

AU-240

M.Sc.—I Semester—I (C.B.C.S. Scheme) Examination
CHEMISTRY (New)
(Physical Chemistry—I)
Paper—III

Time : Three Hours]

[Maximum Marks : 80

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

(2) Use of log table and calculator is permitted.

1. (a) Calculate the probability, P , of locating a particle between $x = 0$ (left hand side of a box) and $x = 0.25$ nm in its lowest energy state in a box of length 1.0 nm. 4
- (b) Determine the degree of degeneracy of the energy level $6h^2/8ma^2$ of a particle in a cubical box. 4
- (c) Explain linear variation principle and its applications. 8

OR

- (p) Discuss application of perturbation theorem to He atom. 8
- (q) Deduce Eigen values and Eigen functions for angular momentum. 4
- (r) Calculate the magnitude (in atomic units) of angular momentum of an electron that occupies the following atomic orbitals : 1s, 3s, 2p, 3p, 3d. 4
2. (a) Derive and discuss Gibbs adsorption equation. 8
- (b) What is Critical Micellar Concentration (CMC) ? What are the factors affecting the CMC of surfactants ? How to determine Critical Micellar Concentration (CMC) ? 8

OR

- (p) Give an account of micellization and explain hydrophobic interaction between micelles. 6
- (q) Give the Freundlich adsorption isotherm. How it can be experimentally verified ? 6
- (r) Explain :
 - (i) Microemulsion
 - (ii) Reverse emulsion. 4

3. (a) Show that the equation of state for a gas is

$$p(V_m - b) = RT$$

where b is a constant, the fugacity of the gas is given by

$$\ln \frac{f}{p} = \frac{bp}{RT} \quad 4$$

- (b) Explain partial molar volume with its significances. 4
 (c) Explain entropy production and entropy flow for irreversible coupled reaction. 8

OR

- (p) Give an account of Debye-Huckel theory for activity and activity coefficient of electrolyte solution. 8
 (q) Give an account on the principle of microscopic reversibility and the Onsager reciprocal relation. 8
4. (a) ^{64}Cu decays with a half-life of 12.8 h as follows : 42% by EC, 19% by β^+ , and rest by β^- . Find the partial decay constant and half-life for each mode of decay. 6
 (b) Discuss in detail about critical size of a thermal reactor. 5
 (c) What do you mean by parent and daughter nuclear substances ? Calculate number of α and β particles emitted from following nuclear reaction :



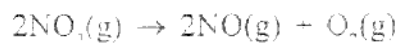
OR

- (p) Discuss α -particle energy spectrum and Breeder reaction in brief. 5
 (q) Give the decay schemes representing α , β , β^+ , EC, IT and branched decay. 6
 (r) What is Geiger Natta law ? Explain it. 5

5. (a) Discuss in detail transition state theory of reaction rates and its application to $H_2 + Br$ reaction. 10
- (b) Give an account of Marcus extension of the RRK treatment in brief. 6

OR

- (p) Give an account of Lindemann theory of unimolecular reactions. Discuss two main reasons for break down of Lindemann theory. 8
- (q) Calculate ΔG^* , ΔH^* and ΔS^* for the second order reaction :



At 500 K. Given $A = 2.1 \times 10^9 \text{ sec}^{-1}$ and the energy of activation = 121 kJ/mole.

8

