



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCES**  
**JULY 2017 EXAMINATION QUESTIONS**

**CHM409: ELECTROCHEMISTRY CHEMISTRY**

**CREDIT UNIT: 2 CREDIT UNIT**

**TIME: 2 HOURS**

**INSTRUCTION: ANSWER QUESTION ONE & ANY OTHER THREE QUESTIONS.**

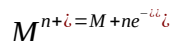
**QUESTION ONE**

- 1(a) Highlight the different processes that can create a difference in potential in an electrochemical system. (4 marks)
- (b) List the three major electrochemical interphases that you know and explain the order expected for diffusion of ions or other elementary particles in each of them. (5 marks)
- (c) What are the factors that are responsible for a complex distribution of charge within the interphase region of an electrochemical system. (3 marks)
- (d) In every electrochemical system, it is required that there should be an anode and cathode. If a piece of iron metal is immersed in a solution of HCl, do you expect to have the anode and the cathode in that system. Give reason for your answer. (2 marks)
- (e) Given an electrochemical cell, identify the three major zones that exist between an electrode and electrolyte. Where do Faradic and none Faradic transfer occur? Hence, explain why the concentration of ions in each of the zone is expected to differ. (5 marks)
- (f) Highlight the process of oxidation and reduction in electrochemical cell. (4 marks)
- (g) What is the major electrode in Polarography experiment. (2 marks)

## QUESTION TWO

2(a) Differentiate between polarizable and non polarizable interphases. (5 marks)

(b) Consider the following chemical reaction and answer the questions that follows it,



- (i) What will happened to the electrode potential if current is pumped or withdrawn from the electrode system?. Sketch suitable graphs to support your answer. (6 marks)
- (ii) What is the meaning of exchange current density? (4 marks)

## QUESTION THREE

3(a) What is the relationship between electrode potential and overpotential? (3 marks)

(b) Differentiate between the two types of polarization that you know and provide suitable

equation to show how they are related.(5 marks)

(c) If the equilibrium potential difference generated in a polarization experiment is 12 mV. When

current is pumped into the cell, the electrode potential shifted to 6 mV but when current is

pumped out of the cell, the potential shifted to 24 mV. Calculate the cathodic and anodic

overpotential of the call. (7 marks)

## QUESTION FOUR

4(a) Define the term, ion transport. (2 marks)

(b)i Write the mathematical expression that relates conductance to length and cross sectional area. (2 marks)

ii. Define all the terms in the equation stated in (4bi). (2½ marks)

iii. Hence calculate the conductivity of a cell whose length is 10 cm, cross sectional area is 20 cm<sup>2</sup> and the conductance is 50 S/cm.(3 marks)

- (c)i. List the three major factors that affect the conductivity of ions. (1½ marks )
- ii. Hence show that the mobility of ion can be expressed as  $k = F z_i C_i u_i$ . (4 marks)

### QUESTION FIVE

- 5 (a) Draw a block diagram of a polarization circuit and identified the major electrodes that are used in circuit. (5 marks)
- (b) What is the factor that determines the type of signal processor that is needed in an electrochemical instrument? (2 mark)
- (c) Define the terms, sensitivity and selectivity with respect to electrochemical instrument. (4 marks)
- (d) Define the term, transducer and explain why the pH electrode is a transducer. (4 marks)