



**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 413

COURSE TITLE: ANALYTICAL CHEMISTRY II

COURSE UNIT: 2

TIME: 2 HRS

INSTRUCTION: Answer question one (1) and any other two questions

- 1a. (i) What is the meaning of the following error: Gross Errors, Random Errors and Systematic Errors. **(6 marks)**
(ii) State four ways that can be used to minimize systematic error in an experiment **(4 mark)**
- b. (i) What is the least square method concerning application in linear regression hence state the primary objective of the method **(3 mark)**
(ii) Outline three steps associated with the least square method in linear regression **(3 marks)**
- c. (i) State four key benefits of using linear regression analysis in data analysis and modeling. **(4 mark)**
(ii) Define electrical resistance and conductance and explain their relationship according to Ohm's law. **(6 mark)**
- d. State the Kohlrausch law of independent migration of ions and its applications. **(4 mark)**
(Overall total = 30 marks)
- 2a. What is the significance of standard deviation in analytical experiments, and how does it reflect the precision and variability of the measurements?. **(4 mark)**
- b. With appropriate equation, define the term variance and state the relationship between variance and standard deviation **(4 mark)**
- c. (i) Why is it necessary to make repeated measurements in analytical experiments? **(1 mark)**
(ii) Mention two criteria used to compare repeated experimental results? **(1 mark)**
(iii) What is the range in the context of experimental results? **(1 mark)**
(iv) What is a more useful measure of spread than the range, and why? **(1 mark)**
- d. Explain the process of Thin Layer Chromatography (TLC), its principle of separation, and its applications. **(8 marks)**
(Overall total = 20 marks)
- 3a. What is Pearson's correlation coefficient, and what are the key assumptions required for its appropriate use in statistical analysis? **(6 marks)**
- b. State three limitations of Pearson's correlation coefficient when analyzing data, Also state three methods can be used to address these limitations? **(6 marks).**
- c. (i) Why do supporting electrolytes minimize solution resistance in electrochemical measurements? **(1 mark)**
(ii) How do supporting electrolytes maintain a constant ionic environment during electrochemical reactions? **(1 mark)**

- (iii) What role do supporting electrolytes play in suppressing electrolyte migration in electrochemical experiments? (1 mark)
- (iv) How do supporting electrolytes improve signal quality in electrochemical measurements? (1 mark)
- d. State four potential issues in voltammetric experiments when supporting electrolytes are not used? (4 marks)
- (Overall = 20 marks)**
- 4a. What is the primary function of a potentiometer in electroanalytical chemistry and what is the principle behind its operation? **(3 marks)**
- b. What are the key components of an electrode and their functions? **(7 marks)**
- c. (i) Describe the construction and function of a glass electrode used for measuring pH. **(4 marks)**
- (ii) How can the presence of silver ions interfere with the measurement of chloride, bromide, and iodide ions? **(3 marks)**
- d. (i) Who is considered the founder of calorimetry and what is the basic concept of this science? (2 marks)
- (ii) What is the fundamental principle of calorimetry? **(1 marks)**
- (Overall total = 20 marks)**
- 5a. (i) What is the concept of multicollinearity in multiple regression analysis, and what are its effects? **(3 marks)**
- (ii) Mention two methods that can be used to detect multicollinearity in multiple regression analysis **(2 marks)**
- b. What does the Kohlrausch law of independent migration of ions state, and how is the limiting equivalent conductivity of an electrolyte mathematically expressed? (4 marks)
- c. What is precipitation in a chemical reaction, and how is it related to the concept of supersaturation? (5 marks)
- d. How are precipitates formed in a chemical reaction, and what are the processes involved in producing large crystals and purifying the precipitate? (6 marks)
- (Overall total = 20 marks)**