

M.Sc. 1st Semester Examination, 2012**CHEMISTRY***(Inorganic)*

PAPER – CEM- 103

*Full Marks : 40**Time : 2 hours*

Answer any **five** questions
taking at least **two** from each Group

The figures in the right hand margin indicate marks

GROUP – A

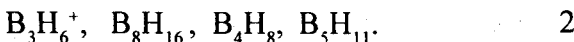
1. (a) 'The distal protein drastically reduces the co-affinity of hemoglobin and myoglobin' – Justify the statement. 2
- (b) What do you mean by 'picket-fence' model for hemoglobin or myoglobin? 1
- (c) Discuss the structural features in oxygenated hemocyanin. 2

(Turn Over)

- (d) How Vasca's complex can act as 'Synthetic O_2 -carrier'? Write down the structural representation. 2
- (e) Write down the structure of 4Fe - 4S protein. 1
2. (a) What happens when H_2O_2 is added to an acidified solution of $[Cr_2O_4]^{2-}$? How the final product can be isolated? Write down the structure. 2
- (b) Write down the structure of $NbCl_4$ and NbF_5 . 2
- (c) Complete the following reactions 2
- (i) $[RuO_4]^- + [OH^-] \longrightarrow$
- (ii) $[OsO_4] \xrightarrow[\text{in cold}]{\text{aq. KOH}}$
- (d) Discuss how trans- $[OsO_2(OH)_4]^{2-}$ is diamagnetic. 2
3. (a) In $CuCl_2$, four Cu - Cl bond distances are of 2.30 Å and two bond distances are of 2.95 Å. Whereas in K_2CuF_4 , four Cu-F bond distances are of 2.08 Å and two bond distances are of 1.95 Å. Explain. 3

- (b) Which of the compound among FeAl_2O_4 , CoAl_2O_4 and NiAl_2O_4 is most likely inverse spinel structure. 3
- (c) $[\text{CuCl}_4]^{2-}$ is tetrahedral but other four coordinated Cu(II) complexes are square planer. Explain. 2

4. (a) Identify Closo/Nido/Arachno/Hypo boranes



- (b) Calculate the styx number of B_5H_9 and draw the possible structure of the compound. 4
- (c) What happens when $[\text{Os}_2\text{Cl}_6]^{2-}$ is reduced with N_2H_4 ? Write down the structure of the final product. 2

GROUP – B

5. (a) For SO_3^{2-} ion, show that symmetry operations belong to three different class. 3
- (b) Explain why the formation of a crystal with D_{4d} symmetry is impossible. 2

(c) What do you mean by "point group"? Identify the point group for each of the following molecules: 1 + 2

(i) SOCl₂

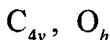
(ii) Ethane (staggered)

(iii) B₂H₆

(iv) XeF₄.

6. (a) Justify that the sum of the squares of the dimensions of the irreducible representations of a group can not be greater than the order of the group. 2

(b) Write the "Hermann-Mauguin" notation for the following point groups: 2



(c) Find the order of the improper axis in the following molecules and identify the other elements of symmetry generated by this axis. 2

(i) PCl₅

(ii) Ni(CO)₄.

(d) Find the subgroups of D_{4h} group. 2

7. (a) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ gives absorption at 8500, 15200 and 26000 cm^{-1} . Explain. 2
- (b) Verify that the scalar product of vectors \vec{M} and \vec{N} in p -dimensional space is equal to the sum of the products of the lengths of projections of the vectors in p -orthogonal axes with no cross terms. 3
- (c) A borane molecule has its styx number 4020. Predict the formula of the molecule and draw the possible structure. 2
- (d) Show that if P is conjugate with Q and R , then Q and R are conjugate with each other. (Where P, Q and R are the elements of a group). 1
8. (a) Evaluate all the term symbols associated with p^2 electronic configuration. 2
- (b) Draw the active site structure of oxygenated form of hemerythrin. 2
- (c) What are the most stable oxidation states of "Ru" and "Rh"? 1

- (d) What is rubredoxin ? 1
- (e) Explain why the electronic spectral bands due to *d-d* transitions in a transition metal complex are broad. 2
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