Exam. Code : 107404
Subject Code : 2141

B.Sc. (Bio-Technology) Semester—IV

PHYSICAL CHEMISTRY—B

Paper—BT-I

Time Allowed—3 Hours] [Maximum Marks—40

Note :— The question paper consists of **THREE** Sections. Section A contains **8** very short answer type questions (Q. Nos. **1** to **8**), each carrying **1** mark. Section B contains **8** short answer type questions (Q. Nos. **9** to **16**), each carrying **4** marks. Section C contains **4** essay type questions (Q. Nos. **17** to **20**), each carrying **6** marks. Attempt all the questions from Section A, any **5** questions from Section B and any **2** questions from Section C.

SECTION—A

(Each question carries **1** mark)

1. Define electromotive force.

2. Discuss the working principle of quinine-hydroquinone electrode. What is its application ?

3. Differentiate between order and molecularity of reaction.

4. Define rate constant and give its units for second order reaction.

5. Differentiate between weak and strong electrolytes. Give one example for each.

6. Define buffer index and buffer capacity.

7. How does the molar conductance varies with dilution ?

8. What is heterogeneous catalysis ? Elaborate it by citing one example.

SECTION– B

(Each question carries 7 marks)

9. A zinc rod is placed in 0.1 M solution of $ZnSO_4$ at 298.15 K. Assuming that the salt is dissociated to the extent of 95 percent at this dilution, calculate the potential of electrode at this temperature. $E^0(Zn^{2+}, Zn) = -0.76$ V.

10. What is a glass electrode ? Draw its structure. How pH of a solution can be measured by using glass electrode ?

11. Name four methods used for determining the order of reaction. Discuss any one in detail.

12. The activation energy of a non-catalyzed reaction at 37° C is 83.68 kJ mol^{-1} and the activation energy of the same reaction catalyzed by an enzyme is 25.10 kJ mol^{-1}. Calculate the ratio of the rate constant of the enzyme catalyzed and the non-catalyzed reaction.

13. Discuss the transition state theory of bimolecular process and derive Eyring equation.

14. What is transference number ? How is it determined using Hittorf's method ?

15. Draw the titration curve for conductometric titration of an equimolar mixture of strong and weak acid with strong base providing reasons for observed changes.

16. Explain the theory of acid-base indicators.

SECTION—C

(Each question carries **6** marks)

17. (a) What is liquid junction potential ? How can it be minimized ?

    (b) What are Electrolyte-concentration cells ? Give one example each of concentration cell with and without transference.

18. (a) Derive Michaelis-Menten equation for enzyme catalysis.

(b) Derive integrated rate expression for the first order reaction $A \rightarrow P$ and show that concentration of a reactant in such reaction decreases exponentially with time.

19. (a) Calculate the pH of a solution obtained by mixing 50 ml of 0.2 M HCl with 50 ml of 0.1 M NaOH.

(b) Discuss Debye-Huckel theory of activity coefficients.

20. (a) The molar conductance of sodium acetate, hydrochloric acid and sodium chloride at infinite dilution are 91.0×10^{-4}, 426.16×10^{-4} and 126.45×10^{-4} S m^2 mol^{-1}, respectively, at 25° C. Calculate the molar conductance for acetic acid at infinite dilution.

(b) Write a short note on heterogeneous catalysis.