



Seat No. : _____

XW-111

April-2013

M.Sc. (Sem.II)

407 : CHEMISTRY (Inorganic Chemistry)

Time : 3 Hours]

[Max. Marks : 70

- Instructions :** (1) Character tables are to be provided.
(2) Figure to the right indicate marks.

1. (a) In a cyclic conjugated system prove that $E = \alpha + 2\beta \cos 2j \pi/N$. 4
(b) Calculate the π electron energy and delocalization energy of butadiene. 3
(c) Calculate and comment on the stability of cyclopentadiene radical and anion. 3
(d) Discuss the PPP approximation. 4

OR

- (a) Considering the case of AH_2 molecule explain the Walsh diagram. 4
(b) Explain the Bent rule taking the example of fluoromethanes. 4
(c) Discuss the energies involved in hybridization. 3
(d) Based on band theory explain conduction in semiconductors. 3
2. (a) Consider a AB_5 molecule (C_{4v}), with s, p and d orbitals available on atom A. Which hybridization scheme do you propose for σ bonding? 5
(b) Write the different steps involved in working out the molecular orbitals in AB_n type molecule. 5
(c) How would you distinguish between two, AB_4 type of molecules, having Td and D_{4h} point groups, from their vibrational spectrum (IR and Raman). 4

OR

- (a) Consider a tetrahedral AB_4 molecule with s, p and d orbitals available on atom A. Which hybridization scheme do you propose for π bonding? 5
(b) Interpret in Raman spectrum of CCl_4 . 5
 $\nu_1 = 459 \text{ cm}^{-1}$ (Pol)
 $\nu_2 = 315 \text{ cm}^{-1}$ (depol)
 $\nu_3 = 217 \text{ cm}^{-1}$ (depol)
 $\nu_4 = 762 \text{ cm}^{-1}$ (depol)
 $\nu_5 = 791 \text{ cm}^{-1}$ (depol)
- (c) In a molecule $[(M(CO)_4L_2], (C_{2v})$, the symmetries of stretching vibrations are $2A_1 + B_1 + B_2$. Assign which will be IR active and which will be Raman active. Will there be any coincidence? 4

3. (a) Explain the structure and bonding in cyclobutadiene. 5
 (b) Explain why there is lot of scope and opportunities available for research in π bonded organometallic chemistry. 5
 (c) Comment on the stability of M—C bond in organometallic compounds. 4
- OR**
- (a) Explain the structure and bonding in ferrocene. 5
 (b) Write a short note on organometallic reagents used in different organic catalytic reactions. 5
 (c) Differentiate between σ bonded and π bonded organometallic compounds. 4
4. (a) Explain the mechanism of substitution reaction in square planar complexes of Pt(II) ion. 5
 (b) Give an account of outer sphere mechanism. 5
 (c) Discuss the following kinetics data of substitution reaction of Platinum(II) complexes. (i) Effect of leaving group, (ii) Charge effect. 4
- OR**
- (a) Give an account on Tunneling effect. 5
 (b) Explain the unstable oxidation state with suitable examples. 5
 (c) Discuss the effect of solvent and trans effect on the rate of reaction of Pt (II) complexes. 4
5. Answer the following : **(1 mark each)**
- (a) LCAO stands for _____.
 (b) The bond angle of NF_3 is less than that of NH_3 , give reason.
 (c) BeF_2 is a linear molecule. True or False.
 (d) The total electron density $q_i =$
 (e) What do you understand about the symmetry of a transition when it is polarized in Raman spectrum.
 (f) If two fundamental bands are found at ν_i and ν_j then a binary combination will be found at _____.
 (g) Name the d orbital used in σ bonding in AB_5 (D_{3h}).
 (h) In a molecule $[\text{M}(\text{CO}_4)\text{L}_2]$, (D_{4h}), the symmetries of stretching vibrations are $\text{A}_{1g} + \text{B}_{1g} + \text{Eu}$. How many IR active bands are there ?
 (i) Write the formula of catalyst used in hydrogenation reaction.
 (j) Are all coordination compounds are organometallic compounds ? Yes/No.
 (k) When five carbon atoms are within the bonding distance of one metal atom they are called _____ type of complexes.
 (l) The rate of replacement of X from a metal complex show a decreasing rate in the order _____.
 (m) Good trans activators are strongly bonded to metal. True or False ?
 (n) The ligand atom sulphur is better nucleophile than _____ towards Pt(II).