

- (b) Calculate the equilibrium constant at 25°C for the reaction : 3



E° for the cell is 1.10 V.

SECTION - D

1. (a) Derive an expression for rate constant based on simple collision theory. 5
- (b) Calculate the pH of 0.1 M sodium acetate solution at 25°C. The ionization constant of acetic acid is 1.8×10^{-5} and K_w is 10^{-14} at 25°C. 3
2. (a) Describe in detail various experimental (any *three*) methods for studying the rate of a chemical reaction. 4
- (b) What are various types of electrodes used in acid base titration carried out potentiometrically. 4

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B. Sc. (Chemistry) (Hons.) 4th Semester Examination – May, 2019

PHYSICAL CHEMISTRY

Paper : CH(H)-402

Time : Three hours / [Maximum Marks : 40

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting *one* question from each Section. Question Number **1** is *compulsory*. All questions carry equal marks.

1. Compulsory Question : 1, 1, 1, 1, 1, 1, 1, 1

- (a) What are partial molar quantities ?
- (b) Why second law of thermodynamics is required ?
- (c) What is the criterion of spontaneity in terms of enthalpy change for a reversible process ?

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- (d) Define chemical potential.
- (e) What are the functions of salt bridge ?
- (f) What is the significance of electrochemical series ?
- (g) Explain Buffer action in terms of acidic buffer.
- (h) Describe the effect of temperature on reaction rate.

SECTION - A

2. (a) Derive an expression for the entropy change associated with the change in temperature and pressure of an ideal gas simultaneously. 5
- (b) For a heat engine having efficiency 50%; what is the ratio of temperatures (T_1 & T_2). 3
3. (a) Derive an expression showing the variation of Gibbs Free energy with Temperature, Pressure and Volume in a reversible process. 5
- (b) Calculate the change in free energy when the compression of 1 mole of CO_2 at 57°C from 5 atm to 50 atm. Assume that CO_2 behaves like an ideal gas. 3

(2)

SECTION - B

4. (a) Derive Gibb's Duhem equation.
- (b) The change in free energy for a reaction are to be -75.8 KJ at 25°C and -72.6 KJ at 30°C . Calculate the enthalpy change for the reaction.
5. (a) State third law of thermodynamics. Give applications.
- (b) Derive expressions for showing the variation of chemical potential with temperature and pressure.

SECTION - C

6. (a) Describe in detail various types of reversible electrodes.
- (b) How will you determine the solubility of sparingly soluble salt using EMF ?
7. (a) Devise a reversible cell in which overall reaction is :
- $$\text{Zn} + \text{Hg}_2\text{SO}_4 \longrightarrow \text{ZnSO}_4 + 2\text{Hg}$$
- Also write down the reaction taking place at the two electrodes and Nernst equation for calculating the EMF of the cell.

(3)

P. T. O.