

M.Sc. Examination, 2017

Semester-II

Chemistry

Course: CH-807

(Inorganic Chemistry)

Time: Three Hours

Full Marks: 40

Questions are of value as indicated in the margin.

Answer **any four** questions.

1. a) Attempt **any three**: 3x3
 - i) Explain the high lability of $V(aq)^{2+}$, $Cr(aq)^{2+}$ and $Cu(aq)^{2+}$.
 - ii) Explain the high lability order of Co^{III} , Rh^{III} and Ir^{III} complexes.
 - iii) How can you account for the high lability of $Co(aq)^{3+}$?
 - iv) Comment on the aquation kinetics of $cis/trans-Co^{III}(NH_3)_4(L)(X)$ ($L = \pi$ -acceptor non-leaving group).b) What is the difference between lability and stability? 1
2. a) Attempt **any three**: 3x3
 - i) What are the T and R forms of hemoglobin (Hb)? Discuss the factors stabilizing the T-form of Hb.
 - ii) Comment on the oxidation state and spin state of iron in oxy-Hb and deoxy-Hb.
 - iii) What do you mean by picket fence model of Hb? What does it signify?
 - iv) What are the roles of catalase, peroxidase and superoxide dismutase to nullify the untoward activity of ROS (reactive oxygen species)?b) What are the origin of colour of oxy-Hb, oxy-Hr and oxy-Hc? (Hr for hemerythrin, Hc for hemecyanin). 1
3. a) Attempt **any three**: 3x3
 - i) How does the metal ion catalyse the hydrolysis of ATP?
 - ii) Give the structures of rubredoxin, Fe_2S_2 , rieske protein and Fe_3S_4 ferredoxin.
 - iii) Give the pathway of CO_2 transport by Hb.
 - iv) Give the mechanism of base hydrolysis (D-CB patha) of $[Co^{III}(tren)(NH_3)Cl]^{2+}$.b) Draw the energy profile diagram of I-path (interchange path) of ligand substitution. 1
4. Attempt **any five**: 5x2
 - a) Comment on the structures of $MgAl_2O_4$ and $NiAl_2O_4$.
 - b) Compare the structure of the spinels $CuFe_2O_4$ and $CuCr_2O_4$.
 - c) Define the tolerance factor with its expression.
 - d) Which one of $CaCO_3$ and $CaTiO_3$ is perovskite and why?
 - e) Crystal defect is an usual process: why?
 - f) $NaCl$ and $AgCl$ preferentially show Schottky and Frenkel defect respectively: why?
 - g) What are Koch cluster and split interstitial? Give suitable example.
 - h) Unlike F-center, a hole center is rarely observed in alkali halides: why?
5. Attempt **any five**: 5x2
 - a) What are the degenerate and non-degenerate semiconductors?
 - b) How does the position of Fermi level change with the change in temperature for n- and p-type semiconductors?
 - c) What is the origin of opening up a gap at the Fermi level in a superconductor?
 - d) What are the piezoelectricity and pyroelectricity?
 - e) Taking in consideration of molecular field derive the Curie-Weiss law and give the expression for molecular field constant.

P.T.O.

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- f) Qualitatively explain the origin of ferromagnetism in Fe, Co and Ni on the basis of exchange interaction.
- g) Comment on the magnetization (M) vs. field (H) curves of paramagnetic and superparamagnetic system.

6. Attempt ***any five***:

5x2

- a) Describe the working principle of a photocopying machine.
 - b) Describe different types of solid state reaction with an example of each type.
 - c) How does a solid state reaction proceed? Explain with an example.
 - d) What is nucleation? Derive the critical size and critical energy of a nucleus.
 - e) What are DTA and DSC? What are the advantages of these techniques over TGA?
 - f) Why do we need a reference in DTA technique?
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