



KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2009/2010
INSTITUTE OF OPEN LEARNING
EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE AND
BACHELOR OF EDUCATION
SCH 401: ELECTROCHEMISTRY

DATE: THURSDAY, 18TH FEBRUARY 2010 **TIME: 11.00 A.M. - 1.00 P.M.**

INSTRUCTIONS: Attempt ALL Questions

F = 96500 C mol⁻¹
R = 8.314 JK⁻¹ mol⁻¹
Molar mass of Li = 6.94 g
Molar mass of Cl = 35.5 g

- Q1. (a) Distinguish between the terms Resistance and Resistivity, showing the relationship between them. (6 marks)
- (b) The following table gives conductance data at infinite dilution at 25°C.

Electrolyte	λ ohm ⁻¹ cm ² mol ⁻¹
Sodium butyrate (Na Bu)	82.6
Hydrochloric Acid (HCl)	426.2
Sodium Chloride (NaCl)	126.5

Calculate the molar conductance of Butyric Acid (HBu) at infinite dilution. (6 marks)

- Q2. The variation of conductance \wedge with concentration C, at 25°C for a particular electrolyte is given in the table below:

C x 10 ⁻³	0.5	1	5	10	20	50	100
\wedge Ω^{-1} cm ² mol ⁻¹	147.8	146.9	143.5	141.3	138.4	133.4	129.0

- (i) By plotting a graph, determine the molar conductance at infinite dilution \wedge of the solution. (10 marks)
- (ii) Calculate the apparent degree of dissociation α for the same solution at a concentration of 6 x 10⁻³ mol dm⁻³. (4 marks)
- (iii) Classify the above electrolyte. (2 marks)

- Q3. (a) With the help of a diagram explain how you would use the moving boundary method to determine the transport number of a particular ion. (10 marks)
- (b) Using the Hittorf method, calculate the transport number of Ag^+ and NO_3^- ions if a solution of silver Nitrate was electrolysed between silver electrodes and the amount of silver Nitrate in the Anode compartment was 0.2278 g before electrolysis and 0.2819 g after electrolysis. During electrolysis 0.0194 g of copper was deposited on the cathode of copper coulometer in series with the Hittorf cell. (4 marks)
- (c) Which ions will carry majority of the current? (2 marks)

- Q4. The following data refer to a moving boundary experiment with 0.1 mol dm^{-3} Potassium chloride using $0.065 \text{ mol dm}^{-3}$ Lithium chloride as indicator solution.

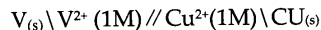
Current 5.893 mA

Cross – section of Tube	11.42 mm ²
Boundary velocity	0.0263 mm s ⁻¹
Temperature	25°C

Given the conductivity of 0.1 mol dm^{-3} Potassium chloride of 25°C is $1.29 \text{ ohm}^{-1} \text{ m}^{-1}$. Calculate the transport number and the mobility of the Potassium ions. (6 marks)

- Q5. (a) For a given voltaic cell, the

$$E^{\circ} \text{ cell} = 1.47 \text{ V}$$



Determine the value of $E^{\circ} (\text{V}_{(s)} \mid \text{V}^{2+})$ and calculate the equilibrium constant K eq. (4 marks)

- (b) The e.m.f. of the cell $\text{Zn} \mid \text{ZnCl}_2 (0.05 \text{ mol dm}^{-3}) / \text{AgCl}_{(s)}, \text{Ag}$ is 1.015V at 298 K silver being positive, while the temperature coefficient of its e.m.f. is $0.000492 \text{ V K}^{-1}$.

(i) Write down the equation for the reaction occurring when the cell is allowed to discharge.

(ii) Calculate the changes in:

- (a) Free energy
 (b) Heat content (enthalpy)
 (c) Entropy attending this reaction (at 298 K) (6 marks)

- (c) Give the electrochemistry of Nickel cadmium cell by:-
- (i) Showing the reactions at the cathode, Anode and overall reaction of the cell.
 - (ii) The electrolytes used
 - (iii) The current collector
 - (iv) Give the value of ΔG and reversible cell potential.
 - (v) Two Applications. (10 marks)
