Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF **PURE AND APPLIED SCIENCES**

DIPLOMA IN SCIENCE LABORATORY TECHNOLOGY
(DSLT 10 J / DAC 10J)

ACH 2310: INSTRUMENTATION III

SPECIAL/SUPPLEMENTARY: EXAMINATIONS

SERIES: FEBRUARY 2013

TIME: 2 HOURS

<u>**INSTRUCTIONS:**</u>

You should have the following for this paper
- *Answer booklet*

This paper consists of *FIVE* questions.
Answer Question **ONE (compulsory)** and any other **TWO** questions
This paper consists of 2 PRINTED pages

Question ONE

a) (i) Define the following terms
  I. Atomization in AAS **(2marks)**
  II. Resolution in HPLC **(2marks)**
 (ii) Distinguish between isocratic elution and gradient elution **(4marks)**

b) (i) A 20ppm solution of copper gives an AAS signal of 15 percent transmittance. Calculate the sensitivity of the instrument for copper (Cu = 64) **(4marks)**
 (ii) List FOUR quantitative methods used in both HPLC and GLC **(4marks)**
 (iii) Outline the basic principle involved in the 'Normalized area' method of quantitative HPLC **(4marks)**

c) (i) Distinguish between 'rich' and 'lean' flames as applied in AAS **(4marks)**
 (ii) Explain why solvents are purged off dissolved air during analysis by HPLC. **(2marks)**
 (iii) List FOUR characteristics of the mobile liquid phase in HPLC **(4marks)**

d) (i) The chromatogram of a sample containing 1- and 2- naphthol had two peaks with retention times 228 and 235 seconds. Their widths at half-height were 2.4 sec and 2.5 sec respectively. Calculate the average number of theoretical plates. **(4marks)**
 (ii) State the advantages of AAS **(4marks)**
  State TWO causes of deviation from Beer-Lambert's Law in AAS **(2marks)**

Question TWO

a) (i) Name FOUR major parts of the HPLC instrument **(2marks)**
 (ii) Substance A and B have retention times of 16.40 and 17.63 minutes respectively, on a 30.0cm column. An unretained species passes the column in 1.30 minutes. The peak widths for A and B are 1.11 and 1.21 minutes, respectively. Calculate:
  I. The column resolution **(1mark)**
  II. Average number of theoretical plates **(4marks)**
  III. The plate height **(2marks)**
  IV. State ONE advantage of using internal standard method in HPLC or GLC.

  (1mark)
b) Draw a labeled diagram of a hollow cathode lamp and give ONE disadvantage of using such lamps in AAS. **(5marks)**

Question THREE

a) (i) Distinguish between 'releasing' and protecting agent as used in atomic spectroscopy, giving an example of each **(5marks)**
 (ii) Describe the following terms as used in HPLC or GC stating when and how they are applied
  I. Reversed phase – phase HPLC **(4marks)**
  II. Resolution (Rs) **(4marks)**
b) Describe how a liquid can be injected into the HPLC column **(2marks)**

Question FOUR

a) (i) Explain the corpuscular theory of electromagnetic radiations and state its applications in AAS. **(4marks)**
(ii) Give FOUR requirements for HPLC column packing materials **(4marks)**
b) (i) Give reasons to explain why capillary columns (small diameter columns) are preferred ever packed columns (larger diameter columns) in HPLC
(4marks)
(ii) Explain haw a signal is produced in AAS **(3marks)**

Question FIVE

a) Differentiate between:
(i) Dead and retention time **(2marks)**
(ii) Mobile and stationary phase as used in chromatography. **(2marks)**
b) Define the terms:
(i) Elution **(1mark)**
(ii) Eluent **(1mark)**
(iii) Chromatogram **(2marks)**
c) (i) Write the van Deemter equation and identify all symbols in it **(3marks)**
(ii) Explain briefly how 'standard addition' technique is applied in AAS **(4marks)**