THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

P.O. Box 62157
00200 Nairobi - KENYA
Telephone: 891601-6
Fax: 254-20-891084
E-mail:academics@cuea.edu

MAIN EXAMINATION

MAY – JULY 2015 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

CHEM 309: ELECTROCHEMISTRY

SCHOOL FOCUSED PROGRAMME

Date: JULY 2015	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. Useful Information

$O^0c = 273\ k$ $^{RT}/_{F}$ $\ln x = 0.0591 \log_{10} x$ at 298k

1 F = 96500 c mol^{-1} R = 8.314J MOL^{-1} K^{-1}

a) A conductivity cell has a resistance of 845.5 Ω when filled with a 0.015MKcl solution and a resistance of 876 Ω when filled eith a 0.005M $CaCl_2$ solution both at 25^0c. Given that the specific conductivity of Kcl solution at 25^0c is 0.14114SE $\Omega^{-1}M^{-1}$ calculate:

i The cell constant. **(3 marks)**

ii The specific conductance of $CaCl_2$ solution. **(3 marks)**

b) i By means of a Hirtoff's cell describe how the transport numbers of H^+ and Cl^- may be determined. **(8 marks)**

ii Perform the analysis of the anode and cathode compartments of the above cell when 1 F of electricity is passed through the electrolyte. **(6 marks)**

c) Calculate the equilibrium constant for the reaction $2Fe^{3+} + 3I \rightleftharpoons 2Fe^{2+} + I_3$ at 298k.

Given $2Fe^{3+} + 2e^- \rightleftharpoons 2Fe^{2+}$ $E^0 = 0.771$

$I^-_3 + 2e^- \rightleftharpoons 3I^-$ $E^0 = 0.536$

d) Calculate the ionic strength of a 0.15m solution of $Ca_3(po_4)_2$ **(4 marks)**

Q2. a) Consider the cell $Ag^-/Ag_{(a+)1}NO_3 // Ag_{(a+)2} / Ag$ Suppose the activities of the silver ions in the right and left hand electrodes are $(a+)_2$ and $(a+)_1$ and the corresponding potentials being E_2 and E_1 respectively. Derive an equation for the emf of the cell. **(12 marks)**

b) Describe how the emf of an electrochemical cell is measured. **(8 marks)**

Q3. a) The resistance R of an electrical conductor is proportional to its length (l) and inversely proportional to its cross section area (A) Show that k=J/E and define all the terms. **(8 marks)**

b) For the cell $pb/pbCl_{2(s)}/kcl/Agcl/Ag$ The emf and its temperature coefficients at 25^0c are 0.49002v and a $0.000186vk^{-1}$ respectively.

i Write down the cell reaction. **(3 marks)**

ii Calculate ΔG, ΔH and ΔS for the reaction at 25^0c. **(9 marks)**

Q4. a) Briefly discuss the arrhenius theory of ionization and by using HAC show how the results were expressed in the ostwald dilution law. **(10 marks)**

b) i Describe how iodine coulometer works. **(6 marks)**

ii Differentiate between electronic and electrolytic conductors. **(4 marks)**

Q5. a) Explain the origin of electrochemistry. **(6 marks)**

b) Using the De-bye Huckel limiting equation calculate the mean activity coefficient and the mean activity of a 0.015m solution of $ZnCl_{2(aq)}$ ($A = 0.51mol^{-1/2}$ for aqueous solution. **(6 marks)**

c) Using appropriate plots describe how the end points may be determined using conductivity measurement for a tiltration between

i Hcl and NaoH

ii CH_3 COOH and NaoH. **(8 marks)**

END