MANIPAL
ACADEMY of HIGHER EDUCATION
(Deemed to be University under Section 3 of the UGC Act, 1956)

Reg. No.										

DEPARTMENT OF SCIENCES, I SEMESTER M.Sc., (Chemistry)
END SEMESTER EXAMINATIONS, (Makeup) March 2022
Physical Chemistry-I [CHM 5103]
(CBCS Scheme)

Time: 2 Hours | Date: 16 March 2022 | MAX. MARKS: 40

Note: (i) Answer **any four full** questions.
(ii) Draw diagrams, and write equations wherever necessary

1 A Explain the following with appropriate reasoning
(a) During thermal oxidation of hydrogen, first two explosion limits are isothermal limits whereas third limit is thermal explosion limit
(b) Arrhenius equation is useful tool to evaluate energy of activation of a chemical reaction.
(c) Order and molecularity of reaction need not be same

1 B Temperature of the reaction was increased from T_1 to T_2. If the product of T_1 and T_2 is equal to $\frac{Ea}{0.0693R}$ and the difference ($T_2 - T_1$) is 10, what is the value of ratio of rate constants?

1 C Explain the assumption of CTST. Based on CTST, derive an equation to relate rate constant and thermodynamic parameters of a gas phase reaction **[3+ 2+5]**

2 A Explain the following with appropriate reasoning
(a) In gas phase reaction, not all collisions lead to the formation of products
(b) In solution phase reaction, variation of rate constant with ionic strength helps to understand the mechanism of reaction
(c) Activated complex and energized molecules are not same

2 B Write assumptions of B.E.T adsorption isotherm and write mathematical form of it. Explain how it is useful in explaining Type II to Type V adsorption isotherms.

2 C Explain characteristic features of enzyme catalysis. Derive Michaelis-Menten equation, and explain the determination of Km by graphical methods **[3+ 2+5]**

3 A Deduce any two Maxwell's relations.

3 B Calculate the thickness of ionic atmosphere for 0.01 M 1:2 electrolytes in water at 298 K (Dielectric constant = 78.54)

3 C Write an explanatory note on the following
(i) Influence of pH on reaction rate of acid base catalysis. (Draw suitable graph)
(ii) Mechanism of uni-molecular and bi molecular surface reactions.

[3+ 2+5]

4 A (i) The latent heat of vaporization of benzene at its boiling point (80 °C) is 743 cal mol^{-1}. What is the vapour pressure of benzene at 27 °C ?
(ii) Calculate the standard free energy of formation of NH_3 (g) , NO(g) and H_2O(l) are –16.8, 86.7 and –237.2kJmol^{-1} respectively

4 B Justify: a) Fugacity of a gas can both be less or more than the pressure.
b) Eutectic is a mixture and not a compound.

4 C Mention any two merits and limitations of phase rule. Explain in detail the phase diagram of $Na_2SO_4 – NaCl – H_2O$ **[3+ 2+5]**

5 A Deduce Gibbs – Duhem equation. Give its significance.

5 B **(i)** Calculate the mean ionic activity coefficient of K_2SO_4 at a molality of 0.001 in aqueous solution at 25 °C
(ii) Justify: Work is not a state function while entropy change is a state function.

5 C Discuss the structure of electrified interfaces with reference to the Stern model.

[3+ 2+5]

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