KENYATTA UNIVERSITY
UNIVERSITY EXAMINATIONS 2008/2009
FIRST SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 401: ELECTROCHEMISTRY

DATE: Tuesday 25th November 2008 **TIME:** 11.00am-1.00pm

INSTRUCTIONS:
Attempt ALL questions
F = 96500 c mol^{-1}
R = 8.314 jk-1 mol^{-1}
0^oC = 273 k
Molar mass of **Li = 6.94g Cu = 52g**
Cl = 35.5g S = 32g
Sn = 119.g 0 = 16g

Question 1:

(a) Define the following electrochemical terms:

(i) Conductance

(ii) Conductivity

(iii) Conductivity ratio [6 marks]

(b) Distinguish between

(i) Transference number and ionic mobility.

(ii) Standard cell e.m.f (E^o cell) and standard electrode potential.

(iii) Electrophoretic and asymmetric effects. [12 marks]

[Total = 18 marks]

Question 2

The variation of conductance Λ with concentration, c, at 25^oC for a particular electrolyte is given in the table below.

C x 10^{-3} mol dm^{-3}	0.5	1	5	10
Λ ohm^{-1} cm^2 mol^{-1}	422.75	421.36	415.80	412.00

(a) Graphically determine the molar conductance of infinite dilution $\Lambda\alpha$ of the solution above. [2 marks]

(b) Calculate the apparent degree of dissociation α for the same solution at a concentration of 2.5 x 10^{-3} mol dm^{-3}. [6 marks]

(c) From the graph, classify the above electrolyte and by the use of the Deby-Hunckel theory explain what happens to the electrolyte as it expresses change in dilution. [2 marks]

[Total = 10 marks]

Question 3

(a) With the help of a diagram, state and explain the essential features of an experimental method, based on the wheat-stone bridge for measuring the conductance of a solution. [8 marks]

(b) The resistance of a conductivity cell containing 0.1 mol dm^{-3} solution of Lithium Nitrate at 18^oC was found to be 192 ohms. The resistance of the same cell containing 0.02 mol dm^{-3} pottasium chloride solution (also at 18^oC) was 620 ohms. If the conductivity of 0.02 mold m^{-3} potassium chloride solution at 18^oC is 0.242 ohm^{-1} m^{-1}. Calculate:

(i) The cell constant

(ii) The conductivity of lithium solution

(iii) And molar conductivity of lithium nitrate solution and

(iv) The apparent degree of dissociation of o.1 mol dm^{-3} Lithium Nitrate solution.

Ionic conductivities for L i^+ ion is 0.00334 ohm^{-1} m^2 mol^{-1} and for NO_3^{-1} ions is 0.00618 ohm^{-1} m^2 mol^{-1}. [4 marks]

Question 4

(a) With the help of a diagram briefly explain how laboratory apparatus can be used in determining the transference number using the Hittorfs method. [6 marks]

(b) A solution of Li Cl was electrolyzed in a Hittorf cell. After a current of 0.79A had been passed for 2 hours, the mass of Li Cl in the Anode compartment had decreased by 0.793 g.

(i) Calculate the transport number of L i^+ and Cl^- ions. [2 marks]

(ii) If Λ_o (Li Cl) is 115.0 ohm^{-1} cm^2 mol^{-1} what are the molar ionic conductivities and the ionic mobilities of Li^+ and Cl^- ions. [4 marks]

Question 5

(a) (i) Write the cell reaction for the voltaic cell

T1 $_{(s)}$ 1T $|_{(aq)}{}^{2+}$ nS $|$ $|^{2+}{}_{(aq)}$ nS $|_{(s)}$. [3 marks]

(ii) Find how long it will take to deposit 2g of tin in the above cell when a current at 0.240A flows through it. [4 marks]

(b) During electrolysis of 1M $ZnSO_4$ in 1M H^+ ions using zinc electrodes, what would you expect to be released at the cathode electrode. [2 marks]

(c) The electrochemistry of the zinc carbon cell. Show the reaction at the cathode, anode and overall reaction, the electrolyte used, current collector and two applications. The values for ΔG and reversible cell potential. [9 marks]

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