

AQ - 825

First Semester M. Sc. (Part - I) Chemistry (CBCS)
Examination

PHYSICAL CHEMISTRY - I

Paper - III

P. Pages : 4.

Time : Three Hours]

[Max. Marks : 80

Note : (1) All questions carry equal marks and are compulsory.

(2) Use of log-table and calculator is allowed.

1. (a) Discuss rigid rotor using Schrodinger wave equation. 4
- (b) What are Slater - Condon parameters ? 4
- (c) What is Zeeman effect ? Discuss how a single transition $2p \rightarrow 1s$ splits three in pressure of magnetic field. 4
- (d) Show that particle in one dimensional box the wave functions ψ_1 and ψ_2 of any two state are orthogonal. 4

OR

- (p) Discuss application of variation theorem to Helium like Li^+ ion. 8
- (q) Mention eigen values and eigen functions for angular momentum. 4

- (q) Explain magnetic properties of the nucleus and net magnetic moment of the nuclei. 5

- (r) Discuss collective model and give its advantages. 5

5. (a) Describe the difference between activated complex and transition state. 4
- (b) Derive the Eyring equation for the rate constant in transition state theory. 8
- (c) What is application of Eyring equation ? 4

OR

- (p) Write postulates of transition state theory. Compare transition state Theory with Collision theory. 8
- (q) Explain factors determining reaction rate. 4
- (r) For the hydrolysis of sulphamic acid, velocity constant is $1.16 \times 10^{-3} \text{ mole}^{-1} \text{ dm}^3 \text{ sec}^{-1}$ at 363 K, while $E_a = 127490 \text{ J/mole}$. From these data find $\Delta G^\ddagger$, $\Delta H^\ddagger$ and $\Delta S^\ddagger$ of the reaction at 363 K. 4



- (r) Determine term symbols for the ground state electronic configuration ($1s^2 2s^2 2p^2$) of carbon. 4

2. (a) Give an account of the mechanism of catalytic activity at surfaces. 4
 (b) Write note on estimation of surface area of adsorbent by Brauner, Emmell and Teller (B.E.T.) method. 4
 (c) What micellisation ? Discuss the thermodynamics and mechanism of micellisation. 8

OR

- (p) Derive and discuss Gibbs adsorption equation. 8
 (q) Write a note on micro-emulsion. 4
 (c) Explain Reverse Micelles. 4
3. (a) How will you determine the partial molar properties of a system from intercept method ? 4
 (b) Write a note on electro kinetic phenomena. 6
 (r) Discuss the term activity and activity coefficient. 6

OR

- (p) How chemical potential varies with respect to pressure ? 4

- (q) Discuss entropy productions in coupled phenomena. 6

- (r) Discuss the term ideal and non-ideal solutions. 6

4. (a) Explain in brief :—

(i) Fermi gas model.

(ii) Optical model. 8

- (b) What is angular momentum ? Discuss total angular momentum of the nucleus. 4

- (c) Calculate dipole moment in Bohr magneton and nuclear magneton in CGS and SI units, using following data

$$m_e = 9.107 \times 10^{-28} \text{ g}, e = 4.8 \times 10^{-10} \text{ e.s.u}$$

$$m_p = 1.673 \times 10^{-24} \text{ g}, e = 1.602 \times 10^{-19} \text{ coulomb}$$

$$m_n = 1.675 \times 10^{-24} \text{ g}, h = 1.055 \times 10^{-27} \text{ erg/sec}$$

$$c = 3 \times 10^{10} \text{ cm/sec}, h = 1.055 \times 10^{-34} \text{ J/sec.}$$

4

OR

- (p) Give a brief description of nuclear shell model and discuss its merits. 6