MANIPAL
ACADEMY of HIGHER EDUCATION

Reg.No.									

DEPARTMENT OF SCIENCES, III SEMESTER M.Sc. (Chemistry)
END SEMESTER EXAMINATIONS, DECEMBER 2023
PHYSICAL CHEMISTRY-I [CHM 5103]
(CHOICE BASED CREDIT SYSTEM - 2021)

Time: 3 Hours | Date: DD MM YYYY | MAX. MARKS: 50

Note (i) Answer ALL questions
(ii) Draw diagrams, and write equations wherever necessary

1A. Need of model and its explanation — 1 Mark

Diagram and full explanation with graph for stern model — 3 Mark

1B. (i) $Ca(NO_3)_2$

$I = \frac{1}{2}(0.0050\ molkg^{-1} * 2^2 + 2 * 0.0050) = 0.015\ molkg^{-1}$ — 1 Mark

$\text{Log}\ \gamma_\pm = -A/Z^+Z^-\sqrt{I}$

$= -0.509 * 2 * \sqrt{0.015}$ — 1 Mark

$= -0.509 * 2 * 0.1224$

$\gamma_\pm = 0.75$

(ii) Ion-pair formation — ½ Mark

Ion-pair formation not possible — ½ Mark

1C. Asymmetric effect — 1 Mark

Electrophoretic effect — 1 Mark

It plays a crucial role in understanding various electrochemical and chemical process, such as ionic conductivity, chemical equilibrium. Activity coefficients, Ionic strength and ion pairing — 1 Mark

2A. One pair partially miscible liquids with explanation, diagram — 3 Mark

Two pair partially miscible liquids with explanation, diagram — 1 Mark

2B. Derivation of Gibbs-Helmholtz equation — 2 Mark

Application — 1 Mark

2C. (i) $\Delta H = nF[E - T\left(\frac{\partial E}{\partial T}\right)_P$ — 1 Mark

$= 2 * 96500\ [1.005 - (298)\ (-4.0 \times 10^{-4})]$

$= 2 * 96500 * 0.8858$

$= 170$

4A	Write an explanatory note on isothermal explosion during gas phase combustion of hydrogen. Derive rate expression.	4	1	2
4B	Explain the influence of solvent dielectric constant on the rate of the reaction	3	1	4
4C	Using Rice and Herzfeld mechanism, show that thermal decomposition of ethane to ethylene is a first order reaction.	3	1	3
5A	Explain the Michaelis Menten concept of mechanism for explaining the influence of substrate on the rate of reaction.	4	1	4
5B	Apply van't Hoff intermediate for general catalytic mechanism and arrive to a rate expression for reaction catalyzed by surfaces.	3	1	3
5C	Derive rate expression for bimolecular surface reaction using Langmuir-Hinshelwood mechanism.	3	1	3

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