M.Sc. 1st Semester Examination, 2015

CHEMISTRY

(Inorganic)

PAPER — CEM-103

Full Marks : 40

Time : 2 hours

The figures in the right-hand margin indicate marks

GROUP — A

1. Answer any *five* questions from the following : 2 × 5

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

   (b) What is homeostatic control ? Why selectivity of ion uptake is essential in biological system ?

   (c) Show that if X is conjugate with Y and Z, then Y and Z are conjugate with each other.

(*Turn Over*)

(**2**)

(*d*) What do you mean by the secondary structure of protein ? Explain with figure.

(*e*) What do you mean by "subgroup" ? Write the conditions which must obey to form "subgroup" of a "group".

(*f*) What is the intermediate formed during the oxygenation of hemerythrin ? Mention the oxidation states of the metal centers.

(*g*) What do you mean by 'reciprocal lattice' ?

(*h*) Define 'glide plane'.

GROUP — B

Answer any **one** question

2. (*a*) Derive the matrix representation of vertical planes in NH_3 molecule.   3

(*b*) Identify the point group for each of the following molecules/ions :   3

(*i*) $[Re_2Cl_8]^{2-}$

(*ii*) CO_3^{2-}

(iii) Staggered $Fe(C_5H_5)_2$

(iv) B_2H_6

(v) ClF_3

(vi) $B_3N_3H_6$

(c) Explain why a crystal cannot possess a C_n axis of order five.   3

(d) Write the "Hermann-Mauguin" notation for D_4 and D_{4h} point groups.   1

3. (a) Verify that if there are two twofold axes at right angles to one another, there must necessarily be a third at right angles to both. 1

(b) What are the differences between reducible and irreducible representations of a group ? 2

(c) With regular trigon only three regular polyhedrons are possible. Explain.   1

(d) Determine the classes present in SO_3^{2-} ion. 2

(e) Derive the matrix form of $C_n(y)$ operation. 2

(*f*) Prove that the vectors whose components are the characters of two different irreducible representations are orthogonal. 2

GROUP – C

Answer any **one** question

4. (*a*) What is the basic function of the enzyme 'Carbonic Anhydrase' ? 2

   (*b*) What is the structural feature of carbonic anhydrase enzyme ? 2

   (*c*) Briefly explain the role of central metal ion present in the enzyme carbonic anhydrase. 2

   (*d*) Schematically elucidate the enzymatic mechanism of the enzyme 'urease'. 2

   (*e*) Draw the active site str. of the enzyme 'urease'. 2

5. (*a*) Write down the overall chemical reaction involved in ferritin mineralization. 2

          (Continued)

(b) Schematically present the Iron storage and transfer mechanism in a combined way in a living system. 3

(c) Briefly discuss the cause and effect of 'Wilson's disease'. 2

(d) What do you mean by cyclic Ionophores ? Explain its function with an example. 1 + 2

GROUP – D

Answer any **one** question

6. (a) A compound with molecular weight 600 crystallizes in orthorhombic system and shows the following crystallographic parameters.

$$a = 10 \text{ Å}, b = 10 \text{ Å}, c = 15 \text{ Å}, Z = 4$$

Find out the density of the crystal in gm/cm^3. 4

(b) Write short notes on of the following : 2 + 2 + 2

(i) Bravais Lattice

(ii) Screw axis

(iii) Isogonal Symmetry Group.

7. (a) If X-rays of wavelength 0·5 Å are diffracted at an angle $5°$ in the first order, what is the spacing between the adjacent planes of the crystal ? At what angle will second maximum occurs ?   4

(b) State the meaning, and draw stereographic projections, of the following point groups : $1\frac{1}{2} \times 4$

    (i) m3m

    (ii) mmm

    (iii) $\overline{3}$ m

    (iv) 42m

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