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M.Sc. (Part—I) Semester—II (CBCS Scheme) Examination
CHEMISTRY (Old) (Upto Winter–2018)
(Physical Chemistry—II)
Paper—VII

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) Discuss the kinetics of branched chain reactions. Explain the term first explosion limit and second explosion limit. 6

(b) Discuss the relaxation methods for the study of kinetics of fast reactions. 4

(c) Discuss Belousov-Zhabotinsky reaction in detail. 6

OR

(p) Explain the kinetics and mechanism of thermal reaction between H_2 and Br_2. 6

(q) Describe the sloped flow method for studying kinetics of fast reactions. 4

(r) Define and explain :

(i) Acid base catalysis

(ii) Enzyme catalysis. 6

2. (a) Explain Huckel theory of conjugated systems, their bond order and calculations of charge density. 6

(b) What are wave functions and how energy levels are calculated from wave functions ? 4

(c) Apply HMO theory to ethylene molecule and find out HMO energies. 6

OR

(p) Construct sp^3 hybrid orbitals by combining one 2s and three 2p orbitals and establish the value of angle between the hybrid orbitals. 8

(q) Apply HMO theory to butadiene molecule and calculate HMO energies. 4

(r) Explain the criteria for forming M.O's and A.O's. 4

3. (a) Explain :

(i) Random coils

(ii) Configuration of macromolecules. 6

(b) Define number average and mass average molecular mass of polymer. 6

(c) Describe the Osmometry method used for determination of molecular mass. 4

OR

(p) Write notes on :

(i) Electrophoresis

(ii) Polymer liquid crystals. 6

(q) Explain the stability, kinetics and mechanism of polymerization. 6

(r) A protein sample consists of an equimolar mixture of ribonuclease ($M = 13.7$ kg mol^{-1}) haemoglobin ($M = 15.5$ kg mol^{-1}). Calculate number average mass and wt. average mass. 4

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4. (a) Discuss Butler-Volmer equation, the low and high overpotential limit. Also explain Tafel Plot. 8

(b) What are different types of corrosion ? Explain corrosion inhibitors also. 4

(c) Define electrified interfaces and electric potential at the interfaces. 4

OR

(p) Discuss Debye Huckel Onsager treatment and ion solvent interactions. 6

(q) Write notes on :

(i) Electron transfer processes

(ii) Electrode solution interface. 6

(r) Explain experimental technique involved in voltammetry. Also explain phenomenon of concentration polarization. 4

5. (a) For homonuclear diatomic and symmetrical linear polyatomic molecules derive rotational partition function $Zr = \frac{T}{\sigma \theta_r}$.

where θ_r = Characteristic rotation temperature

σ = Symmetry number. 4

(b) Define the concept of distribution, thermodynamic probability and most probable distribution. 6

(c) Compare microcanonical, canonical and grand canonical ensemble based on their thermodynamic environment. 6

OR

(p) Calculate the value of molecular rotational partition function for $N_2(g)$ at 298 K. The moment of inertia is 1.407×10^{-46} kg m^2 and the symmetry number is 2 for $N_2(g)$.

Give $K = 1.381 \times 10^{-23}$ JK^{-1}

$h = 6.626 \times 10^{-34}$ Js 4

(q) Derive an expression for translational partition function for H_2 molecule at room temperature. 6

(r) Explain corresponding distribution law using Lagrange's method of undetermined multiplier. 6

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