

Seat No. : _____

MG-123

March-2022

M.Sc., Sem.- I

403 : Chemistry

(Physical Chemistry)

Time : 2 Hours]

[Max. Marks : 50

Instruction : Section – II is **compulsory**.

Section – I

Answer any **three** of the following questions : (14 marks each)

1. (a) State the third law of thermodynamics. Show how the absolute entropy of a substance can be determined with the help of this law. 7
- (b) What are partial molar properties ? Explain direct method to determine the partial molar properties. Explain the effect of pressure on chemical potential. 7
2. (a) Discuss the Nernst's heat theorem and derive an equation giving the relation between free energy, enthalpy and heat capacity. 7
- (b) Explain in brief a chemical affinity. Give the applications and limitations of chemical affinity. 7
3. (a) Discuss the collision theory of bimolecular reactions. 7
- (b) Discuss the kinetics of diffusion control reaction in solutions. 7
4. (a) Discuss activated complex theory of bimolecular reactions. 7
- (b) Explain the influence of solvent properties on rate of reactions. 7

5. (a) Discuss the BET theory and the Harkins and Jura method of determining the surface area of adsorbents. 7
- (b) Give difference between physical and chemical adsorption. Adsorption of N_2 on TiO_2 was carried out at 75K. A Plot of $\frac{1}{(1-z)v}$ versus Z gives a straight line with an intercept $4.0 \times 10^{-6} \text{ mm}^{-3}$ and slope $1.0 \times 10^{-3} \text{ mm}^{-3}$. Calculate the volume (round off) corresponding to the monolayer coverage. 7
6. (a) What is surface tension ? Derive Gibbs adsorption isotherm equation. 7
- (b) Write any one verification method on Gibb's equation. When $1 \times 10^{-5} \text{ gm}$ of fatty acid ($M = 602.3 \text{ gm/mol}$) was placed on water as a surface film, a monomolecular layer of area 100 cm^2 was formed on compression. Calculate the cross-sectional area (in $\text{A}^{\circ 2}$) of acid molecule. 7
7. (a) Explain the determination of particle size of crystallite with the help of X-ray powder method. 7
- (b) Explain the band theory of solids. 7
8. (a) Name the different types of imperfections in solids. Derive an equation to calculate the number of Schottky defects in solids. 7
- (b) What is superconductivity ? Explain about low temperature and high temperature superconductivity. 7

Section – II

9. Answer the following question : (One mark each) 8
- (1) Why the value of ΔG at melting point of ice is zero ?
 - (2) Pure silicon is an insulator but becomes a semiconductor on heating. Why ?
 - (3) Why a finely divided substance is more effective as an adsorbent ?
 - (4) Frenkel defect is not seen in pure alkali metal halides, why ?
 - (5) Why the rate of reaction in the remaining mixture is not affected when a portion is removed for the analysis of the product ?
 - (6) What are the characteristic of free energy ?
 - (7) Why adsorption is an exothermic reaction ?
 - (8) Why rate of reaction always increases with temperature whether the reaction is exothermic or endothermic ?