Seat No. : _____

# ZM-139

**May-2014**

## M.Sc., Sem.-II

## 407 : Chemistry

**(Inorganic Chemistry)**

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

**Instructions :** (1) Figure to the right indicate marks.

(2) Character table is to be provided.

1. (a) Explain the Walsh diagram and predict the shape of $AB_2$ type of molecule. **7**

**OR**

Based on the value of delocalization energy, find out the order of stability in cyclopropenyl system.

(b) Explain 'Self Consistent Field Method'. **7**

**OR**

Explain (i) Bent rule and (ii) VSEPR theory in short.

2. (a) In a molecule ($AB_5$), central atom A has s, p and d orbitals, what are the orbitals available on A which will form $\sigma$ bonds with B and which orbitals will be responsible for its two different geometries. **7**

**OR**

Write the different steps involved in working out the molecular orbitals in $AB_3$ type molecule.

(b) Following bands were observed in the vibrational spectrum of $SO_2$. **7**

| IR ($cm^{-1}$) Vapour phase | Raman ($cm^{-1}$) Liquid phase |
|---|---|
| 518 | 524 (pol) |
| 1151 | 1145 (pol) |
| 1362 | 1336 (depol) |

Assign these bands to their corresponding irreducible representation.

**OR**

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) Name and draw the structures of organometallic compounds used as catalyst in Hydrogenation and polymerization. Draw the catalytic cycle of one of these. **7**

**OR**

Give the differences between organometallic compounds of butadiene and cyclobutadiene.

(b) Name and draw the structures of organometallic compounds used as catalyst in Hydroformylation. Draw its catalytic cycle. **7**

**OR**

Discuss the structure and bonding of Zeises's salt and discuss the practical findings which supports the theory.

4. (a) Discuss the trans effect and steric effect on the rate of reaction in square planar Pt (II) complexes. **7**

**OR**

Discuss the effect of solvent and leaving group on the rate of reaction in square planar Pt (II) complexes.

(b) Explain the unstable oxidation state with suitable examples. **7**

**OR**

Discuss hydrated electron.

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

(1) What is the physical significance of Hii in Secular equation ?

(2) According to the Walsh diagram, what is the bond angle <H–C–H in $CH_2$ ?

(3) More electronegative substituent, like fluorine, prefer hybrid orbital having which character ?

(4) Define insulators.

(5) Total number of active vibration in a non linear molecule will be _____.

(6) In a molecule $[M(CO)_4L_2]$, $(D_4h)$, the symmetries of stretching vibrations are $A_1g + B_1g + Eu$. Which symmetry species will be IR active ?

(7) What is the symmetry of a transition which is polarized in Raman spectrum ?

(8) What will be the level of coincidence in a centrosymmetric molecule ?

(9) When two metal atoms are within the bonding distance of one carbon atom, they are called _____ type of complexes.

(10) What is the oxidation state of Fe in ferrocene ?

(11) Are all coordination compounds are organometallic compounds ? Yes/No.

(12) The ligand atom sulphur is a better nucleophile than _____ towards Pt(II).

(13) The order of decreasing rate for changes in $X^-$ (leaving group) is _____.

(14) Good trans activators are strongly bonded to metal. (True or False)

---