MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya
Tel: +254(0) 799 529 958, +254(0) 799 529 959, + 254 (0) 712 524 293,
Website: info@must.ac.ke Email: info@must.ac.ke

University Examinations 2024/2025

FOURTH YEAR FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE AND BACHELOR OF SCIENCES

SCH 3401: ELECTROCHEMISTRY

DATE: JANUARY 2025 **TIME: 2 HOURS**

INSTRUCTIONS: *Answer question **one** and any other **two** questions*

QUESTION ONE (30 MARKS)

a) Explain two applications of electrochemical series (4 marks)

b) State two differences between metallic and electrolytic conduction (2 marks)

c) The molar conductivity of 0.1M KCI at 298 k is 129 $\Omega^{-1}cm^2mol^{-l}$. The measured resistance in the conductivity cell was 28.44 Q. The resistance was 31.6 Q, when the same cell contained 0.85 M NaOH. Calculate the molar concentration of NaOH at that concentration (4 marks)

d) State the preferential discharge theory. (2 marks)

e) Define conductometric titrations (1 mark)

ii) State two advantages of conductometric titration (2 marks)

iii) Draw and explain conductometric titration of a mixture of a strong (HCl) and a weak acid (CH_3COOH) with a strong base (NaOH) (6 marks)

f) (i) Define battery (1 mark)

ii) Briefly, explain the classification of batteries giving example in each case (6 marks)

iii) Explain why does a dry cell become dead even if it has not been used for a long time (2 marks)

QUESTION TWO (20 MARKS)

a) Distinguish between voltammetry and coulometry electroanalytical techniques (2 marks)

b) (i) What is electrode potential? (1 mark)

ii) Consider a cell Ni/Ni^{2+} (0.01M) $\|Cu^{2+}$ (0.5M)/Cu. The standard reduction potential of Ni and Cu are -0.25 and 0.34 V, respectively. Calculate the EMF of the cell. (5 marks)

iii) List any two applications of Nernst equation. (2 marks)

c) The Resistance of a cell containing (i) .100 N potassium chloride solution and (ii) .100 N silver nitrate solution, was 307.62 and 362.65 ohms respectively at 25°C. The specific conductance of 0.100 N potassium chloride was 0.01286 ohm^{-1} cm^{-1} at 25°C. Calculate

i) the cell constant, and (2 marks)

ii) the equivalent conductance of a 0.100 N solution of silver nitrate

d) Discuss how the following factors affecting electrode potential (3 marks)

i) Nature of electrode (3 marks)

ii) Concentration of ionic solution (2 marks)

QUESTION THREE (20 MARKS)

a) (i) Define the term polarization (1 mark)

ii) Discuss overpotential and discuss the factors that causes overpotential (7 marks)

b) The equivalent conductance values of 0.0005M (at 25°C) NaCl, NH_4Cl, NaOH and NH_4OH are 124.50, 149.1, 245.6 and 9.38 mho cm^2 equiv-1 respectively. Calculate the dissociation constant of NH_4OH.

c) (i) What are buffer solutions? (1 mark)

ii) Explain the mechanism of buffer action of acidic (6 marks)

d) A decinormal solution of NaCl has specific conductivity equal to 0.0092. If ionic conductance of Na^+ and Cl^- ions at the same temperature are 43.0 and 65.0 ohm respectively, calculate the degree of dissociation of NaCl solution. (5 marks)

QUESTION FOUR (20 MARKS)

a) State three functions of the salt bridge (3 marks)

b) Distinguish between physical and chemical sensors (3 marks)

c) (i) State Kohlrausch's law of independent migration of ions (2 marks)

ii) The equivalent conductivity of I-ICI of concentrations 0.1, 0.01 and 0.001 N solutions are 391.3, 412.0 and 421.4 S cm^2 equiv-1 respectively. Calculate Kohlrausch constant and $\lambda\infty$. (HCl.) (4 marks)

d) A solution of a salt of a metal of atomic weight 112 was electrolysed for 150 minutes with a current of 0.15 amperes. The weight of metal deposited was 0.783 mg. find the equivalent weight and valency of the metal in the salt (4 marks)

e) The resistance of 0.2 N solution of an electrolyte was found to be 250 ohms at 25^{o}C. Calculate the equivalent conductivity if the cell constant is 0.75 cm^{-1} (4 marks)