University of Information Technology & Sciences (UITS)

Faculty of Science and Engineering

Department of Computer Science and Engineering

Program: B.Sc. in CSE

Term Final Examination, Spring-2023

Course Title: Chemistry

Course Code: CHEM 175

Marks: 50 **Time: 3 *(three)* Hours**

(Answer any five (05) out of following seven (07) questions. Assume necessary data/values if missing)

1. a) What is energy of activation (Ea)? Derive an equation showing the relationship between temperature and rate constant (k). **[05]**

   b) Discuss the isolation and differential methods to find the order of a reaction. **[05]**

2. a) Define heat of solution and heat of combustion with suitable examples. How can you determine the heat of combustion in a laboratory? **[04]**

   b) Derive mathematical equation showing the effect of temperature on the heat of reaction. Name the equation. **[03]**

   c) The heat of reaction of $N_2 + 3H_2 \rightarrow 2NH_3$ at 27^0C was found to be -21.976 kcal. What will be the heat of reaction at 50°C? The heat capacities Cp at 27°C for N_2, H_2 and NH_3 are 6.8, 6.77 and 8.86 $cal.mol^{-1}.deg^{-1}$ respectively **[03]**

3. a) What do you understand by Equilibrium and Equilibrium constant? Derive a relationship between Kp and Kc and explain with examples. **[04]**

   b) Show how the change of catalyst and temperature affect a gaseous reaction according to Le Chatelier principle. **[03]**

   c) The value of Kp for the reaction $2N_2O_5(g) \leftrightarrow 4NO_2(g) + O_2(g)$ is 1.9×10^3 atm^{-3} at 45^0C. Calculate the value of Kc at the same temperature. **[03]**

4. a) State and explain Lowry-Bronsted and Arrhenius concepts of acids and bases. Mention the salient features of the concepts with suitable examples. **[04]**

   b) What is buffer solution? Give the types and mode of operation of buffer solution. **[04]**

   c) Discuss the meaning of the term pH and Kw and show how they are inter-related. **[02]**

5. a) Derive the integrated rate equation for a first order reaction A→P and prove that the half-life for a first order reaction is independent of initial concentration. **[06]**

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b) A first order reaction is 40% complete at the end of 50 mins. What will be value of the rate constant (k)? In how many minutes will the reaction be 80% complete? [04]

6. a) Define and explain the terms Paramagnetism, Diamagnetism and Bond Order with suitable examples. [04]

b) Draw the molecular diagram of NO and CN and explain the bond order and magnetic properties of them. [06]

7. a) Explain why is Sulphuric acid stronger than acetic acid in aqueous medium. [03]

b) Define Rate and Order of a reaction. Mention the factors affecting reaction rate. [03]

c) For the reaction $2NO(g) + Cl_2(g) \leftrightarrow 2NOCl(g)$ at 25^0C, the values of partial pressures at equilibrium were found to be 1.2 atm; $5.0x10^{-2}$atm and $3x10^{-1}$ atm for NOCl; NO and Cl_2 respectively. Calculate the Kp for the reaction. [04]