KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

OPEN, DISTANCE AND E-LEARNING

EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE AND BACHELOR OF EDUCATION

SCH 401: ELECTROCHEMISTRY

DATE: WEDNESDAY 6TH JULY 2011 TIME: 11.00 A.M. – 1.00 P.M.

INSTRUCTIONS: Attempt ALL Questions.

F= 96500 c mol $^{-1}$

R= 8.314 JK-1 mol $^{-1}$

0 ^{0}C= 273 K

Molar Mass of Li =6.94g ,Cu =52g,Cl =35.5g,S=119g,O =16g

Q1. a) Define the following eletcrochemical terms:

i. Electrode potential

ii. Electrochemical Half reactions

iii. Electrochemical equivalent of a substance

iv. Transference number (4marks)

b. Distinguish between

i. Ionic mobility and Ionic velocity

ii. Chemical cells and concentrations cells (give examples)

iii. Electrophoretic and Asymmetric effects (6 marks)

Q2. The variation of conductance Λ with concentration, C at 25^0C for a particular electrolyte is given in the table below;

Cx 10^{-3} dm^{-3}	0.5	1	5	10
Λ Ω^{-1} cm^2 mol^{-1}	422.75	421.36	415.80	412.00

i. Graphically determine the molar conductance at infinite dilution , $\Lambda\alpha$ for the solution above. (8marks)

ii. Calculate the apparent degree of dissociation α for the same solution at a concentration of $3x10^{-3}$ mol dm^{-3} (2marks)

iii. From your graph, classify the above electrolyte and by the use of the Deby-Huckel theory explain what is happens to the electrolyte as its dilution increases. (2marks)

Q3 . (a) By 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. (8marks).

(b). The resistance of a conductivity cell containing 0.1 mol dm^{-3} solution of Lithium Nitrate at 18^oC was found to be 1922 ohms. The resistance of the same cell containing 0.02 mol dm^{-3} Potassium Chloride solution (also at 18^0C) was 620 ohms.

If the conductivity of 0.02mol dm^{-3} Potassium Chloride solution at 18^0C is 0.242 ohm^{-1} m^{-1}.Calculate

i. The cell constant

ii. The conductivity of Lithium Nitrate solution

iii. And molar conductivity of Lithium Nitrate solution and

iv. The apparent degree of dissociation of 0.1 mol dm^{-3} Lithium Nitrate solution. Ionic conductivities for Li^+ ion is 0.00334 $\Lambda^{-1}m^2$ mol^{-1} and for NO^{-1}_3 ions is 0.00618 $\Omega^{-1}m^2$ mol^{-1} (4 Marks)

Q4. a) With the help of a diagram briefly explain how laboratory apparatus are used in determining the transference number using the Hittorfs method. (6Marks)

b). A solution of LiCl was electrolyzed in a Hittorf cell. After a current of 0.79A had been passed for 2 hrs the mass of LiCl in the anode compartment had decreased by 0.793g.

i.) Calculate the transport numbers of Li^+ and Cl^-ions. (2marks)

ii) If Λo (LiCl) is 115.0 Ω^{-1} cm^2 mol^{-1}, what are the molar ionic conductivities and the ionic mobilities of Li^+ and Cl^- ions. (4 marks)

Q5. (a) The standard Hydrogen electrode (SHE) is used as a reference electrode in measuring half reactions. With the help of a diagram explain :

i. The structure and main composition of the SHE electrode. (4 marks)

ii. The molecular depiction of the process that occur at the SHE when it is taken as the cathode of a cell. (4 marks)

iii. The molecular depiction of the process that occur at the SHE when it is taken to be Anode of a cell. (4marks)

(b) Give the electrochemistry of the Lead Acid Battery by:

(i) Write the expected reactions at the cathode Anode and overall reaction. (3marks)

(ii) The electrolyte used (2marks)

(iii) Current collectors (2marks)

(iv) The values at ΔG and revisable potential (1mark)

(v) One application (1mark)

END.