2022

1st Semester Examination

CHEMISTRY

Paper : CHEM 103

(Inorganic)

Full Marks : 40 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Group - A

Answer any ***four*** of the following questions : 2×4=8

1. (a) Verify that the scalar product of two vectors in h-dimensional space is equal to the sum of the products of the lengths of projections of the individual vectors in h-orthogonal axes with no cross terms. 2

(b) If x-rays of wavelength 0.5Å are diffracted at an angle of 5° in the first order, what is the spacing between the adjacent planes of the crystal? 2

(c) What is the composition of the polynuclear aggregate formed in ferritin during the mineralization process. 2

P.T.O.

(d) Prove that if P is conjugate with Q and R, then Q and R are also conjugate to each other. 2

(e) Draw the coordination sphere around Fe(III) in transferrin. 2

(f) Determine the Miller indices of a plane which is parallel to x-axis and cuts intercepts at two and half respectively along y and z-axis. 2

Group - B

Answer any ***one*** of the following questions : $8\times1=8$

2. (a) Derive the matrix form of all symmetry operations present in SO_3^{2-} anion. 5

(b) What do you mean by subgroup of a group? Find the subgroups of D_{2h}-group. 3

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

(b) Find out the point group of the following molecules : 1

$$(C_6H_6)Cr(CO)_3\,;\; mer-\left[Co(NH_3)_3Cl_3\right]$$

(c) What do you mean by "abelian group"? Show that C_{2v} is an "abelian group" but C_{3v} is a "non-abelian group". 1+3

Group - C

Answer any ***one*** of the following questions : 8×1=8

4. (a) Show the coordination environment in detail around the zinc(II) in carbonic anhydrase-II.

   (b) Discuss the structure of ferritin.

   (c) Schematically present how iron is recycled in RBC.

   Or,

   Discuss the mechanism of sodium potasium pump. 3+2+3

5. (a) Discuss how the catalytic activity of carbonic anhydrase depends on pH. 2

   (b) Discuss the Soret band in the context of electronic transitions in myoglobin/haemoglobin. 2

   (c) Comment on the oxygenation and spectral properties of hemocyanin. 2+2

Group - D

Answer any ***two*** of the following questions : 4×2=8

6. State the meaning and draw stereographic projections of the following point groups. 4

   (i) 622; (ii) m3; (iv) 4 mm and (iv) 32

7. What do you mean by reciprocal lattice? Derive Bragg's expression in terms of reciprocal lattice. 4

P.T.O.

8. For an orthorhombic lattice the three sides are 10Å, 12Å and 15Å, respectively. The number of lattice point per unit cell is 4. The molar mass of this species is 600g. Then what will be the density of that lattice? 4

Group - E

Answer any ***two*** of the following questions : 4×2=8

9. Establish the matrix form of $S_n(y)$ symmetry operation. 4

10. Discuss the irreversible oxidation mechanism of *Fe*(II) in hemoglobin and myoglobin. 4

11. Derive the relation between inter planar distance and Miller Indices. 4