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 : $2\frac{1}{2}$ 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 A^0 are diffracted by atoms of a crystal. Given that inter-planar distance is 3.8 A^0 .

   iv) Justify Dulong-Petit's law from classical mechanics.

   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 probabilit.

   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^{o}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

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