



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

BTAC15S YR1 SII

ACH 4102: INTRODUCTION TO ANALYTICAL CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: APRIL 2016

TIME: 2 HOURS

DATE: 10th 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.

QUESTION 1

- a) Outline the five aspects considered by analytical chemists in designing an experimental procedure/ (5 marks)
- b) Differentiate the following basic tools of analytical chemistry;
 - i. Molarity and molality (2 marks)
 - ii. Formality and normality (2 marks)
 - iii. Technique and method (2 marks)
 - iv. Procedure and protocol (2 marks)
- c) A concentrated solution of aqueous ammonia is 28.0% w/w NH_3 and has a density of 0.899 g/mL. What is the molar concentration of NH_3 in this solution? (3 marks)
- d) The data below shows the concentration of lead in ppb present in waste water for the municipal city; 3.056 3.080 3.094 3.107 3.112 3.174 3.198. Calculate the;

- i. mean, (2 marks)
 - ii. median, (2 marks)
 - iii. range, (1 marks)
 - iv. standard deviation(3 marks)
- e) Outline three limitations of Beer's law. (3 marks)
- f) Draw a schematic diagram of atomic absorption spectrophotometer. (4 marks)

QUESTION 2

- a) A sample of an ore was analyzed for Cu^{2+} 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^{2+} in the final solution was 4.62 ppm. What is the weight percent of Copper in the original ore?(6 marks)
- b) Discuss four factors that are considered when selecting an analytical method of analysis. (12 marks)
- c) Differentiate between calibration and standardization. (2 marks)

QUESTION 3

- a) Define the following terms as used in sampling plan for a given data;
- i. Stratified random sampling. (2 mark)
 - ii. Cluster sampling. (2 mark)
 - iii. Random sampling. (2 mark)
- b) Outline three major causes of systematic or determinate errors in statistics giving the correction or ways of minimizing the errors. (6 marks)
- c) Before determining the amount of Na_2CO_3 in an unknown sample, a student decides to check her procedure by analyzing a sample known to contain 98.76% w/w Na_2CO_3 . Five replicate determinations of the %w/w Na_2CO_3 in the standard were made with the following results; 98.71% 98.59% 98.62% 98.44% 98.58% Is the mean for these five trials significantly different from the accepted value at the 95% confidence level ($\alpha = 0.05$) and tabulated value is 2.79 (8 marks)

QUESTION 4

- a) Define the following terms;
- i. Detection limits (2 marks)
 - ii. Limit of identification. (2 marks)
 - iii. Limit of quantization. (2 marks)
 - iv. Multi point standardization. (2 marks)
- b) Discuss the theory and practice of the four types of gravimetry. (8 marks)
- c) Explain giving example the application of titrimetric method in organic analysis. (4 marks)

QUESTION 5

- a) Draw a schematic diagram of typical column chromatographic column components. (5marks)
- b) Discuss the application of chromatography as a separation technique in clinical, environment and food sciences citing examples.(9 marks)
- c) Discus three quantitative applications of UV visible spectrophotometer in analytical chemistry. (6 marks)