PG/IS/CEM-103/19

M.Sc. 1st Semester Examination, 2019

CHEMISTRY

(*Inorganic Chemistry*)

PAPER — CEM-103

Full Marks : 40

Time : 2 hours

Answer **all** questions

The figures in the right hand margin indicate marks

GROUP—A

1. Answer any *four* questions :   2 × 4

   (*a*) Prove that if *P* is conjugate with *Q* and *R*, then *Q* and *R* are also conjugate with each other.

   (*b*) 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.

   (*c*) What are the functions of hemeprotein ?

(d) Critically comment on the dioxygen binding in hemocyanin.

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

(f) What will be the spacing between the adjacent planes of the crystal when X-rays of wavelength $0 \cdot 5 \overset{\circ}{A}$ are diffracted at an angle of $5°$ in the first order ?

(g) What do you mean by point group ?

GROUP—B

2. Answer any *one* question : 8×1

(a) (i) Prove that if a C_4 axis are one plane containing this axis exists, then there must be a second plane which contain C_4 axis and at an angle of $45°$ to the first one.   3

(ii) Considering P—O bond along z-axis, derive the matrix representation of vertical planes in $POCl_3$ molecule.   5

(b) (i) What do you mean by "Subgroup"? Write the conditions which must obey to form "Subgroup" of a "group". Determine the sub-groups of D_2h and D_3h groups.   6

(ii) Identify the point group for each of the following molecules/ions :   2

ClF_3; CH_2BrCl; N_2O ; Staggered C_2H_6.

GROUP—C

3. Answer any *one* question :   8 × 1

(a) (i) Discuss the recycling of iron in RBC.   4

(ii) Explain the mechanism of action of the enzyme carbonic anhydrase.   4

(b) (i) What is the role of Mg^{2+} ion during the Na^+ - K^+ pump action.   2

(ii) Discuss the mechanism of action regarding iron storage.   4

(iii) Are the tetrameric units of hemoglobin identical ?   2

GROUP—D

4. Answer any *two* questions :   4 × 2

(a) Show that the reciprocal lattice of a bcc lattice is fcc and vice-versa.

(b) What do you mean by reciprocal lattice ? Derive Bragg's expression for reciprocal lattice.

(c) For an orthorhombic lattice the three sides are $10\overset{\circ}{A}$, $10\overset{\circ}{A}$, and $15\overset{\circ}{A}$, respectively. The number of lattice point per unit cell is 4. The molar mass of this species is 600g. Calculate the density of that lattice ?

(d) State the meaning and draw stereographic projections of the following point groups :

  (i)   622

  (ii) m3

  (iii) 4mm

  (iv) 32

(Continued)

GROUP—E

5. Answer any *one* question :   4 × 1

(*a*) Derive the matrix form of Sn(z) symmetry element.

(*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.

GROUP—F

6. Answer any *one* question :   4 × 1

(*a*) (*i*) Explain the role of Zn(II) ion during the function of the enzyme carboxy-peptidase-A.   2

(*ii*) What do you mean by sovet band ? Discuss such band in the context of iron-porphyrin complex.   2

(*b*) For a hexagonal lattice the three edges are 15Å , 15Å and 20Å , calculate the volume of the lattice.   4

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