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 25^0C.

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 25^0C for a particular electrolyte is given in the table below:

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

(i) By ploting a graph, determine the molas conductance at infinite dilution $\wedge$ α 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 mol dm^{-3} Lithium chloride as indicator solution.

Current 5.893 m A

Cross – section of Tube	11.42 mm^2
Boundary velocity	0.0263 mm s^{-1}
Temperature	25^0C

Given the conductivity of 0.1 mol dm^{-3} Potassium chloride of 25^0C is 1.29 ohm^{-1} m^{-1}. Calculate the transport number and the mobility of the Potassium ions. (6 marks)

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

E^0 cell = 1.47 V

$V_{(s)} \backslash V^{2+}$ (1M) // Cu^{2+}(1M) $\backslash CU_{(s)}$

Determine the value of E^0 ($V_{(s)} \backslash V^{2+}$) and calculate the equilibrium constant K eq. (4 marks)

(b) The e.m.f. of the cell Zn | $ZnCl_2$ (0.05 mol dm^{-3}) / $AgCl_{(s)}$, Ag is 1.015V at 298 K silver being positive, while the temperature coefficient of its e.m.f. is -0.000492 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)

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