Name:

Enrolment No:

UPES

End Semester Examination, May 2023

Course: Physical Chemistry IV **Semester:** IV

Program: BSc (H) Chemistry & Int. B.Sc.-M.Sc. Chemistry **Time** : 03 hrs.

Course Code: CHEM 2025 **Max. Marks:** 100

Instructions:

1) Read all questions carefully.

2) Attempt all questions under one section in one place.

SECTION A

(5Qx4M= 20 Marks)

S. No.		Marks	CO
Q 1	Calculate the value of an einstein of energy in electron volts for radiation of 3 x 10^{13} s^{-1} frequency.	**4**	**CO1**
Q2	At room temperature the molar conductance of H_2O is 1.0 x 10^{-6} S m^2 mol^{-1} and the molar conductance at infinite dilution is 550 S m^2 mol^{-1}. Calculate the degree of dissociation of water?	**4**	**CO1**
Q3	The rate constant for a reaction of zero order is 0.0030 mol L^{-1} s^{-1}. How long will it take for the initial concentration to fall from 0.10 M to 0.075 M?	**4**	**CO1**
Q4	Differentiate between (i) Specific conductance and Equivalent conductance (ii) Galvanic cell and Electrolytic cell	**2 +2**	**CO1**
Q5	Calculate equilibrium constant for the reaction $Zn_{(s)}+Cu^{2+}_{(aq)} \leftrightarrows Cu_{(s)}+Zn^{2+}_{(aq)}$ at 25 ^{0}C. Standard *emf* of the cell is 1.10 V.	**4**	**CO1**
SECTION B **(4Qx10M= 40 Marks)**			
Q6	Calculate the transmittance, absorbance and absorption coefficient of a solution which absorbs 90% of a certain wavelength of light beam passed through a 1 cm cell containing a 0.25 M solution.	**10**	**CO2**
Q7	Write a brief note on Norrish Type-I and Norrish Type-II reactions.	**10**	**CO1**
Q8	Ionization constant of acetic acid and ionic product of water at 25 ^{0}C are 1.75 x 10^{-5} and 1 x 10^{-14} respectively. Calculate the hydrolysis constant of sodium acetate and its degree of hydrolysis in 0.1 molar solution at 25 ^{0}C.	**10**	**CO3**
Q9	What is meant by transport number of an ion? How is it determined using Hittorf's method and Moving Boundary method? *Or*	**10**	**CO2**

	A first order gas reaction $A_2B_{2(g)} \rightarrow 2A_{(g)}$ at the temperature 400 ^{0}C has the rate constant k = 2.0 x 10^{-4} s^{-1}. What percentage of A_2B_2 is decomposed on heating for 900 seconds?		
SECTION-C (2Qx20M=40 Marks)			
Q10	(a) What do you understand by quantum yield of a photochemical reaction? Why do some reactions have high quantum yield whereas some others have very low value? What is the modified definition of Stark-Einstein law? (b) The resistance of a conductivity cell when filled with 0.02 M KCl solution is 164 ohms at 298 K. However, when filled with 0.05 M $AgNO_3$ solution, its resistance is found to be 78.5 ohms. If specific conductivity of 0.02 M KCl is 2.768 x 10^{-3} ohm^{-1}, calculate (i) The conductivity of 0.05 M $AgNO_3$ (ii) The molar conductivity of $AgNO_3$ solution	**10 +10**	**CO2**
Q11	(a) Prove that degree of hydrolysis of a salt of weak acid and weak base is independent of the concentration of the solution *Or* Calculate the electrode potential of a copper wire dipped in 0.1 molar copper sulphate solution at 25 ^{0}C. At this temperature, the standard electrode potential of copper is 0.34 volt (F= 96500 coulombs; R = 8.314 J deg^{-1} mol^{-1}). Assume $CuSO_4$ to be completely ionized and take the activity of copper ions equal to the molar concentration. (b) The decomposition of N_2O_5 to NO_2 and O_2 is first order with a rate constant of 4.8 x 10^{-4} per second at 45 ^{0}C. (i) if the initial concentration is 1.65 x 10^{-2} mol/L, what is the concentration after 825 second? (ii) How long would it take for the concentration of N_2O_5 to decrease to 1.0 x 10^{-2} mol/L from its initial value, given in (i)?	**10 +10**	**CO3**