is $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$, then the electrons involved in bonding will be.

(1) $3p^6$ (2) $3p^6\ 4s^2$ (3) $3p^6\ 3d^2$ (4*) $3d^2\ 4s^2$

Sol. Element belongs to d-block in d-block elements (n – 1) d and ns electron take part in the bonding.

2. Two ice cubes are pressed together until they form one block. Which of the following force is primarily responsible for holding the cubes together?

(1) Dipole–dipole interaction (2) Van der Waals forces

(3) Ionic interaction (4*) Hydrogen bonding

3. A sigma bond may be formed by the overlap of 2 atomic orbitals of atoms A and B. If the bond is formed along as the x-axis, which of the following overlaps is acceptable ?

(1) s orbital of A and p_z orbital of B (2) p_x orbital of A and p_y orbital of B

(3) p_z orbital of A and p_x orbital of B (4*) p_x orbital of A and s orbital of B

4. NH_3 and BF_3 combine readily because of the formation of :

(1) a covalent bond (2) a hydrogen bond (3*) a coordinate bond (4) an ionic bond

5. Maximum bond energy is in :

(1) F_2 (2*) N_2 (3) O_2 (4) equal in all

6. The structure of XeF_2 involves hybridization of the type :

(1) sp^3 (2) sp^3d^3 (3*) sp^3d (4) sp^3d^2

7. The bond angle and hybridization in ether (CH_3OCH_3) is :

(1)106° 51', sp^3 (2) 104°31', sp^3 (3) 109°28' sp_3 (4*) >109°28' sp_3

8. Which of the following have maximum boilling point

(1) CH_4 (2) CF_4 (3*) CCl_4 (4) CD_4

9. In which of the following molecule / ion all the bonds are not equal ?

(1) XeF_4 (2) BeF_4^- (3*) C_2H_4 (4) SiF_4

10. The correct order of increasing X – O – X bond angle is (X = H, F or Cl) :

(1) $H_2O > Cl_2O > F_2O$ (2*) $Cl_2O > H_2O > F_2O$ (3) $F_2O > Cl_2O > H_2O$ (4) $F_2O > H_2O > Cl_2O$

11. Which of the following is paramagnetic ?

(1*) O_2^- (2) CN^- (3) CO (4) NO^+

12. Which of the following is non-polar :

(1) NF_3 (2*) BF_3 (3) PF_3 (4) SF_4

13. Strongest hydrogen bond present in :

(1) O – H ------ S (2) S – H ------ O (3*) F – H ------ F (4) F – H ------ O

14. Resonance structure of a molecule should not have

(1*) Identical bond position (2) Identical arrangements of atoms

(3) Nearly the same energy content (4) The same number of paired electrons

15. The paramagnetic property of oxygen is well explained by :

(1*) Molecular orbital theory (2) Resonance theory

(3) Valence bond theory (4) VSEPR theory

16. Which of the following statement is correct regarding molecular orbital theory (MOT) :

(1*) Energy of bonding orbital is less than anti-bonding orbital.

(2) Energy of bonding orbital is more than anti-bonding orbital.

(3) Bonding orbitals are monocentric.

(4) Bonding orbital follow n + ℓ rule

17. PF_2Cl_3 in non polar because :

(1) P – Cl bond is non-polar (2*) Its dipole moment is zero

(3) P – Cl bond is polar (4) P & Cl have equal electronegativity

18. The hybrid states of central atom in diaborane, diamond and graphite are respectively :

(1) sp^2, sp^3, sp^2 (2*) sp^3, sp^3, sp^2 (3) sp^3, sp^3, sp^3 (4) sp, sp^2, sp^3

19. Which of the set of species have same hybridization state but different shapes:-

(1) NO_2^+, NO_2, NO_2^- (2) ClO_4^-, SF_4, XeF_4 (3*) NH_4^+, H_3O^+, OF_2 (4) $SO_4^{-2}, PO_4^{-3}, ClO_4^-$

20. The bonds present in N_2O_5 are :

(1) Only ionic (2*) Covalent & coordinate

(3) Only covalent (4) Covalent & ionic

21. The correct statement for the reaction-

$NH_3 + H^+ \longrightarrow NH_4^+$

(1) Hybridisation state is changed (2*) Bond angle increases

(3) NH_3 act as a Lewis acid (4) Regular geometry is changed

22. The correct order of decreasing polarisabality of ions is :

(1) $Cl^- > Br^- > I^- > F^-$ (2) $F^- > I^- > Br^- > Cl^-$ (3) $F^- > Cl^- > Br^- > I^-$ (4*) $I^- > Br^- > Cl^- > F^-$

23. CCl_4 is more covalent than LiCl because :

(1*) There is more polarization of Cl in CCl_4 (2) There is more polarization of Cl in LiCl

(3) CCl_4 has more weight (4) None of the above

24. An ionic compound $A^+ B^-$ is most likely to be formed when -

(1) Ionization energy of A is low (2) Electron affinity of B is high

(3) Electron affinity of B is low (4*) Both (1) and (2)

25. Which of the following statements regarding $HClO_3$:

(1) oxidation state of chlorine is +5 (2) it has two pπ-dπ bonds

(3) it has two type of Cl–O bond (4*) all of these

26. The correct sequence of increasing covalent character is represented by -

(1) $BeCl_2 < NaCl < LiCl$ (2*) $NaCl < LiCl < BeCl_2$

(3) $BeCl_2 < LiCl < NaCl$ (4) $LiCl < NaCl < BeCl_2$

27. Correct order bond length is :

(1) N – H > P – H > Sb – H (2*) N – H < P – H < Sb – H

(3) P – H > N – H > Sb – H (4) Sb – H > N – H > P – H

28. Which of the follwing species contains three bond pairs and one lone pair around the central atom ?

(1) NH_2^- (2*) PCl_3 (3) H_2O (4) BF_3

29. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals ?

(1) $\sigma^* 2p_z$ orbital (2) $\sigma 2p_z$ orbital

(3*) $\pi^* 2p_x / \pi^* 2p_y$ orbital (4) $\pi 2p_x / \pi 2p_y$ orbital

30. The number of S-S bonds in sulphur trioxide trimer (S_3O_9) is :

(1) 3 (2*) 0 (3) 1 (4) 2

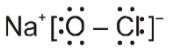
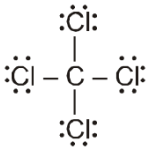
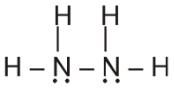
PART - II : PRACTICE QUESTIONS

Practice Questions: 20-50 depending on chapter length.

1. If the atomic number of element X is 7 the lewis diagram for the element is :

(1) (2)  (3*)  (4) 

2. Which of the following Lewis diagram is incorrect ?

(1)  (2)  (3*)  (4) 

3. If the electronic configuration of an element is $Is^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^2\ 4s^2$, then the electrons involved in bonding will be.

(1) $3p^6$ (2) $3p^6\ 4s^2$ (3) $3p^6\ 3d^2$ (4*) $3d^2\ 4s^2$

4. A Bond formed between two same atoms cannot be

(1*) Ionic (2) Covalent (3) Metallic Bond (4) None of these

5. The correct order of decreasing polarisabality of ions is :

(1) $Cl^- > Br^- > I^- > F^-$ (2) $F^- > I^- > Br^- > Cl^-$ (3) $F^- > Cl^- > Br^- > I^-$ (4*) $I^- > Br^- > Cl^- > F^-$

6. CCl_4 is more covalent than LiCl because :

(1*) There is more polarization of Cl in CCl_4 (2) There is more polarization of Cl in LiCl

(3) CCl_4 has more weight (4) None of the above

7. The correct sequence of increasing covalent character is represented by -

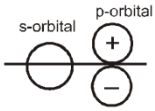
(1) $BeCl_2 < NaCl < LiCl$ (2*) $NaCl < LiCl < BeCl_2$

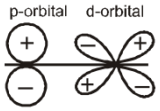
(3) $BeCl_2 < LiCl < NaCl$ (4) $LiCl < NaCl < BeCl_2$

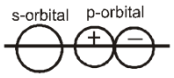
8. NH_3 and BF_3 combine readily because of the formation of :

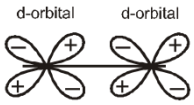
(1) a covalent bond (2) a hydrogen bond (3*) a coordinate bond (4) an ionic bond

9. Which of the following leads to bonding ? **[Kerla CEE 2003]**

(1) 

(2*) 

(3*) 

(4) 

10. In which of the following molecule / ion all the bonds are not equal ?

(1) XeF_4 (2) BeF_4^- (3*) C_2H_4 (4) SiF_4

11. Which of the follwing species contains three bond pairs and one lone pair around the central atom ?

(1) NH_2^- (2*) PCl_3 (3) H_2O (4) BF_3

12. Which does not form linear structure ? **[RPMT 2003]**

(1) CO_2 (2*) NO_2 (3) C_2H_2 (4) $BeCl_2$

13. Structure of ICl_4^- is :

(1) trigonal (2) distorted trigonal bipyramid

(3) octahedral (4*) square planar

14. The correct order towards bond angle is :

(1) Bond angle does not depend on hybridisation. (2) $sp < sp^2 < sp^3$

(3) $sp^2 < sp < sp^3$ (4*) $sp^3 < sp^2 < sp$

15. Which is not true about CH_4 molecule ?

(1) Tetrahedral hybridisation (2) 109.5º bond angle

(3) Four sigma bonds (4*) One lone pair of electrons on carbon

16. The structure of XeF_2 involves hybridization of the type :

(1) sp^3 (2) sp^3d^3 (3*) sp^3d (4) sp^3d^2

17. Which of the set of species have same hybridization state but different shapes:

(1) NO_2^+, NO_2, NO_2^- (2) ClO_4^-, SF_4, XeF_4 (3*) NH_4^+, H_3O^+, OF_2 (4) SO_4^{-2}, PO_4^{-3}, ClO_4^-

18. The correct statement for the reaction-

$NH_3 + H^+ \longrightarrow NH_4^+$

(1) Hybridisation state is changed (2*) Bond angle increases

(3) NH_3 act as a Lewis acid (4) Regular geometry is changed

19. Among the following pairs in which the two species are not isostructural is :

(1*) SiF_4 and SF_4 (2) IO_3^- and XeO_3 (3) BH_4^- and NH_4^+ (4) PF_6^- and SF_6

20. Which among the following molecules have sp^3d hybridisation with one lone pair of electrons on the central atom ?

(i) SF_4 (ii) $[PCl_4]^+$ (iii) XeO_2F_2 (iv) $ClOF_3$

(1) (i), (ii) and (iii) only (2*) (i), (iii) and (iv) only (3) (i) and (iii) only (4) (iii) and (iv) only

21. The bond angle and hybridization in ether (CH_3OCH_3) is :

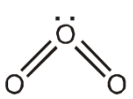
(1)106° 51', sp^3 (2) 104°31', sp^3 (3) 109°28' sp_3 (4*) >109°28' sp_3

22. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals ?

(1) $\sigma^* 2p_z$ orbital (2) $\sigma 2p_z$ orbital

(3*) $\pi^* 2p_x / \pi^* 2p_y$ orbital (4) $\pi 2p_x / \pi 2p_y$ orbital

23. Which of the following statements are correct ?

(I)  structure is not allowed because octet around 'O' can not be expanded.

(II) H_2O_2 is ionic compound

(III) In B_2 molecule, the highest occupied molecular orbital is σ molecular orbital.

(IV) The lp–bp repulsion is stronger than bp–bp repulsion.

(1) (I) and (III) (2) (II) and (III) (3*) (I) and (IV) (4) (III) and (IV)

24. Which of the following is paramagnetic ?

(1*) O_2^- (2) CN^- (3) CO (4) NO^+

25. The boiling point of a compound is raised by -

(1*) intermolecular hydrogen bonding (2) High volatility

(3) Intramolecular hydrogen bonding (4) Non-polarity

26. Which of the following have maximum boiling point

(1) CH_4 (2) CF_4 (3*) CCl_4 (4) CD_4