

Seat No. : _____

NM-82

May-2012

407 – Chemistry (Inorganic Chemistry)

Time : 3 Hours]

[Max. Marks : 70]

Instruction : Figures to the right indicate marks.

1. (a) Write down the applications of VSEPR. 3
 (b) State and explain Bent Rule taking the example of fluoromethane. 4
 (c) Explain Walsh diagram and predict the shape of BeH_2^- . 4
 (d) Discuss the important properties of superconductor. 3

OR

- (a) Derive the equation for the calculation of energy of cyclic conjugated systems. 4
 (b) Calculate the electron density and bond order of allyl radical. (Using) 3
 (c) Discuss briefly the self consistent field method. 4
 (d) Based on band theory explain conduction in extrinsic semiconductors. 3

2. (a) Consider a AB_3 molecule with s, p and d orbitals available on atom A. Which hybridization scheme do you propose for π , bonding? 5
 (b) Write the different steps involved in working out the molecular orbitals in AB_6 type molecule. 5
 (c) How would you distinguish between two, AB_3 type of molecules, having T_d and D_{3h} point groups, from their vibrational spectrum (IR and Raman)? 4

OR

- (a) Write a short note on Fermi resonance.
 (b) Assign the shape and point group of the following XY_3 type molecules with the help of their IR and Raman spectral data.

<u>IR Active vibrations (cm^{-1})</u>	<u>Raman Active Vibrations (cm^{-1})</u>
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

- (c) In a molecule $[\text{M}(\text{CO})_4\text{L}_2]$, (D_{4h}), the symmetries of stretching vibrations are $A_{1g} + B_{1g} + E_u$. Assign which vibrations will be IR active and which will be Raman active. Will there be any coincidence?

3. (a) Discuss the difference between coordination compound and organo metallic compounds. 5
 (b) Differentiate between η and μ type of organometallic compounds with examples. 5
 (c) Name the famous organometallic homogenous catalyst used in hydrogenation reaction and draw its catalytic cycle. 4

OR

- (a) Write a short note on organometallic reagents used in different catalytic reactions. 5
 (b) Comment on the stability of M - C bond in organometallic chemistry. 5
 (c) Explain the structure and bonding in cyclobutadiene. 4

4. (a) Discuss the unstable oxidation state. 5
 (b) Explain the outer sphere mechanism. 5
 (c) Discuss the effect of charge and solvent on the rate of reaction. 4

OR

- (a) Discuss the effect of ion on the rate of reaction. 5
 (b) Give an account on hydrated electron. 4
 (c) Discuss the effect of leaving group and steric effect on the rate of reaction in P(II) complexes. 5

5. Answer the following : (One mark each)

- (a) The shape of dsp^3 hybridisation is _____
 (b) The delocalisation energy of cyclobutadiene, DE = _____, O _____.
 (c) The valence state ionization potential of 1s electron of hydrogen is -13.6 eV .
 (d) LCAO stands for Linear Combinination of atomic orbitals.
 (e) The electron density of a linear conjugated system $\Sigma \psi_i = \text{Total } \pi \text{ density}$
 (f) The Pt-X bond strength increases for change in X in the order I $> Br > Cl > F$. (X = halide)
 (g) Good transactivators are strongly bonded to the metal. (True or False).
 (h) What do you understand about the symmetry of a transition when it is depolarized in Raman spectrum? The Raman vibration is due to the transition from the initial state to the final state.
 (i) If a fundamental band is found at ν_1 , then the first overtone band is found at $2\nu_1$. second overtone at $3\nu_1$.
 (j) In a molecule $[M(CO)_4L_2]$, (C_2v), the symmetries of stretching vibrations are A_1 , $2A_1 + B_1 + B_2$. How many IR active bands are there? $A_1 \rightarrow (x^2-y^2, z^2, 2)$, $B_1 \rightarrow (x, y^2)$, $B_2 \rightarrow z$.
 (k) What will be the level of coincidence in a centrosymmetric molecule?
 (l) Name the catalyst used in polymerisation. \rightarrow Di methyl aluminium $[C_2H_5Al]$
 (m) Are all coordination compounds are organometallic compounds? Yes/No.
 (n) Catalyst used in hydroformylation is Fe, Ni, Co and $Co_2(CO)_8$.