[This question paper contains 5 printed pages.]

1365 *Your Roll No.* .....

B.Sc. (Hons.)/I **A**

BIOCHEMISTRY – PAPER I

(Physical Chemistry)

(Admissions of 2000 & onwards)

Time : 3 Hours *Maximum Marks : 60*

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **five** *questions in all, including Question No.* **1** *which is compulsory. Log tables and graph papers are allowed.*

1. Answer the following briefly **(ANY EIGHT)**

   (a) Spontaneous reactions need not be instantaneous. Explain.

   (b) Higher the activation energy of a reaction, slower is the reaction. Explain.

   (c) Why does a real crystal have more entropy than an ideal crystal ?

   (d) Explain why the solubility of a salt is affected by the presence of a common ion ?

P.T.O.

(e) Differentiate between first order and pseudo-first order reactions.

(f) Differentiate between Extensive and Intensive variables with suitable examples.

(g) Why KCl solution is used in Salt bridge ?

(h) Define Buffer Capacity and Buffer Index.

(i) Substances like charcoal and silica gel are used to create high vaccum. Explain.

(j) Electrolysis of molten NaCl yields Na metal at the cathode but electrolysis of aqueous NaCl gives hydrogen gas at the cathode. Why ? (2×8=16)

2. (a) Derive an expression for the rate constant of first order reaction. Show that the half life period is independent of initial concentration. (4)

(b) Discuss the collision theory of Bimolecular reactions. Why is the theory applicable to reactions involving simple gaseous molecules ? (3)

(c) The values of rate constants for reaction

$$2HI \rightleftharpoons H_2 + I_2$$

were observed as 3.0×10^{-5} $mol^{-1}dm^3s^{-1}$ and 2.5×10^{-3} $mol^{-1}dm^3s^{-1}$ at 357°C and 447°C, respectively. Calculate the $E_{activation}$ for forward and backward reaction. Given

$$\Delta H = 15.5 \text{ kJ mol}^{-1}.$$ (4)

3. (a) Derive Wadden's rule. On the basis of this explain why Ionic molar conductivity at infinite dilution increase in the order

$$Li^+ > Na^+ > K^+ > Rb^+ \qquad (4)$$

(b) Explain how the conductometric measurements can be employed for the determination of

(i) Degree of dissociation of a weak electrolyte

(ii) Solubility and Solubility Product of a Sparingly Soluble Salt (4)

(c) State Kohlrausch's law of independent migration of ions.

Given the following $\Lambda^\infty/\Omega^{-1}\ cm^2\ mol^{-1}$ values at 25°C; $AgNO_3$ 133.4; KCl 149.9; KNO_3 144.9. What is the molar conductivity at infinite dilution of AgCl ? (3)

4. (a) What is an acid-base indicator ? How does its colour change with change in H^+ ion concentration of the solution ? (4)

(b) Explain the nature of titration curve obtained in the titration involving weak acid and strong base. What would be the choice of a suitable indicator for the same ? (3)

(c) The solubility of CaF_2 in water at 20°C is 15.6×10^{-3} g/dm^3 of solution. Calculate the solubility product of CaF_2 (mol wt of CaF_2 = 78 g mole^{-1}). (4)

5. (a) The E.M.F. of the Standard Weston cell written as

$Cd(Hg), CdSo_4.\ 8/3\ H_2O(S)/CdSo_4(Sat)/Hg_2So_4(S), Hg$

in which the cell reaction is

$$Cd(Hg) + Hg_2So_4(S)+8/3H_2O(l) \rightleftharpoons CdSo_4.\ 8/3H_2O(S) + 2Hg(l)$$

is 1.0185 V at 25°C. Calculate $\Delta G°$, $\Delta S°$ and $\Delta H°$ for the cell reaction if $(\partial E°/\partial T)_P$ for the cell is 5.00×10^{-5} VK^{-1}. (4)

(b) Differentiate between Homogeneous and Heterogeneous catalysis. Explain the following on the basis of Heterogeneous catalysis

(i) Active centres

(ii) The action of catalytic poisons (4)

(c) Discuss the applications of adsorption. (2)

(d) What are redox indicators ? (1)

6. (a) Derive the Nernst equation giving the effect of concentration of surrounding electrolyte on the electrode potential. (3)

(b) One mole of an ideal monoatomic gas at 27°C expands reversibly and adiabatically from a volume of 10 dm^3 to 20 dm^3. Calculate the values of

(i) q (ii) ΔE (iii) W and (iv) ΔH (4)

(c) Set up a Born Haber cycle to find the lattice energy of NaCl crystal.

Given $\Delta H_f°(NaCl) = -410.87$ kJ mol^{-1}

I.E. of Na = 495.8 kJ mol^{-1},

EA of chlorine = 365.26 kJ mol^{-1}

Sublimation enthalpy of Na = 317.57 kJ mol^{-1}

Dissociation enthalpy of $Cl_2(g)$ = 241.84 kJ mol^{-1}

(4)

7. (a) Write short notes on any **three** :

(i) Osmotic Pressure

(ii) Steady State approximation

(iii) Glass Electrode

(iv) Principles for UV and NMR spectra

(v) Donnan Equilibrium (3×3)

(b) Calculate pH of a solution 10^{-7} MHCl. (2)