

**D 70918**

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Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE (REGULAR) EXAMINATION  
NOVEMBER 2019**

Chemistry

CH 3C 10—ORGANOMETALIC AND BIO-INORGANIC CHEMISTRY

Time : Three Hours

Maximum : 36 Weightage

**Part A**

*Answer all questions.*

*Each question carries a weightage of 1.*

1. What is 18 electron rule ? Check whether the complex  $\eta^5\text{-}(\text{C}_5\text{H}_5)\text{Fe}(\text{CO})_2\text{Cl}$  obeys this rule.
2. Metals which are in high oxidation state or surrounded by strong  $\pi$  acceptor ligands can form stable dihydrogen complexes. Why ?
3. What is hapticity of an organic ligand ? Predict the hapticity of cyclopentadienyl ligand in ferrocene.
4. Explain the synergistic effect of CO in metal carbonyls.
5. What is Zeise's salt ? The C-C bond length in zeise's salt is longer than in free ethylene. Why ?
6. Ir spectroscopy is a very useful technique to study the progress of ligand substitution reactions in metal carbonyls. Explain.
7. What is Zeigler-Natta catalyst ? Early transition metal halides can function as good Zeigler -Natta catalyst along with aluminium alkyls, but not late transition metal halides. Why ?
8. What is hydroformylation reaction ? Which is the catalyst used? Give the industrial importance of this reaction.
9. Simple heme units cannot act as oxygen carriers. Why ?
10. What is haemocyanin ? What is its role in living system ? Its oxy form is blue and deoxy form is colourless. Why ?
11. Why Co-based macrocyclic complex is well suited for radical-based rearrangements rather than Fe-complex like haem ?
12. What is superoxide dismutase ? Which is the active site in the enzyme ? What is the role of this enzyme ?

(12 × 1 = 12 weightage)

**Turn over**

2

**Part B**

*Answer any eight questions.*

*Each question carries a weightage of 2.*

13. What is Collman's reagent ? How it is prepared ? Discuss its significance in synthetic organic chemistry.
14. Determine the total electron count, polyhedral electron count and predicted structure of the following metal clusters. (1)  $[\text{Ru}_6\text{N}(\text{CO})_{16}]^-$ , (2)  $\text{Os}_5(\text{CO})_{16}$ , (3)  $\text{Ru}_5\text{C}(\text{CO})_{16}$  (4)  $\text{Rh}_6\text{C}(\text{CO})_{16}$ .
15. Discuss olefin metathesis reaction with example.
16. Write a note on substitution reactions in organometallic complexes. With suitable examples differentiate between associative and dissociative substitution reactions.
17. What type of reaction is the following, insertion or migration ? Justify your answer.  
 $(\text{CH}_3)\text{Mn}(\text{CO})_5 + \text{CO} \rightarrow (\text{CH}_3\text{CO})\text{Mn}(\text{CO})_5$ .
18. Give one method of preparation of cyclobutadiene complex. Discuss the bonding. Cyclobutadiene is more stable in the complex form than free ligand. Why ?
19. What are chevreton compounds ? Give their method of preparation and structure. Discuss their important applications.
20. What is isolobal analogy ? Justify the isolobality of the following species.  
 $\text{H}$ ,  $\text{Cl}$ ,  $\text{CH}_3$ ,  $\text{Co}(\text{CO})_4$ ,  $\text{Fe}(\text{Cp})(\text{CO})_2$ .
21. Briefly explain the mode of transport and storage of iron in living organism.
22. What is Cytochrome P-450 ? Explain its function and mechanism of action.
23. What is cis-platin ? Discuss its pharmaceutical application and the mechanism of action.
24. What is  $\text{Na}^+/\text{K}^+$  pump ? Explain the mechanism of its function.

(8 × 2 = 16 weightage)

**Part C**

*Answer any two questions.*

*Each question carries a weightage of 4.*

25. Briefly explain the structure and function of Haemoglobin. Give the mechanism of oxygen transport by haemoglobin in living system.
26. What are LNCCs and HNCCs ? Discuss the polyhedral skeletal electron pair approach (Mingos' rules). Find out the total electron count, polyhedral electron count and predict the structures of  $[\text{Os}_5(\text{CO})_{15}]^{2-}$  and  $\text{Ru}_5\text{C}(\text{CO})_{16}$ .
27. Explain the mechanism of Wacker process using catalytic cycle. Give evidences for the mechanism.
28. What is Wilkinson catalyst ? Give the industrial importance of this catalyst. Briefly discuss the mechanism of the reaction. How the nature of the alkene affect the rate of the reaction ?

(2 × 4 = 8 weightage)