



**NATIONAL OPEN UNIVERSITY OF NIGERIA PLOT 91, CADASTRAL ZONE, NNAMDI
AZIKIWE EXPRESSWAY, JABI – ABUJA
FACULTY OF SCIENCES, DEPARTMENT OF CHEMISTRY
2025_2 EXAMINATIONS**

COURSE CODE: CHM 409

COURSE TITLE: ELECTROCHEMISTRY

COURSE UNIT: 2

INSTRUCTION: Answer question 1 and any other two questions

Time: 2 hours

- 1 (a)(i) Write the general form of the Levich equation, defining all terms (5 marks) (ii) Discuss the limitations of the stated Levich equation in electrochemistry (2 marks)
1. (b) Define the term 'over voltage'. Mention any three (3) important application of this phenomenon (6 marks)
1. (c) Using the concept of pumping current to the system and taking current away from the system, describe what happens during the polarization of a single electrode when the equilibrium is disturbed (8 marks)
1. (d) Draw a diagram to show typical nature of a polarogram and explain the significant of half wave potential in polarography (7 marks)
1. (e) What is the condition required for an electrochemical reaction to be spontaneous? (2 marks)
- 2 (a) What is meant by exchange current density? (3 marks)
2. (b) Why is the study of charge transfer at the interphase in an electrochemical system significant? (3 marks)
2. (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) $\alpha_c = 0.25$ (ii) $\alpha_c = 0.50$ (iii) $\alpha_c = 0.75$ (14 marks)
- 3 (a)(i) Describe the three (3) major aspect of mass transport in electrochemistry? (9 marks)
(ii) Write a general equation to show how these three aspects are related to mass transport. (5 marks)
3. (b) Discuss what each of the three (3) major aspect of mass transport listed in (3ai) above depends on. (6 marks)
4. (a) Give the mathematical expression of the Fick's second law of diffusion, defining all the terms (5 marks)
4. (b) List any two (2) type of polarization that can take place in an electrochemical cell and explain what normally causes them (6 marks)
4. (c) Calculate the equilibrium constant and free energy change of the cell reaction given below,
 $Cu_{(s)} + Ag_{(aq)}^+ \rightarrow Cu_{(aq)}^{2+} + Ag_{(s)}$, if at 298 K, $E_{cell}^0 = 0.46 V$ (6 marks)
4. (d) Explain what is meant by 'potential at zero charge' according to IUPAC (3 marks)
5. (a) Explain the following (i) Determination of solubility by conductance measurements (5 marks) (ii) Conductivity titrations (4 marks)
5. (b) Describe the following: (i) Polarizable interface (4 marks) (ii) Non-polarizable interface (4 marks)
5. (c) Why is the study of charge transfer at the interphase in an electrochemical system significant? (3 marks)