


Name:			
Enrolment No:			
UPES End Semester Examination, May 2024			
Course: Physical Chemistry IV Program: BSc (H) Chemistry Course Code: CHEM2025		Semester: IV Time : 03 hrs. Max. Marks: 100	
Instructions: All questions are compulsory. Support your answer with suitable examples and figures wherever required.			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	A monochromatic radiation is incident on a solution of 0.05 molar concentration of an absorbing substance. The intensity of radiation is reduced to one-fourth of the initial value after passing through 10 cm length of the solution. Calculate the molar extinction coefficient of the substance.	4	CO1
Q 2	The rate constant for a second order reaction is $3.33 \times 10^{-2} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$. If the initial concentration of the reactant is 0.05 mol dm^{-3} . Calculate the half-life?	4	CO1
Q 3	A solution of AgNO_3 was electrolyzed between silver electrodes. The speed ratio of silver and nitrate ions was found to be 0.916. Calculate the transport number of the silver and nitrate ions.	4	CO2
Q 4	Describe two limitations of Beer-Lambert's Law and explain how they can affect the accuracy of concentration measurements.	4	CO1
Q 5	What are the key factors influencing the efficiency of a catalytic process, and how can catalyst design be optimized to enhance performance?	4	CO1
SECTION B (4Qx10M= 40 Marks)			
Q 6	For a Hydrogen-Bromine reaction the rate varies as the square root of the intensity of the absorbed radiation. Justify this statement.	10	CO3
Q 7	The rate constant of a second-order reaction is $5.70 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 25°C and $1.64 \times 10^{-4} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 40°C . Calculate the activation energy and the Arrhenius pre-exponential factor.	10	CO2
Q 8	A substance when dissolved in water at 10^{-3} M concentration absorbs 10% of the incident radiation in a path of 1cm length. What should be the concentration of the solution in order to absorb 90% of the same radiation.	10	CO1

Q 9	<p>How does Walden's Rule explain the variation in molar conductivity when different salts are dissolved in the same solvent?</p> <p style="text-align: center;"><i>Or</i></p> <p>Discuss the significance of transference numbers in battery electrolytes. How do variations in transference numbers affect the efficiency and performance of batteries?</p>	10	CO3
<p>SECTION-C (2Qx20M=40 Marks)</p>			
Q 10	<p>(a) What is meant by transport number of an ion? How is it determined using Hittorf's method and Moving Boundary method?</p> <p>(b) What is photosensitization, explain with the help of energy diagram. Highlight the same process in photosynthesis of plants.</p>	10 +10	CO2
Q 11	<p>(a) What are the different mechanisms for the formation of Anthracene. Write differential rate law for it.</p> <p style="text-align: center;"><i>Or</i></p> <p>Explain the role of photochemical reaction in biochemical process. Discuss with examples.</p> <p>(b) Derive the integrate rate expression for a second order reaction ($A + B \rightarrow P$).</p> <p style="text-align: center;"><i>Or</i></p> <p>For the first-order isomerization of an organic compound at 130 °C, the activation energy is 108.4 kJ mol⁻¹ and the rate constant is 9.12 x 10⁻⁴ s⁻¹. Calculate the standard entropy of activation for this reaction.</p>	10 +10	CO3