

U.G. 6th Semester Examination - 2022

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 thermodynamic probability.
 - ii) Write the applications of Boltzmann's distribution law.
 - iii) Calculate the angle at which a first order reflection which occurs in a x-ray spectrometer when x-rays of wavelength 1.52 \AA are diffracted by atoms of a crystal. Given that inter-planar distance is 3.8 \AA .
 - iv) Justify Dulong-Petit's law from classical mechanics.

[Turn Over]

- v) Write the difference between thermoplastic and thermosetting polymers.
- vi) Calculate the inter-planar spacing ratio $d_{100} : d_{110} : d_{111}$ for FCC lattice.
- vii) Draw the planes with Miller Indices (101) and (111).

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

5×2=10

- i) Express entropy, enthalpy, free energy, internal energy and heat capacity at constant volume in terms of molar partition function. 5
- ii) a) Deduce the relation between entropy and thermodynamic probability.
- b) If the radius of an element is 400 pm and it crystallizes as FCC lattice, calculate the edge length of unit cell. 3+2=5
- iii) Derive Einstein's equation for heat capacity of solids and write its limitations. 3+2=5

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

10×2=20

- i) a) Derive Boltzmann distribution equation with evaluation of β -value.

- b) Describe Osmometric method for the determination of molecular weight of polymers. $6+4=10$
- ii) a) Explain the kinetics of free radical mechanism of addition polymerization .
- b) Write the third law of thermodynamics and explain how absolute entropy value at any temperature can be determined using third law.
- c) A compound having BCC geometry has molar mass 50. Calculate the density of the unit cell if its edge length is 290 pm. $3+(1+3)+3=10$
- iii) a) Deduce Bragg's Equation for crystal study and write its significance.
- b) Distinguish between tetragonal and orthorhombic crystals with examples.
- c) Using Boltzmann's molecular distribution equation, calculate the ratio of populations at 25°C of energy levels separated by 400 KJ of energy per mole assuming the energy levels to be non-degenerate. $3+1+3+3=10$
