



TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES PURE AND APPLIED SCIENCES DEPARTMENT SUPPLEMENTARY/ SPECIAL UNIVERSITY EXAMINATION FOR BTAC 15S

ACH 4205 : METHODS OF CHEMICAL SEPARATION END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2016

TIME: 2 HOURS

DATE:

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

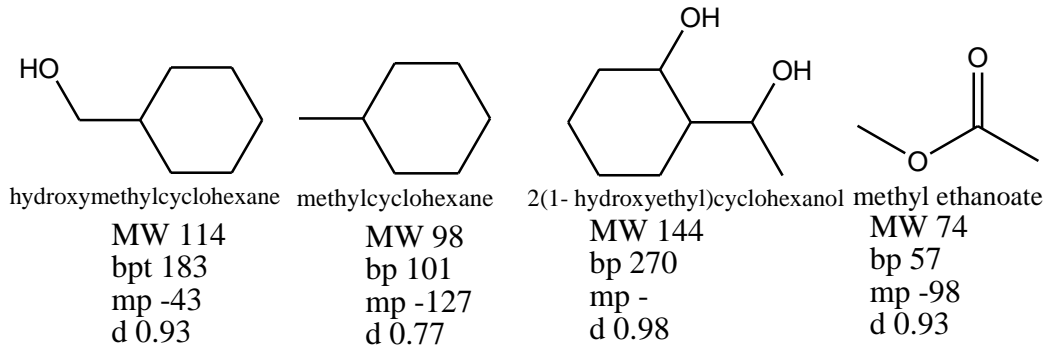
This paper consists of five questions. Answer question one and any other two.

Do not write on the question paper.

Question ONE

- a) Explain the following terms as used in separation methods
- i) Permeate
 - ii) Anisotropic membrane
 - iii) Capillary electrophoresis
 - iv) Concentration polarisation
 - v) Segmented flow analysis (SFA)
- (10marks)
- b) Devise a combination of membrane processes to accomplish the separation of a mixture of protein, glucose and sodium chloride in a solution in water .
- (4 mks)
- c) Ultrafiltration(UF) is one of the oldest membrane processes. List any four materials used in production of the membranes in UF.
- (4marks)

- d) i) List the three quantitative parameters in Reverse Osmosis process. (3marks)
- ii) Explain the main essence of pretreatment in reverse osmosis. (2marks)
- e) List any three separation modes in liquid Chromatography (3marks)
- f) Rank in an increasing order the following compounds in terms of their expected retention times on a GC non-polar column (OV-101 column) and explain the order. (4marks)



Question TWO

- a) Describe the following separation modes in HPLC chromatography and their applications. (10marks)
- Reversed phase
 - Normal phase
 - Hydrophilic interaction
 - Ion-exchange
 - Size exclusion
- b) Explain the following terms as used in HPLC separation. (6marks)
- Resolution
 - Efficiency
 - Selectivity
- c) Differentiate between the following terms (4marks)
- Flow injection analysis (FIA) and cross flow
 - Liquid chromatography and supercritical fluid chromatography

Question THREE

- a) Explain the general manufacturing steps for ultrafiltration membranes. (4marks)
- b) i) Outline the different types of liquid membranes.
ii) Explain each of the membrane types in b(i) above. (6marks)
- c) Describe facilitated diffusional transport mechanism in liquid membranes.

- (5marks)
- d) Using Van't Hoff equation show which of the following two solutions will have a higher osmotic pressure, 5% calcium chloride solution or 5% urea solution.
(5marks)

Question FOUR

- a) State the stationary and mobile phases in each type of the following:
i) thin layer chromatography
ii) liquid chromatography
iii) gas chromatography
(6marks)
- b) Describe the Knudsen flow separation mechanism in membrane technology.
(5marks)
- c) Explain the separation mechanism of components of a mixture in gas chromatography column.
(5marks)
- d) Explain the basic principles in Affinity chromatography.
(4marks)

Question FIVE

- a) Illustrate the following types of membrane module configurations
i) Plate and frame
ii) Tubular or open channel
(6marks)
- b) Describe the procedure for the non-destructive integrity test for membranes referred to as the bubble point test
(5marks)
- c) Outline any five factors that affect column separation in gas chromatography.
(5mks)
- d) Write the expression that relates water flux to membrane area in reverse osmosis and define all the terms.
(4marks)