STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI 600 086
(For candidates admitted from the academic year 2019-20 & thereafter)

SUBJECT CODE: 19CH/MC/IC64

B.Sc. DEGREE EXAMINATION, APRIL 2022
BRANCH IV - CHEMISTRY
SIXTH SEMESTER

COURSE : MAJOR-CORE
PAPER : INORGANIC CHEMISTRY - III
TIME : 3 HOURS **MAX. MARKS :100**

SECTION – A

ANSWER ALL THE QUESTIONS. **(30x1=30)**
I. CHOOSE THE CORRECT ANSWER:

1. The prosthetic group in carbonic anhydrase is ----------
   a. Manganese b. Zinc c. molybdenum d Chromium

2. The stable oxidation state of Europium is ----------
   a. +4 b. 0 c. +3 d. +1

3. The reagent used for the determination of Nickel is
   a. alizarin b. DMG c. oxine d. all the above

4. The coordination number of cobalt in the complex is $[Fe(H_2O)_6]^{2+}$
   a. 3 b. 4 c. 6 d. 2

5. An example for an ambidentate ligand is ----------
   a. thiocyanate b. cyanide c. carbonyl d. nitrosyl

6. First synthesized metal alkene complex is ----------
   a. Grignard reagent b. Zeisse's salt c. Vaska's complex d. Zeigler-Natta catalyst

7. Jahn - Teller effect is shown by ----------
   a. linear molecules with non-degenerate energy levels
   b. non- linear molecules with degenerate energy levels
   c. linear molecules with degenerate ground state
   d. none of the above

8. Which of the following valence-shell electronic configurations represents an inner transition element?
   a. ns^2np^6 b. ns^2 c. ns^2np^{1-5} d. $(n-2)f^{1-14}\ (n-1)d^{0-1}\ ns^2$

9. The crystal field stabilization energy CFSE for d^4 ion in high spin octahedral complex is
   a. 18 Dq b. +6 Dq c. -16 Dq+P d. -6 Dq

10. $[Cu(NH_3)_4]^{2+}$ is
    a. paramagnetic, square planar b. paramagnetic, tetrahedral
    c. diamagnetic, tetrahedral d. diamagnetic, square planar

II. FILL IN THE BLANKS:

11. The number of unpaired electrons present in d^4 low spin complex is _____.
12. Cytochromes are ---------- transfer agents.
13. The geometry of $[Ni(Cl)_4]$ is ----------
14. The IUPAC name of $[Co(H_2O)(NH_3)_2(CN)(Cl)(Br)]$ is ----------
15. Lanthanides can be isolated by _____ chromatography.
16. Ti^{4+} compounds exhibit an intense colour due to _____transition.
17. Hapticity of a ligand is _____
18. The number of 'd 'electrons in $[Fe(bpy)3]^{3+}$coordination complex is calculated to be _____
19. Inner orbital octahedral complexes exhibit _____hybridization.
20. Copper proteins act as _____agents.

III. STATE WHETHER TRUE OR FALSE:

21. Highest oxidation state of Plutonium is +3
22. Magnetic moment of lanthanides has both orbital and spin contribution
23. In metal carbonyls the oxidation states of the metal are mostly Zero.
24. The tetrahedral complexes do not show geometrical isomerism
25. Platinum mostly forms octahedral complexes

IV. ANSWER IN A LINE OR TWO:

26. Draw the linkage isomers for $[Cr(NH_3)_5NO_2]^{2+}$
27. Apply 18 electron rule to$[Mn(CO)_5(C_2H_4)]^+$
28. Draw the structure of ferrocene
29. Calculate CFSE for a d^5 ion in a weak octahedral field
30. How many geometrical isomers are possible in $[Pt(Py)(NH_3)BrCl]$?

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5x6 = 30)

31. Discuss the properties of the transition metals with respect to
    a) oxidation state b) Magnetic property c) Colour

32. a) What is spectrochemical series for ligands? How can it be used to predict whether the given complex is low or high spin.
    b) Aqueous solution of Ni^{2+} in $[Ni(H_2O)_6]^{2+}$ has a magnetic moment of 2.83 BM. What is the magnetic moment when ammonia solution is added ? (3+3)

33. How is uranium extracted from pitch blende?

34. Draw the CFT diagram and calculate CFSE for the octahedral complexes.
    a) $[Cr(H2O)6]^{2+}$ b) $[Co(NH3)6]^{3+}$

35. a) Apply EAN rule to i. $[Fe_2(CO)_9]$. ii. $[V(CO)6]^-$
    b) Draw and explain the structure of Ziese's salt (3+3)

36. What is lanthanide contraction and what are its consequences?

37. i. Name the following complex compounds or ions.
    a) Tetraaquadichlorocobalt (III) chloride
    b) Tetraamminedichloroplatinum (IV) hexachloroplatinate (IV)
    c) Dichlorobis(ethylenediamine)cobalt(III)chloride.
    ii. Write the formula for each of the following complex compounds or ions.
    d) $[Co\ (NH_3)_{6]}\ Cl_3$
    e) $[Pt\ (NH_3)_2\ Br_4]\ Br_2$
    f) $[Cd\ (H_2O)_4]\ (NO_3)_2$

SECTION – C

ANSWER ANY TWO QUESTIONS: (2x20 = 40)

38. a) Discuss the preparation, properties and structure of Fe(CO)5.
    b) What are the basic principles of crystal field theory? Give an account of crystal field splitting in octahedral complexes
    c) Explain Jahn Teller effect in $[Cu(H_2O)_6]^{2+}$ (8+6+6)

39. a) Explain the magnetic properties with crystal field splitting diagram of the following complexes
    i. $[CoF_6]^{3-}$ ii. $[Co\ (NH_3)_6]^{2+}$
    b) Give a comparative account of oxides of V and Mn group metals
    c) Discuss geometrical isomerism exhibited by 6- coordinated complexes (6+6+8)

40. a) Discuss the biological significance of Fe
    b) Explain the applications of the following i. Alizarin ii. DMG iii. K4[Fe(CN)6] in qualitative analysis
    c) Give a comparative study of lanthanides and actinides
    d) How does methyl lithium react with the following?
    i. CO_2 ii.HCHO iii H_2O (5+6+5+4)

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