

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 2133607****Date: 01-01-2015****Subject Name: Physical Chemistry****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1 (a)** Discuss and define; **07**
 a. Molar heat capacity at constant volume (C_v)
 b. Molar heat capacity at constant pressure (C_p)
 and prove that $C_p - C_v = R$.
- (b)** (i) Explain the term component. How many components are present in the following system; **04**
 a. $\text{Water} \leftrightarrow \text{Water} - \text{vapour}$
 b. $\text{KCl} + \text{Water} \leftrightarrow \text{KCl} - \text{Hydrate}$
 (ii) How many phases are present in each of following system; **03**
 a. A drop of water placed in a stoppered bottle
 b. A piece of molten ice placed in a beaker covered with a watch glass
 c. Mixture of N_2 , H_2 & O_2 gases.
- Q.2 (a)** What is reference electrode? Describe the construction and working model of Calomel electrode. **07**
- (b)** (i) Write a note on: Pseudo-Order reaction. **03**
 (ii) Distinguish between Molecularity & Order of reaction in details. **04**
- OR**
- (b)** Write a cell reaction and calculate EMF for the cell: **07**
 $\text{Zn} / \text{Zn}^{+2}_{(0.001\text{M})} // \text{Ag}^{+}_{(0.1\text{M})} / \text{Ag}$
 $E^\circ \text{Ag} / \text{Ag}^{+} = -0.80\text{V}$ & $E^\circ \text{Zn} / \text{Zn}^{+2} = +0.76\text{V}$.
- Q.3 (a)** Define two component systems. Discuss the salient features of the phase diagram of silver-lead system. **07**
- (b)** (i) The following data was obtained on the hydrolysis of methyl acetate at 25°C . in 0.35N HCl . **05**
- | | | | | |
|-------------|-------|-------|-------|----------|
| Time (sec.) | 0 | 4500 | 7140 | ∞ |
| Volume | 24.36 | 29.32 | 31.72 | 47.15 |
- Show that it is a first order reaction.
- (ii) Prove that time taken to change the concentration of a reactant to half of its initial value is independent of the initial concentration of the reactant for first order reaction. **02**
- OR**
- Q.3 (a)** Write a note on: Relation between EMF & Free energy. **07**
- (b)** (i) Distinguish between Reaction rate & Rate constant of a reaction. **02**
 (ii) A first order reaction is $1/5$ completed in 40 minutes; calculate the time required for 100% completion. **05**
- Q.4 (a)** (i) Define heat of combustion and heat of formation. **02**
 (ii) The heat of combustion of ethyl alcohol is -330Kcal . If the heat of formation of $\text{CO}_2(\text{g})$ & $\text{H}_2\text{O}(\text{l})$ be -94.3 Kcal & -68.5 Kcal respectively. Calculate the heat of formation of ethyl alcohol. **05**

- (b) (i) Define: 03
 a. Critical temperature
 b. Absolute Zero
 c. Specific heat.
 (ii) Explain Faraday's method for liquefaction of gases. 04
- OR**
- Q.4** (a) (i) Define enthalpy of a system. Calculate the change in enthalpy by showing that enthalpy is a function of state. 04
 (ii) For the reaction : 03

$$\text{H}_2(\text{g}) + 0.5\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}),$$
 The value of enthalpy change & free energy changes are -68.32 & -56.69 Kcal respectively. Calculate the value of free energy change at 25°C.
- (b) How and why real gases deviate from ideal behavior. Derive Vander Waal's equation for 'n' moles. 07
- Q.5** (a) Derive Young-Laplace & Kelvin equation for droplets. 07
 (b) What is catalysis? Discuss intermediate compound formation theory and adsorption theory. 07
- OR**
- Q.5** (a) Define surface tension. Describe drop formation method of determining surface tension of a liquid in details. 07
 (b) Give characteristic of enzyme catalysis. Discuss Michaelis & Menten's enzyme mechanism in detail to express the rate of reaction. Derived the required equation. 07
