AU–236

M.Sc. Semester—I (C.B.C.S. Scheme) Examination
CHEMISTRY (Old)
(Upto Summer–2018)
(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) Derive an expression for energy of a rigid rotator using Schrodinger wave equation.   8

(b) Calculate the degeneracies of the particle of mass 'm' in a three dimensional box of width

'a' having energies equal to [06] and [09] in units of $\left[\dfrac{h^2}{8Ma^2}\right]$.   4

(c) Explain in detail Zeeman Splitting.   4

OR

(p) Discuss in detail application of variation theorem to the Helium atom.   8

(q) Explain generalised angular momentum of a particle. Derive the eigen values of angular

momentum operator $\hat{j}^2$ and $\hat{j}_z$ using commutation.   8

2. (a) Derive BET equation and give its significance.   8

(b) What is micellization ? Discuss the counter ion binding to micelles.   8

OR

(p) Deduce an expression for Langmuir's adsorption isotherm and discuss its importance.

8

(q) Give an account of solubilization of surfactant solutions.   8

3. (a) State and explain chemical potential. Give its significance.   6

(b) Explain partial molar heat content and write its significance.   6

(c) Explain entropy production and entropy flow for heat flow irreversible process.   4

OR

(p) Describe entropy production in coupled chemical reactions. 6

(q) Explain experimental method for determination of fugacity. 6

(r) At concentration of 0.25 molal, the volume of NaCl solution per 1000 gm of water at 25°C is given by

$$V = 1002.9 - 16.40\ m + 2.5\ m^2 - 1.2\ m^3\ ml.$$

Calculate partial molar volume of Sodium Chloride for 1 molal solution. 4

4. (a) Explain orbital angular momentum and total angular momentum of the nucleus. 6

(b) Explain structure of nucleus in terms of optical model. 6

(c) Discuss collective model in detail. 4

OR

(p) Write an account of nuclear fermi gas model and shell model. 10

(q) Discuss magnetic properties of the nucleus. 6

5. (a) What are the salient features of Collision theory ? Discuss its limitations. 8

(b) Explain in detail Lindemann's theory of unimolecular reactions. 8

OR

(p) Discuss in brief transition state theory. 8

(q) Give an account of Marcus extension of RRK treatment. 8