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: APRIL2016

TIME: 2HOURS

DATE: Pick DateMay2016

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.

Do not write on the question paper.

QUESTION 1

a) With the aid of a flow diagram outline the 5 step process involved in analytical chemistry to solve problems. (5 marks)

b) Define the following terms;

i. Quantitative analysis (2 marks)

ii. Fundamental analysis (2 marks)

iii. Characterization analysis(2 marks)

iv. Total analysis techniques (2 marks)

v. Concentration techniques (2 marks)

c) The maximum allowed concentration of chloride in a municipal drinking water supply is 2.50 ´x 10^2 ppm Cl^-. When the supply of water exceeds this limit, it often has a distinctive salty taste. What is this concentration in moles Cl^-/liter. (3marks)

d) 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.(4marks)

e) Outline the sources and ways of gross errors. (4marks)

f) Outline the steps involved in making a chromatographic column for separation. (4 marks)

QUESTION 2

a) Describe how you would prepare the following three solutions:

   i. 500 mL of approximately 0.20 M NaOH using solid NaOH. (2 marks)

   ii. 1 L of 150.0 ppm Cu^{2+} using Cu metal (2 marks)

   iii. 2 L of 4% v/v acetic acid using concentrated glacial acetic acid. (2 marks)

b) Barnett and colleagues developed a new method for determining the concentration of codeine during its extraction from poppy plants. As part of their study they determined the method's response to codeine relative to that for several potential interferents. For example, the authors found that the method's signal for 6-methoxycodeine was 6 (arbitrary units) when that for an equimolar solution of codeine was 40.

   i. What is the value for the selectivity coefficient when 6-methoxycodeine is the interferents and codeine is the analyte? (4 marks)

   ii. If the concentration of codeine is to be determined with an accuracy of ±0.50%, what is the maximum relative concentration of 6-methoxycodeine (i.e., [6-methoxycodeine][codeine]) that can be present? (4 marks)

c) Discuss how interferences are compensated for in analytical procedures. (6 marks)

QUESTION 3

a) With the aid of a schematic diagram, outline the process standard addition as used in calibration procedures (8 marks).

b) Discuss the four main applications of titrimetric analysi giving n example for each case. (12 marks)

QUESTION 4

a) Outline four criteria used to classify the separation techniques (4 marks)

b) Differentiate between precipitation and electrogravimetry. (4 marks)

c) Outline three quantitative applications of gravimetric and titrimetric analysis. (3marks)

d) State beers law and explain the two broad limitations of the law.(4marks)

e) A 5.00 x10^{-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 5

a) Describe clearly a method for determining quinine in urine and in waste waters using UV visible spectrophotometer. (12 marks)

b) Outline how thin layer chromatography & High pressure TLC (TLC & HPTLC) is used for both qualitative and quantitative analysis. In your answer include advantages of using HPTLC over traditional TLC, and application of the technique in a modern analytical laboratory.(8 marks)