INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 22

Total Marks : 31

Max. Time : 35 min.

Topic : Chemical Bonding

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.3	(3 marks, 3 min.)	[9, 9]
Multiple choice objective ('–1' negative marking) Q.4	(4 marks, 4 min.)	[4, 4]
True or False (no negative marking) Q.5	(2 marks, 2 min.)	[2, 2]
Subjective Questions ('–1' negative marking) Q.6 to Q.7	(4 marks, 5 min.)	[8, 10]
Match the Following (no negative marking) Q.8	(8 marks, 10 min.)	[8, 10]

1. Which of the following molecule is/are non polar :
    (A) XeF_2 (B) PCl_3F_2 (C) XeF_4 (D) All of these

2. The dipole moments of the given molecules are such that :
    (A) $BF_3 > NF_3 > NH_3$ (B) $NF_3 > BF_3 > NH_3$ (C) $NH_3 > NF_3 > BF_3$ (D) $NH_3 > BF_3 > NF_3$.

3. In which type of molecule, the dipole moment may be non-zero :
    (where   A – Central atom,   B – Bonded atom, L – Lone pair)
    (A) AB_2L_2 (B) AB_2L_3 (C) AB_4L_2 (D) AB_4

4.* Which is incorrect order for net dipole moment :
    (A) HF > HCl > HBr > HI
    (B) CH_3– F > CD_3 – F
    (C) $SO_3 > SO_2$
    (D) CH_3 – CH = CHCl (cis)> CH_3 – CH = CHCl (trans)

5. **True or False**
    (a) The dipole moment of HCl molecule is 1.05 D and its internuclear separation is 1.25 Å. The charge effectively held by the chlorine atom is 7/40 times the electronic charge.
    (Given : charge of an electron = 4.8×10^{-10} esu)
    (b) All the N–N bond lengths are same in azide ion and hydroazoic acid.

6. Arrange in order of increasing dipole moment : BF_3, H_2S, H_2O.

7. The gaseous Potassium chloride molecule has a measured dipole moment of 9.6 D, which indicates that it is a very polar molecule. The separation between the nuclei in this molecule is 2.67×10^{-8} cm. Calculate the percentage ionic character in KCl molecule.

8. **Match the following :**

Column I (Species)		Column II (Characteristics)
(A) NH_3	(p)	Non-polar molecule
(B) PF_2Cl_3	(q)	Polar molecule
(C) XeF_2	(r)	Bonding taking place in ground state
(D) H_2S	(s)	Bonding taking place in excited state.

1. (D)   2. (C)   3. (A)   4.* (BCD)

5. (a)True (b) False

6. $BF_3 < H_2S < H_2O$. BF_3 has a zero dipole moment because of its symmetry. H_2S has a lower dipole moment than H_2O because of the much lower bond polarity of H–S bond compared to H–O bond.

7. 75%.   8. (A – q, r) ; (B – p, s) ; (C – p, s) ; (D – q, r).

Hints & Solutions

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1. All are symmetrical molecules.   ∴ μ = 0 (Non polar compounds).

2. The dipole moment of BF_3 , NF_3 and NH_3 respectively is zero, 0.24D and 1.46D.

3. $AB_2L_2 \to$ Bent ($\mu \neq 0$), $AB_2L_3 \to$ Linear ($\mu = 0$), $AB_4L_2 \to$ Square planar ($\mu = 0$), $AB_4 \to$ Tetrahedral ($\mu = 0$).

4.* Correct orders of dipole moment are
    HF > HCl > HBr > HI   (decreasing bond polarity)
    $CD_3F > CH_3F$ (D is more electro +ve than hydrogen)
    $SO_2 > SO_3$ (SO_3 is symmetircal so dipole moment - 0)

5. (a) 1.07×10^{-8} esu –cm = $\delta \times 1.2738 \times 10^{-8}$
    $\Rightarrow$ 8.4×10^{-11} esu

    Fraction = $\dfrac{\delta}{e}$ = $\dfrac{8.4 \times 10^{-11}}{4.8 \times 10^{-10}}$ = $\dfrac{7}{40}$ or 0.175.
    (b) All N – N bond length are same in azide ion but not in hydrazoic acid.

6. $BF_3 < H_2S < H_2O$. BF_3 has a zero dipole moment because of its symmetry. H_2S has a lower dipole moment than H_2O because of the much lower bond polarity of H–S bond compared to H–O bond.

7. Dipole moment of compound if it would have been completely ionic
          = $(4.8 \times 10^{-10}$ esu$)$ $(2.67 \times 10^{-8}$ cm$)$ = 12.8 D

    so % ionic character = $\dfrac{9.6}{12.8}$ × 100% = 75%

8.   (A) NH_3 : $\mu \neq 0$ (polar molecule). 3 unpaired electron and 3 bonds.
    ∴ Bonding takes place in ground state.
    (B) PF_2Cl_3 : $\mu = 0$ (Non-polar molecule) 3 unpaired electron and 5 bonds.
    ∴ Bonding takes place in excited state.
    (C) XeF_2 : $\mu = 0$ (Non-polar molecule) 0 unpaired electron and 2 bonds.
    ∴ Bonding takes place in excited state.
    (D) H_2S : $\mu \neq 0$ (Polar molecule) 2 unpaired electron and 2 bonds.
    ∴ Bonding takes place in ground state.