UNIVERSITY OF ESWATINI

Final Examination– 2020/2021

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| TITLE OF PAPER: | Separation Techniques |
| COURSE NUMBER: | CHE606 |
| TIME ALLOWED: | Three Hours |

INSTRUCTIONS:

Answer any four (4) questions of the six (6) questions and every question holds 25 marks.

NB: all questions are to be answered in a separate answer sheet.

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This Examination Paper Contains THREE Printed Pages Including This Page

*You are not supposed to open the paper until permission to do so has been granted by the Chief Invigilator.*

## Question 1

a. Explain the experimental techniques for the separation of mixtures by:

i. Simple distillation (5)

ii. Fractional distillation (5)

iii. Precipitation (5)

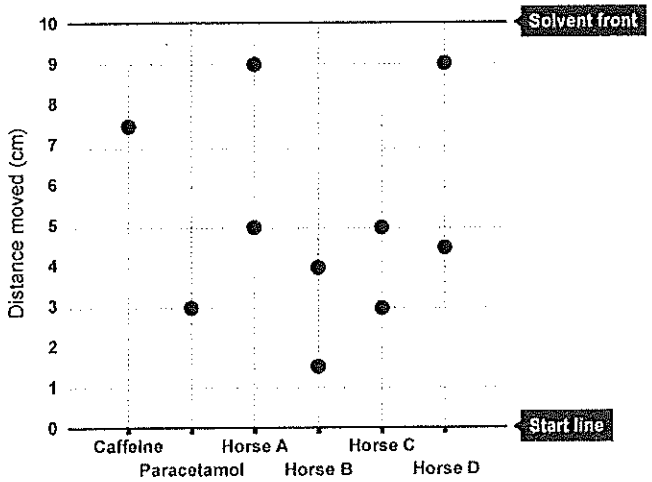
iv. Liquid-liquid Extraction (5)

v. Chromatographic techniques (5)

## Question 2

a. Chromatography can be used to separate the pigments in ink. Describe how chromatography can be used to determine whether two inks contain the same pigments. (15)

b. Chromatography can be used to test if racehorses have been given drugs. Urine samples from four horses, A-D, were tested to find out whether they contained caffeine or paracetamol. The following diagram shows the results obtained.




c. Calculate the $R_f$ values for paracetamol and caffeine (4)

d. Explain how the results show that none of the horses had been given caffeine. (6)

## Question 3

Simple distillation can be used to separate a mixture of ethanol and water. Ethanol has a boiling point of 78°C. Another sample contained water, ethanol and compound X, where compound X has a boiling point of 75°C.

a. Explain why this separation method would not be very effective in separating compound X and ethanol. (5)

b. Suggest how you could adapt the method to improve the separation of compound X and ethanol. Explain the principle of this adapted method (10)

c. What properties of precipitates are desired for effective separation (5)

d. How would you use liquid-solid extraction for the analysis of an environmental pollutants? (5)

## Question 4

a. Explain in detail all the parameters in normal and reverse phase liquid chromatography when used as a separation technique for mixtures. (15)

b. Describe the principles of ion exchange chromatography. (10)

## Question 5

a. Thin layer chromatography is a chromatographic technique that find application in several processes including synthesis and natural products chemistry, explain why TLC is used in both synthesis and natural products chemistry and what information it gives. (15)

b. HPLC can employ both isocratic and gradient solvent systems. Explain what is the difference between the 2 solvent systems and when to use them. (10)

## Question 6

a. Discuss three applications of GC method, giving local examples. (10)

b. What detectors are usually used in Gas chromatographic techniques and how do they differ? (15)