

M.Sc. Examination, 2019
Semester-IV
Chemistry
Optional Course: CH-1021
(Inorganic Chemistry)

Time: Three Hours

Full Marks: 40

Questions are of value as indicated in the margin.

Answer *any four* questions.

1. a) Write down the Marcus equation for OSET, explaining all the involved terms and graphically represent the LFER plot in terms of Marcus equation. 2.5
 b) How can you prove that the ligand transfer occurs simultaneously along with the electron transfer in the reduction of $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ by $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$? 2.5
 c) Classify the ISET reaction in terms of different possible rate determining steps (r.d.s) and give one example for each case. 2.5
 d) Give the mechanism of reduction for $[\text{Fe}(\text{CN})_6]^{3-}$ by $[\text{Co}(\text{CN})_5]^{3-}$. 2.5
2. a) Unlike Mo(VI) and W(VI), Cr(VI) does not show extensive polyanion chemistry: why? 2.5
 b) Write down special features of coordination polymers. 2.5
 c) Critically compare turnbull's blue and Prussian blue. 2.5
 d) Briefly describe the laboratory synthesis, structure and importance of MOF-5. 2.5
3. a) Explain the EPR spectral pattern of Cr^{3+} in the light of zero field splitting factor. 4
 b) Explain the EPR spectral output of a metal complex with paramagnetic metal centre and paramagnetic ligand. 3
 c) Write a short discussion about rhombic spectral patterns of an inorganic complex in EPR spectroscopy. 3
4. a) Tough band theory predicts CoO is metallic, but in reality it is an insulator. Briefly explain why? 2.5
 b) Briefly describe the effect of dynamic Jahn-Teller distortion on magnetic property of hole doped manganites. 2.5
 c) What do you mean by control of bandwidth and band filling in $\text{Ln}_{1-x}\text{A}_x\text{MnO}_3$ (where Ln and A are trivalent and divalent cation, respectively). 2.5
 d) What do you mean by charge ordering? Comment on charge ordering in $\text{La}_{1/3}\text{Sr}_{2/3}\text{FeO}_3$. 2.5
5. a) Compare the rate of reduction of for $[\text{Co}^{\text{III}}(\text{NH}_3)_5\text{X}]^{n+}$ by $[\text{V}(\text{OH}_2)_6]^{2+}$, where $\text{X}^- = \text{NCS}^-$, SCN^- , N^{3-} . 3
 b) Comment on the pathway of reduction for $[\text{Co}^{\text{III}}(\text{NH}_3)_5\text{X}]^{n+}$ by $[\text{V}(\text{OH}_2)_6]^{2+}$, where X^- is a suitable bridging ligand. 3
 c) What do you mean by ' $g_{\parallel}$ ' and ' $g_{\perp}$ ' in EPR spectroscopy? How can you distinguish naphthalene anion radical and naphthyl radical through EPR spectroscopy? 4
6. a) What is orbital ordering? How does it affect magnetic state? Give an example showing effect of orbital ordering on magnetism. 2.5
 b) Comment on the magnetic ground state of $d^5\text{-O-d}^5$ 90°-superexchange interaction with plausible explanation. 2.5
 c) What is ruthenium red? Discuss its importance. 2.5
 d) Compare between polythiophosphazene and polycarbophosphazene. 2.5