



# NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

CHROMATOGRAPHIC SEPARATIONS

SCH 4292

Second Semester Examination Paper

August 2015

This examination paper consists of 3 printed pages

Time Allowed: 3 hours

Total Marks: 100

Examiner's Name: Mr Audacity Maringa

## INSTRUCTIONS

1. Answer any **FOUR** questions in this question paper.
2. Each question carries **25 marks**.

## MARK ALLOCATION

QUESTION	MARKS
1	25
2.	25
3.	25
4.	25
5	25
<b>TOTAL POSSIBLE MARKS</b>	<b>100</b>

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1. (a). Define the following terms as they apply in chromatography.

- (i) Chromatography
- (ii) Mobile phase
- (iii) Distribution constant
- (iv) Retention time
- (v) Eluent

[10 marks]

(b). A mixture of benzene, toluene, and methane was injected into a gas chromatograph. Methane gave a sharp spike in 42 s, whereas benzene required 251 s and toluene was eluted in 333 s. Find the adjusted retention time ( $t_s$ ) and retention factor for each solute and the selectivity factor.

[10 marks]

(c). List the variables that lead to band broadening in chromatography. [5 marks]

2. What are the principal advantages and the principal limitations of each of the detectors: (a) thermal conductivity, (b) flame ionization, (c) electron capture, (d) thermionic, and (e) photoionization. [25 marks]

3. (a). Define the following terms:

- (i) Sparging
- (ii) Gradient elution (in HPLC)
- (iii) Gel permeation
- (iv) Bond phase packing
- (v) Ion chromatography

[10 marks]

(b). Indicate the order in which the following compounds would be eluted from an HPLC column containing a reversed-phase packing:  
benzene, diethyl ether, *n*-hexane. [3 marks]

(c). Why does eluent strength increase as solvent becomes less polar in reversed-phase chromatography, whereas eluent strength increases as solvent becomes more polar in normal-phase chromatography? [2 marks]

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(d). Although temperature does not have nearly the effect on HPLC separations that it has on GC separations, it nonetheless can play an important role. Discuss how and why temperature might or might not influence the following separations:

- (i) a reversed-phase chromatographic separation of a steroid mixture.
- (ii) an adsorption chromatographic separation of a mixture of closely related isomers.

[10 marks]

4. (a). Describe the steps involved in thin layer chromatography (TLC). [10 marks]

(b). Discuss the advantages of HPTLC over TLC. [10 marks]

(c). What material is used to make the special paper for paper chromatography and state its characteristics? [5 marks]

5. (a). Define the following terms:

- (i) Supercritical fluid
- (ii) Critical temperature [4 marks]

(b). What properties of a supercritical fluid are important in chromatography? [6 marks]

(c). How do instruments for supercritical fluid chromatography differ from those for (i) HPLC and (ii) GC? [15 marks]

***End of question paper!!!***