COURSE CODE: CHM 321

COURSE TITLE: ELECTROCHEMISTRY

COURSE UNITS: 2

TIME ALLOWED: 1½ HOURS

INSTRUCTIONS: ANSWER ANY THREE (3) QUESTIONS

1(a) Calculate the cell emf of the Daniell cell $Zn/ZnSO_4$; $CuSO_4/cu$, given that;

$Zn \longrightarrow Zn^{2+} + 2e,\quad E^\circ = -0.76V$ and $Cu^{2+} + 2e \longrightarrow Cu,\ E^\circ = +0.34V$ *(4 Marks)*

(b) Describe the standard Hydrogen Electrode (SHE).   *(4 Marks)*

(c) Give an example of how a concentration cell without liquid junction can be represented. *(4Mks)*

(d) State the steps involved in the potentiometric determination of cell potential.   *(4 Marks)*

(e) Show how you would represent the cell obtained by coupling Zinc and Silver half-cells

and state the direction of flow of electrons externally. Given that;

$Zn^{2+}/Zn,\ E^\circ = -0.76V$ and $Ag^+/Ag.\ E^\circ = +0.80V$ *(4 Marks)*
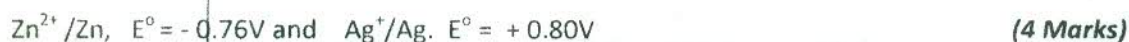
2. (a) What is overvoltage?   *(2 Marks)*

(b) State five (5) factors which affect hydrogen overvoltage.   *(5 Marks)*

(c) Describe briefly the overvoltage exhibited in the cathodic deposition of metals.   *(10 Marks)*

(d) Calculate the resistance (R) of a solution whose electrolytic conductivity (K) is 5×10^{-4}

and the cell constant is 5×10^3.   *(3 Marks)*

3. (a) What is Transport Number?   *(2 Marks)*

(b) Describe the moving boundary method for the determination of transport number. *(10 Marks)*

(c) In a moving boundary experiment with $0.1mol/dm^3$ KCl, the boundary moved 6.60cm

in 65minutes when the current was 5.21×10^3 amperes. The cross-sectional area of

the tube was $0.23cm^2$. Calculate the transport number of K^+ ions. (F = 96500C).   *(8 Marks)*

4. (a) Explain the following terms in relation to Debye-Huckel Theory.

        (i)   Electrophoretic effect   (ii)   Asymmetric effect   **(6 Marks)**

(b) Calculate E^o for the dissociation of AgBr at 27^oC, given that the solubility product, Ksp

    $= 1.25 \times 10^{-2}$.   (R = 8.314J/K/mol; F = 96500C).   **(6 Marks)**

(c) Explain why a voltmeter is unsuitable for the measurement of the e.m.f of a cell.   **(4 Marks)**

(d) State two types of polarization in chemical cells.   **(4 Marks)**