



ALUPE UNIVERSITY
COLLEGE

Bastion of Knowledge...

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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FIRST YEAR FIRST SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF
EDUCATION SCIENCE

COURSE CODE: CHE 112

COURSE TITLE: INTRODUCTION TO
ANALYTICAL CHEMISTRY

DATE: 27TH JANUARY, 2022

TIME: 1400 – 1700 HRS

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF PRINTED PAGES 3

PLEASE TURN OVER

REGULAR – MAIN EXAM

CHE 112: INTRODUCTION TO ANALYTICAL CHEMISTRY

STREAM: BED (Scie)

DURATION: 3 Hours

INSTRUCTIONS TO CANDIDATES

- i. *Answer ALL questions.*
- ii. *Diagrams may be used whenever they serve to illustrate the answer.*
- iii. *Do not write on the question paper.*

Question One

- a. Explain the meaning of the following terms
 - i. Qualitative analysis (1 marks)
 - ii. Quantitative analysis (1 marks)
- b. List the various steps in a typical quantitative analysis (4 marks)
- c. Explain the following with respect to liquid chromatography
 - i) Partition chromatography (1 marks)
 - ii) Adsorption chromatography (1 marks)
 - iii) Ion-exchange chromatography (1 marks)
 - iv) Size-exclusion chromatography (1 marks)
- d. Explain the following terms; (2 marks)
 - i) Precision and accuracy
 - ii) Standard deviation and variance

Question Two

- a. Describe the classification of quantitative analysis methods into various categories based on the nature of the measurement (8 marks).
- b. Describe the preparation of 2.000 L OF 0.0500 M AgNO_3 (169.87 g/mol) from the primary standard grade solid (4 marks)

Question Three

- a. Describe a Case Study Illustrating the Use of Analytical Chemistry to Solve a Problem in Toxicology (10 marks)
- b. A standard 0.0100 M solution of Na ion is required to calibrate an ion selective electrode method to determine sodium. Describe how 500 mL of this solution can be prepared from primary standard Na_2CO_3 (105.99 g/mol) (2 marks)

Question Four

- a. Describe three categories of separation methods alongside the principle behind each separation method (12 marks)

Question Five

- a. What are systematic errors (1 marks)
- b. Describe the various methods that are based on mass measurements (8 marks).
- c. The calcium in a 200.0 mL sample of a natural water was determined by precipitating the cation as CaC_2O_4 . The precipitate was filtered, washed, and ignited in a crucible with an empty mass of 26.6002 g. The mass of the crucible plus CaO (56.077 g/mol) was 26.7134 g. Calculate the concentration of Ca (40.078 g/mol) in water in units of grams per 100 mL of the water (3 marks)

Question Six

- a. List several Properties of ideal Precipitates (2 marks)
- b. Describe the mechanism of precipitate formation (3 marks)
- c. A bottle of metal hydrate $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ is mixed with an unknown amount of KCl. In order to find the purity of the $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$, 9.51 g of the metal hydrate mixture is heated to remove water from the sample. After heating, the sample has a reduced mass of 9.14 g.
 - i) calculate change in sample mass (1 mark)
 - ii) Calculate the moles of evaporated water (1 mark)
 - iii) calculate moles of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ (1 mark)
 - iv) calculate mass of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ in grams (1 mark)
 - v) calculate the mass percent of $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ in the original sample (1 mark)
