

Exam. Code : 103205
Subject Code : 1329

B.A./B.Sc. 5th Semester
CHEMISTRY
(Physical Chemistry—III)

Time Allowed—3 Hours] [Maximum Marks—35

Note :—Attempt **FIVE** questions in all, selecting at least **ONE** question from each section. The fifth question may be attempted from any section. Each question carries 7 marks. Log Tables may be asked for.

SECTION—A

- (a) Describe Hittorf method for the determination of transport numbers.
- (b) Derive Nernst equation for the measurement of EMF of an electrochemical cell.
- (c) The specific conductance of a saturated aqueous solution of barium sulphate at 300 K is $1.80 \times 10^{-4} \text{ Sm}^{-1}$. The ionic conductivities of Ba^{2+} and $(\text{SO}_4)^{2-}$ ions at 300 K are 64×10^{-4} and $80 \times 10^{-4} \text{ Sm}^2 \cdot \text{mol}^{-1}$ respectively. Calculate the solubility and solubility product of barium sulphate at 300 K. 2.5, 1.5, 3

2. State and explain the following :—
- (a) Ostwald's dilution law
 - (b) Kohlrausch law
 - (c) Electrochemical series
 - (d) Over-potential
 - (e) Liquid junction potential. 1.5,1.5,1.5,1.5,1

SECTION—B

3. Explain the difference between the following :—
- (a) Nuclear and chemical reactions
 - (b) Nuclear fission and nuclear fusion
 - (c) Binding and bond energies
 - (d) Natural and artificial radioactivity. 2,2,1.5,1.5
4. (a) Give an account of the nuclear forces.
- (b) Calculate the binding energy of α -particle in ergs. Given masses of a proton, neutron and helium nucleus as 1.00758, 1.00897 and 4.00820 a.m.u. respectively.
- (c) Enlist the hazards of nuclear radiations. 3,2.5,1.5

SECTION—C

5. (a) Outline the basic features of different spectrometers.
- (b) The rotational spectrum of HCl has lines 21 cm^{-1} apart. Calculate the moment of inertia and bond length in HCl.

(c) What is the significance of selection rules in molecular spectroscopy ? 3,3,1

6. Write notes on the following :—

(a) Rigid Rotor Model

(b) Degrees of Freedom

(c) Isotope effect. 3,2,2

SECTION—D

7. (a) What do you understand by P, Q and R branches in vibrational-rotational spectra ? Explain.

(b) State and explain Franck-Condon principle.

(c) The force constant of CO molecule is 1870 Nm^{-1} . Calculate the vibrational frequency in cm^{-1} .

2,3,2

8. (a) Describe the effect of polar solvents on $n-\pi^*$ and $\pi-\pi^*$ transitions.

(b) Elaborate the effect of anharmonic motion and isotope on the vibrational spectrum.

(c) Enlist the advantages of Raman spectroscopy over IR spectroscopy.

(d) Differentiate between combination bands and hot bands. 2,2,2,1