



# **MAASAI MARA UNIVERSITY**

## **REGULAR UNIVERSITY EXAMINATIONS 2018/2019 ACADEMIC YEAR FOURTH YEAR SECOND SEMESTER**

**SCHOOL OF SCIENCE  
BACHELOR OF SCIENCE CHEMISTRY AND  
BACHELOR OF EDUCATION**

**COURSE CODE: CHE 419**

**COURSE TITLE: ELECTROCHEMISTRY**

**DATE: 26<sup>TH</sup> APRIL, 2019**

**TIME: 0830 - 1030 HRS**

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### **INSTRUCTIONS TO CANDIDATES**

1. Answer Question **ONE** and any other **TWO** questions
2. No writing on the Question paper

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***FOUR YEAR, SECOND SEMESTER***

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### Question One (30 marks)

Q1. (a) Define the following electrochemical terms and show how they are related to each other.

- i. Conductance
- ii. Conductivity
- iii. Molar conductivity
- iv. Transport numbers
- v. Standard electrode potentials [10 marks]

(b) (i) Discuss quantitatively the way in which conductivity and molar conductivity changes with increase in dilution for strong intermediate and weak electrolyte. [6 marks]

(ii) Describe any three factors that affect conductance. [6 marks]

(iii) Name four types of electrodes and describe each [8 marks]

### Question Two (20 marks)

Q2. (a) In a moving boundary experiment a current of 1.6 mA was applied to a 0.02 M NaCl solution at 25°C using CdCl<sub>2</sub> as the following solution. It was found out that the boundary had moved 10 cm in 3453 seconds in a tube of cross sectional area 0.1115 cm<sup>2</sup>. The conductivity of this solution chloride solution at 25°C is 2.313 x 10<sup>-3</sup> cm<sup>2</sup>mol<sup>-1</sup>. Calculate

(i) The mobility of Na<sup>+</sup> [5 marks]

(ii) The transport number of Na<sup>+</sup> [5 marks]

(b) In a Hittorf cell experiment, a solution of silver nitrate was electrolyzed between silver electrodes. The amount of silver nitrate in the anode compartment was 0.227 g before electrolysis and 0.2819 g after electrolysis. During electrolysis, 0.0194 g of copper were deposited on the cathode of copper coulometer in series with the Hittorf cell.

(i) Calculate the transport number of Ag<sup>+</sup> and NO<sup>3-</sup> ions. [8marks]

(ii) Which of the ions (between Ag<sup>+</sup> and NO<sup>3-</sup>) carry majority of the current. [2 mark]

### Question Three (20 marks)

Q3. (a) Given the metals silver and copper and solutions of silver nitrate and copper nitrate at 25°C.

(i) Construct a cell which will operate spontaneously [1 mark]

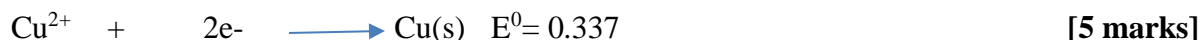
(ii) Write the equation for the reaction [2 marks]

(iii) Calculate the equilibrium constant for the reaction [4 marks]

(b) Explain how a fourth year chemistry student would be able to determine the transference number of  $H^+$  in aqueous solution of HCl using boundary method. Include diagrams and equations where necessary. [8 marks]

(c) Calculate the  $E_{cell}$  for the following:

Zn/ZnSO<sub>4</sub> (1.0M)// CuSO<sub>4</sub>(1.0M)/Cu given that



#### Question Four (20 marks)

(a) The specific conductivity of a saturated solution of barium sulphate is  $4.41 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$  and that of water used is  $1.6 \times 10^{-6} \text{ ohm}^{-1}\text{cm}^{-1}$ . If the limiting molar conductance at infinite dilution of  $Ba^{2+}$  and  $SO_4^{2-}$  ions are 134 and  $122.8 \text{ ohm}^{-1}\text{cm}^2\text{mol}^{-1}$ , respectively. Calculate

i. The solubility of BaSO<sub>4</sub> in  $\text{mol dm}^{-3}$  [5 marks]

ii. The solubility product of BaSO<sub>4</sub> [5 marks]

(b) Define a coulometer and name any four types of coulometers [5 marks]

(c) With the aid of a diagram describe a galvanic cell [5 marks]