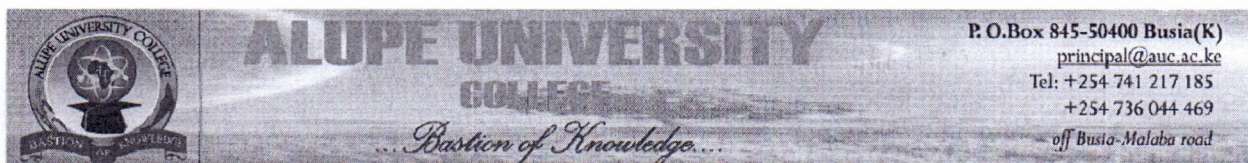


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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

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**

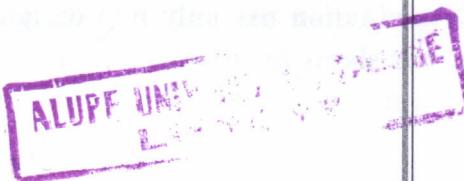
DATE: 14th December, 2017 TIME: 2.00pm-5.00pm

INSTRUCTION TO CANDIDATES: SEE INSIDE

THIS PAPER CONSISTS OF 22 PRINTED PAGES

For examiner's Use Only

| Question | I.E | E.E |
|--------------|-----|-----|
| | | |
| CAT | | |
| EXAM | | |
| TOTAL | | |



PLEASE TURN OVER

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

| | | | | | | | | | | | | | | | | | | | | |
|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|
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Student Admission No.....Exam Card No.....Signature.....

INSTRUCTION TO CANDIDATES

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

Duration of the examination: 3 hours

=====

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 Fe^{2+} to Fe^{3+} in acidic conditions and gets to chromium ion (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_3 by diluting concentrated HNO_3 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 |