CHEMISTRY-2

Chemical bonding and Molecular Structure

[Set-2]

SECTION-A

1. In which of the following pairs, both the species are electron deficient?

   (i) BF_3, $AlCl_3$ (ii) $BeCl_2$, CCl_4 (iii) NH_4^+, BCl_3 (iv) NH_3, H_2O

2. Which of the following contain a dative σ bond?

   (a) NH_4^+ (ii) P_4O_{10} (c) H_3O^+ (iv) None of these

3. Each of the following species has a central atom sp^2 hybridized except

   (i) SO_2 (ii) CO_2 (iii) OH_2 (iv) Cl_2O

4. Most number of unpaired electrons present in

   (i) O_2^+ (ii) F_2 (iii) N_2 (iv) O_2

Match the following:

5.

	Column-I		**Column-II**
	Molecule		**(shape)**
	A: SO_3	1.	Trigonal pyramidal
	B: XeO_3	2.	Trigonal planar
	C.: BF_3	3.	Distorted T-shape
	D.: ClF_3	4.	Tetrahedral
		5.	Angular

	A	**B**	**C**	**D**
(i)	2	5	1	4
(ii)	2	1	2	3
(iii)	3	1	2	4
(iv)	2	4	2	5

Assertion-Reason type Questions:

(a) Both A and R are true and R is the correct explanation of A

(b) Both A and R are true and R is not the correct explanation of A

(c) A is true but R is false

(d) A is false but R is true

6. A: Ethene and ethyne both contains carbon-carbon pi bonds.

   R: pi bonds are formed by sideways overlapping of atomic orbitals.

7. A: NF_3 and NH_3 both are having trigonal pyramidal geometry.

   R: Both NF_3 and NH_3 have same value of dipole moment.

Passage based type questions:

Molecular orbital are formed by the linear combination of atomic orbital. There are different types of molecular orbitals: bonding and antibonding. Bonding molecular orbitals are more stable and have a lower energy than the antibonding molecular orbital. Molecular orbitals may also have a node like atomic orbitals. Molecular orbitals are also filled with electrons with increasing energy and can accommodate with maximum two electrons with opposite spins. Bond order can be defined as half of the difference of bonding electron and antibonding electron.

8. Which of the following molecular orbital has, only one node?

   (i) $\sigma 1s$ (ii) $\pi 2p_x$ (iii) $\pi^* 2p_x$ (iv) $\sigma 2p_z$

9. In which of the following pair both the species have same bond order?

   (i) O_2, N_2^{2-} (ii) N_2^+, N_2^- (iii) O_2, F_2 (iv) B_2, C_2

10. Which are has maximum number of one or more electron in bonding molecular orbitals?

    (i) C_2 (ii) N_2 (iii) N_2^+ (iv) O_2

SECTION-B

11. (i) Out of σ and π bonds, which one is a stronger bond and why?

    (ii) Predict which out of the following molecules will have higher dipole moment and why?

    CS_2 and OCS

12. Draw the Lewis dot structures of

    (a) $BeCl_2$ (b) NH_3

OR

Using VSEPR theory, draw the molecular structures of SF_4 and XeF_4 indicating the location of lone pair(s) of electrons and hybridization of the central atom

13. Give reason for the following:

    (i) H_2^+ has more stability than H_2^- although both have the same bond order.

    (ii) N_2^+ and N_2^- both have the same bond order.

    (ii) HF has higher boiling point than HCl.

14. Using orbital diagram, explain the hybridization and formation of pi bond in ethene, C_2H_4 molecule

OR

Using orbital diagram, explain the hybridization in ethyne molecule, C_2H_2. Also, explain how carbon-carbon pi bonds are formed?

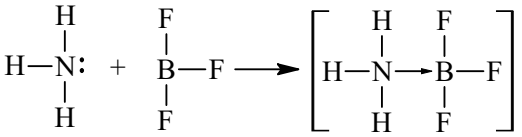
15. (i) Give reason:

(a) ClF_3 and NF_3 are not isostructural.

(b) All five P – Cl bonds in PCl_5 are not equal in length.

(c) Glucose, $C_6H_{12}O_6$ although a covalent molecule but soluble in water.

(ii) How the hybridization and shape of B and N change in the reaction



OR

(i) Give reason:

(a) B – F bond in BF_3 is slightly shorter than the B – F bond in BF_4^-.

(b) H_2O is a liquid whereas H_2S is a gas at room temperature.

(c) Both the bonds in C_2 molecule are pi bonds.

(ii) Draw the molecular orbital energy level diagram for F_2 molecule. Also, calculate the bond order and predict the magnetic properties of F_2.

