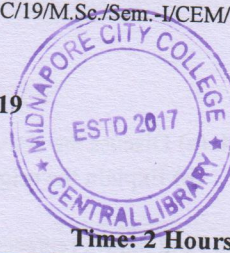**PG (NEW) CBCS**
M.Sc. Semester-I Examination, 2019
CHEMISTRY
PAPER: CEM-103
(INORGANIC CHEMISTRY-I)

Full Marks: 40

Time: 2 Hours

Group- A

Answer any <u>four</u> questions of the following: $\qquad$ 2×4=8

1. What are the symmetry criteria for a molecule to be optically active?
2. Draw (220), (202) and (230) crystal plane in a cubic system.
3. What is Bohr's effect in the function of hemoglobin?
4. Prove that, $S_2 = i$ with the help of corresponding matrices.
5. Comment on the magnetic behavior of oxy-hemoglobin and de-oxy hemoglobin.
6. Construct the 'group multiplication table' for H_2O molecule.
7. What is Reciprocal lattice?
8. Explain the preferential binding of myoglobin to di-oxygen in comparison to carbon monoxide.

Group-B

Answer any <u>four</u> questions of the following: $\qquad$ 4×4=16

9. (a) Find out the inversion operation of S_n^m operation when
   (i) n is even and m is odd and
   (ii) n is odd and m is even
   (b) Write down the 'Hermann-Mauguin notation' for the following point Groups:

   $$D_2, \ C_{3v}$$

   $\qquad$ (2+2)
10. (a) What are the essential criteria for a collection of entities must have to Form a group?
    (b) What do you mean by 'Abelian group'? $\qquad$ (2+2)
11. (a) Assign the point group to the following molecules and ions:
    (i) ClF_3; (ii) B_2H_6; (iii) cis-$[Co(en)_2Cl_2]^+$, (iv) $Be(C_2O_4)_2^{2-}$
    (b) Work out the product of the following elements in C_{3v} point group.
    $\sigma_v''C_3^1\sigma_v$ and $\sigma_v'C_3^2\sigma_v$ $\qquad$ (2+2)
12. (a) Write down the number of faces, vertices and edges for dodecahedron and icosahedron.
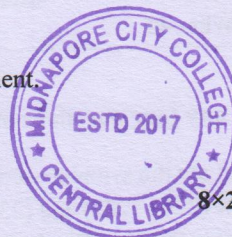   (b) Define Screw axis. $\qquad$ (3+1)
13. Derive the expression for equilibrium concentration of Frenkel defects. (4)

(Turn Over)

14. (a) Discuss the active site structure of Hemerythrin.
    (b) Explain the origin of red color in blood from spectroscopy point of view.
    (2+2)

15. Find matrix representation of C_{3v} point group. (4)
16. Derive the matrix form of $C_n(x)$ symmetry element. (4)

Group-C

Answer any <u>two</u> questions of the following: $8 \times 2 = 16$

17. (a) Discuss the type of crystal lattice according to the number of lattice point per unit cell.
    (b) Calculate the glancing angle on the cube face (100) of a rock salt crystal (a=2.814 Å) corresponding to second order reflection of X-ray of wave length 0.710 Å.
    (c) What is glide plane? Explain. (3+3+2)

18. (a) What is Hall effect? How will you identify whether a semiconductor is n-type or p-type?
    (b) The colour of ZnO changes from white to yellow when heated in air.- Explain
    (c) At what temperature does the first vacancy become stable in Cu crystal?
    Given: No. of atoms in the crystal $= N_{Avogadro}$
    $$\Delta H_f (Cu) = 1.24 \text{ eV/vacancy}$$
    $$k_B = 8.62 \times 10^{-5} \text{ eV/K}$$
    (3+2+3)

19. (a) Write down the chemical reactions occur during ferritin mineralization.
    (b) Discuss the dioxygen binding mechanism in hemerythrine.
    (c) What is the structural feature of carbonic anhydrase enzyme? (3+3+2)

20. (a) Discuss 4Fe-ferredoxin with respect to structure electron transfer and mechanism.
    (b) Discuss the role of distal and proximal histidine residues in haemoglobin and myoglobin. (4+4)

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