Exercise-1

✍ **Marked Questions may have for Revision Questions.**

ONLY ONE OPTION CORRECT TYPE

Section (A) :Introduction to Bonding and Ionic bond

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

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

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

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

5.✍ Which of the following have low lattice energy ?
(1) Cs – F (2) Cs – Cl (3) Cs – Br (4) Cs – I

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

7. 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

Section (B) : Covalent Bond, Octet Rule and Coordinate Bond

1. The maximum covalency of representative elements 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.

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

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

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

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

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

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

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

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

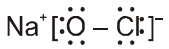
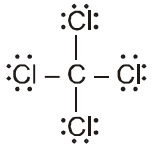
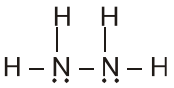
11. Which of the following is the electron deficient molecule?
(1) C_2H_6 (2) SiH_4 (3) PH_3 (4) $BeCl_2$ (g)

Section (C) : Lewis Structures, Formal Charge, Resonance

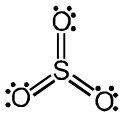
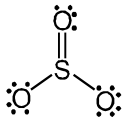
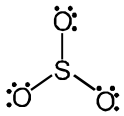
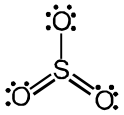
1. If the atomic number of element X is 7 the lewis diagram for the element is :

(1) X• (2)  (3)  (4) 

2. Which of the following Lewis diagram is incorrect ?

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

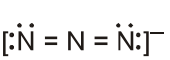
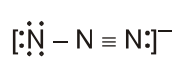
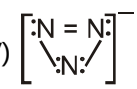
3. Which of the following structure is the most preferred structure for SO_3 ?

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

4. What are the formal charges on central sulphur and each terminal oxygen atoms in SO_2?
(1) 0, 0, 0 (2) + 2, 0, – 1 (3) 0, – 1, + 1 (4) + 2, + 2, + 2

5. Resonating structures have different :
(1) atomic arrangements (2) electronic arrangements
(3) function groups (4) alkyl groups

6. 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

7. Which one in the following is not the resonating structure of CO_2 :
(1) $O \equiv C = O$ (2) $O = C = O$ (3) $^{-}O - C \equiv O^{+}$ (4) $^{+}O \equiv C - O^{-}$

8. What is correct order of bond order of Cl–O bond.
(1) $ClO_4^- > ClO_3^- > ClO_2^- > ClO^-$ (2) $ClO^- < ClO_2^- > ClO_3^- < ClO_4^-$
(3) $ClO_3^- < ClO_2^- < ClO_4^- < ClO^-$ (4) $ClO_2^- < ClO_3^- < ClO_4^- < ClO^-$

9. Identify the correct statement :
(1) single N–N bond is stronger than single P–P bond
(2) single N–N bond is weaker than single P–P bond
(3) N ≡N is weaker than P≡P
(4) None of these

Section (D) : V.B.T. and Hybridisation

1. VBT is given by :
(1) Hitler & london (2) Pauling & Slater (3) Hund & Muliken (4) Huckel & Hund

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

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

4. Acetylene consists of :
(1) both sigma and pi bonds (2) sigma bond only
(3) pi bond only (4) none of these

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

6. 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) $sp^3 < sp^2 < sp$

7. 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) $sp^2 < sp < sp^3$

8. 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

9. Choose the molecules in which hybridisation occurs in the ground state ?
(1) BCl_3 (2) NH_3 (3) PCl_3 (4) BeF_2
The correct answer is -
(1) 1, 2, 4 (2) 1, 2, 3 (3) 2, 3 (4) 3, 4

10. 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

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

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

13. sp^2 – hybridisation is shown by :
(1) $BeCl_2$ (2)) BF_3 (3) NH_3 (4) XeF_2

14. 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

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

16. 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

17. 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) $[ClF_4O]^-$, $[XeOF_4]$

18. 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

19. Effective overlapping will be shows by :
(1) ⊕⊖+⊕⊖ (2)  (3) ⊕⊖+⊖⊕ (4) All the above

Section (E) : VSEPR THEORY

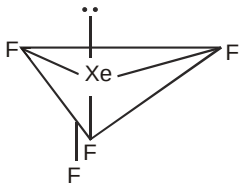
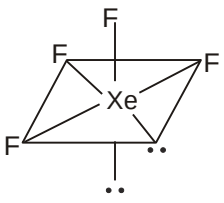
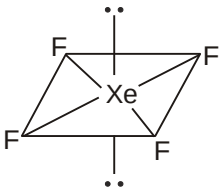
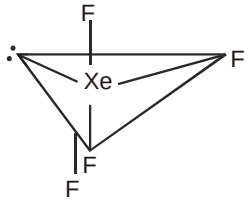
1. Which among the following molecules have sp^3d hybridisation with one lone pair of electrons on the central atom ?
(i) SF_4 (ii) $[PCl_4]^+$ (iii) XeO_2F_2 (iv) $ClOF_3$
(1) (i), (ii) and (iii) only (2) (i), (iii) and (iv) only (3) (i) and (iii) only (4) (iii) and (iv) only

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

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

Code :

	(1)	(2)	(3)	(4)		(1)	(2)	(3)	(4)
(1)	2	1	3	5	(2)	1	2	3	5
(3)	2	1	5	4	(4)	1	2	5	4

3. Which is the right structure of XeF_4 ?
(1)  (2)  (3)  (4) 

4. 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

5. 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 .

6. 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

7. Which one of the following species is not linear ?

(1) CO_2 (2) ClO_2 (3) I_3^- (4) NO_2^+

8. The ion which is not tetrahedral in shape is :

(1) BF_4^- (2) NH_4^+ (3) XeO_4 (4) ICl_4^-

9. The molecule/ion which has trigonal pyramidal shape is :

(1) PCl_3 (2) SO_3 (3) CO_3^{2-} (4) NO_3^-

10. 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

11. 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

12. 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

13. 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

14. Structure of ICl_4^- is :

(1) trigonal (2) distorted trigonal bipyramid

(3) octahedral (4) square planar

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) $NH_3 > NH_4^+ > NH_2^-$

16. Which is having highest bond angle :

(1) PCl_3 (2) PBr_3 (3) PF_3 (4) PI_3

17. Which of the following molecules has two lone pairs and bond angle (need not be all bond angles) < 109.5°?

(1) SF_2 (2) KrF_4 (3) ICl_4^- (4) All of these

18. The correct order of bond angle is :

(1) $H_2S < NH_3 < BF_3 < CH_4$ (2) $NH_3 < H_2S < CH_4 < BF_3$

(3) $H_2S < NH_3 < CH_4 < BF_3$ (4) $H_2S < CH_4 < NH_3 < BF_3$

19. In which of the following molecules are all the bonds not equal?

(1) NF_3 (2) ClF_3 (3) BF_3 (4) AlF_3

20. Which of the following is correct order of bond length ?
(1) $BF_4^- < BF_3$ (2) $NO_2^+ < NO_2^-$ (3) $CCl_4 < CF_4$ (4) $^+CH_3 > CH_4$

Section (F) : Molecular Orbital Theory (MOT)

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

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

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

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

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

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

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

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.

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

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

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

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

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

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

Section (G) : Fajan's rule

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

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

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) $SrCl_2 > BeCl_2 > CaCl_2 > MgCl_2$

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) $LiCl < BeCl_2 < CCl_4 < BCl_3$

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

6. Which is most ionic according to Fajan's rule?:
(1) AlF_3 (2) Al_2O_3 (3) AlN (4) Al_4C_3

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

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. 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

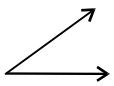
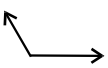
10. Which one of the following pairs of elements is most likely to form an ionic compound?
(1) B and Cl_2 (2) K and O_2 (3) O_2 and Cl_2 (4) Al and I_2

11. 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) $Al^{3+} > Na^+ > Mg^{2+}$

Section (H) : Polarity of Bond / Dipole Moment, Hydrolysis and back bonding

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

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

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

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

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

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) $HClO_2$

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) $NH_3 > BF_3 > NF_3$

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) $H_2O < NH_3 < NF_3 < CH_4$

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

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

11. The dipole moment of HCl is 1.03 D. If H–Cl bond distance is 1.26 Å, what is the percentage of ionic character in the H–Cl bond -
(1) 60% (2) 39% (3) 29% (4) 17%

12. Which of the following can not be completely hydrolysed in cold water at room temperature ?
(1) BCl_3 (2) PCl_3 (3) BBr_3 (4) CCl_4

13. 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.

14. 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

15. Which of the following are incorrect for dipole moment ?
(1) Lone pair of elements present on central atom can give rise to dipole moment
(2) Dipole moment is vector quantity
(3) PF_5 (g) molecule has non zero dipole moment
(4) Difference in electronegativities of combining atom can lead to dipole moment

Section (I) : Hydrogen bonding

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

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

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

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

5. Which compound have lowest B.P.
(1) NH_3 (2) H_2O (3) H_2S (4) HF

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

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

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

9. 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

10. H-bonding is maximum in
(1) C_6H_5OH (2) C_6H_5COOH (3) CH_3CH_2OH (4) CH_3COCH_3

11. Give the correct order of initials T or F for following statements. Use T if statement is true and F if it is false.
S_1 : HF boils at a higher temperature than HCl
S_2 : HBr boils at lower temperature than HI
S_3 : Bond length of N_2 is less than N_2^+
S_4 : F_2 has higher boiling point than Cl_2
(1) T F T T (2) T T F F (3) T T T F (4) T T T T

12. Which of the following has minimum melting point
(1) CsF (2) HCl (3) HF (4) LiF

13. Select the correct statement for the sulphuric acid.
(I) It has high boiling point and viscosity.
(II) There are two types of bond lengths in its bivalent anion.
(III) $p\pi$-$d\pi$ bonding between sulphur and oxygen is observed.
(IV) Sulphur has the same hybridisation that is of boron in diborane.
(1) II and III only (2) II, III and IV only (3) I, III and IV only (4) III and IV only

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

Section (J) : Intermolecular forces

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

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

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 $I_2 > Br_2 > Cl_2$

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) van der Waals forces

5. Among the following, van der Waals forces are strongest in :
(1) HBr (2) LiBr (3) LiCl (4) AgBr

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

7. 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.

8. Which of the following is false ?
(1) Van der Waals forces 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, van der Waals forces act between the carbon layers.
(4) Boiling point of NH_3 is greater than SbH_3.

Exercise-2

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

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

3. 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) $1s^2 2s^2 2p^1$

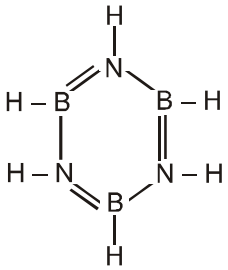
4. Which of the following does not contain coordinate bond ?
(1) BH_4^- (2) NH_4^+ (3) CO_3^{2-} (4) H_3O^+

5. Which of the following is electron deficient compounds ?
(1) $NaBH_4$ (2) B_2H_6 (3) Al_2Cl_6 (4) $LiAlH_4$

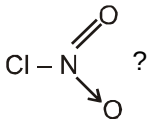
6. The species which is diamagnetic is :
(1) NO (2) NO_2 (3) ClO_2 (4) N_2O_4

7. N_2O is isoelectronic with CO_2 and N_3^-, which is the structure of N_2O ?
(1) $\overset{+}{N}=\overset{-}{N}=O$ (2) N–O–N (3)  (4) $N \equiv N \rightarrow \ddot{O}:$

8. 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

9. What is the formal charge on N in  ?

(1) + 1 (2) – 1 (3) 0 (4) + 2

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

$H - N = N^{+} = N^{-} \longleftrightarrow H - N^{+} - N^{+} = N^{2-} \longleftrightarrow H - N^{-} - N^{+} \equiv N$

(I) (II) (III)

(1) I (2) I I (3) I I I (4) none of these

11. Which of the following overlaps is **<u>incorrect</u>** [assuming z-axis to be the internuclear axis] ?

(1) 2 py + 2 py $\rightarrow \pi$ 2 py (2) 2 pz + 2 pz $\rightarrow \sigma$ 2pz

(3) 2 px + 2 px $\rightarrow \pi$ 2 px (4) 1 s + 2 py $\rightarrow \pi$ (1 s-2 py)

(1) 'a' & 'b' (2) 'b' & 'd' (3) only 'd' (4) None of these

12. 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.

13. p-p overlapping will be observed in the molecule of :

(1) H_2 (2) HBr (3) HCl (4) Cl_2

14. 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)

15. In which of the following molecules/species all following characteristics are found ?

(1) Tetrahedral gometry

(2) Hybridisation can be considered to have taken place with the help of empty orbital(s).

(3) All bond lengths are identical i.e. all A – B bond lengths are identical.

(1) B_2H_6 (2) Al_2Cl_6 (3) $BeCl_2$ (g) (4) BF_4^-

16. In a change from PCl_3 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

17. 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.

18. 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

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

(1) H_2O shows sp^3 hybridisation where as H_2S do not show

(2) Oxygen is a gas whereas sulphur is solid

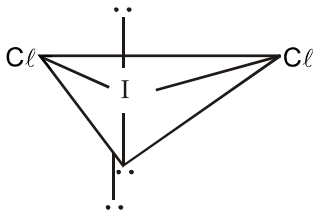
(3) Sulphur contains d-orbitals whereas oxygen does not

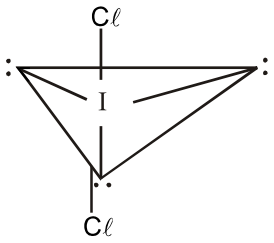
(4) The number of lone pairs present on oxygen and sulphur is not equal

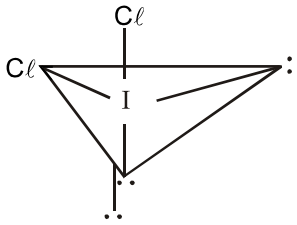
20. The shape of O_2F_2 is similar to :

(1) C_2F_2 (2) H_2O_2 (3) H_2F_2 (4) C_2H_2

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

(1) 

(2) 

(3) 

(4) None of these

22. In which of the following compounds B–F bond length is shortest ?

(1) BF_4^- (2) $BF_3 \leftarrow NH_3$ (3) BF_3 (4) $BF_3 \leftarrow N(CH_3)_3$

23. Which of the following statement is false for trisilylamine ?

(1) Three sp^2 orbitals are used for σ bonding, giving a plane triangular structure.

(2) The lone pair of electrons occupy a p-orbital at right angles to the plane triangle and this overlaps with empty p–orbitals on each of the three silicon atoms resulting in π bonding.

(3) The N–Si bond length is shorter than the expected N–Si bond length.

(4) It is a weaker Lewis base than trimethyl amine.

24. 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

25. The correct order of increasing $X-O-X$ bond angle is $(X = H, F \text{ or } Cl)$:

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

26. Incorrect order about bond angle is :

(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) $ClO_2 > H_2O > H_2S > SF_6$

27. The ONO angle is maximum in :

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

28. 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.

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

(1) LUMO level for C_2 molecule is σ_{2p_z} 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

30. Which of the following species will have the minimum bond energy?
(1) N_2 (2) N_2^- (3) N_2^+ (4) N_2^{2-}

31. 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 $\pi(2px) = \pi(2py)$, $\sigma(2pz)$
(4) All the above three statements are correct

32. Among the following which one will have the largest O – O bond length ?
(1) KO_2 (2) O_2 (3) $O_2^+[AsF_6]^-$ (4) K_2O_2

33. The correct order in which the O–O bond length increases in the following is :
(1) $H_2O_2 < O_2 < O_3$ (2) $O_2 < H_2O_2 < O_3$ (3) $O_2 < O_3 < H_2O_2$ (4) $O_3 < H_2O_2 < O_2$

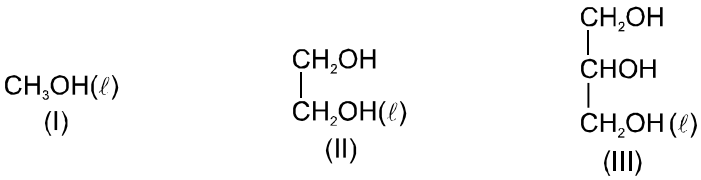
34. Which of the following is a **wrong** order with respect to the property mentioned against each ?
(1) $O_2^{2-} > O_2 > O_2^+$ [Paramagnetic moment] (2) $(NO)^- > (NO) > (NO)^+$ [bond length]
(3) $H_2 > H_2^+ > He_2^+$ [bond energy] (4) $NO_2^+ > NO_2 > NO_2^-$ [bond angle]

35. Which of the following option with respect to increasing bond dissociation energies is correct ?
(1) $NO < C_2 < O_2^- < He_2^+$ (2) $C_2 < NO < He_2^+ < O_2^-$
(3) $He_2^+ < O_2^- < NO < C_2$ (4) $He_2^+ < O_2^- < C_2 < NO$

36. In which of the following compounds B atoms are in sp^2 and sp^3 hybridisation states ?
(1) Borax (2) Diborane (3) Borazole (4) All

37. 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

38. 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

39. 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

40. The decreasing order of the boiling points of the following hybrides is
(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)

41. 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.

42. 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

43. 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

44. 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

45. Which of the following molecules is trigonal bipyramidal?
(1) BF_3 (2) CH_4 (3) PCl_5 (4) SF_6

46. The sequence that correctly describes the relative bond strengths partaining to oxygen molecule and its cation or anion is
(1) $O_2^{2-} > O_2^- > O_2 > O_2^+$ (2) $O_2 > O_2^+ > O_2^- > O_2^{2-}$ (3) $O_2^+ > O_2 > O_2^{2-} > O_2^-$ (4) $O_2^+ > O_2 > O_2^- > O_2^{2-}$

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

48. Which statement is true ?
(1) The boiling point 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.

49. 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.

50. 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.

51. Among the following, the paramagnetic compound is :
(1) Na_2O_2 (2) O_3 (3) N_2O (4) KO_2

52. The percentage of p-character in the orbitals forming P – P bonds in P_4 is :
(1) 25 (2) 33 (3) 50 (4) 75

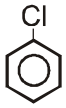
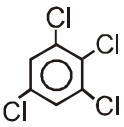
53. Assuming that Hund's rule is violated, the bond order and magnetic nature of the diatomic molecule B_2 is:
(1) 1 and diamagnetic (2) 0 and diamagnetic

(3) 1 and paramagnetic (4) 0 and paramagnetic

54. Assuming *2s-2p* mixing is **NOT** operative, the paramagnetic species among the following is :
(1) Be_2 (2) B_2 (3) C_2 (4) N_2

55. 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) $H_2O < PH_3 < P_4$

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

57. The dipole moment of  is 1.5 D. The dipole moment of  will be -
(1) 0 D (2) 1.5 D (3) 2.86 D (4) 2.25 D

58. Which of the following compound has Zero dipole moment -
(1) PCl_3 (2) PCl_2F_3 (3) PCl_3F_2 (4) $PClF_4$

Exercise-3

PART - I : NEET / AIPMT QUESTION (PREVIOUS YEARS)

1. The correct order of C–O bond length among CO, CO_3^{2-} and CO_2 is : **[AIPMT 2007]**
(1) $CO_2 < CO_3^{2-} < CO$ (2) $CO < CO_3^{2-} < CO_2$ (3) $CO_3^{2-} < CO_2 < CO$ (4) $CO < CO_2 < CO_3^{2-}$

2. In which of the following pairs, the two species are isostructural ? **[AIPMT 2007]**
(1) SF_4 and XeF_4 (2) SO_3^{2-} and NO_3^- (3) BF_3 and NF_3 (4) BrO_3^- and XeO_3

3. The angular shape of ozone molecule (O_3) consists of **[AIPMT 2008]**
(1) 1 sigma and 2 π bonds (2) 2 sigma and 1 π bonds
(3) 1 sigma and 1 π bonds (4) 2 sigma and 2 π bonds

4. The correct order of increasing bond angles in the following triatomic species is **[AIPMT 2008]**
(1) $NO_2^- < NO_2^+ < NO_2$ (2) $NO_2^- < NO_2 < NO_2^+$
(3) $NO_2^+ < NO_2 < NO_2^-$ (4) $NO_2^+ < NO_2^- < NO_2$

5. Four diatomic species are listed below in different sequences. Which of these presents the correct order of their increasing bond order ? **[AIPMT 2008]**
(1) $O_2- < NO < C_2^{2-} < He_2^+$ (2) $NO < C_2^{2-} < O_2^- < He_2^+$
(3) $C_2^{2-} < He_2^+ < NO < O_2^-$ (4) $He_2^+ < O_2^- < NO < C_2^{2-}$

6. According to MO theory which of the following lists rank the nitrogen species in terms of increasing bond order ? **[AIPMT 2009]**
(1) $N_2^- < N_2 < N_2^{2-}$ (2) $N_2^{2-} < N_2^- < N_2$ (3) $N_2 < N_2^{2-} < N_2^-$ (4) $N_2^- < N_2^{2-} < N_2$

7. In the case of alkali metals, the covalent character decreases in the order **[AIPMT 2009]**
(1) MCI > MI > MBr > MF (2) MF > MCI > MBr > MI
(3) MF > MCI > MI > MBr (4) MI > MBr > MCI > MF

8. In which of the following molecules/ions BF_3, NO_2^-, NH_2^- and H_2O, the central atom is sp^2 hybridised ? **[AIPMT 2009]**
(1) NO_2^- and NH_2^- (2) NH_2^- and H_2O (3) NO_2^- and H_2O (4) BF_3 and NO_2^-

9. What is the dominant intermolecular force on bond that must be overcome in converting liquid CH_3OH to a gas ? **[AIPMT 2009]**

(1) Hydorgen bonding (2) Dipole-dipole interaction
(3) Covalent bonds (4) London dispersion force

10. In which of the following pairs of molecules/ions, the central atoms have sp^2 hybridization ? **[AIPMT 2010]**

(1) NO_2^- and NH_3 (2) BF_3 and NO_2^- (3) NH_2^- and H_2O (4) BF_3 and NH_2^-

11. Which one of the following species does not exist under normal conditions ? **[AIPMT 2010]**

(1) Be_2^+ (2) Be_2 (3) B_2 (4) Li_2

12. The correct order of increasing bond angles in the following species are : **[AIPMT 2010]**

(1) $Cl_2O < ClO_2 < ClO_2^-$ (2) $ClO_2 < Cl_2O < ClO_2^-$
(3) $Cl_2O < ClO_2^- < ClO_2$ (4) $ClO_2^- < Cl_2O < ClO_2$

13. Which one of the following compounds is a peroxide ? **[AIPMT 2010]**

(1) KO_2 (2) BaO_2 (3) MnO_2 (4) NO_2

14. Which one of the following molecular hydrides acts as a Lewis acid ? **[AIPMT 2010]**

(1) NH_3 (2) H_2O (3) B_2H_6 (4) CH_4

15. The tendency of BF_3, BCl_3 and BBr_3 to behave as Lewis acid decreases in the sequence : **[AIPMT 2010]**

(1) $BCl_3 > BF_3 > BBr_3$ (2) $BBr_3 > BCl_3 > BF_3$ (3) $BBr_3 > BF_3 > BCl_3$ (4) $BF_3 > BCl_3 > BBr_3$

16. Among the following which one has the highest cation to anion size ratio? **[AIPMT 2010]**

(1) CsI (2) CsF (3) LiF (4) NaF

17. In which of the following molecules, the central atom does not have sp^3 hybridization? **[AIPMT 2010]**

(1) CH_4 (2) SF_4 (3) BF_4^- (4) NH_4^+

18. How many bridging oxygen atoms are present in P_4O_{10}? **[AIPMT 2010]**

(1) 6 (2) 4 (3) 2 (4) 5

19. Some of the properties of the two species, NO^-_3 and H_3O^+ are described below. Which one of them is correct ? **[AIPMT 2010]**

(1) Dissimilar in hybridization for the central atom with different structures
(2) Isostructural with same hybridization for the central atom
(3) Isostructural with different hybridization for the central atom
(4) Similar in hybridiation for the central atom with different structures

20. Which of the following has the minimum bond length ? **[AIPMT 2011]**

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

21. Which of the two ions from the list given below that have the geometry that is explained by the same hybridization of orbitals, NO_2^-, NO_3^-, NH_2^-, NH_4^+, SCN^- ? **[AIPMT 2011]**

(1) NO_2^- and NO_3^- (2) NH_4^+ and NO_3^- (3) SCN^- and NH_2^- (4) NO_2^- and NH_2^-

22. Which of the following is least likely to behave as Lewis base ? **[AIPMT 2011]**

(1) H_2O (2) NH_3 (3) BF_3 (4) OH^-

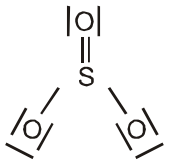
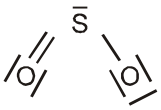
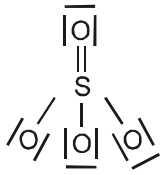
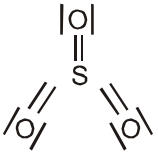
23. Name the type of the structure of silicate in which one oxygen atom of $[SiO_4]^{4-}$ is shared ?

(1) Linear chain silicate (2) Sheet silicate **[AIPMT 2011]**

(3) Pyrosilicate (4) Three dimensional

24. The correct order of increasing bond length of C–H, C–O, C–C and C=C is : **[AIPMT 2011]**
(1) C–H < C=C < C–O < C–C (2) C–C < C=C < C–O < C–H
(3) C–O < C–H < C–C < C=C (4) C–H < C–O < C–C < C=C

25. Which of the following structures is the most preferred and hence of lowest energy for SO_3 ? **[AIPMT 2011]**

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

26. The pairs of species of oxygen and their magnetic behaviours are noted below. Which of the following presents the correct description ? **[AIPMT 2011]**
(1) O_2^-, O_2^{2-} – Both diamagnetic (2) O_2^+, O_2^{2-} – Both paramagnetic
(3) O_2^+, O_2 – Both paramagnetic (4) O_2, O_2^{2-} – Both paramagnetic

27. Which one of the following pairs is isostructural (i.e. having the same shape and hybridization) ? **[AIPMT 2012]**
(1) [BCl_3 and $BrCl_3$] (2) [NH_3 and NO^-_3] (3) [NF_3 and BF_3] (4) [BF_4^- and NH^+_4]

28. Bond order of 1.5 is shown by : **[AIPMT 2012]**
(1) O_2^+ (2) O_2^- (3) O_2^{2-} (4) O_2

29. Which of the following statements is not valid for oxoacids of phosphorus ? **[AIPMT 2012]**
(1) Orthophosphoric acid is used in the manufacture of triple superphosphate
(2) Hypophosphorous acid is a diprotic acid
(3) All oxoacids contain tetrahedral four coordinated phosphorus
(4) All oxoacids contain atleast one P=O unit and one P–OH group

30. Which of the following species contains three bond pairs and one lone pair around the central atom ? **[AIPMT 2012]**
(1) H_2O (2) BF_3 (3) NH_2^- (4) PCl_3

31. The pair of species with the same bond order is : **[AIPMT 2012]**
(1) O_2^{2-} , B_2 (2) O_2^+ , NO^+ (3) NO, CO (4) N_2, O_2

32. During change of O_2 to O_2^- ion, the electron adds on which one of the following orbitals? **[AIPMT 2012]**
(1) π^* orbital (2) π orbital (3) σ^* orbital (4) σ orbital

33. Four diatomic species are listed below. Identify the correct order in which the bond order is increasing in them: **[AIPMT 2012]**
(1) $NO < O_2^- < C_2^{2-} < He_2^+$ (2) $O_2^- < NO < C_2^{2-} < He_2^+$
(3) $C_2^{2-} < He_2^+ < O_2^- < NO$ (4) $He_2^+ < O_2^- < NO < C_2^{2-}$

34. Which of the following is electron-deficient ? **[NEET 2013]**
(1) $(SiH_3)_2$ (2) $(BH_3)_2$ (3) PH_3 (4) $(CH_3)_2$

35. Which one of the following molecules contains no π bond ? **[NEET 2013]**
(1) H_2O (2) SO_2 (3) NO_2 (4) CO_2

36. Which of the following is a polar molecule ? **[NEET 2013]**
(1) SF_4 (2) SiF_4 (3) XeF_4 (4) BF_3

37. Which of the following is paramagnetic ? **[NEET 2013]**
(1) O_2^- (2) CN^- (3) NO^+ (4) CO

38. XeF_2 is isostructural with : **[NEET 2013]**
(1) ICl_2^- (2) $SbCl_3$ (3) $BaCl_2$ (4) TeF_2

39. Dipole-induced dipole interactions are present in which of the following pairs : **[NEET 2013]**
(1) Cl_2 and CCl_4 (2) HCl and He atoms (3) SiF_4 and He atoms (4) H_2O and alcohol

40. Which of the following molecules has the maximum dipole moment ? **[AIPMT 2014]**
(1) CO_2 (2) CH_4 (3) NH_3 (4) NF_3

41. Which one of the following species has plane triangular shape ? **[AIPMT 2014]**
(1) N_3^- (2) NO_3^- (3) NO_2 (4) CO_2

42. The correct bond order in the following species is : **[AIPMT 2015]**
(1) $O_2^{2+} < O_2^- < O_2^+$ (2) $O_2^+ < O_2^- < O_2^{2+}$ (3) $O_2^- < O_2^+ < O_2^{2+}$ (4) $O_2^{2+} < O_2^+ < O_2^-$

43. Which of the following pairs of ions are isolectronic and isostructural ? **[AIPMT 2015]**
(1) ClO_3^-, CO_3^{2-} (2) SO_3^{2-}, NO_3^- (3) ClO_3^-, SO_3^{2-} (4) CO_3^{2-}, SO_3^{2-}

44. Maximum bond angle at nitrogen is present in which of the following ? **[AIPMT 2015]**
(1) NO_2^- (2) NO_2^+ (3) NO_3^- (4) NO_2

45. Which of the following species contains equal number of σ-and π-bonds ? **[AIPMT 2015]**
(1) XeO_4 (2) $(CN)_2$ (3) $CH_2(CN)_2$ (4) HCO_3^-

46. Predict the **correct** order among the following : **[NEET-1 2016]**
(1) lone pair – bond pair > bond pair – bond pair > lone pair – lone pair
(2) lone pair – lone pair > lone pair – bond pair > bond pair – bond pair
(3) lone pair – lone pair > bond pair – bond pair > lone pair – bond pair
(4) bond pair – bond pair > lone pair – bond pair > lone pair – lone pair

47. Consider the molecules CH_4, NH_3 and H_2O. Which of the given statement is **false** ? **[NEET-1 2016]**
(1) The H–C–H bond angle is CH_4 is larger than the H–N–H bond angle is NH_3
(2) The H–C–H bond angle is CH_4 the H–N–H bond angle in NH_3 and the H–O–H bond angle in H_2O are all greater than 90º.
(3) Then H–O–H bond angle in H_2O is larger than the H–C–H bond angle in CH_4
(4) The H–O–H bond angle in H_2O is smaller than the H–N–H bond angle in NH_3

48. Match the compound given in column I with the hybridization and shape given in column II and mark the correct option. **[Chemical Bonding]** **[NEET-1 2016]**

	Column-I		**Column-II**
(a)	XeF_6	(i)	distorted octahedral
(b)	XeO_3	(ii)	square planar
(c)	$XeOF_4$	(iii)	pyramidal
(d)	XeF_4	(iv)	square pyramidal

Code :

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

49. Which one of the following compounds shows the presence of intramolecular hydrogen bond ?

(1) Concentrated acetic acid (2) H_2O_2 **[NEET-2 2016]**
(3) HCN (4) Cellulose

50. The hybridizations of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are **[NEET-2 2016]**
(1) sp^2, sp and sp^3 (2) sp, sp^3 and sp^2
(3) sp^2, sp^3 and sp (4) sp, sp^2 and sp^3

51. Which of the following pairs of ions is isoelectronic and isostructural ? **[NEET-2 2016]**
(1) ClO_3^-, SO_3^{2-} (2) CO_3^{2-}, NO_3^- (3) ClO_3^-, CO_3^{2-} (4) SO_3^{2-}, CO_3^{2-}

52. The correct geometry and hybridization for XeF_4 are - **[NEET-2 2016]**
(1) square planar, sp^3d^2 (2) Octahydral, sp^3d^2
(3) trigonal bipyramidal, sp^3d (4) planar triangle, sp^3d^3

53. Among the following, which one is a wrong statement? **[NEET-2 2016]**
(1) I_3^+ has bent geometry. (2) PH_5 and $BiCl_5$ do not exist.
(3) $p\pi$-$d\pi$ bonds are present in SO_2 (4) SeF_4 and CH_4 have same shape.

54. Which of the following species is not paramagnetic? **[NEET 2017]**
(1) CO (2) O_2 (3) B_2 (4) NO

55. In the structure of ClF_3, the number of lone pairs of electrons on cetral atom 'Cl' is : **[NEET 2018]**
(1) one (2) Three (3) four (4) two

56. Consider the following species : **[NEET 2018]**
CN^+, CN^-, NO and CN
Which one of these will have the highest bond order?
(1) NO (2) CN (3) CN^+ (4) CN^-

PART - II : AIIMS QUESTION (PREVIOUS YEARS)

1. The number of P–O–P bonds in the structure of phosphorus pentaoxide and phosphorus trioxide are respectively: **[AIIMS 2005]**
(1) 6, 6 (2) 5, 5 (3) 5, 6 (4) 6, 5

2. In diborane, the two H — B — H angles are nearly : **[AIIMS 2005]**
(1) 60°, 120° (2) 95°, 120° (3) 95°, 150° (4) 120°, 180°

3. **Assertion :** H–S–H bond angle in H_2S is closer to 90° but H–O–H bond angle in H_2O is 104.5°.
Reason : *lp* - *lp* repulsion is stronger in H_2S than in H_2O. **[AIIMS 2007]**
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

4. **Assertion :** The S–S–S bond angle in S_8 molecule is 105°. **[AIIMS 2008]**
Reason : S_8 has V-shape.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

5. **Assertion :** Fluorine molecule has bond order one. **[AIIMS 2008]**
Reason : The number of electrons in the antibonding molecular orbitals is two less than that is bonding molecular orbitals.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.

(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

6. The type of hybrid orbitals used by iodine atom in hypoiodous acid molecule are **[AIIMS 2010]**
(1) sp^3 (2) sp^2 (3) sp (4) sp^3d

7. The correct order of increasing covalent character is : **[AIIMS 2010]**
(1) LiCl, NaCl, $BeCl_2$ (2) $BeCl_2$, NaCl, LiCl
(3) NaCl, LiCl, $BeCl_2$ (4) $BeCl_2$, LiCl, NaCl

8. **Assertion :** HOF bond angle is higher than HOCl bond angle in HOX. **[AIIMS 2010]**
Reason : Oxygen is more electronegative than halogens.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

9. **Assertion :** The HF_2^- ions exists in the solid state and also in liquid state but not in aqueous solution.
Reason : The magnitude of hydrogen bonds in between HF – HF molecule is weaker than that in between HF and H_2O molecules. **[AIIMS 2010]**
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

10. Decreasing order of bond angle is : **[AIIMS 2011]**
(1) $BeCl_2 > NO_2 > SO_2$ (2) $BeCl_2 > SO_2 > NO_2$ (3) $SO_2 > BeCl_2 > NO_2$ (4) $SO_2 > NO_2 > BeCl_2$

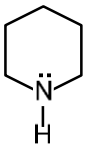
11. The wrong statement about fullerene is : **[AIIMS 2011]**
(1) it has 5-membered carbon ring
(2) it has 6-membered carbon ring
(3) it has sp^2 hybridization
(4) it has 5-membered rings more than 6-membered rings.

12. **Assertion :** $R_3P = O$ exists $R_3N = O$ does not exist. **[AIIMS 2011]**
Reason : P is more electronegative than N.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

13. N_2 and O_2 are converted into monocations, N_2^+ and O_2^+ respectively. Which of the following is wrong? **[AIIMS 2012]**
(1) In N_2^+, N — N bond weakens (2) In O_2^+, the O – O bond order increases
(3) In O_2^+, paramagnetism decreases (4) N_2^+ becomes diamagnetic

14. N_2 and O_2 are converted into monoanions N_2^- and O_2^- respectively. Which of the following statements is wrong ? **[AIIMS 2013]**
(1) In N_2^-, N–N bond weakens (2) ln O_2^-, O–O bond order increases
(3) ln O_2^-, O–O bond order decreases (4) N_2^- becomes paramagnetic

15. Which one of the following arrangements of molecules is correct on the basis of their dipole moments ? **[AIIMS 2013]**
(1) $BF_3 > NF_3 > NH_3$ (2) $NF_3 > BF_3 > NH_3$ (3) $NH_3 > BF_3 > NF_3$ (4) $NH_3 > NF_3 > BF_3$

16. In piperidine  , the hybrid state assumed by N is **[AIIMS 2013]**

(1) sp (2) sp^2 (3) sp^3 (4) dsp^2

17. **Assertion**: Bond angle of H_2S is smaller than H_2O. **[AIIMS 2013]**

Reason: Electronegativity of the central atom increases, bond angle decreases.

(1) If both assertion and reason are true and reason is the correct explanation of assertion.

(2) If both assertion and reason are true but reason is not the correct explanation of assertion.

(3) If Assertion is true but reason is false.

(4) If both assertion and reason are false.

18. The shapes of SF_4 and XeF_2 respectively are : **[AIIMS 2015]**

(1) trigonal bipyramidal and trigonal bipyramidal (2) see-saw and linear

(3) T-shape and linear (4) square planar and trigonal bipyramidal

19. Consider the statements : **[AIIMS 2015]**

I. Bond length in N_2^+ is 0.02Å greater than in N_2

II. Bond length in NO^+ is 0.09Å less than in NO.

III. O_2^{2-} has shorter bond length than O_2

Which of the following statements are true ?

(1) I and II (2) II and III (3) I, II and III (4) I and III

20. **Assertion (A)** H_2O is the hybride of group-16 which is only liquid at ordinary temperature. **[AIIMS 2015]**
Reason (R) IN ice, each oxygen atom is surrounded by two covalent bonds and two hydrogen bonding.
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

21. Correct or der of increasing C—O bond length of CO, CO_3^{2-} , CO_2 is : **[AIIMS 2016]**
(1) $CO_3^{2-} < CO_2 < CO$ (2) $CO_2 < CO_3^{2-} < CO$ (3) $CO < CO_3^{2-} < CO_2$ (4) $CO < CO_2 < CO_3^{2-}$

22. In formation of NO^+ from NO, the electron is removed from **[AIIMS 2017]**
(1) a σ-orbital (2) a π-orbital (3) a σ^*-orbital (4) a π^*-orbital

23. Which of the following conversions involve change in both hybridization and shape ? **[AIIMS 2017]**
(1) $CH_4 \rightarrow C_2H_6$ (2) $NH_3 \rightarrow NH_4^+$ (3) $BF_3 \rightarrow BF_4^-$ (4) $H_2O \rightarrow H_3O^+$

24. Among the following, the true statements are **[AIIMS 2017]**
I. PH_5 and $BiCl_5$ donot exist. II. $p\pi$-$d\pi$ is present in SO_2.
III. Electrons travel with speed of light. IV. SF_4 and CH_4 has same shape
V. I_3^+ has bent shape.
(1) I, III (2) I, II, V (3) I, III, V (4) I, II, IV

25. **Assertion (A)** : The central atom of NH_3 and H_2O, are both sp^3-hybridised yet H—N—H bond angle is greater than that of H—O—H. **[AIIMS 2017]**
Reason (R) : In NH_3, N-atom has one lone pair of electron whereas in H_2O, oxygen atom has two low pairs of electron
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If Assertion is true but reason is false.
(4) If both assertion and reason are false.

25. Which of the following cantain at least one lone pair in all of its halide **[AIIMS 2018]**
(1) Xe (2) Se (3) Cl (4) N

26. Which is incorrect regarding S and P mixing (along Z –axis.) **[AIIMS 2018]**
(1) Nodal plane(s) present in ABMO
(2) Nodal plane is absent in BMO
(3) MO formed may have higher energy than parent AO
(4) MO formed are asymmetric

27. Which molecule pair do not have identical structure **[AIIMS 2018]**
(1) I_3^- , BeF_2 (2) HClO, SO_2 (3) BF_3, ICl_3 (4) BrF_4^- , XeF_4

28 Which contain at least one e^- in $\sigma 2p$ bonding MO **[AIIMS 2018]**
(1) O_2 (2) B_2 (3) C_2 (4) Li_2

29. For N_3^- which statement is wrong **[AIIMS 2018]**
(1) Iso electronic with CO_2 (2) NH_2OH and N_3^- have same O.N. on nitrogen atom
(3) N–N bond length are same (4) HN_3 have linear shape

30. Which pair of diatomic species do not have same bond order ? **[AIIMS 2018]**
(1) B_2^- , C_2 (2) O_2^{2-} , F_2^- (3) N_2^+ , O_2^- (4) B_2^{2-} , C_2

31. ClF_2^- , ClF_4^- find out number of lone pair and geometry. **[AIIMS 2018]**

(1) 3 – Linear, 2 – Square planar (2) 3 – Square planar, 2 – Linear
(3) 0 – Linear, 3 – Square planar (4) 2 – Linear, 2 – Square planar

32. Which have correct order of dipole moment : **[AIIMS 2018]**
(1) $SO_2 > H_2O$ (2) $NF_3 > NH_3$ (3) $BF_3 < NH_3$ (4) $SO_2 < SO_3$

33. In which of the following shape is same but hybridization is different: **[AIIMS 2018]**
(1) ICl_2^-, XeF_2 (2) SO_2, NO_2^+ (3) SO_2, NH_2^- (4) CO_2, SO_2

34. Correct order of bond angle is : **[AIIMS 2018]**
(1) $SO_2 < H_2S$ (2) $SO_2 < H_2O$ (3) $NH_3 < H_2O$ (4) $NH_3 < SO_2$

35. % s-character of N–H bond is maximum in : **[AIIMS 2018]**
(1) N_2H_2 (2) N_2H_4 (3) NH_3 (4) NH_4^+

36. **Assertion :** SO_2 is more covalent than SeO_2 **[AIIMS 2018]**
Reason : Covalent radius of Se is more than S
(1) If both assertion and reason are true and reason is the correct explanation of assertion.
(2) If both assertion and reason are true but reason is not the correct explanation of assertion.
(3) If assertion is true but reason is false.
(4) If both assertion and reason are false.

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

1. The number of lone pairs on Xe in XeF_2, XeF_4 and XeF_6 respectively are : **[AIEEE-2002, 3/225]**
(1) 3, 2, 1 (2) 2, 4, 6 (3) 1, 2, 3 (4) 6, 4, 2

2. The hybridisation of the underline atom changes in : **[AIEEE-2002, 3/225]**
(1) $\underline{Al}H_3$ changes to AlH_4^- (2) $H_2\underline{O}$ changes to H_3O^+
(3) $\underline{N}H_3$ changes to NH_4^+ (4) in all cases

3. Bond angle of 109º 28' is found in : **[AIEEE-2002, 3/225]**
(1) NH_3 (2) H_2O (3) CH_3^+ (4) NH_4^+

4. Increasing order of bond strength of O_2, O_2^-, O_2^{2-} and O_2^+ is : **[AIEEE-2002, 3/225]**
(1) $O_2^+ < O_2 < O_2^- < O_2^{2-}$ (2) $O_2 < O_2^+ < O_2^- < O_2^{2-}$
(3) $O_2^- < O_2^{2-} < O_2^+ < O_2$ (4) $O_2^{2-} < O_2^- < O_2 < O_2^+$

5. In the anion $HCOO^-$ the two C–O bonds are found to be of equal length. What is the reason for it ? **[AIEEE-2003, 3/225]**
(1) Electronic orbits of carbon atom are hybridised.
(2) The C=O bond is weaker than the C–O bond.
(3) The anion $HCOO^-$ has two resonating structures.
(4) The anion is obtained by removal of a proton from the acid molecule.

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

7. 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.

8. 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.

9. 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

10. 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

11. The maximum number of 90º angles between bond pair–bond pair of electrons is observed in : **[AIEEE-2004, 3/225]**

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

12. 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) $H_2S < NH_3 < BF_3 < SiH_4$

13. 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)

14. 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

15. 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

16. 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^-.

17. The structure of diborane (B_2H_6) contains : **[AIEEE-2005, 4½/225]**

(1) four 2c–2e bonds and four 3c–2e bonds (2) two 2c–2e bonds and two 3c–3e bonds

(3) two 2c–2e bonds and four 3c–2e bonds (4) four 2c–2e bonds and two 3c–2e bonds

18. 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 atom, 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.

19. The number and type of bonds between two carbon atoms in calcium carbide are : **[AIEEE-2005 (3/225), 2011 (4/120)]**

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

20. 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

21. 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

22. 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) $Be^{2+} < K^+ < Ca^{2+} < Mg^{2+}$

23. 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

24. Which of the following species exhibits the diamagnetic behaviour? **[AIEEE-2007, 3/120]**

(1) O_2^{2-} (2) O_2^+ (3) O_2 (4) NO

25. 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) $NO \longrightarrow NO^+$

26. Which one of the following pairs of species has 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^+

27. 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 $p\pi$-$p\pi$ 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 $p\pi$-$p\pi$ 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.

28. Using MO theory predict which of the following species has the shortest bond length ? **[AIEEE-2009, 4/144]**

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

29. 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) $MgCl_2$

30. 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

31. What is the best description of the change that occurs when $Na_2O(s)$ is dissolved in water ? **[AIEEE-2011, 4/120]**

(1) Oxide ion accepts sharing in a pair of electrons

(2) Oxide ion donates a pair of electrons

(3) Oxidation number of oxygen increases

(4) Oxidation number of sodium decreases

32. The structure of IF_7 is : **[AIEEE-2011, 4/120]**

(1) square pyramid (2) trigonal bipyramid (3) octahedral (4) pentagonal bipyramid

33. 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

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

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

35. 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

36. Which of the following exists as covalent crystals in the solid state ? **[AIEEE-2013, 4/120]**

(1) Iodine (2) Silicon (3) Sulphur (4) Phosphorus

37. 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

38. 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+}

39. Stability of the species Li_2, Li_2^- and Li_2^+ increases in the order of : **[JEE-Mains 2013, 4/120]**

(1) $Li_2 < Li_2^+ < Li_2^-$ (2) $Li_2^- < Li_2^+ < Li_2$ (3) $Li_2 < Li_2^- < Li_2^+$ (4) $Li_2^- < Li_2 < Li_2^+$

40. 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.

41. 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

42. Which one has the highest boiling point ? **[JEE(MAIN)-2015, 4/120]**

(1) He (2) Ne (3) Kr (4) Xe

43. 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.

44. 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^+

45. Which of the following species is not paramagnetic? **[JEE(Main)-2017, 4/120]**

(1) CO (2) O_2 (3) B_2 (4) NO

46. Total number of lone pair of electrons in I_3^- ion is : **[JEE(Main)-2018, 4/120]**

(1) 9 (2) 12 (3) 3 (4) 6

47. Which of the following are Lewis acids ? **[JEE(Main)-2018, 4/120]**

(1) PH_3 and $SiCl_4$ (2) BCl_3 and $AlCl_3$ (3) PH_3 and BCl_3 (4) $AlCl_3$ and $SiCl_4$

48. Which of the following compounds contain(s) no covalent bond(s) ? **[JEE(Main)-2018, 4/120]**

KCl, PH_3, O_2, B_2H_6, H_2SO_4

(1) KCl (2) KCl, B_2H_6 (3) KCl, B_2H_6, PH_3 (4) KCl, H_2SO_4

49. According to molecular orbital theory, which of the following will **not** be a viable molecule ?

[JEE(Main)-2018, 4/120]

(1) H_2^- (2) H_2^{2-} (3) He_2^{2+} (4) He_2^+

50. According to molecular orbital theory, which of the following is true with respect to Li_2^+ and Li_2^- ?

[JEE(Main)-2019, 4/120]

(1) Li_2^+ is unstable and Li_2^- is stable (2) Li_2^+ is stable and Li_2^- is unstable

(3) Both are stable (4) Both are unstable

51. In which of the following processes, the bond order has increased and paramagnetic character has changed to diamagnetic? **[JEE(Main)-2019, 4/120]**

(1) $NO \longrightarrow NO^+$ (2) $O_2 \longrightarrow O_2^{2-}$ (3) $O_2 \longrightarrow O_2^+$ (4) $N_2 \longrightarrow N_2^+$

52. The type of hybridisation and number of lone pair(s) of electrons of Xe in $XeOF_4$, respectively, are :

[JEE(Main)-2019, 4/120]

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

53. Two pi and half sigma bonds are present in : **[JEE(Main)-2019, 4/120]**

(1) N_2^+ (2) O_2 (3) O_2^+ (4) N_2

54. The pair that contains two P–H bonds in each of the oxoacid is: **[JEE(Main)-2019, 4/120]**

(1) $H_4P_2O_5$ and H_3PO_3 (2) $H_4P_2O_5$ and $H_4P_2O_6$

(3) H_3PO_2 and $H_4P_2O_5$ (4) H_3PO_3 and H_3PO_2

55. The hydride that is NOT electron different is : **[JEE(Main)-2019, 4/120]**

(1) GaH_3 (2) SiH_4 (3) AlH_3 (4) B_2H_6

56. The element that shows greater ability to form $p\pi$-$p\pi$ multiple bonds, is: **[JEE(Main)-2019, 4/120]**

(1) Ge (2) Sn (3) C (4) Si

Answers

EXERCISE - 1

SECTION (A)

1.	(2)	**2.**	(2)	**3.**	(1)	**4.**	(3)	**5.**	(4)	**6.**	(1)	**7.**	(3)

SECTION (B)

1.	(4)	**2.**	(3)	**3.**	(4)	**4.**	(4)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(3)	**9.**	(3)	**10.**	(2)	**11.**	(4)						

SECTION (C)

1.	(3)	**2.**	(3)	**3.**	(1)	**4.**	(1)	**5.**	(2)	**6.**	(1)	**7.**	(1)
8.	(1)	**9.**	(2)										

SECTION (D)

1.	(1)	**2.**	(2)	**3.**	(1)	**4.**	(1)	**5.**	(3)	**6.**	(4)	**7.**	(1)
8.	(4)	**9.**	(3)	**10.**	(3)	**11.**	(1)	**12.**	(4)	**13.**	(2)	**14.**	(1)
15.	(4)	**16.**	(3)	**17.**	(3)	**18.**	(1)	**19.**	(3)				

SECTION (E)

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

SECTION (F)

1.	(1)	**2.**	(3)	**3.**	(4)	**4.**	(4)	**5.**	(1)	**6.**	(2)	**7.**	(1)
8.	(3)	**9.**	(1)	**10.**	(2)	**11.**	(1)	**12.**	(1)	**13.**	(3)	**14.**	(1)

SECTION (G)

1.	(2)	**2.**	(2)	**3.**	(3)	**4.**	(3)	**5.**	(2)	**6.**	(1)	**7.**	(3)
8.	(4)	**9.**	(2)	**10.**	(2)	**11.**	(2)						

SECTION (H)

1.	(3)	**2.**	(4)	**3.**	(1)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(3)
8.	(1)	**9.**	(2)	**10.**	(3)	**11.**	(4)	**12.**	(4)	**13.**	(1)	**14.**	(3)
15.	(3)												

SECTION (I)

1.	(4)	**2.**	(1)	**3.**	(2)	**4.**	(3)	**5.**	(3)	**6.**	(1)	**7.**	(3)
8.	(3)	**9.**	(3)	**10.**	(2)	**11.**	(3)	**12.**	(2)	**13.**	(3)	**14.**	(1)

SECTION (J)

1.	(3)	**2.**	(2)	**3.**	(2)	**4.**	(3)	**5.**	(4)	**6.**	(4)	**7.**	(4)
8.	(4)												

EXERCISE - 2

1.	(4)	**2.**	(3)	**3.**	(2)	**4.**	(3)	**5.**	(2)	**6.**	(4)	**7.**	(4)
8.	(1)	**9.**	(1)	**10.**	(2)	**11.**	(3)	**12.**	(4)	**13.**	(4)	**14.**	(4)
15.	(4)	**16.**	(3)	**17.**	(2)	**18.**	(1)	**19.**	(1)	**20.**	(2)	**21.**	(4)
22.	(3)	**23.**	(2)	**24.**	(4)	**25.**	(2)	**26.**	(3)	**27.**	(2)	**28.**	(3)
29.	(4)	**30.**	(4)	**31.**	(4)	**32.**	(4)	**33.**	(3)	**34.**	(1)	**35.**	(4)
36.	(1)	**37.**	(2)	**38.**	(2)	**39.**	(3)	**40.**	(1)	**41.**	(3)	**42.**	(2)
43.	(2)	**44.**	(3)	**45.**	(3)	**46.**	(4)	**47.**	(2)	**48.**	(2)	**49.**	(3)
50.	(1)	**51.**	(4)	**52.**	(4)	**53.**	(1)	**54.**	(3)	**55.**	(4)	**56.**	(2)
57.	(2)	**58.**	(3)										

EXERCISE - 3

PART-I

1.	(4)	**2.**	(4)	**3.**	(2)	**4.**	(2)	**5.**	(4)	**6.**	(2)	**7.**	(4)
8.	(4)	**9.**	(1)	**10.**	(2)	**11.**	(2)	**12.**	(3)	**13.**	(2)	**14.**	(3)
15.	(2)	**16.**	(2)	**17.**	(2)	**18.**	(1)	**19.**	(1)	**20.**	(1)	**21.**	(1)
22.	(3)	**23.**	(3)	**24.**	(1)	**25.**	(4)	**26.**	(3)	**27.**	(4)	**28.**	(2)
29.	(2)	**30.**	(4)	**31.**	(1)	**32.**	(1)	**33.**	(4)	**34.**	(2)	**35.**	(1)
36.	(1)	**37.**	(1)	**38.**	(1)	**39.**	(2)	**40.**	(3)	**41.**	(2)	**42.**	(3)
43.	(3)	**44.**	(2)	**45.**	(1)	**46.**	(2)	**47.**	(3)	**48.**	(2)	**49.**	(4)
50.	(4)	**51.**	(2)	**52.**	(1)	**53.**	(4)	**54.**	(1)	**55.**	(4)	**56.**	(4)

PART-II

1.	(1)	**2.**	(2)	**3.**	(2)	**4.**	(3)	**5.**	(1)	**6.**	(1)	**7.**	(3)
8.	(4)	**9.**	(1)	**10.**	(1)	**11.**	(4)	**12.**	(3)	**13.**	(4)	**14.**	(2)
15.	(4)	**16.**	(3)	**17.**	(3)	**18.**	(2)	**19.**	(1)	**20.**	(2)	**21.**	(4)
22.	(4)	**23.**	(3)	**24.**	(2)	**25.**	(1)	**25.**	(1)	**26.**	(2)	**27.**	(3)
28	(1)	**29.**	(4)	**30.**	(1)	**31.**	(1)	**32.**	(3)	**33.**	(3)	**34.**	(4)
35.	(1)	**36.**	(2)										

PART-III

1.	(1)	**2.**	(1)	**3.**	(4)	**4.**	(4)	**5.**	(3)	**6.**	(3)	**7.**	(2)
8.	(4)	**9.**	(3)	**10.**	(1)	**11.**	(4)	**12.**	(3)	**13.**	(3)	**14.**	(3)
15.	(2)	**16.**	(2)	**17.**	(4)	**18.**	(4)	**19.**	(2)	**20.**	(3)	**21.**	(1)
22.	(1)	**23.**	(4)	**24.**	(1)	**25.**	(4)	**26.**	(4)	**27.**	(2)	**28.**	(4)
29.	(3)	**30.**	(2)	**31.**	(2)	**32.**	(4)	**33.**	(3)	**34.**	(3)	**35.**	(3)
36.	(2)	**37.**	(1)	**38.**	(3)	**39.**	(2)	**40.**	(2)	**41.**	(3)	**42.**	(4)
43.	(2)	**44.**	(4)	**45.**	(1)	**46.**	(1)	**47.**	(2)	**48.**	(1)	**49.**	(2)
50.	(3)	**51.**	(1)	**52.**	(1)	**53.**	(1)	**54.**	(3)	**55.**	(2)	**56.**	(3)