NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES

DEPARTMENT OF APPLIED CHEMISTRY

CHROMATOGRAPHIC SEPARATIONS

SCH 4292

Supplementary Examination Paper

July 2017

This examination paper consists of 3 pages

Time Allowed: **3 hours**

Total Marks: **100**

Examiner's Name: Dr. A. Maringa

INSTRUCTIONS

1. Answer ALL questions in section A and any three (3) questions in section B
2. Each question in section A carries 10 marks and each question in section B carries 20 marks

MARK ALLOCATION

QUESTION	MARKS
SECTION A: 1.	**10**
2.	**10**
3.	**10**
4.	**10**
SECTION B: 5	**20**
6	**20**
7	**20**
8	**20**
TOTAL POSSIBLE MARKS	**100**

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SECTION A

1. Define the following terms:

      i.   Sparging

     ii.   Gradient elution (in HPLC)

    iii.   Gel permeation

    iv.   Bond phase packing

     v.   Ion chromatography   [10 marks]

2. (a). Indicate the order of elution of the following compounds from a normal-phase packed HPLC column:

             Ethyl acetate, acetic acid, dimethylamine.   [3 marks]

  (b). Why is high pressure needed in HPLC?   [2 marks]

  (c). A chromatographic peak is found to have a retention time of 52 s. The base width of the peak is equivalent to 3.2 s by intersection of the sides of the peak with the baseline. If the column is 500 cm in length, calculate the HETP in terms of centimetres per plate.

                                       [5 marks]

3. 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), retention factor and the selectivity factor for each solute.

                                       [10 marks]

4. List the variables that lead to (a) band broadening and (b) band separation in gas-liquid chromatography.   [10 marks]

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SECTION B

5. (a) Describe the steps involved in paper chromatography. [10 marks]

   (b) Briefly describe the advantages of TLC over the HPLC. [6 marks]

   (c) What are the advantages of using small particle size in HPTLC. [4 marks]

6. 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. [20 marks]

7. Substances 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 (a) the column resolution, (b) the average number of plates in the column, (c) the plate height, (d) the length of column required to achieve a resolution of 1.5, and (e) the time required to elute substance B on the column that gives an Rs value of 1.5.

   [20 marks]

8. Discuss how you can change the theoretical plate number in chromatography. [20 marks]

End of question paper!!!!