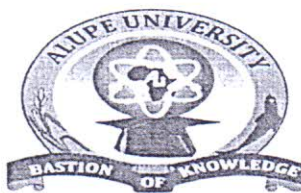


CHE 112



ALUPE UNIVERSITY

OFFICE OF THE DEPUTY VICE CHANCELLOR

ACADEMICS, RESEARCH AND STUDENTS AFFAIRS

---

**UNIVERSITY EXAMINATIONS**

**2022/2023 ACADEMIC YEAR**

**FIRST YEAR FIRST SEMESTER REGULAR MAIN  
EXAMINATION**

**FOR THE DEGREE OF BACHELOR OF  
EDUCATION SCIENCE**

**COURSE CODE: CHE 112**

**COURSE TITLE: INTRODUCTION TO ANALYTICAL CHEMISTRY**

**DATE: 21.12.2022**

**TIME: 9 am-12pm**

---

**INSTRUCTION TO CANDIDATES**

- SEE INSIDE

**THIS PAPER CONSISTS OF 4 PRINTED PAGES**

**PLEASE TURN OVER**

REGULAR – MAIN EXAM

## CHE 112: INTRODUCTION TO ANALYTICAL CHEMISTRY

STREAM: BED (Scie)

DURATION: 3 Hours

INSTRUCTIONS TO CANDIDATES*Answer all questions***Question One**

- a) Explain the meaning of the following terms
- Qualitative analysis (2 Marks)
  - Quantitative analysis (2 Marks)
- b) Describe the classification of quantitative analysis methods into various categories based on the nature of the measurement (8 Marks)

**Question Two**

- a) List the various steps in a typical quantitative analysis (4 Marks)
- b) Describe the preparation of 2.000 L OF 0.0500 M  $\text{AgNO}_3$  (169.87 g/mol) from the primary standard grade solid (4 Marks)
- c) 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  $\text{Na}_2\text{CO}_3$  (105.99 g/mol) (2 Marks)
- d) Describe the mechanism of precipitate formation (2 Marks)

**Question Three**

- a) What is sampling? (1 Marks)
- b) What are the goals of an analytical separation? (3 Marks)
- c) Explain the following with respect to liquid chromatography;
- Partition chromatography (1 Marks)
  - Adsorption chromatography (1 Marks)
  - Ion-exchange chromatography (1 Marks)
  - Size-exclusion chromatography (1 Marks)
- d) What does the work of an analytical chemist entail? (2 Marks)
- e) Explain the importance of Beer Lambert's law (2 Marks)

**Question Four**

- a) A  $7.25 \times 10^{-5}$  M solution of potassium permanganate has a transmittance of 44.1% when measured in a 2.10 cm cell at a wavelength of 525 nm.  
Calculate;
- the absorbance of this solution (2 Marks)
  - the molar absorptivity of  $\text{KMnO}_4$  (2 Marks)
- b) Calculate;
- the wavenumber of a beam of infrared radiation with a wavelength of  $5.00 \mu\text{m}$  (2 Marks)
  - Calculate the energy in joules of one photon of radiation with the above wavelength (2 Marks)
- c) Describe the categories of separation methods alongside the principle behind each separation method (4 Marks)

**Question Five**

- a) Describe a Case Study Illustrating the Use of Analytical Chemistry to Solve a Problem in Toxicology (10 Marks)
- b) The calcium in a 200.0-mL sample of a natural water was determined by precipitating the cation as  $\text{CaC}_2\text{O}_4$ . The precipitate was filtered, washed, and ignited in a crucible with an empty mass of 26.6002 g. The mass of the crucible plus  $\text{CaO}$  (56.077 g/mol) was 26.7134 g. Calculate the concentration of  $\text{Ca}$  (40.078 g/mol) in water in units of grams per 100 mL of the water (2 Marks)

**Question Six**

- a) List several properties of ideal precipitates (2 Marks)
- b) A bottle of metal hydrate  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  is mixed with an unknown amount of  $\text{KCl}$ . In order to find the purity of the  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ , we heat 9.51g of the metal hydrate mixture to remove water from the sample. After heating, the sample has a reduced mass of 9.14g.
- calculate change in sample mass (1 Mark)
  - Calculate the moles of evaporated water (1 Mark)
  - calculate moles of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  (1 Mark)
  - calculate mass of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  in grams (1 Mark)
  - calculate the mass percent of  $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$  in the original sample (1 Mark)

c) Describe the various methods that are based on mass measurements

(3 Marks)

\*\*\*\*\*