

P. Pages : 2

Time : Three Hours



GUG/S/18/5708

Max. Marks : 80

- Notes : 1. Attempt all questions
2. All questions carry equal marks.

1. a) What is Orgel diagram? Discuss the electronic spectra of d^2 and d^8 configuration with suitable examples. 8
- b) i) Discuss the orbital contributions and quenching of orbital angular momentum. 8
- ii) Explain high spin and low spin crossover.

OR

- c) Derive the term symbols for d^2 configuration. 4
- d) Discuss Tanabe – Sugano diagram for d^2 - Octahedral complex 4
- e) Discuss the electronic spectra and structure of tetrahalocobalt (II) complex. 4
- f) Write a note on 4
 - i) Hund's rule
 - ii) Hole formulation
2. a) What is trans effect? Discuss the different types of theories in trans effect. 8
- b) What is electron transfer reaction? Explain the mechanism of inner sphere electron transfer reaction with example. 8

OR

- c) Explain the effect of solvent and temperature on the substitution reaction in square planar complexes. 4
- d) What are the conditions for outer sphere electron transfer reaction? Why electron transfer reaction between $[\text{Co}(\text{NH}_3)_6]^{2+}$ and $[\text{Co}(\text{NH}_3)_6]^{3+}$ is slow? Explain. 4
- e) Discuss the applications of trans effect. 4
- f) Write a note on 4
 - i) Cross-reactions
 - ii) Marcus-Hush theory.
3. a) Classify the metal carbonyl cluster with suitable examples. 8
Discuss non-bridge and bridge structure of $\text{Co}_2(\text{CO})_8$.

- b) Explain the use of vibrational spectra of metal carbonyls for bonding and structure elucidation. 8
 Calculate the Effective Atomic Number (EAN) of central atom in following carbonyls.
 i) $\text{Cr}(\text{CO})_6$ ii) $\text{Mn}_2(\text{CO})_{10}$
- OR**
- c) Give the valence bond structure of following metal carbonyls. 4
 i) $\text{Fe}(\text{CO})_5$ ii) $\text{Fe}_2(\text{CO})_9$ iii) $\text{Fe}_3(\text{CO})_{12}$
 Do these compounds obey EAN rule?
- d) Describe the preparation and reactions of $\text{Ni}(\text{CO})_4$. 4
- e) What do you mean by Synergic bonding in metal carbonyls? Explain. 4
- f) How many metal-metal bonds are included to obey the EAN rule in the following metal carbonyls? 4
 i) $\text{Os}_3(\text{CO})_{12}$ ii) $\text{Os}_4(\text{CO})_{14}$
 iii) $\text{Os}_4(\text{CO})_{15}$ iv) $\text{Os}_4(\text{CO})_{16}$
4. a) Write a note on metal nitrosyls. Discuss vibrational spectra and x-ray diffraction studies of transition metal nitrosyls for bonding and structure. 8
- b) Discuss the structure and bonding in dinitrogen and dioxygen complexes. 8
- OR**
- c) Discuss nitrosylating agent for synthesis of metal nitrosyls. 4
- d) Write a note on Wilkinson catalyst. 4
- e) Give the important reactions of transition metal nitrosyls. 4
- f) Discuss the structure and bonding in mononuclear nitrosyl complexes including linear and bent arrangement. 4
5. a) Write a note on Laporte orbital selection rule. 2
- b) What is Racah parameter. 2
- c) What is complimentary and non-complimentary reaction? Give examples. 2
- d) Write a note on tunneling effect. 2
- e) Draw the structure of $\text{Rh}_6(\text{CO})_{12}$. 2
- f) CO is π -acceptor ligand. Why? 2
- g) Write a note on Vaska's compound. 2
- h) Explain the utility of dinitrogen metal complexes. 2
