BG-117

May-2015

M.Sc., Sem.-II

407 : Chemistry

(Inorganic Chemistry)

Time : 3 Hours]   **[Max. Marks : 70**

Instruction : Figure to the right indicate marks.

1. (a) For the cyclopentadienyl cation, find out $E\pi$, π-bond energy, delocalization energy, Electron & Charge Densities and π-bond order.   **7**

   Given : $\Psi_1 = 0.288\ P_1 + 0.5\ P_2 + 0.577\ P_3 + 0.5\ P_4 + 0.288\ P_5$,

   $\Psi_2 = 0.5\ (P_1 + P_2 - P_4 - P_5)$, $\Psi_3 = 0.577\ (P_1 - P_3 + P_5)$

   OR

   (a) Discuss Walsh diagram for XH_2 type of the molecule.

   (b) Explain the Bent's rule. Discuss its effects on the bond distance and bond angles on the different fluoromethanes.   **7**

   OR

   (b) Explain the terms band theory of solids and fermi level.

2. (a) In a molecule (AB_5; C_{4v}), central atom A has s, p and d orbitals, what are the orbitals available on A which will form σ bonds with B ?   **7**

   OR

   (a) Write the different steps involved in working out the molecular orbitals in AB_6 type molecule.

   (b) Assign the shape and point group of the following XY_3 type molecules with the help of their IR and Raman spectral data.   **7**

IR Active vibrations (cm^{-1})		Raman Active Vibrations (cm^{-1})
PCl_3 :	190, 258, 484, 511	190,258,484,511
ClF_3 :	326,364,434,528,703,752	326,364,434,528,703,752
BF_3 :	480,691, 1454	888,480,1454

   OR

   (b) In a molecule $[M(CO)_4L_2]$, (C_2v), find out the symmetries of stretching vibrations only for CO. Assign which will be IR active and which will be Raman active. Will there be any coincidence ?

3. (a) Discuss the structure and bonding in OMC of Acetylene. 7

   OR

   (a) Explain the structure and bonding in η^4-OMC considering butadiene.

   (b) Define organometallic compound, their classification and properties of OMC of transition metals. 7

   OR

   (b) Describe the use of OMC as catalyst in hydrogenation.

4. (a) Discuss the factors affecting the rate of reaction. 7

   OR

   (a) Explain Tunneling effect.

   (b) Discuss "Marcus-Hush Theory" and derive Marcus Equation. 7

   OR

   (b) Write a note on 'Hydrated Electron'.

5. Answer the following : (**1** mark each)

   (i) Give one example of a molecule of the type AX_5E_1 according to VSEPR theory.

   (ii) Define Charge Density.

   (iii) Which orbital will be HOMO for BeH_2 molecule according to Walsh diagram ?

   (iv) Why the valance state ionization potential of electrons of 2p orbital is lower than that of 2s orbital for nitrogen atom ?

   (v) How would you distinguish between IR and Raman vibrations if a molecule possess centre of symmetry ?

   (vi) In a molecule $[M(CO)_3L_3]$, (C_3v), the symmetries of stretching vibrations are $A_1 + E$. How many bands will be active in both i.e. IR and Raman ?

   (vii) What do you understand about the symmetry when a transition is polarized in Raman spectrum ?

   (viii) Define Mutual exclusion rule.

   (ix) What is the oxidation state of Cr in di-benzene chromium ?

   (x) Give the name of catalyst used in polymerization reaction of alkenes.

   (xi) Write the use of 'Silicon-oil'.

   (xii) When three metal atoms are within the bonding distance of one carbon atom, they are called _____ type of complex.

   (xiii) Give the formula for nuclear factor in Marcus equation.

   (xiv) Give the order of energy of nucleophilic attraction.

   _____