

U.G. 6th Semester Examination - 2021

CHEMISTRY

[HONOURS]

Discipline Specific Elective (DSE)

Course Code : CHEM-H-DSE-T-3

(Advanced Physical Chemistry)

Full Marks : 40

Time : 2½ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer any **five** questions : 2×5=10
- i) Define Microstate and Macrostate of a system.
 - ii) What are the assumptions made for deriving the Boltzmann Distribution Law?
 - iii) What are the drawbacks of using Weiss Indices for indicating the planes in a crystal?
 - iv) Calculate the void space of BCC crystal.
 - v) Write Dulong-Petit's law and its application.
 - vi) Define the axis of symmetry in a cubic crystal.
 - vii) Define homo-polymers and co-polymers with suitable examples.

2. Answer any **two** questions from the following:

5×2=10

- i) a) Describe the Viscosity method for the determination of Molecular Weight of a polymer. 3
- b) A sample of polymer contains 0.4 mole fraction of molecules with molecular weight 1×10^5 and rest of molecules with molecular weight 2×10^5 . Calculate the number-average and mass-average molecular weights. 2
- ii) Explain why only X-rays are used for crystal analysis. Derive Bragg's equation for crystal analysis. 2+3
- iii) a) What is Partition Function and write its physical significance. 1+2
- b) Express Entropy in terms of Partition function. 2

3. Answer any **two** questions from the following :

10×2=20

- i) a) Explain Nernst heat theorem and write its significance. 2+2
- b) Calculate the thermodynamic probability of Macrostate (2,6) if 8 distinguishable particles are distributed in 2 equal sized boxes. 2

[Turn Over]

- c) Derive Barometric Distribution Formula and explain the effect of molar mass upon this distribution. 2+2
- ii) a) Derive Einstein's theory for heat capacity of solids. Write its significance and limitations. How these limitations are overcome by Debye? 2+2+1+2
- b) The molar heat capacity of a solid in SI unit is given by $C_{p(s)} = 1.926 \times 10^{-4} T^3$ between 0 K to 50 K. Calculate the absolute entropy of the substance at 50 K using 3rd law of thermodynamics. 3
- iii) a) Derive the expressions of inter-planar spacing between successive planes with Miller indices (h k l) for orthorhombic and cubic crystals. 3
- b) Calculate the number of atoms present per unit cell and occupied space in a hexagonal close packing (HCP) crystal. 2+2
- c) NaCl crystallizes in FCC structure, its density is 2.165 gm/cc. Calculate the distance between Na^+ and its nearest Cl^- ions. 3