

**THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2018**

(CUCSS—PG)

Chemistry

CH 3C 10—ORGANOMETALLIC AND BIO-INORGANIC CHEMISTRY

(2015 Syllabus Year)

Time : Three Hours

Maximum : 36 Weightage

**Section A***Answer all questions.**Each question carries weightage of 1.*

1. Explain the bonding mode of  $N_2$  in transition metal complexes.
2. What hapticities are possible for 1,3-butadiene with a transition metal ? Sketch the interactions.
3. Write down the structures of the possible isomers of  $[Mo_2Cp_2(CO)_6]$ .
4. Arrange the following in the increasing order of stability :  
 $[Fe(\eta^5-C_5H_5)_2]$ ,  $[Ni(\eta^5-C_5H_5)_2]$ ,  $[Co(\eta^5-C_5H_5)_2]$ . Justify your answer.
5. What is Collman's reagent. Give one example for its synthetic application.
6. Discuss the effects of CO and  $H_2$  pressure on hydroformylation reaction.
7. Palladium does not readily form stable carbonyl clusters ; why ?
8. Give two examples for naked clusters.
9. How does dioxygen binding affect the spin state of iron in hemoglobin?
10. Hemocyanin is colourless ; but in the oxy form it is coloured. Give reasons.
11. What do you mean by 'red drop' in photosynthesis ?
12. Explain the significance of entatic state in metalloenzymes.

(12 × 1 = 12 weightage)

**Section B***Answer any eight questions.**Each question carries weightage of 2.*

13. How transmetallation reaction is useful for the synthesis of organometallics ? How is this reaction related to electrochemical series ?
14. Discuss briefly the structure and bonding in metal carbonyls.

**Turn over**

15. What are fluxional organometallics ? Discuss the application of NMR spectroscopy in the study of these compounds.
16. Do you expect any change in F-C bond length during the oxidation of  $\text{FeCp}_2$  to  $[\text{FeCp}_2]^+$ . Substantiate your answer.
17. Explain the mechanism involved in the following reaction :



Give evidences for such a mechanism.

18. Discuss the changes that occur on a ligand when it gets co-ordinated to a metal ion.
19. Discuss the structure and bonding in  $[\text{Re}_2\text{Cl}_8]^{2-}$ .
20. Write note on Chevrel phases.
21. Compare the similarities between copper and iron in biological system.
22. Differentiate between active and passive transport across cell membrane.
23. Au(III) and Pt(II) are isoelectronic and can also form isostructural complexes, but Au(III) is not effective in designing anticancer drug. Give reasons.
24. Explain how the oxidation state and co-ordination environment of cobalt in vitamin  $\text{B}_{12}$  suit its biological role.

(8 × 2 = 16 weightage)

### Section C

*Answer any two questions.*

*Each question carries weightage of 4.*

25. (a) Write an account of the classification of organometallics.  
(b) Explain the synthesis, structure and bonding in Zeise's salt.
26. (a) Discuss the mechanism of oxidative addition and reductive elimination reactions of organometallic compounds with suitable examples.  
(b) Briefly discuss the factors that favour the formation of metal-metal bonds.
27. Describe the structural features of hemocyanin and hemoerythrin. How does oxygen uptake occur in these systems.
28. What is biological nitrogen fixation ? Explain the role M-cluster and P-cluster of nitrogenases in nitrogen fixation.

(2 × 4 = 8 weightage)