



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES PURE AND APPLIED SCIENCES DEPARTMENT SUPPLEMENTARY/ SPECIAL UNIVERSITY EXAMINATION FOR BTAC 16S

ACH 4205 : METHODS OF CHEMICAL SEPARATION SPECIAL/ SUPPLEMENTARY EXAMINATIONS

SERIES: SEPTEMBER 2018

TIME: 2 HOURS

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.

Do not write on the question paper.

Question ONE

- a) Differentiate between the following terms used in separation methods
- i) Cross flow and dead end
 - ii) Pervaporation and gas permeation
 - iii) Diffusion and permeation
 - iv) Mechanical and chemical fouling
 - v) Stationary and mobile phase
- (10marks)
- b) With the help of a labelled diagram illustrate how reverse osmosis takes place.
(4 marks)
- c) i) Explain the feed pretreatment step and its importance in Reverse Osmosis.
(4marks)
- ii) State the driving force in dialysis and electro dialysis
(2marks)

- d) List three chromatographic techniques based on sorption mechanisms (3marks)
- e) Give three applications of Affinity chromatography. (3marks)
- f) Explain the following terms
 i) Flow injection analysis (FIA)
 ii) Segmented flow analysis (SFA) (4marks)

Question TWO

- a) During HPLC determination of caffeine in an analgesic tablet, a 10 µL injection loop was used in preparing the caffeine standards. The following data were obtained:

Standard (ppm)	50.0	100.0	150.0	200.0	250.0
Signal (arbitrary units)	8354	16925	25218	33584	42002

A single analgesic tablet was placed in a small beaker, dissolved with 10.0 mL of methanol and the contents, including the binder, were transferred into a 25 - mL volumetric flask and diluted to level with methanol. The sample was then filtered and a 2.50 mL aliquot was transferred into another 25 mL volumetric flask, diluted to level with methanol and analyzed similarly as the standards.

- (i) Plot a calibration curve using the values in the table above. (4marks)
- (ii) Given that a signal of 21469 was obtained for the sample tablet. Estimate the amount of caffeine (mg), in the analgesic tablet. (6 marks)
- b) Describe the separation mechanism of components of a mixture in a GC column (5marks)
- c) Oxygen and nitrogen can be separated from air by gas permeation. Explain (5marks)

Question THREE

- a) Outline the uses of isotropic and anisoyropic membranes in various membrane processes. (10marks)
- b) Explain the following terms and their contribution to resolution in HPLC .
 i) Mechanical separation power
 ii) Chemical separation power (6marks)
- c) List any four materials used in production of membranes in microfiltration (4marks)

Question FOUR

- a) Describe the process of electro dialysis with at least two applications. (9marks)
- b) The following data was obtained by a researcher in separation of R and S isomers using liquid chromatography with different stationary phases

Compound	Silica based stationary phase Retention time (min)	Polymer based stationary phase Retention time (min)
Unretained marker peak	2.0	2.0
R- enantiomer	4.8	3.5
S- enantiomer	7.0	5.7

- i) Which stationary phase is more selective for the separation of the enantiomers? Show your working. (4mks)
- ii) Comment on the difference in selectivity in terms of the chemical composition of the two stationary phases. (3mks)
- iii) Given that all the six peaks have the same width at the base of 0.8 minutes. Which stationary phase offers better chromatographic resolution per separation run time? Show your working. (4mks)

Question FIVE

- a) Explain the following terms
i) Membrane flux
ii) Retention
iii) Gel polarization (6marks)
- b) Describe the procedure for the challenge test for membranes referred to as the molecular weight cut off (5marks)
- c) Outline the steps involved in a typical cleaning sequence of a membrane system (5mks)
- d) Explain the basic principles in capillary zone electrophoresis (4marks)