REV-01
MSC/07/12

2025/12

SET A

M.Sc. CHEMISTRY
FIRST SEMESTER
PHYSICAL CHEMISTRY - I
MSC – 103

[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

Objective

Time: 15 mins. **Marks: 10**

Choose the correct answer from the following: ***1×10=10***

1. Micelle formations is accompanied by the
   a. Decrease in overall entropy due to ordering
   b. Increase in overall entropy mostly due to increase in solvent entropy
   c. Increase in overall entropy mostly due to increase in solute entropy
   d. Increase in overall entropy mostly and decrease in enthalpy

2. The correct statement about chemisorption is
   a. Chemisorption results in multi molecular layer adsorption
   b. Chemisorption is reversible in nature
   c. Chemisorption has lower specificity than physisorption
   d. Chemisorption occurs due to formation of chemical bonds.

3. A monoatomic gas, X, adsorbed on a surface, follows Lagmuir adsorption isotherm. A plot of the fraction of the surface coverage, θ against the concentration of the gas [X], for very low concentration of the gas is described by the equation
   a. $\theta = K[X]$
   b. $1 - \theta = 1 / K[X]$
   c. $\theta = K^{1/2}[X]^{1/2}$
   d. $\theta = K[X] / (1- K[X])$

4. Which of the following options are correct?
   a. Micelle formation by soap in aqueous solution is possible at all temperatures.
   b. Micelle formation by soap in aqueous solution occurs above a particular concentration
   c. Soap solution behaves as a normal strong electrolyte at all concentrations.
   d. None of the above

5. Which isotherm is applicable for multilayer adsorption process
   a. Freundlich adsorption isotherm
   b. Langmuir adsorption isotherm
   c. BET isotherm
   d. All of the above

6. According to the Arrhenius equation, the rate constant (k) is directly proportional to:
   a. Temperature
   b. Concentration of reactants
   c. Pressure
   d. Catalyst concentration

7. In Arrhenius equation, the activation energy and pre-exponential factor both are-
   a. Temperature Independent
   b. Temperature Dependent
   c. Pressure Independent
   d. Pressure Dependent

8. Effective collisions are those that
   a. Occur between identical molecules only
   b. Form correct products regardless of orientation
   c. Have proper orientation and sufficient energy
   d. Occur at low pressure

9. The activated complex according to Transition state theory exists at
   a. Maximum potential energy
   b. Minimum potential energy
   c. Zero energy
   d. Constant energy

10. In Michaelis–Menten kinetics, Vmax represents:
   a. Rate when no substrate is present
   b. Rate when enzyme is fully saturated
   c. Rate at infinite enzyme concentration
   d. Minimum possible rate

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Descriptive

Time : 1 hr. 15 mins **Marks : 25**

[Answer question no.1 & any two (2) from the rest]

1. a. What is extent of adsorption? Explain the variation of adsorption isobars for physisorption and chemisorption. **3+2=5**
   b. A first order reaction is 50% completed in 20 minutes at 27 °C and in 5 minutes at 47 °C. The activation energy of the reaction is?

2. a. Why adsorption process occurs? Explain. **1+2+2+2+2+1=10**
   b. Write the difference between physisorption and chemisorption? Write the applications of Adsorption process?
   c. Explain graphically the Effect of pressure and temperature in adsorption process?
   d. Write the Freundlich Adsorption Isotherm equation for adsorption from solution.
   e. Write the Young-Laplace equation and its importance?
   f. Why the shape of liquid drop is spherical?

3. a. Why the bubbles are formed? Derive the Kelvin equation for liquid droplets? **3+2+2+2+2=10**
   b. Write the Young-Laplace equation and its importance?
   c. What are surfactants? Write about Zwitterionic surfactants and their applications.
   d. Soap contains which type of surfactant? Explain their structure and properties.
   e. Write about the micelle, critical micelle concentration and Kraft temperature? What is reverse micelle? Write the applications of reverse micelle?

4. a. Write the postulates of Collision theory. **3+3+2+2=10**
   b. Find the relation and draw the plot between **r/[S]** *vs* **r**, from the Michalies Menten equation.
   c. According to T.S theory, the plot with slope equal to $-\Delta H^{\#}/R$ is?
   d. For a reaction, $A + B \leftrightarrow X^{\#}$, $E_a = 20.0$ KJ mol^{-1} at 300 K. The enthalpy change for the formation of the activated complex from the reactants in KJ mol^{-1} is?

5. a. Explain what are fast reactions? **2+3+3+ 2=10**
   b. For a reaction, the rate constant "k" at 27 °C was found to be k = 5.4 $\times 10^{11} e^{-50}$, the activation energy is?
   c. For an enzyme substrate reaction, the Michalies constant is 0.042 mol dm^{-3} S^{-1}. The rate of this reaction is 2.45×10^{-5} mol dm^{-3} S^{-1}. When the substrate concentration is 0.89 mol dm^{-3}. The maximum velocity is?
   d. The half-life of a first order reaction varies with temperature as?

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