STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI-86
(For candidates admitted during the academic year 2019-20 & thereafter)

SUBJECT CODE: 19CH/PC/CO34
M.Sc. DEGREE EXAMINATION, NOVEMBER 2022
BRANCH IV- CHEMISTRY
THIRD SEMESTER

COURSE: CORE
PAPER : COORDINATION CHEMISTRY
TIME : 3 HOURS **MAX.MARKS :100**

SECTION – A **(20x1=20)**

Answer all the questions:
Choose the correct answer:

1. Which of the following is known as luteocobalt chloride?
   a. $[Co(H_2O)_6]^{3+}$ b. $[Co(NH_3)_4]Cl_2$ c. $[Co(NH_3)_6]Cl_3$ d. $[Co(NH_3)_5Cl]^{2+}$

2. The ground state term state for the complex ion $[Mn(H_2O)_6]^{2+}$ is
   a. ^5D b. ^4F c. ^6S d. ^3F

3. $[FeF_6]^{3-}$ is paramagnetic because F^- is
   a. a weak field ligand b. a very small ion
   c. high electronegative d. highly electromagnetic

4. The rates of water exchange for
   (i) $[V(H_2O)_6]^{2+}$ (ii) $[Co(H_2O)_6]^{2+}$ (iii) $[Cr(H_2O)_6]^{2+}$
   a. (i) > (ii) > (iii) b. (ii) > (i) > (iii) c. (i) = (ii) > (iii) d. (i) > (ii) = (iii)

5. The number of Fe atom, sulphur bridge and cysteine present in rubredoxins are respectively
   a. 2,0,3 b. 1,3,2 c. 1,2,4 d. 1,0,4

Fill in the blanks:

6. Myoglobin has greater affinity towards O_2, so only it easily abstracts O_2 from _____.
7. In a Tanabe-Sugano diagram, the energy E is expressed as ____.
8. The $f-f$ transition electronic absorption bands for the lanthanide(III) complexes are ___.
9. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are complexes for ____ isomerism.
10. The values of Δ_o for an octahedral complex can be calculated by the equation $\Delta_o = f.g$; this equation was proposed by _____.

State whether true or false:

11. Thermodynamic stability of a complex depends on activation energy.
12. The absorption of visible light by a complex primarily results from the excitation of *d*-electrons into *d*-states of high energy.
13. In most inner sphere reactions the electron transfer step and not the formation of a bridged complex is the rate determining step.
14. The light pink colour of $[Co(H_2O)_6]^{2+}$ and the blue colour of $[CoCl_4]^{2-}$ are due to LMCT transition in both.
15. Deoxyhemocyanine is an O_2 transporter and paramagnetic.

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Match the following:

16. Plastocyanin - paramagnetic
17. Heteroleptic - copper chelates
18. $V(CO)_6$ - Marcus – Hush principle
19. Carbonic *anhydrase* - $[Mn(CN)_3(H_2O)_6]$
20. Electron transfer reacton - Zn

SECTION – B

Answer any five questions: **(5x8=40)**

21. How is stability constant determined by polarographic method?
22. a. Explain the Mössbauer spectrum of $[Fe(CN)_6]^{4-}$ and $Fe(CO)_5$. (4)
    b. Draw and explain the ESR spectrum of *bis*(salicylaldimine)copper(II). (4)
23. a)Explain the magnetic behaviour of lanthanides.
    b) Explain the orgel diagram of $[V(H_2O)_6]^{3+}$
24. Explain the photosubstitution and photoisomerisation of chromium complexes.
25. a. Explain the adsorption spectrum of octahedral MnF_2 (4)
    b. Draw and explain the structures of 12- molybdohetropoly anion
26. Construct a MO diagram for an octahedral complex having σ interaction.
27. Discuss Charge-transfer spectra of MnO_4^- and CrO_4^{2-} complexes..

SECTION – C

Answer any Two questions. **(2x20=40)**

28. a. Draw and explain the Tanabe Sugano diagram for d^6 octahedral complex with only ^5D ,^3H and ^1F and ^1I terms representing both high and low spin complex (12)
    b. Explain the salient features of Tanabe-Sugano diagram. (8)

29. a. What is a non-complementary electron transfer reaction? (3)
    b. The rate constant for a reaction $[Cr(H_2O)_5F]^{2+} + H^+ \rightleftharpoons [Cr(H_2O)_6]^{3+} + HF$ is $6.2 \times 10^{-10}\ s^{-1}$ in neutral solution but $1.4 \times 10^{-8}\ s^{-1}$ in acid solution: rationalise. (3)
    c. What is an outer sphere mechanism? Discuss its mechanism in detail. (14)

30. a. Explain the role of Fe, Mn, Mo and Zn in biological processes. (8)
    b. Describe the structural significance of vitamin B_{12} . (4)
    c. How many ligand to metal transitions are possible for a manganese (VII) complex? Depict each of these transitions and which among them is in the visible range and hence responsible for the colour. (8)

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