University of Information Technology & Sciences (UITS)

Faculty of Science and Engineering

Department of CSE

Term Final Examination, Autumn-2023

Course Title: Chemistry

Course Code: CHEM- 175

Set:B

Marks: 50 **Time: 3 Hours**

Answer any five (05) out of the following six (06) questions. Assume necessary data/values if missing

1. (a) "Bronsted-Lowry concept is superior to Arrhenius concept" explain this statement with proper example. 5

   (b) If a solution has a pH of 5.50 at 25°C, calculate its $[OH^-]$. 5

2. (a) Derived Henderson-Hasselbalch equation for an acidic buffer system. 5

   (b) A chemist needs a buffered solution of propanoic acid, CH_3CH_2COOH, and its salt, CH_3CH_2COONa. Calculate the ratio [CH3CH2COOH]/[CH3CH2COONa] required to yield a pH of 4.30. Ka for propanoic acid is $1.3 \times 10-5$. 5

3. (a) Derive the rate equation for the second order rate equation. Show that: Half-life is independent of initial concentration for first order reaction. 5

   (b) A certain first order chemical reaction required 120 seconds for the concentration of the reactant to drop from 2.00 M to 1.00 M. Find the rate constant and the concentration of reactant after 80 seconds 5

4. (a) Discuss the effect of temperature and pressure on various gaseous equilibrium according to Le-Chatelier's principle, 5

$N_2(g) + 3H_2(g) \leftrightarrows 2NH_3(g)$ $\Delta H = -92KJ/mol$

(b) $2HI_{(g)} \longleftrightarrow H_{2(g)} + I_{2(g)}$ 5

4.00 mol HI was placed in a 5.00 L vessel at 458°C, the equilibrium mixture was found to contain 0.442 mol I_2. What is the value of K_c ? Calculate the molar concentrations, and put them into the equilibrium expression to find it's value.

5. (a) Why does sodium chloride solution conduct electricity not sugar solution? 5

An Olympic sized swimming pool contains 2,500,000 L of water. If 1 tsp of salt (NaCl) is dissolved in the pool, what is the concentration in ppm?

(b) Balance the reaction in acidic medium: $FeSO_4 + KMnO_4 + H_2SO_4 \longrightarrow ?$ 5

6. (a) A voltaic cell is formed from a piece of iron in a solution of $Fe(NO_3)_2$ and silver in a solution of $AgNO_3$. Which is the cathode, and which is the anode? Why? 5

(b) When a copper strip is dipped into a solution of zinc sulfate solution what would be happened? 5

Calculate the standard cell potential for the following reaction:

$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

Given: $E°(Zn^{2+}/Zn) = -0.76$ V and $E°(Cu/Cu^{2+}) = -0.34$ V