KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2016/2017 ACADEMIC YEAR

SECOND YEAR FIRST SEMESTER
SUPPLENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 440

COURSE TITLE: ELECTROCHEMISTRY

DURATION: 2 HOURS

DATE: 29TH SEPTEMBER 2017 TIME: 11:30AM – 1:30PM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **3** printed pages. Please Turn Over

1)(a) Given the following half cell equation

Pt, $H_2/H^+//Cu^{2+}(1M)/Cu$ $E^o = 0.34V$

Pt, $H2/H^+(1M)//Zn^{2+}(1M)$ $E^o = -0.76V$

Write the overall equation and comment on the spontaneity of the reaction .....(4)

(b)(i) What are electrochemical processes? ..... (3)

(ii) Using a diagram, explain the working principle of a galvanic cell of zinc and copper cells. Show the flow of electrons as well as the salt bridge..... (10)

(iii) A galvanic cell consists of Mg electrode in a 1.0M $Mg(NO_3)_2$ solution and a Ag electrode in a 1.0M $AgNO_3$ solution. Calculate the standard e.m.f of this cell at 25^0C and write the cell reactions. (Standard reduction potential of Ag and Mg are 0.8V and -2.37V respectively)..... (5)

(iv) What are standard state conditions..... (2)

(c) Device a cell in which the overall reaction is

$Zn + Hg_2SO_{4(s)}$ $ZnSO_4 + 2Hg_{(l)}$

And write the separate electrode reactions..... (2)

(d) From your knowledge of electrochemistry, deduce whether 1M copper sulphate solution can be stored in a Nickel vessel and given that $E^o(Ni^{2+}, Ni)$ and $E^o(Cu^{2+}, Cu)$ are – 0.25V and +0.34V respectively..... (2)

(e) The e.m.f of the concentration cell.

$Ag/AgCl_{(s)}/KCl$ (0.05M)/Kx(Hg)/$KCl(0.5M)/AgCl_{(s)}/Ag$ is 0.107V. For the corresponding cell with transference, the e.m.f is 0.053V. What is the transport number of the Cl-..... (2)

QUESTION 2

(a) A column of diameter 1cm and length 50cm is filled with 0.05mol/l NaOH solution. The resistance of the column is found to be 5.55×10^3 ohm. Calculate its resistivity, conductivity, molar conductivity and equivalent conductivity.....(7)

(b) (i)Define the term corrosion..... (1)

(ii) State two ways of preventing corrosion..... (2)

(c) With the help of sketches, explain the following conductometric titration curves

(i) Titration of CH_3COOH against NaOH..... (5)

(ii) Titration of HCl against NH_4OH ..... (5

QUESTION 3

(a) In a Hirtoff experiment, a student electrolysed aqueous silver nitrate ($AgNO_3$) solution using silver electrodes. The amount of $AgNO_3$ in the anode

compartmentbefore electrolysis was 0.288g and the amount after electrolysis was 0.282g. it was found that 0.019g of copper was deposited on the copper coulometer connected in s series with Hirtoff cell. Calculate the transport number of Ag^+ and hence that of NO^{3-}

..... (6)

(b) Explain the five factors that affect conductance of electrolysis..... (10)

(c) Explain two applications of conductance measurements..... (4)

QUESTION 4

Write the cell produced by a combination of $Zn/ZnSO_4$ solution (m = 1) and a decinormal calomel electrode (E_{el} = + 0.334) and show the electrode reaction and the overall reaction.

(i) Calculate the e.m.f of the cell given that for $ZnSO_4$ at m = 1, γ_{+-} = 0.045 and E^o ($Zn/ZnSO_4$) = - 0.76V.....6mks

(ii) Find the free energy change of the overall cell reaction to show that the cell as written can spontaneously deliver current.....2mks

(iii) Some of 0.02M CH_3COOH titrated with 0.1M NaOH.
Calculate the PH of the solution for the following cases

(a) When no NaOH is added.....3Mks

(b) When 4ml of NaOHis added.....3Mks

(c) When 10ml NaOH is added.....3Mks

(d) When 16ml NaOH is added.....3Mks