



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE
EXPRESS WAY,
JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2024_2 EXAMINATION

COURSE CODE: CHM413
COURSE TITLE: ANALYTICAL CHEMISTRY II
COURSE UNIT: 2
TIME: 2 HOURS
INSTRUCTION: Answer question one and any other two questions.

QUESTION ONE

- 1(ai) Define the following terms:
(i) Standard deviation (ii) Outliers (iii) Type I error (iv) Confidence limit
(6 marks)
- 1b. In a new method for determining selenourea in water, the following values were obtained for tap water samples spiked with 50ngml^{-1} of selenourea: 50.4, 50.7, 40.1, 49.1, 49.0, 51.1ngml^{-1} . Is there any evidence of systematic error?
(6 marks)
- 1c. What is adsorptive stripping voltammetry?
(3marks)
- 1d. With the aid of a diagram, explain the following types of voltammetry (i) linear sweep voltammetry (ii) cyclic voltammetry
(6 marks)
- 1e. What is anodic stripping voltammetry?
(3marks)
- 1f. In a comparison of two methods for the determination of chromium in ryegrass, the following results ($\text{mgkg}^{-1}\text{Cr}$) were obtained:
Method 1: mean=1.48; standard deviation 0.28
Method 2: mean=2.33; standard deviation 0.31
Given that five determinations were made for each method. Do these two methods give results having means that differ significantly?
(6 marks)

Values of t for confidence intervals

Degrees of freedom	Values of t for confidence interval of				
	80%	90%	95%	99%	99.9%
1	3.08	6.31	12.7	63.7	637
2	1.89	2.92	4.30	9.92	31.6
3	1.64	2.35	3.18	5.84	12.9
4	1.53	2.13	2.78	4.60	8.60
5	1.48	2.02	2.57	4.03	6.86
6	1.44	1.94	2.45	3.71	5.96
7	1.42	1.90	2.36	3.50	5.40
8	1.40	1.86	2.31	3.36	5.04
9	1.38	1.83	2.26	3.25	4.78
10	1.37	1.81	2.23	3.17	4.59

QUESTION TWO

2(a) Discuss briefly the following:

(i) Distillation (ii) Solvent Extraction (iii) Ion Exchange (iv) Electrochemical deposition
(8 marks)

2(b) Highlight four different types of potentiometric titrations (4marks)

2(c) List the two commonly used instrument for making potential measurement. (2 marks)

2d. Explain three differences between Gas chromatography and column chromatography
(6 marks)

QUESTION THREE

3ai. Explain squared correlation coefficient (2 marks)

3aii Calculate equivalence point potential if 0.02 M $\text{Fe}(\text{CN})_6^{4-}$ is titrated with 0.1 M Ce^{4+} .
(6 marks)

(c) What is equivalence point potential when 0.1 M I_2 solution is titrated with 0.1 M solution of $\text{S}_2\text{O}_3^{2-}$. $E^{\circ}_{\text{I}_2/\text{I}^-} = 0.535\text{V}$, $E^{\circ}_{\text{S}_2\text{O}_8^{2-}/\text{S}_2\text{O}_3^{2-}} = 0.08\text{V}$
(10 marks)

3d. Define regression analysis in statistics. (2 marks)

QUESTION FOUR

- 4(a) Explain the following
(i) Glass Membrane Electrode (ii) Solid state membrane (iii) pH Meter (6marks)
- 4(b) Explain the Determination of the degree of ionization (α) of weak electrolyte with the equation. (7 marks)
- 4c. Explain Liquid-Membrane Electrodes (4 marks)
- 4d. Give three examples of liquid-membranes and their respective test ions (3 marks)

QUESTION FIVE

- 5a. Explain the following terms (i) calorimeter (ii) insulator (iii) conductors (6 Marks)
- 5bi. Define the following basic Chromatography Terms
i. analyte ii. bonded phase iii. Preparative chromatography iv. eluotropic series (4 marks)
- 5bii. Differentiate between the following pairs of terms used in chromatography. (6 marks)
- i Chromatogram and chromatograph
- ii. Eluate and Eluent
- iii. Mobile phase and stationary phase
- 5(c). List any four uses of affinity chromatography (4 marks).