

Exam. Code : 210401

Subject Code : 3808

M.Sc. Chemistry 1st Semester**PHYSICAL CHEMISTRY-THERMODYNAMICS****Course—III**

Time Allowed—Three Hours] [Maximum Marks—50

Note :— Attempt **FIVE** questions, selecting at least **ONE** question from each section. The **fifth** question may be attempted from any section. Non-programmable calculator is allowed. All questions carries equal marks.

SECTION—A

- Define the term Gibbs free energy. Explain the variation of Gibbs free energy change (ΔG) with temperature and pressure.
 - State the partial molar properties. Explain any two methods for the determination of partial molar volume.
- How the absolute entropies of solids, liquids and gases can be determined from the third law of thermodynamics ?
 - Determine the entropy change when 4.5 kJ of heat is transferred from a reservoir at 550 K to a reservoir at 350 K.

SECTION—B

3. (a) Briefly explain the Debye-Huckel theory of activity coefficients for electrolyte solutions.
- (b) Determine the ionic strength of a solution containing 50 ml of 0.2 M KNO_3 , 20 ml of 0.15 M K_2SO_4 and 30 ml of 0.05 M $\text{Cu}(\text{NO}_3)_2$.
4. (a) What do you understand by thermodynamic probability? Derive an expression for Maxwell-Boltzmann Statistics.
- (b) Explain the application of ternary phase diagram in crystallization of pure components only.

SECTION—C

5. (a) For $\text{CO}_{(g)}$, $\theta_{\text{rot}} = 2.77 \text{ K}$ and $\theta_{\text{vib}} = 3.084 \text{ K}$. For one mole of $\text{CO}_{(g)}$, at 25°C and 1 atmospheric pressure, determine the translational, rotational, vibrational and electronic partition functions.
- (b) Derive an expression for entropy with the use of the related partition function.
6. (a) Determine the molar entropy of H atom at 1000 K and 1000 bar.
- (b) Describe the salient features of Einstein theory of the heat capacity of monoatomic crystals.

SECTION—D

7. (a) Define the terms; flux, force and phenomenological coefficient. Derive the Law of Onsager's reciprocal relations.
- (b) Explain the coupled reactions. What is their significance in biological systems ?
8. Write short notes on the following :
- (i) Entropy production in open systems.
- (ii) Electrokinetic effects in irreversible processes.