NATIONAL OPEN UNIVERSITY OF NIGERIA PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI – ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2022_2 EXAMINATION QUESTIONS

COURSE CODE: CHM409
COURSE TITLE: ELECTROCHEMISTRY
COURSE UNIT: 2
INSTRUCTION: Answer question 1 and any other two questions
Time: 2 hours

QUESTION 1

1. (a)(i) Write the general form (defining all terms) of the Levich equation. What are the limitations of the stated Levich equation in electrochemistry **(10 marks)**
   (ii)Highlight any **four (4)** factors that the magnitude and sign of the potential in a metal – solution interphase depends on. **(4 marks)**
   (b)(i) Differentiate between sensitivity and selectivity of a transducer **(4 marks)**
   (ii)Mention any **four (4)** factors that are responsible for a complex distribution of charge within the interphase region of an electrochemical system **(4 marks)**
   (c) Explain what happens during the polarization of a single electrode when the equilibrium is disturbed (i) by pumping current to the system (ii) by taking current away from the system. **(8 marks)**

QUESTION 2

2. (a)What is meant by exchange current density? **(3 marks)**
   (b)Why is the study of charge transfer at the interphase in an electrochemical system significant? **(3 marks)**
   (c) Give a schematic plot for the variation of current density with over potential in accordance with the Butler Volmer equation. Explain the effect of cathodic transfer coefficient values (α_C) on the current density at **(i)** α_C = 0.25 **(ii)** α_C = 0.50 **(iii)** α_C = 0.75 **(14 marks)**

QUESTION 3

3. (a) Define the term "potential at the point of zero charge". **(4 marks)**
   (b) Sketch the variation in the electric potential (ϕ) with distance from the electrode according to Helmholtz double layer model **(5 marks)**
   (c) Differentiate between polarizable and non-polarizable electrodes **(8 marks)**
   (d) Give one major application of Randles circuit in electrochemistry (**3 marks)**

QUESTION 4

4. (a) Give the mathematical expression of the Fick's second law of diffusion and define all the terms **(5 marks)**

(b) List any **two (2)** type of polarization that can take place in an electrochemical cell and explain what normally causes them **(6 marks)**

(c) Give a Schematic diagram of the apparatus for the determination of polarization curves of a metal in a solution using a potentiostat. (**9 marks)**

QUESTION 5

5. (a) What is the function of transducer in an electrochemical instrument **(3 marks).**

(b) A 5 x 10^{-4} M solution of $BaCl_2$ in 0.1 M $(CH_3)_4NCl$ was found to give the half – wave potential of 1.94 V versus SCE and the average diffusion current of 4.0 micro amperes. The dropping rate was 24 drops per minute; the mass of 20 drops collected was 0.0750 g. calculate the diffusion coefficient of Ba^{2+} ion. **(14 marks)**

(c) What is a Randles circuit? **(3 marks)**