

B. Inst. & Elect. Engg. 1<sup>st</sup> Year 1<sup>st</sup> Semester EXAM 2019(Old)

Time :

SUBJECT: Chemistry-I

Full Marks : 100

Use a separate Answer-Script for each group

Question No.	Group A Answer <i>any five</i> questions	Marks
1	(a) Define molar conductance of an electrolytic solution? At 25 °C, the resistance of 0.01 N KCl in a conductivity cell is 145 Ω and that of 0.01N HCl is 50.4 Ω. The specific conductance of 0.01 N KCl at 25 °C is 0.00141 Ω <sup>-1</sup> cm <sup>-1</sup> . What is the molar conductance of 0.01 N HCl solution? (b) Define Kohlrausch's law of independent migration of ions with suitable justification. (c) At 300K, the specific conductances of pure water and the saturated solution of AgCl in water are 1.65×10 <sup>-4</sup> Sm <sup>-1</sup> and 3.44×10 <sup>-4</sup> Sm <sup>-1</sup> respectively. The molar ionic conductivities of the Ag <sup>+</sup> and Cl <sup>-</sup> ions at infinite dilution are 76.2×10 <sup>-4</sup> Sm <sup>2</sup> mol <sup>-1</sup> and 61.9×10 <sup>-4</sup> Sm <sup>2</sup> mol <sup>-1</sup> respectively. Calculate the solubility product of AgCl.	1+2= 3 3 4
2	(a) The hydrogen ions and hydroxyl ions show an abnormally high value of molar conductivity in solvents like water - Explain. (b) Describe the common ion effect with a suitable example. (c) Calculate the hydrolysis constant and the degree of hydrolysis of 0.03M aqueous solution of the salt, NH <sub>4</sub> Cl. (Given, K <sub>w</sub> =1.0×10 <sup>-14</sup> and K <sub>b</sub> (NH <sub>4</sub> OH)=1.85×10 <sup>-5</sup> at 298K).	4 3 3
3	(a) Describe the Asymmetric effect (Relaxation effect) and the Electrophoretic effect influencing the ionic motion in solution in presence of external electric field. (b) Show pictorially and explain how the conductance varies during conductometric titration of an aqueous solution of moderately weak acid, CH <sub>3</sub> COOH with a solution of NaOH added from a burette. (c) At 298K, the specific conductance of pure distilled water is 5.80×10 <sup>-6</sup> Sm <sup>-1</sup> and the density of water is 0.997 Kgdm <sup>-3</sup> . The molar ionic conductivities at infinite dilution for the H <sub>3</sub> O <sup>+</sup> and OH <sup>-</sup> ions are 349.8×10 <sup>-4</sup> Sm <sup>2</sup> mol <sup>-1</sup> and 198.0×10 <sup>-4</sup> Sm <sup>2</sup> mol <sup>-1</sup> respectively. Calculate the ionic product of water.	4 3 3
4	(a) Define buffer capacity of a buffer solution and derive the condition under which it has maximum value for a buffer solution. (b) In a titration of 100 mL of 0.1N acetic acid (pK <sub>a</sub> =4.74) with 0.2N sodium hydroxide (NaOH), calculate pH of the solution after addition of: (i) 49.9mL of NaOH; and (ii) 50.1mL of NaOH.	4 2x3=6
5	(a) Define EMF of a cell. Describe the basic principle of potentiometric measurement of the EMF of an electrochemical cell. (b) Derive an expression of pH for an aqueous solution of a salt of weak acid and weak base. (c) The resistance of 0.02mol.dm <sup>-3</sup> solution of acetic acid in a cell of cell-constant 0.202cm <sup>-1</sup> is estimated to be 840Ω. Find the degree of dissociation and dissociation constant of the acid. Given, the molar conductance at infinite dilution, Λ <sub>m</sub> <sup>0</sup> (CH <sub>3</sub> COOH) =387.5Smol <sup>-1</sup> m <sup>2</sup> .	1+3=4 3 3
6	(a) Define Entropy and comment on the Clausius inequality. (b) Joule-Thomson effect involves isoenthalpic change : justify or criticize. (c) Define efficiency of a Carnot engine and state the Carnot theorem.	3 4 3

Chemistry 2<sup>nd</sup> Part, (Organic Chemistry)

Group B : Full Marks: 50

All questions are of equal value. ( 5 X 10 = 50 )

- 1) Explain with suitable example what is Huckel's rule of aromaticity.  
Designate with reasoning which of the following is aromatic, anti-aromatic or nonaromatic.  
(i) Cyclobutadiene (ii) Cyclopropyl cation (iii) Cyclooctatetraene (iv) Cyclopentadienyl anion  
What products will be obtained when bromine water is added to aniline and phenol separately?
- 2) What is a Chemical Bond? Mention the different type of bonds which are found in Organic Chemistry. Describe how a sigma bond is formed. Explain why a pi bond is weaker than a sigma bond.  
Predict the product of the reaction,  $\text{CH}_3\text{CH}=\text{CH}_2 + \text{HBr} \longrightarrow ?$   
What will happen in presence of Hydrogen per oxide. State Markownikof's Rule and explain.
- 3) Explain with suitable example what is meant by a Chemical Reaction. Draw the energy profile diagram of Nitration of Benzene. Label the curve with structural formulae of each reaction intermediate.  
Explain why the rate of nitration of toluene is faster than that of benzene.
- 4) What is **SN2** Reaction? Explain with suitable example and mention its difference from **SN1** reaction with mechanism.  
Write the names and formulae of two physiologically active compounds and show how they can be synthesised.
- 5) What do you mean by the Mechanism of a chemical reaction?  
Write the mechanism of the following reaction.  
$$2\text{C}_6\text{H}_5-\text{CHO} \xrightarrow{\text{Hot aq. Ethanolic KOH}} \text{C}_6\text{H}_5-\text{COOK} + \text{C}_6\text{H}_5-\text{CH}_2\text{OH}$$
  
Give an example of a reaction intermediate. What are Substrate and Reagent? Try to explain with examples.
- 6) Describe one example where Carbanion is generated. Mention two rearrangement reactions involving electron deficient C-atom and electron deficient N-atom. Write the mechanism of those two reactions. Mention any special feature/s of those reactions.
- 7) Write short Notes on any five of the following:
  - a) Homolytic Fission
  - b) Carbocation
  - c) Hybridisation
  - d) Nucleophiles
  - e) Free Radical
  - f) Conjugative Effect
  - g) Bond Energy
  - h) Inductive Effect
  - i) Elimination Reaction