C 4713 (Pages : 3) Name.....

Reg. No.....

SECOND SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, APRIL 2021

(CBCSS)

Chemistry

CHE 2C 06—CO-ORDINATION CHEMISTRY

(2019 Admissions)

Time : Three Hours Maximum : 30 Weightage

General Instructions

1. *In cases where choices are provided, students can attend* **all** *questions in each section.*
2. *The minimum number of questions to be attended from the Section / Part shall remain the same.*
3. *There will be an overall ceiling for each Section / Part that is equivalent to the maximum weightage of the Section / Part.*

Section A

Answer any **eight** *questions.*

Each question carries a weight of 1.

1. Which is stabler ; EDTA complex of Mg^{2+} or Ca^{2+} ? Substantiate your answer.
2. The successive formation constants for the formation of $[CdBr_4]^{2-}$ in aqueous medium are : $K_1 = 36.2$, $K_2 = 3.47$, $K_3 = 1.15$, $K_4 = 2.34$. Explain why $K_4 > K_3$?
3. The nephelauxetic effect produced by CN-is greater than that of NH_3 ; why ?
4. Why tetrahedral complexes are always of high-spin ?
5. Differentiate between microstate and atomic state.
6. Arrive at the ground state term symbols for metal ions with the following electronic configuration :

   (a) $3d^5 4s^0$; (b) $3d^8 4s^0$.

Turn over

7. How infrared spectroscopy can be used to identify intermolecular and intramolecular hydrogen bonding in ligand systems ? Explain.

8. What information do you gather from chemical shift observed in NMR spectra of ligands and metal complexes ? Explain with suitable examples.

9. Explain aquation reaction in metal complexes with a suitable example.

10. Explain the mechanism and catalysts involved in photolysis of water in photosynthetic process.

(8 × 1 = 8 weightage)

Section B

Answer any **six** *questions.*
Each question carries a weight of 2.

11. Discuss the factors that affect the stability of metal complexes.

12. What is Jahn-Teller distortion ? Which of the following are expected to show this type of distortion ? Explain :

(a) $[Cr(acac)_3]$.

(b) $[Co(CN)_6]^{4-}$.

(c) $[CuCl_6]^{4-}$.

13. Octahedral cobalt (II) complexes have higher magnetic moment values than tetrahedral cobalt (II) complexes ; why ?

14. An iron (II) complex exhibits a Mössbauer peak at 98 K, while at 155 K it gives two peaks. What might be the reason for this temperature dependent behavior ?

15. Explain the factors that affect the rate of substitution reaction in metal complexes.

16. Write a note on metal complex sensitizers.

17. Sketch the different bonding modes of acetate group towards a metal ion. How infrared spectroscopy can be used to identify these bonding modes ?

18. Differentiate between chelate effect and macrocyclic effect with suitable examples. Compare the stabilities of $[Cu(en)_2(H_2O)_2]^{2+}$ and $[Cu(en)_3]^{2+}$ (en = ethylenediamine).

(6 × 2 = 12 weightage)

Section C

Answer any **two** *questions.*

Each question carries a weight of 5.

19. What is CFSE ? Discuss the consequences of crystal filed splitting on ionic radii, heat of hydration and lattice energy of bivalent 3d metal ions.

20. (a) Give an account of the ferromagnetism and antiferromagnetism exhibited by metal complexes.

    (b) Describe the experimental details for finding out the magnetic moment value of a solid metal complex. What is the significance of Pascal's constants in this experiment ?

(2 + 3 = 5 weightage)

21. What is trans effect ? What are the important theories put forward to explain it ? Explain any *one* of its synthetic applications.

22. Discuss the mechanisms involved in outer-sphere and inner-sphere electron transfer reactions of metal complexes, bringing out the factors favouring these reactions.

[2 × 5 = 10 weightage]