REV-01
MSC/68/34/39

2023/01

SET A

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

[USE OMR SHEET FOR OBJECTIVE PART]

Duration : 1.30 hrs. **Full Marks : 35**

(Objective)

Time: 15 min. **Marks: 10**

Choose the correct answer from the following: ***1X10=10***

1. Which of the following is not a favourable condition for physical adsorption?
   a. High pressure
   b. Negative ΔH
   c. High temperature
   d. All of the above

2. The term 'sorption' stands for _____
   a. Absorption
   b. Adsorption
   c. Both absorption and adsorption
   d. Desorption

3. At the critical micelle concentration, the surfactant molecules
   a. Decompose
   b. Dissociate
   c. Associate
   d. Both B and C

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 of the following phenomenon occurs when a chalk stick is dipped in ink?
   (i) adsorption of coloured substance
   (ii) adsorption of solvent
   (iii) absorption and adsorption both of solvent
   (iv) absoprtion of solvent
   a. Only (i) correct
   b. Both (i) and (iv) are correct
   c. Only (iii) is correct
   d. Both (ii) and (iv) are correct

6. The value of activation energy is primarily determined by
   a. Temperature
   b. Effective Collision
   c. Concentration of reactants
   d. Chemical nature of reactants and products

7. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{-Ea/RT}$. Activation energy (Ea) of the reaction can be calculated by plotting

a. k vs. $\frac{1}{\log T}$
b. $\log k$ vs. $\frac{1}{T}$
c. k vs. T
d. $\log k$ vs. $\frac{1}{\log T}$

8. The statement which is true in respect of order of a reaction is

a. it is always a whole number
b. it is always a fraction
c. it may be zero, a whole number or a fraction
d. it can never be a fraction

9. For the chemical change A→B, it is found that the rate reaction doubles when the concentration is increased four times. The order in A for this reaction is

a. two
b. one
c. zero
d. half

10. What does the equation $V_0 = \frac{V_{max}[S]}{K_m + [S]}$ represent?

a. Lineweaver Burk equation
b. Miachelis Menten equation
c. Eadie-Hofstee plot equation
d. Hanes plot equation

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Descriptive

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

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

1. a. Explain the capillary action of liquid. **2+3=5**

   b. Consider the following Lindeman mechanism for the unimolecular decomposition of a molecule 'A'

   $$A + M \underset{k_r}{\overset{k_f}{\rightleftharpoons}} A^* + M$$

   $$A^* \xrightarrow{k_2} P$$

   Using the steady state approximation derive the rate law for the formation of the product.

2. a. What is micelle, critical micelle concentration and Kraft temperature? **3+2+3+2=10**

   b. What is reverse micelle? Explain with examples.

   c. Write the postulates of Langmuir Adsorption isotherm.

   d. Discuss briefly the BET theory of adsorption.

3. a. Why the adsorption process occurs? Explain. **2+2+1+2+3=10**

   b. Why do physisorption and chemisorption behave differently with rise in temperature?

   c. What are the limitations of this Freundlich adsorption isotherm?

   d. Explain the cleansing Action of Soaps.

   e. What is an anionic surfactants? Give some examples of anionic surfactant. Explain the applications area of this surfactant.

4. a. Give five points of difference between the Collision and activated theory. **5+3+2=10**

   b. $X \xrightarrow{k_1 = 2.05\ s^{-1}} Y \xrightarrow{k_2 = 0.1 s^{-1}} Z$

   What is the time (in second) required for Y to reach its maximum concentration, assuming only X is present at the time t=0. [log 2=0. 0.3010]

   c. What is primary and secondary salt effect?

5. a.Consider the reaction for the production of HBr from H_2 and Br_2 in the gas phase, for which the following mechanism has been proposed: **5+5=10**

$Br_2 \xrightarrow{k_1} 2Br$

$Br + H_2 \xrightarrow{k_2} HBr + H$

$H + Br_2 \xrightarrow{k_3} HBr + Br$

$HBr + H \xrightarrow{k_4} Br + H_2$

$2Br \xrightarrow{k_5} Br_2$

Use the steady state approximation for H and Br to show that the rate law is given by:

$$\frac{d[HBr]}{dt} = \frac{k[H_2][Br_2]^{1/2}]}{1 + k'[HBr]/[Br_2]}$$

And give the expressions for k and k' in terms of the rate constants of the mechanism.

b. Describe any two methods of determining rate law.

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