

D 70018

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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 π 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

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 chevrel compounds? Give their method of preparation and structure. Discuss their important applications.
20. What is *isolobal analogy*? Justify the isolobality of the following species.
 H , Cl , 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 Na^+/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 $\text{Ru}_6\text{C}(\text{CO})_{16}$.
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 affects the rate of the reaction?

(2 × 4 = 8 weightage)