



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

**UNIVERSITY EXAMINATION FOR:**

**APPLIED ANALYTICAL CHEMISTRY**

ACH 4302 : ANALYTICAL INSTRUMENTATION II PAPER TWO

SPECIAL/ SUPPLEMENTARY EXAMINATIONS

**SERIES: SEPTEMBER 2018**

**TIME: 2HOURS**

**DATE:** Pick Date Sep 2018

## 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 (Compulsory) and any other TWO questions.

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

## Question ONE

- a)
- i. List three ways in which background absorption can be corrected in an atomic absorption spectroscopy **(3 marks)**
  - ii. Explain why atomic emission methods with ICP source is better suited for elemental analysis than are flame atomic absorption methods **(3 marks)**
  - iii. Briefly explain the importance of the hollow cathode lamp in AAS spectroscopy. **(5 marks)**
  - iv. Explain why an internal standard can be used for ICP-OES but is not for AAS **(4 marks)**
- b) Determine the concentration of carbimazole solution with a molar extinction coefficient of  $5020 \text{ Lmol}^{-1} \text{ cm}^{-1}$ , an absorbance of 0.557 measured at 291 nm using a cuvette with dimensions of 1cm. **(5 marks)**
- c) Thin layer chromatography is a widely used method of separation.
- i. Briefly describe briefly how a sample can be separated using thin layer chromatography **(4 marks)**

- ii. Illustrate how the retention factor can be determined (2 marks)
- d) Briefly sample separation can be achieved using thin layer chromatography (6 marks)
- e) Propose ways of improving the resolution between two closely spaced peaks in gas chromatography (4 marks)

### Question TWO

- a)
  - i. Using a block diagram describe the main parts of double beam AAS spectroscopy instrument (5 marks)
  - ii. Explain the principle behind FTIR spectroscopy (5 marks)
  - iii. Discuss the advantages of an FTIR spectrometer compared with a dispersive instrument? (6 marks)
  - iv. Explain why non-dispersive IR instruments often are used for the determination of gases rather than dispersive IR spectrometers? (4 marks)

### Question THREE

- a) Discuss giving reasons why atomic absorption spectrophotometry (AAS) is considered as sensitive, accurate, precise and highly specific technique. (6 marks)
- b) Discuss four sources of interferences in AAS and suggest how they can be minimized or eliminated. (8 marks)
- c) Discuss the similarities and differences of GC-MS and HPLC separations. (6 marks)

### Question FOUR

- a) Sample A and B have retention times of 16.40 and 17.63 min respectively, on a 30.0 cm column. An unretained species passes through the column in 1.30 min. The peak widths (at base) for A and B are 1.11 and 1.21 min, respectively. Calculate;
  - i. The column resolution (4 marks)
  - ii. The average number of plates in the column (4 marks)
  - iii. The plate height (4 marks)
  - iv. The length of column required to achieve a resolution of 1.5 (4 marks)
  - v. The time required to elute substance B on the column that gives an  $R_s$  value of 1.5. (4 marks)
- b) Explain the causes of radiation absorption by a molecule in the mid- infrared region of the electromagnetic spectrum. (4 marks)

### Question FIVE

- a)
  - i. Using a block diagram, describe the main parts of a mass spectrum (5 marks)
  - ii. Explain the basic principle behind mass spectroscopy (5 marks)
- b)

- i. Describe the basic principle behind NMR spectroscopy **(5 marks)**
- ii. With the aid of a schematic diagram, describe the instrumental arrangement of an NMR spectrometer. **(5 marks)**