

**M. Sc. (CHEMISTRY) EXAMINATION, 2023**

(4th Semester)

**PAPER: XIV-I****[ INORGANIC CHEMISTRY SPECIAL ]**

Time : Two Hours

Full Marks : 40

(20 marks for each unit)

**Use a separate answer script for each unit.****Unit: I-4141**

1. Answer the following questions : 6×2
- a) Calculate the paramagnetic molar susceptibility and corresponding effective magnetic moment of  $[\text{Cu}_2(\text{OAc})_4(\text{H}_2\text{O})_2]$  from the following data:
- $$\chi_D(\text{Cu}^{2+}) = -11 \times 10^{-6} \text{ emu/mol}, \quad \chi_D(\text{OAc}^-) = -31.5 \times 10^{-6} \text{ emu/mol}, \quad \chi_D(\text{H}_2\text{O}) = -13 \times 10^{-6} \text{ emu/mol}$$
- and  $\chi_{\text{means}}$  of  $[\text{Cu}_2(\text{OAc})_4(\text{H}_2\text{O})_2] = 1.3 \times 10^{-3} \text{ emu/mol}$  at 296.5 K.
- b)  $\text{K}_3[\text{Mn}(\text{CN})_6]$  shows  $\mu_{\text{eff}} \approx 0$  at very low temperature. However, with the increase in temperature,  $\mu_{\text{eff}}$  gradually increases. Explain.
- c) For  $\text{Ni}^{2+}$ , the magnetic moment of a regular  $t_d$  complex is higher than that of a distorted  $t_d$  complex. Explain.

[ Turn over

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- d) Explain the importance of Langevin-Curie equation.
- e) Rationalize the temperature independent paramagnetic (TIP) behaviour of low-spin  $\text{Co}^{3+}$  system.
- f) Calculate the percentage of a low-spin and high spin state of an octahedral  $[\text{Fe}^{\text{III}}(\text{S}_2\text{CNR}_2)_3]$  complex at room temperature where  $\mu_{\text{obs}} = 4.3$  B.M.,  $\mu_{\text{h.s.}} = 5.92$  B.M.,  $\mu_{\text{l.s.}} = 2.2$  B.M.
2. Answer the following questions : 2×4
- a) Briefly discuss about magnetic interactions observed in  $[\text{M}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}]$  ( $\text{M} = \text{Cu}^{2+}, \text{Cr}^{2+}$ ) systems in the light of M-M bonding.
- b) Explain about super exchange (anti-ferromagnetic system) and double exchange (ferrimagnetic system) phenomena operated in oxide systems with suitable examples.

**Unit: I-4142**

3. Answer the following questions:
- a) Reduction of  $[\text{Co}(\text{NH}_3)_6]^{3+}$  by  $\text{Cr}^{2+}_{\text{aq}}$  is much slower than the reduction of  $[\text{Co}(\text{Cl})(\text{NH}_3)_5]^{2+}$  by  $\text{Cr}^{2+}_{\text{aq}}$ . Suggest plausible reasons. 5
- b)  $\text{Cr}^{2+}_{\text{aq}}$  is a stronger reducing agent than  $\text{V}^{2+}_{\text{aq}}$  thermodynamically; yet  $\text{V}^{2+}_{\text{aq}}$  reduces many Co(III)

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- or Ru(III) complexes faster than  $\text{Cr}^{2+}_{\text{aq}}$ . Explain the reasons behind such observations. 5
4. Answer the following questions:
- a) Explain why *cis*-platin is an effective anticancer drug compare to *trans*-platin. 2
- b) Give examples of ruthenium and titanium based anticancer agents. 2
- c) Comment on the role of copper (II) in Alzheimer's disease. How do metal chelating agents help to treat the Alzheimer's disease? 2+2
- d) Give two examples of gold compounds used for the treatment of Arthritis. 1
- e) What are the differences between Type-1 and Type-2 diabetes? 1