

May 2025
M.Sc.
Second Semester
CORE – 05
CHEMISTRY
Course Code: MCHC 2.11
(Inorganic Chemistry – II)

Total Mark: 70
Time: 3 hours

Pass Mark: 28

Answer five questions, taking one from each unit.

UNIT-I

1. (a) Determine the structure (closo/nido/arathro) of the following.
- (i) $\text{Rh}_6(\text{CO})_{16}$ 2×4=8
 - (ii) $[\text{Fe}_4\text{N}(\text{CO})_{12}]^-$
 - (iii) $\text{Ru}_6\text{C}(\text{CO})_{17}$
 - (iv) $\text{Co}_4(\text{CO})_{12}$
- (b) Define carbonyl clusters. 1
- (c) Give one method of preparation of $\text{Fe}_2(\text{CO})_9$. Explain its structure on the basis of valence bond theory. Mention its magnetic nature. 1+3+1=5
2. (a) Calculate metal-metal bonds present in $\text{Ir}_4(\text{CO})_{12}$. Draw its structure. Does it follow EAN rule or not? 2+1+2=5
- (b) Define supramolecule. Give three applications of it. 1+3=4
- (c) Explain one method of preparation of transition metal complex containing NO as a ligand. Draw its structure. 2+1=3
- (d) Draw the structure of $\text{Co}_2(\text{CO})_8$ in solid state and mention the hybridisation. 2

UNIT-II

3. (a) What are inert and labile complexes? What conclusions can be drawn from the CFT about the lability and inertness of octahedral complexes? 1+4=5
- (b) Give at least two evidence to suggest that the substitution in square planar complexes proceeds through an S_N^2 mechanism. 5
- (c) Discuss with suitable examples the complimentary and non-complimentary two electron transfer reactions. 4
4. (a) What do you understand by nucleophilic substitution reactions for octahedral complexes? Discuss S_N^1 mechanisms for octahedral complexes. 1+2=3
- (b) What is an inert ligand? Explain with chemical equations what type of intermediates and products are formed if the inert ligand is a pi acceptor. 1+5=6
- (c) Discuss the fluxional organometallic compounds with suitable examples. 5

UNIT-III

5. (a) Give one method of preparation of Fischer carbene complexes along with reactions. 4
- (b) $Os(O-Me C_6H_4)_4$ is more stable than $Os(Ph)_4$. Comment. 3
- (c) What are Shrock carbenes? Discuss bonding in Shrock carbenes. Mention any of its reactions. 2+3+2=7
6. (a) What are $C_4R_4^+$ compounds? How are they prepared? Mention its reactions. 2+2+3=7
- (b) What are vinylidenes? Give example. 3+1=4
- (c) What are low valent carbynes complexes? Explain with an example. 3

UNIT-IV

7. (a) Define cyclopentadienyl ion. Give two general methods of preparation and two general properties of metallocenes. 1+3+1=5

- (b) What do you mean by metallocenes? Give the synthesis and reactions of the following: 1+2+2=5
- (i) Cyclopentadienyl metal carbonyls
- (ii) Cyclopentadienyl metal halides
- (c) Explain the structure and bonding in ferrocene. 4
8. (a) Write the reactions of the following for ferrocene: 2×3=6
- (i) Friedel-Craft's alkylation
- (ii) Sulphonation
- (iii) Mannich condensation amino methylation
- (b) Give the Timm's method for the preparation of arene metal complexes. 2
- (c) Write the metallation and reaction with alkyl halides of $\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2$. 2+2=4
- (d) Write the physical properties of arene complexes with special reference to $\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2$. 2

UNIT-V

9. (a) What is hydrozirconation? Discuss with any two examples how it is used in organic synthesis. 1+4=5
- (b) Discuss with chemical equations, the synthesis of glycol by hydrogenation. 4
- (c) What is asymmetric epoxidation? Discuss any one of its applications. 1+4=5
10. (a) With chemical equations, explain η^4 -(diene)iron tricarbonyls in organic synthesis. 6
- (b) Discuss the synthesis of acetic acid by Monsanto process. Write the mechanism of its catalytic cycle. 3+4=7
- (c) What is Collman's reagent? 1