



# TECHNICAL UNIVERSITY OF MOMBASA

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FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

**BSFQA15S YR2 SII**

**ACH 4214: INSTRUMENTAL AND PHYSICOCHEMICAL METHODS  
OF ANALYSIS**

**END OF SEMESTER EXAMINATION**

**SERIES: APRIL 2016**

**TIME: 2 HOURS**

**DATE: Pick Date May 2016**

## **Instructions to Candidates**

You should have the following for this examination

*-Answer Booklet, examination pass and student ID*

This paper consists of five questions. Attempt question one which's compulsory and any other two questions..

**Do not write on the question paper.**

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## **QUESTION 1**

- A concentrated solution of aqueous ammonia is 28.0% w/w  $\text{NH}_3$  and has a density of 0.899 g/mL. What is the molar concentration of  $\text{NH}_3$  in this solution? (2 marks)
- The concentration of  $\beta$ -carotene in ppm values for local beverages was found to be; 13, 14, 18, 28, 10, 6.5, 44.5 and 11.5. Calculate: Range, Mean deviation, variance, standard deviation. (6 marks)
- Determine whether the smallest value is an outlier at 90% confidence limit for the following data; 1.5, 11.0, 10.5, 9.9, 13.6, and 12.6, given that tabulated value is 5.8. (3 marks)
- Outline the sources and ways of minimizing systematic errors. (4 marks)

- e) Draw a schematic diagram showing all the basic components of gas chromatography. ( 4 marks)
- f) Differentiate the following conditions as used in high performance liquid chromatography (HPLC);
- Gradient elution and isocratic elution. (2 marks)
  - Reversed phase and normal phase chromatographic separation. (2 marks)
- g) A 10-mL volumetric pipet was calibrated following the outlined procedure of using a balance calibrated with brass weights having a density of 8.40 g/cm<sup>3</sup>. At 25 °C the pipet was found to dispense 9.9736 g of water. What is the actual volume dispensed by the pipet? (2 marks)
- h) Outline three methods of selecting and evaluating the end point in titrimetric reactions. (3 marks)
- i) Outline how thin layer chromatography (TLC) can be used for both qualitative and quantitative analysis (2 marks)

## **QUESTION 2**

- a) A sample of an ore was analyzed for Cu<sup>2+</sup> as follows. A 1.25-g sample of the ore was dissolved in acid and diluted to volume in a 250-mL volumetric flask. A 20-mL portion of the resulting solution was transferred by pipet to a 50-mL volumetric flask and diluted to volume. An analysis showed that the concentration of Cu<sup>2+</sup> in the final solution was 4.62 ppm. What is the weight percent of Cu in the original ore? (8 marks)
- b) Discuss any four factors to be considered when selecting an analytical method of analysis. (8 marks)
- c) Discuss the advantages and disadvantages of using mean as a measure of central tendencies for a given data. (4 marks)

## **QUESTION 3**

- Outline four criteria used to classify the separation techniques (4 marks)
- Differentiate between precipitation and electrogravimetry. (4 marks)
- Outline three quantitative applications of gravimetric and titrimetric analysis. (3marks)
- State Beer's law and explain the two broad limitations of the law.(4marks)

- e) A  $5.00 \times 10^{-4}$  M solution of an analyte is placed in a sample cell that has a path length of 1.00 cm. When measured at a wavelength of 490 nm, the absorbance of the solution is found to be 0.338. What is the analyte's molar absorptivity at this wavelength?(5marks)

**QUESTION 4**

- a) With the aid of a schematic diagram, outline the process occurring during the atomization process of liquid sample in atomic absorption spectroscopy analysis. (10 marks).
- b) Discuss the four main applications of HPLC in food analysis, giving an example for each case. (10 marks)

**QUESTION 5**

- a) Differentiate the following terms as used in analysis;
- i. Primary reagent and secondary reagent.(2 marks)
  - ii. Matrix matching and standard additions (2 marks)
  - iii. Protocol and method of analysis (2 marks)
  - iv. Polychromatic and monochromatic radiation (2 marks)
- b) Clearly describe the titrimetric method for determining the total proteins in bread sample. (12 marks)