

[This question paper contains 5 printed pages]

Your Roll No .

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B.Sc. (Hons.)/I

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) $2 \times 8 = 16$
- (a) Effect of temperature and pressure for any adsorption reaction is in accordance with Le Chatelier's principle
Explain
 - (b) Why does a strong acid such as HCl and a weak acid as CH_3COOH appear to be of almost equal strength when dissolved in liquid ammonia?
 - (c) Why do the reaction rate almost doubles for every 10°C rise in temperature?
 - (d) Show that for a weak electrolyte $\alpha \rightarrow 1$ as $C \rightarrow 0$
(α is the degree of dissociation of a weak acid)

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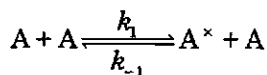
- (e) A spontaneous reaction is not necessarily a fast reaction Why?
- (f) What are the charge carriers in (i) Metals and (ii) Ionic solutions?
- (g) Explain the function of salt bridge in an electrochemical cell
- (h) Quinhydrone electrode is not suitable for pH measurements in strongly alkaline solution
- (i) Elementary processes with molecularity greater than three are not known Why?
- (j) Explain why maximum electrical work is obtained from a cell when it operates reversibly
- 2 (a) What do you mean by the half life time of a reaction? How can the half life time of a reaction be used to determine the order of a reaction? 3
- (b) The half life period and the initial concentration for a reaction are as follows 4

$t_{0.5}$	425	275	941
p/mmHg	354	540	158

What is the order of the reaction? Calculate the rate constant

- (c) Lindeman mechanism for the unimolecular reaction is given as follows 4

(3)



Show that it leads to

$$\frac{d\{\text{Product}\}}{dt} = \frac{k_2 k_1 [A]^2}{k_{-1}[A] + k_2}$$

$[k_1]$ —specific rate constant for forward reaction

$[k_{-1}]$ —specific rate constant for reverse reaction]

Under what conditions will the order of the reaction be equal to one?

- 3 (a) What are Buffer Solutions? Derive the Henderson equation for computing pH of a solution containing large amount of weak acid and salt of its conjugate base 4
- (b) Estimate the pH of a solution obtained by mixing 5 g of acetic acid and 7.5 g of sodium acetate per 500 cm³ of the solution. Dissociation constant of acetic acid at 25°C is 1.8×10^{-5} . 3
- (c) Explain why Methyl orange can not be used as an indicator for titrating a weak acid like acetic acid against a strong base like sodium hydroxide? 2
- (d) Define solubility product of a sparingly soluble salt

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- What is the solubility product of CaF_2 in terms of its solubility S ? 2
- 4 (a) Derive an expression for Langmuir's adsorption isotherm Under what conditions it reduce to Freundlich adsorption isotherm? 4
- (b) What is a catalytic inhibitor? Give an example of a catalytic inhibitor 2
- (c) What is the Principle of acid-base potentiometric titrations? Explain the titration curve of strong acid vs strong base potentiometric 3
- (d) Distinguish between the terms bond energy and bond dissociation energy 2
- 5 (a) Derive the following relations 4

$$\Delta G = nRT \ln \left(\frac{V_1}{V_2} \right)$$

$$\Delta S = nR \ln \left(\frac{P_1}{P_2} \right)$$

- (b) Calculate the change in entropy accompanying isothermal expansion of 5 moles of an ideal gas at 330 K until its volume is increased six times 3
- (c) What are Redox Indicators? What is the condition for a indicator to be suitable for any oxidation reduction reaction? 2

- (d) Why does a real crystal have more entropy than an ideal crystal? 2
- 6 (a) What is standard hydrogen electrode? How can it be used to determine the pH of a solution? 3
- (b) For the cell
 $\text{Ag(s)} | \text{AgBr(s)} | \text{KBr(aq)} | \text{Hg}_2\text{Br}_2\text{(s)} | \text{Hg}$
The emf at 298K is 0.0684 V and the temp coefficient of emf is $4.2 \times 10^{-4} \text{ VK}^{-1}$. What is the cell reaction for the passage of two Faraday charge and what are free energy, enthalpy and entropy changes at 298K? 4
- (c) What are concentration cells? Derive expressions for the emf of a concentration cell with transference 4
- 7 (a) Write short notes on (*any three*) (3 × 3)
- (i) Parallel reactions
 - (ii) Donnan equilibrium
 - (iii) Osmotic pressure
 - (iv) Kirchoff's equation
 - (v) Principle of UV and IR spectra
- (b) Calculate the pH and Hydrogen and hydroxyl ion concentrations of a $3.2 \times 10^{-3} \text{ M}$ solution of Ba(OH)_2 in water at 25°C. 2

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