Register Number:
Date & Session:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU -27
B.Sc. 6th SEMESTER
SEMESTER EXAMINATION: APRIL 2024
(Examination conducted in May/June 2024)
CH 6123 – INORGANIC CHEMISTRY
(For current batch students only)

Time: 2 Hours **Max Marks: 60**

This paper contains 2 printed pages and 3 parts.

Element	**Sc**	**Ti**	**V**	**Cr**	**Mn**	**Fe**	**Co**	**Ni**	**Cu**	**Zn**
At. no.	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**

PART A

Answer any **seven** questions. (7x2= 14)

1. Identify the oxidation state and coordination number of the central metal ion in the complex, $[Fe(ox)_2(H_2O)_2]^-$.
2. Calculate the effective atomic number of the central metal ion in the complex, $[CoBr(NH_3)_5]Cl$.
3. Give any two similarities between lithium and magnesium.
4. Calculate the crystal field stabilization energy (CFSE) of V^{3+} in an octahedral ligand field.
5. Which of the following has a higher crystal field splitting energy, Δ_o? Give reason.
   $[Co(NH_3)_6]^{3+}$ or $[Co(NH_3)_6]^{2+}$
6. Cerium (atomic number = 58) shows a stable +4 oxidation state in addition to the characteristic +3 oxidation state. Give reason.
7. What is meant by lanthanide contraction? Give any one of its consequences.
8. Write the formula of Zeise's salt.
9. Draw the structure of $Mn_2(CO)_{10}$.

PART B

Answer any **six** questions. (6x6= 36)

10. Construct a Born-Haber cycle for the following acid dissociation reaction and write the expression for the overall enthalpy change of the reaction, ΔH_r.
    $HX_{(aq)} \rightarrow H^+_{(aq)} + X^-_{(aq)}$

11. Explain why transition metals (i) show variable oxidation states (ii) are good catalysts and (iii) form coordination complexes.
12. The complex ion $[Co(NH_3)_6]^{3+}$ is octahedral and diamagnetic. The complex ion $[CoF_6]^{3-}$ is also octahedral but paramagnetic. Explain these observations based on valence bond theory.
13. What is the chemical composition of monazite sand? Discuss the bulk separation of lanthanides from monazite sand.
14. Explain the cooperativity mechanism in the binding of oxygen to haemoglobin.
15. a) Arrange the following alkaline earth metal hydroxides in the order of increasing solubility in water. Justify the order. (3+3)

    $Sr(OH)_2$, $Mg(OH)_2$ and $Ca(OH)_2$

    b) Draw the structure of borazine and compare it with that of benzene.
16. a) $[Fe(CN)_6]^{3-}$ has a magnetic moment of 1.74 B.M. Explain this on the basis of crystal field theory. (3+3)

    b) Draw the stereoisomers of $[CoCl_2(en)_2]^+$.
17. a) Arrive at the valence electron count of Fe in the complex, $[Fe(\eta^5\text{-}C_5H_5)_2]$. Indicate the hapticity of the ligand. (3+3)

    b) Write chemical equations to represent (i) Monsanto acetic acid process and (ii) Zeigler- Natta catalysis. Mention the catalyst used in each.

PART C

Answer any **two** questions. (2x5= 10)

18. a) Deduce the structure of ICl_2^+ ion based on VSEPR theory. (3+2)

    b) When 1 mole of $MCl_3.5H_2O$ is treated with an excess of $AgNO_3$ solution, 2 moles of AgCl are obtained. Write the formula of the complex.
19. The colours of two octahedral complexes of Cr^{3+}, A and B, are violet and yellow respectively. One complex is formed with CN^- and the other with F^- ligands. Write the formulae of the complexes and indicate the colour of each. Justify your answer.
20. An octahedral coordination compound is made up of Fe^{3+}, three Cl^- ions, two water molecules, and two ethylenediamine (en) molecules. Involving all the above species, write the formulae of (i) a pair of hydrate isomers and (ii) draw the structures of any one pair of geometrical isomers.
