M.Sc. 1st Semester Examination, 2010

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 do you mean by "Nucleotides" ? Write down the general structural framework of a nucleotide. 1 + 2

   (*b*) Define the term "residue" ? What do you understand by "his-10" ? 1 + 1

   (*c*) What is the quaternary structure of a protein ? 1

   (*d*) Discuss 4 Fe-ferredoxin with respect to structure, electron transfer and magnetism. 4

2. (*a*) Prove that if X is conjugate with Y and Z, then Y and Z are conjugate with each other. 2

(*b*) Verify that the scalar product of vectors $\vec{A}$ and $\vec{B}$ in two-dimensional space is equal to the sum of the products of the lengths of projections of the vectors in two orthogonal axes with no cross terms. 3

(*c*) Using transformation matrices show that S_2 operation is identical to the inversion operation. 2

(*d*) Identify the point group for each of the following molecules/ions: $\frac{1}{2} \times 6$

(*i*) Ethane (staggered)

(*ii*) $[Os_2Cl_8]^{2-}$

(*iii*) fac-$[Co(NH_3)_3Cl_3]$ (ignore H atoms)

(*iv*) Cyclohexane (boat form)

(*v*) CH_2BrCl

(*vi*) SO_3^{2-}.

3. (*a*) Discuss the role of distal and proximal histidine residues in haemoglobin and myoglobin. 4

(*b*) Explain "Tigger mechanism". 2

(*c*) Draw models of haemoglobin and myoglobin involving steric hindrance and hydrophobic interaction. 2

(*d*) Write down the role of Sodium and Zinc metal ion in biological systems. 2

4. (*a*) Derive the matrix form of Sn(y) operation. 3

(*b*) Using "Great Orthogonality Theorem" prove that the sum of the squares of the characters in any irreducible representation equals to the order of the group. 3

(*c*) Construct the "group multiplication table" for NH_3 molecule. Determine the classes present in this molecule. 4

5. (*a*) Though *f*-*f* and *d*-*d* transitions are Laporte forbidden, the colour of the Ln^{3+} aqua ions are less intense than the *d*-block metal ions. Explain. 2

(*b*) Explain the colour of the following anions : 3

MnO_4^- : purple-red

MnO_4^{2-} : green

CrO_4^{2-} : yellow

(*c*) Considering bonding explain the diamagnetic nature of $[Re_2Cl_8]^{2-}$ ion. 4

(*d*) What *d*-orbital splitting pattern would you expect for a planar and triangular ML_3 complex ? 1

6. (*a*) Write notes on : 3 + 2

(*i*) Molybdenum blue

(*ii*) Creutz Taube Cation.

(*b*) Square plannar d^8 paramagnetic complexes are extremely rare. Account for this observation with a crystal field argument. 3

(*c*) Explain why the value of Racah parameter for a complex is less than that for a free ion. 2

7. (*a*) What happens when $B_{10}H_{14}$ is allowed to react with Et_3N in boiling xylene ? 2

(*b*) State and illustrate the Capping principle with a suitable example. 3

(*c*) On the basis of the Wade's rule, predict the core structure of the following species : 3

$$[CpFe(C_2B_9H_{11})]^-$$

$$[(Ph_3P)_2(H)IrB_9H_{13}]$$

(*d*) A borane molecule has its Styx No 3203, predict the formula of the molecule and draw the possible structure. 2