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

B.Sc. DEGREE EXAMINATION, APRIL 2024
BRANCH IV - CHEMISTRY
SIXTH SEMESTER

COURSE : MAJOR-CORE
PAPER : INORGANIC CHEMISTRY – II
SUBJECT CODE : 19CH/MC/IC64
TIME : 3 HOURS **MAX. MARKS :100**

SECTION – A

ANSWER ALL THE QUESTIONS. **(30x1=30)**

I. CHOOSE THE CORRECT ANSWER:

1. Which of the following vanadium species does not exist at a pH of zero?
   a) $[VO_4]^{3-}$
   b) $[V_4O_{12}]^{4-}$
   c) $[VO_3(OH)]^{2-}$
   d) $[VO_2]^{+}$
2. Which one of the following is a ambidentate ligand?
   a) $C_2O_4^{2-}$
   b) NO_2^{-}
   c) SCN^{-}
   d) CN^{-}
3. A Jahn-Teller distortion of $[Ti(H_2O)_6]^{3+}$ causes
   a) an increase in symmetry
   b) removal of electronic degeneracy
   c) loss of H_2O ligand
   d) promotion of a *d*-electron to an antibonding MO and reduction of the metal to Ti°
4. Which one of the following about the actinides is false?
   a) The second half of the actinides more closely resembles the lanthanides.
   b) The atomic spectra of these elements are complex.
   c) The 5*f* orbitals in these atoms have a greater spatial extension relative to the 7*s* and 7*p* orbitals than the 4*f* orbitals have relative to the 6*s* and 6*p*.
   d) Unlike for the lanthanide, the +3 state is not the common oxidation state for this series.
5. Which one of the following carbonyls has only transient existence?
   a) $[Ni(CO)_4]$
   b) $[Re_2(CO)_{10}]$
   c) $[Pt(CO)_4]$
   d) $[V(CO)_6]$
6. What is the colour of the $[Co(H_2O)_6]^{2+}$ complex?
   a) red
   b) Violet
   c) Pink
   d) Green
7. When ambidentate ligands are bound in isomeric forms to metals, the isomerism is called as
   a) ligand isomerism
   b) hydrate isomerism
   c) coordination isomerism
   d) Linkage isomerism

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8. The number of unpaired electrons in $Ni(Cl)_4^-$
   a) 2 b)3 c)1 d)4
9. Which one of the following is not an actinide?
   a) Cm
   b) Fm
   c) Pr
   d) No
10. What is unique about Zeise's salt?
    a) It is trimorphic.
    b) It is naturally found in some minerals.
    c) Its colour varies with its grain size.
    d) It is one of the first organometallic compounds prepared.

II. FILL IN THE BLANKS:

11. Prussian blue is _____.
12. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples for _____ isomerism.
13. Nickel can be gravimetrically using _____
14. The colour of transition metal complexes is due to _____ transition
15. Iron pentacarbonyl reacts with 1,3-butadiene to form _____.
16. Metal atom present in Vit.B_{12}
17. Nitrilotriacetic acid is _____ ligand
18. Ferroin indicator has the ligand _____
19. ~~_____is~~ employed in the large scale separation of uranium isotopes in gas diffusion plants.
20. The structure of $Al_2(Me)_4Cl_2$ is similar to _____.

III. STATE WHETHER TRUE OR FALSE:

21. $Fe(CN_6)^{4-}$ is an outer orbital complex.
22. Multidentate ligands are better able to stabilize high coordination numbers compared with monodentate ligands.
23. The EAN rule for complex formation was proposed by Jorgensen.
24. Most common oxidation state of Pt is +6
25. Iron is in 2+ in ferrocene

IV. ANSWER IN A LINE OR TWO:

26. The +3 is the most stable oxidation state for Fe whereas it is +2 for Co and Ni. Why?
27. Draw the structure of (acac).
28. What is spectrochemical series?
29. Write any two ore names and formula of uranium.
30. How is alkyl lithium prepared?

SECTION – B

ANSWER ANY FIVE QUESTIONS: (5x6 = 30)

31. List the role of Fe, Mo and Cu in biological processes.
32. Discuss the optical isomerism in six coordination complexes.
33. $[Co(CN)_6]^{3-}$ is diamagnetic but $[CoF_6]^{3-}$ is paramagnetic with a moment of about 5.3 BM. Account for this difference in magnetic properties of these two octahedral complexes using CFT.
34. Outline the isolation of Thorium from monazite.
35. How is Ziese's salt prepared? Explain its structure.
36. What is lanthanide contraction .Explain its consequences.
37. Discuss Jahn Teller distortion in Cr^{2+} and Cu^{2+} complexes

SECTION – C

ANSWER ANY TWO QUESTIONS: (2x20 = 40)

38. a. Write a comparative account of the chemistry of,V and Cr group elements with respect to their oxidation state, oxides and complexes.
    b. Explain the factors affecting crystal field splitting
    c. Discuss chelate effect (10+5+5)

39. a. Discuss structural isomerism in coordination compounds. (10)
    b. List the various applications of coordination compounds in qualitative and Quantitative analysis. (10)

40. a. Discuss the preparation, properties and structure of $Ni(CO)_4$
    b. Explain the ion exchange chromatographic separation of lanthanides.
    b. How is ferrocene prepared? Discuss its structure and properties. (8+5+7)

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