LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – **CHEMISTRY**

SECOND SEMESTER – **APRIL 2022**

PCH 2502 – COORDINATION CHEMISTRY

Date: 17-06-2022 Dept. No. Max. : 100 Marks

Time: 09:00 AM - 12:00 NOON

Part – A

Answer ALL Questions. **(10 × 2= 20)**

1. State the postulates of crystal field theory.
2. Why is neutral carbonyl ligand kept at the end in spectrochemical series?
3. Indicate the types of electronic excitations expected for $[Ni(H_2O)_6]^{2+}$.
4. Low spin, octahedral complexes of Co(II) have magnetic moments slightly higher than the spin only value (1.8-1.9 BM vs 1.73 BM). Justify.
5. Which types of metal complexes can readily undergo outer sphere electron transfer reaction? Give reasons.
6. What is SN_1CB mechanism? Cite an example.
7. State Adamson's rule.
8. What are metallocenes?
9. Give an example for template directed synthesis of metal complex.
10. Mention the biological roles of carboxy peptidase-A.

Part – B

Answer any EIGHT Questions. **(8 × 5= 40)**

11. How does the splitting of *d*-orbitals of metal ion vary in octahedral, square planar, tetrahedral and cubic geometry? Give reasons.
12. Explain the bonding in metal complexes with sigma bond forming ligands using MO theory.
13. How does crystal field theory explain the variation of ionic size of M^{2+} ions of first row transition elements?

14a. Describe the role of bridging ligand in inner sphere electron transfer reactions. (3)

b. Explain why is the rate of outer sphere electron transfer reaction is faster in Fe^{2+}/Fe^{3+} than in Co^{2+}/Co^{3+} system with strong field ligands. (2)

15. What are inert and labile complexes? Predict whether the following complexes are inert or labile: $[Mn(H_2O)_6]^{2+}$, $[Fe(CN)_6]^{4-}$
16. What is *trans*-effect? Explain the order of ligands in the *tran*- effect series.

17a. Calculate and represent the number of microstates for d^3 metal ions. (3)

b. Derive the ground term for d^2 and d^5 systems. (2)

18. Explain the variation of magnetic moment of high spin octahedral complexes of first rowtransition elements with A, E and T terms.
19. Explain the differences between linear polymers and dendrimers.
20. How is 3-catenane constructed? Explain.
21. Discuss the mechanism of hydroformylation reaction.
22. Explain the biological significance of cytochromes.

Part – C

Answer any FOUR Questions. **(4 × 10= 40)**

23. Explain the types of Jahn-Teller distortion of d^{1-10} metal ions in low and high spin octahedral and tetrahedral complexes with energy level diagram.

24a. Differentiate between spinel and inverse spinel structures. (4)

b. Compute OSSE to predict whether the given oxides are spinel or inverse spinel:
(i) $CaFe_2O_4$ (ii) Mn_3O_4 (iii) $ZnFe_2O_4$. (6)

25. Describe Orgel diagram in explaining the electronic transitions of octahedral and tetrahedral metal complexes with d^{1-10}configurations.

26. Write a brief note on
(a) different mechanism of substitution reactions of metal complexes. (5)
(b) thephotophysical processes of transition and rare earth metal complexes. (5)

27. Explain the structure and bonding in metal aryls on the basis of MO theory.

28. Discuss the structure, bonding and oxygen transport mechanism of haemoglobin.

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