M.Sc. 1st Semester Examination, 2011

CHEMISTRY

(*Inorganic*)

PAPER—CEM-103

Full Marks : 40

Time : 2 hours

Answer any **four** questions

The figures in the right-hand margin indicate marks

1. (*a*) What is Creutz Taube Cation ? How this is synthesized ? 2

(*b*) Discuss diamagnetism in $[Ru_2OCl_{10}]^{4-}$ complex in the light of Molecular Orbital theory. 3

(*c*) How will you synthesize Ru-dinitrogen complex ? How one can synthesize $[Os(NH_3)_5(N_2)]^{2+}$ starting from $[OsCl_6]^{2-}$? 3

(*d*) What is the use of OsO_3F_2 ? (Give reaction). 2

2. (*a*) How will you synthesize $K[Os(N)O_3]$ from OsO_4 ? Write down the structure of $K[Os(N)O_3]$. 2

(*b*) Complete the following reaction : 3

(*i*) $OsF_6 + 4SbF_5 + 8CO \xrightarrow[HF/SbF_5]{300\ K,\ 1{\cdot}5\ bar\ CO}$

(*ii*) $2[Ru(NO)Cl_5]^{2-} \xrightarrow[HCl]{SnCl_2}$

(*iii*) $[OsCl_6]^{2-} \xrightarrow[EtOH]{HCl(g)}$

(*c*) Discuss the role globin chain in hemoglobin. 2

(*d*) Draw the active site structure of Cytochrome-C. 2

(*e*) What do you mean by 'Trigger Mechanism' ? 1

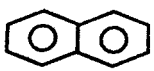
3. (*a*) What do you mean by subgroup of a group ? Find out the subgroups present in D_{2h} group. 3

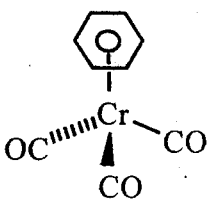
(*b*) Identify the point group for each of the following molecules : $\frac{1}{2} \times 8$

(*i*) NO_2

(*ii*) N_2O

(*iii*) $POCl_3$

(*iv*) 

(*v*) 

(*vi*) Staggered C_2H_6

(*vii*) Cyclohexane (chair conformation)

(*viii*) Borazine.

(*c*) Verify that no two classes of a group can share a common element. 2

(*d*) With regular pentagon only one regular polyhedron is possible. Explain. 1

4. (*a*) The complex bis (dimethylglyoximato) nickel (II) is diamagnetic. What conclusion about its structure can be drawn on the basis of crystal field and molecular orbital theories ? 4

(*b*) Evaluate all the term symbols associate with d^2 electronic configuration. 4

(*c*) $[Cr(H_2O)_6]^{3+}$ ions are pale blue-green but the CrO_4^{2-} ion is an intense yellow. Characterize the origins of transitions and explain the relative intensities. 2

5. (*a*) Derive the matrix form of all the symmetry elements present in $S_2O_3^{2-}$ ion. 5

(*b*) Show that the reciprocal of a product of two or more elements is equal to the product of the reciprocals, in reverse order. 2

(*c*) Derive the matrix form of Sn(x) symmetry element. 3

6. (*a*) Briefly discuss the important structural features of Hemocyanin. 3

(*b*) Draw the active site structure of 'Hemerythrin' in both deoxy and oxy state. How O_2-binding occurs in Hemerythrin ? 2 + 2

(*c*) Write down one model complex for Hemocyanin. 1

(*d*) What are the use of 'Sodium' and 'Molybdenum' metal ion in biology ? 2

7. (*a*) Identify Closo/Nido/Arachno/ Hypo Boranes 2

B_6H_{10}, B_3H_5, B_8H_{14}, $B_{10}H_{18}$.

(*b*) Write balanced equations for the following conversions : 3

(*i*) $[NPCl_2]_3$ to $[NPF_2]_3$

2

(*ii*) BCl_3 to $B_3N_3H_3(Me)_3$

(*iii*) F_2 to OF_2. 3

(*c*) What do you mean by carborane ? Cite one example. 2

(*d*) Draw the structures of the following compounds : 3

BrF_2^+, IF_7, I_2Cl_6.