

CVM UNIVERSITY

M. Sc. (ORGANIC CHEMISTRY) SEMESTER-I EXAMINATION- 2021

Friday, 26th February – 2021

10:00 AM to 12:00 PM

PAPER CODE: 101330103 PAPER NAME: Topics in Physical Chemistry - I

Total Marks: 60

N.B.: (i) Attempt all questions.

(ii) Figures to the right indicate marks.

Que. 1 (A) Choose correct answer of the following questions. [08]

- Which of the following is an intensive property?
(A) Temperature (B) Surface tension
(C) Viscosity (D) All of these
- The ionic strength of a solution of molality C_i and valency of the ion Z_i is _____.
(A) $I = \frac{1}{2} C_i Z_i^2$ (B) $I = \frac{1}{2} \sum C_i Z_i^2$
(C) $I = \frac{1}{2} \sum Z_i^2$ (D) $I = \sum C_i Z_i^2$
- The rate of a chemical reaction tells us about _____.
(A) the reactants taking part in the reaction
(B) the products formed in the reaction
(C) how slow or fast the reaction is taking place
(D) none of the above
- A substance 'A' decomposes by a first-order reaction starting initially with $[A] = 2.00M$ and after 200min, $[A]$ becomes 0.15M. For this reaction $t_{1/2}$ is _____.
(A) 53.51 min (B) 43.11 min
(C) 37.12 min (D) 24.35 min
- An electrochemical cell is also called _____.
(A) battery cell
(B) chargeable cell
(C) Cell
(D) galvanic cell
- Exchange current density does not depend on _____.
(A) chemical composition of the electrode material
(B) surface roughness
(C) surface area of the electrode
(D) volume of the electrolyte
- What is the main result of adding surfactants into a liquid composed of two immiscible phases such as oil and water?
(A) Reduction in the interfacial tension between the phases
(B) Increase in the interfacial tension between the phases
(C) Catalysation of a chemical reaction between the phases
(D) Nothing happens

8. At CMC (critical micelle concentration) the surface molecules _____.
- (A) become bigger in size due to adsorption
 (B) associate
 (C) become smaller in size due to decomposition
 (D) dissociate

Que. 1 (B) Answer the following. (Fill in the blanks and True or False) [08]

1. If two properties (out of P,V,T) of a gas are known, the third can be evaluated. **True or False?**
2. Zeroth law of thermodynamics provides the basis for the concept of _____. (Temperature, Pressure, Volume).
3. The unit of first order rate constant is _____.
4. As temperature is increased, the rate of chemical reaction _____. (Decreases, Increases, Constant)
5. Electrolysis is the passage of electricity through a liquid or a solution accompanied by a _____ (physical/chemical) change.
6. One Faraday is equivalent to _____ Coulombs.
7. _____ surfactants are often sensitive to pH and will behave as anionic or cationic based on pH. (Zwitterionic, Nonionic, Cationic).
8. The hydrophilic moiety may be anionic, cationic, ampholytic, or non-ionic not depending on the type of charge(s) carried, if any. **True or False?**

Que. 2 Attempt any SIX from the following in short. [12]

1. Differentiate the ideal gas and real gas.
2. For oxygen "P" and "f" values at 0 °C are;

<i>P (atm)</i>	50	100	200	400
<i>f (atm)</i>	48	92.5	174	378

Calculate the ΔF for 1 mole of oxygen at 0 °C from 50 to 200 atm. under the ideal and non-ideal condition.

3. The rate constant of one reaction is $1 \times 10^{-4} \text{ min}^{-1}$ at 27 °C and $2 \times 10^{-4} \text{ min}^{-1}$ at 37 °C. Calculate the activation energy of this reaction.
4. Prove that for tri-molecular reaction the activation energy is negative.
5. Discuss the Bockris-Devanathan-Muller model for the EDL at the metal/solution interface.
6. Explain the ion-solvent interaction at electrified interface.
7. For glass capillary, mercury does not wet the glass surface, while water does wet the glass surface. Explain briefly.
8. What are the surface active agents? Briefly discuss the types of surfactant.

Que. 3 Define the term fugacity. Enlist the methods for determination of fugacity and derive the equation of state method for determination of fugacity. [08]

OR

Que. 3 Discuss the vapor pressure curve for non-ideal solution which exhibiting [08]

the positive and negative deviation along with their properties.

Que. 4 What is integrated rate law? Discuss the integrated rate law for first order and second order reaction along with their characteristics. [08]

OR

Que. 4 a) A reaction follows the first order reaction rate law. The rate constant of the reaction is $8.2 \times 10^{-4} \text{ min}^{-1}$ at 45°C . Calculate the time for; (i) the reaction to decrease the concentration of reactant from 0.02M to 0.008M, (ii) 75% reaction having the initial concentration is 10 M, (iii) Half reaction. [08]
b) The half-life for a first order reaction is 32 sec. What was the original concentration if after 2.0 minutes, the reactant concentration is 0.062 M.

Que. 5 What is overvoltage? Discuss the types of overvoltage and factors affecting on overvoltage. [08]

OR

Que. 5 Discuss the Tafel plot and derive the Tafel equations for cathodic and anodic polarization. [08]

Que. 6 What is Critical Micelles Concentration (CMC)? Explain various phases of CMC curve. Discuss the factors affecting to the critical micelles concentration. [08]

OR

Que. 6 What is an ionic liquid? Give two examples of ionic liquids with chemical structures. Discuss the properties and applications of ionic liquids. [08]
