

B.Sc. Bio-Technology Semester—IV

PHYSICAL CHEMISTRY—B

Paper—BT-1

Time Allowed—3 Hours] [Maximum Marks—40

Note : This 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 standard electrode potential.
2. What is liquid junction potential ?
3. Define threshold and activation energy.
4. For a first order reaction $A \rightarrow \text{Products}$, $t_{1/2}$ is 100 s. Calculate the rate constant for the reaction.
5. What is the effect of pressure on reaction rate of a unimolecular surface reaction ? Show it diagrammatically.
6. What is cell constant ? How it is determined ?

7. Define buffer index and buffer capacity.
8. What is indicator constant ? Discuss its significance.

SECTION—B

Each question carries 4 marks.

9. Discuss how activity and activity coefficients are determined from EMF measurements.
10. 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.
 $E^\circ_{(\text{Zn}^{2+}, \text{Zn})} = -0.76 \text{ V}$.
11. What is enzyme catalysis ? Enlist different factors which affect the enzyme catalysis and discuss the effect of temperature on enzyme catalysis in detail.
12. Write a short note on heterogeneous catalysis.
13. Derive integrated rate expression for first the first order reaction $A \rightarrow P$ and show that concentration of a reactant in such reaction decreases exponentially with time. <http://www.gnduonline.com>
14. Discuss Debye-Huckel theory of activity coefficients.
15. What do you mean by ionic product of water ? How it is determined ?
16. Define hydrolysis constant. Derive the necessary equation for hydrolysis of the salt of weak acid and strong base.

SECTION—C

Each question carries 6 marks.

17. (a) Derive Nernst equation for EMF of a cell.
- (b) What are Electrolyte-concentration cells ? Give one example each of concentration cell with and without transference.
18. (a) Discuss the Transition State theory of bimolecular process and derive Eyring equation.
- (b) Name four methods used for determining the order of reaction. Discuss differential rate expression for determination of order of a reaction.
19. (a) Calculate the pH of 1×10^{-7} M solution of HCl at 25°C . Take $K_W = 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$.
- (b) What is transference number ? How is it determined using moving boundary method ?
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 $126.45 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$, respectively, at 25°C . Calculate the molar conductance for acetic acid at infinite dilution.
- (b) Write a short note on surface reactions with special reference to unimolecular surface reactions.