

CHE 112



Chromatographic method.



ALUPE UNIVERSITY COLLEGE

Bastion of Knowledge...

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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR
OF EDUCATION (SCIENCE)
SCHOOL: EDUCATION AND SOCIAL
SCIENCES

COURSE CODE: CHE 112

COURSE TITLE: INTRODUCTION TO ANALYTICAL
CHEMISTRY

DATE: 14th December, 2017 TIME: 2.00pm-5.00pm

INSTRUCTION TO CANDIDATES: SEE INSIDE

THIS PAPER CONSISTS OF 22 PRINTED PAGES

For examiner's Use Only

Table with 3 columns: Question, I.E, E.E. Rows include CAT, EXAM, and TOTAL.

PLEASE TURN OVER

Insert the numbers of the questions you have answered in the order done

Grid for recording question numbers answered.

Student Admission No.....Exam Card No.....Signature.....

**INSTRUCTIONS TO CANDIDATES**

1. Write your **Admission Number**, **Exam Card Number** and **Sign** in the spaces provided at the bottom of each page of the Examination Booklet. **DO NOT** write your name anywhere in this booklet.
2. Write on both sides of the pages.
3. All rough work must be done in the Answer sheets and crossed through.
4. If supplementary pages are used, they must be fastened all together at the end of this Booklet. Supplementary pages should be used only after all the leaves in the booklet have been exhausted.
5. It is a serious examination offence to cheat or to have unauthorized materials including **MOBILE PHONES** (whether on or off) in the examination venue.
6. In no circumstances must Answer Booklet used or unused, be removed from the examination room by a candidate.
7. The Booklet is for **Examination use only** in a designated examination room. Unauthorized possession of the Answer sheets by a student or any other person constitutes an examination irregularity calling for stiff disciplinary action.
8. Do not pluck any page from this Booklet. Any extra/unused answer sheets should be returned to the **Examination Office**.
9. Candidates who come to examination room 30 minutes late will not be allowed to sit for the exam.
10. Candidates will not be allowed to leave the exam room once the exam commences.
11. Candidates are advised that importance is attached by examiners to accuracy and clarity of expression.
12. Committing any form of irregularity is prohibited and shall attract severe disciplinary action in accordance with Alupe University College Examination Regulations.

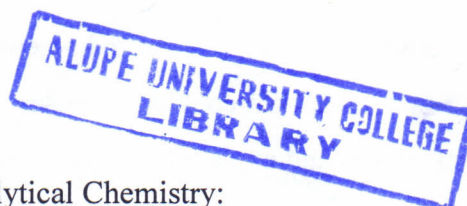
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**INSTRUCTION TO CANDIDATES**

Answer **ALL** questions from section A and any **THREE** from section B.

Duration of the examination: 3 hours

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**SECTION A (24 MARKS)****QUESTION ONE**

- a) Define the following terms as used in Analytical Chemistry:
- (i.) Precision (1 mk)
  - (ii.) Accuracy (1 mk)
  - (iii.) Relative error (1 mk)
  - (iv.) Primary Standard (1 mk)
  - (v.) Qualitative and quantitative analysis (1 mk)
- b) Replicate water samples were analysed for water hardness with the following results: 102.2 ppm, 102.8 ppm, 103.1 ppm and 102.3 ppm. Calculate:
- i. The mean (2 mks)
  - ii. Standard deviation (3 mks)
- c) Briefly explain the student t-test and state its significance in analysis of data? (2 mks)

**QUESTION TWO**

- a) Outline six factors that must be considered when selecting a method to be used for a chemical analysis? (3 mks)
- b) Calculate the absolute and relative error in percent and in parts per thousand in the following: measured value: 45.20 ml, Accepted value: 45.31 ml (5 mks)
- c) Differentiate between masking and interference (2 mks)
- d) What is a representative sample? (1 mk)
- e) What is significance testing? (1 mk)

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**SECTION B****QUESTION THREE**

- a) Differentiate between a homogeneous and heterogeneous sample (2 mks)
- b) Highlight four factors that are considered in sample storage. (4 mks)
- c) Define, give examples and explain how systematic and random errors can be tackled (5 mks)
- d) Briefly explain the principle of chromatography? (1 mk)

**QUESTION FOUR**

- a) You are developing a new colorimetric procedure for determining the glucose content of blood serum. You have chosen the standard Folin-Wu procedure with which to compare your results. From the following two sets of replicate analyses on the same sample, determine whether the variance of your method differs significantly from that of the standard method. (5 mks)

<i>Your Method (mg/dL)</i>	<i>Folin-Wu Method (mg/dL)</i>
127	130
125	128
123	131
130	129
131	127
126	125
129	

- b) With relevant examples, define the following terms:
- i) Gravimetric analysis (1 mk)
- ii) Oxidation and reduction (1 mk)
- iii) Stoichiometry (1 mk)

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- iv) Ligand (1 mk)  
v) Molarity (1 mk)  
c) How many grams of NaOH will be needed to prepare 250 ml of 0.1 M solution? (2 mks)

**QUESTION FIVE**

- a) Discuss any four causes of impurities in precipitates (4 mks)  
b) Dichromate ion ( $\text{Cr}_2\text{O}_7^{2-}$ ) oxidizes  $\text{Fe}^{2+}$  to  $\text{Fe}^{3+}$  in acidic conditions and gets to chromium ion ( $\text{Cr}^{3+}$ ). Write a balanced redox equation for this reaction. (4 mks)  
c) Differentiate between gas chromatography (GC) and liquid chromatography (LC) (2 mks)  
d) With relevant examples, differentiate between mobile phase and stationary phase. (2 mks)

**QUESTION SIX**

- a) What is a mole of a substance (1 mk)  
b) Differentiate between qualitative and quantitative analysis (1 mk)  
c) Define the following terms:  
    (i.)  $R_f$  value (1 mk)  
    (ii.) Thin layer chromatography (1 mk)  
    (iii.) Crystallization (1 mk)  
    (iv.) Ion exchange chromatography (1 mk)  
    (v.) Column chromatography (1 mk)  
d) Outline the main principles Ion exchange and size exclusion Chromatography (5 mks)

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**QUESTION SEVEN**

a) As a lab assistant, you are asked to make 1.5L of 0.25 M HNO<sub>3</sub> by diluting concentrated HNO<sub>3</sub> 16.0 M.

- (i.) What volume of the conc acid is required? (4 mks)
- (ii.) What volume of water should be used in dilution? (3 mks)

b) Approximately 31.6 grams of NaOH are dissolved in water and diluted to 200 ml.

Calculate the molarity (5 mks)

Values of F at the 95% Confidence Level

	$v_1 = 2$	3	4	5	6	7	8	9	10	15	20	30
$v_2 = 2$	19.0	19.2	19.2	19.3	19.3	19.4	19.4	19.4	19.4	19.4	19.4	19.5
3	9.55	9.28	9.12	9.01	8.94	8.89	8.85	8.81	8.79	8.70	8.66	8.62
4	6.94	6.59	6.39	6.26	6.16	6.09	6.04	6.00	5.96	5.86	5.80	5.75
5	5.79	5.41	5.19	5.05	4.95	4.88	4.82	4.77	4.74	4.62	4.56	4.50
6	5.14	4.76	4.53	4.39	4.28	4.21	4.15	4.10	4.06	3.94	3.87	3.81
7	4.74	4.35	4.12	3.97	3.87	3.79	3.73	3.68	3.64	3.51	3.44	3.38
8	4.46	4.07	3.84	3.69	3.58	3.50	3.44	3.39	3.35	3.22	3.15	3.08
9	4.26	3.86	3.63	3.48	3.37	3.29	3.23	3.18	3.14	3.01	2.94	2.86
10	4.10	3.71	3.48	3.33	3.22	3.14	3.07	3.02	2.98	2.85	2.77	2.70
15	3.68	3.29	3.06	2.90	2.79	2.71	2.64	2.59	2.54	2.40	2.33	2.25
20	3.49	3.10	2.87	2.71	2.60	2.51	2.45	2.39	2.35	2.20	2.12	2.04
30	3.32	2.92	2.69	2.53	2.42	2.33	2.27	2.21	2.16	2.01	1.93	1.84

process of isolating and weighing an element.  
 Precipitation method  
 Extraction method  
 Electroanalytical method  
 Extraction method

Student's T-test - is a test used for small samples. Its purpose is to compare the mean from a sample with some standard value. It is also used to test the difference ~~into~~ the mean of two sets of data.

gravimetric It is the process of isolating and weighing an element