DEPARTMENT OF CHEMISTRY

FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA

SECOND SEMESTER EXAMINATION 2011/2012 SESSION

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;

$Zn \longrightarrow Zn^{2+} + 2e$, $E^o = -0.76V$ and $Cu^{2+} + 2e \longrightarrow Cu$, $E^o = +0.34V$ **(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, $E^o = -0.76V$ and Ag^+/Ag. $E^o = +0.80V$ **(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}

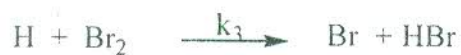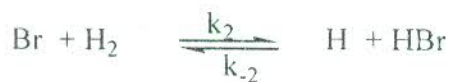and the cell constant is 5×10^3.   **(3 Marks)**

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)**

3a). What is a complex reaction?

b). The $H_2 + Br_2 \longrightarrow HBr$ reaction takes place in the following steps

$$Br_2 \xrightarrow{k_1} 2Br$$

$$Br + H_2 \underset{k_{-2}}{\overset{k_2}{\rightleftharpoons}} H + HBr$$

$$H + Br_2 \xrightarrow{k_3} Br + HBr$$

$$Br + Br \xrightarrow{k_4} Br_2$$

Derive the kinetic equation for the formation of HBr

4a) Define the term fast reaction

b). Discuss any two of the following methods of monitoring fast reactions

i). Stopped flow method. ii). Continues flow method and iii). Flash photolysis.

2013.

300 LEVEL

CHEMISTRY