MAASAI MARA UNIVERSITY

REGULAR UNIVERSITY EXAMINATIONS
2023/2024 ACADEMIC YEAR
SECOND YEAR SECOND SEMESTER

SCHOOL OF PURE APPLIED AND HEALTH SCIENCES
MASTER OF SCIENCE IN CHEMISTRY

COURSE CODE: CHE 8209

COURSE TITLE: ADVANCED ANALYTICAL CHEMISTRY II

DATE: 31/1/2024 **TIME: 1430-1730 HRS**

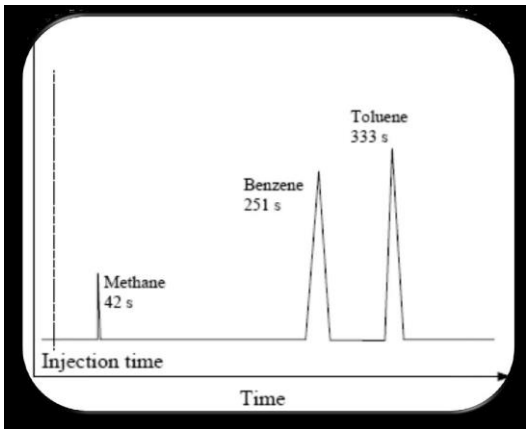
INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** and any other **TWO** questions**.**

QUESTION ONE (20mks)

a) An analyte eluted from a 10.2m column in 387s. The width at the base of the peak was measured to be 13s. Calculate the number of plates **(4mks)**

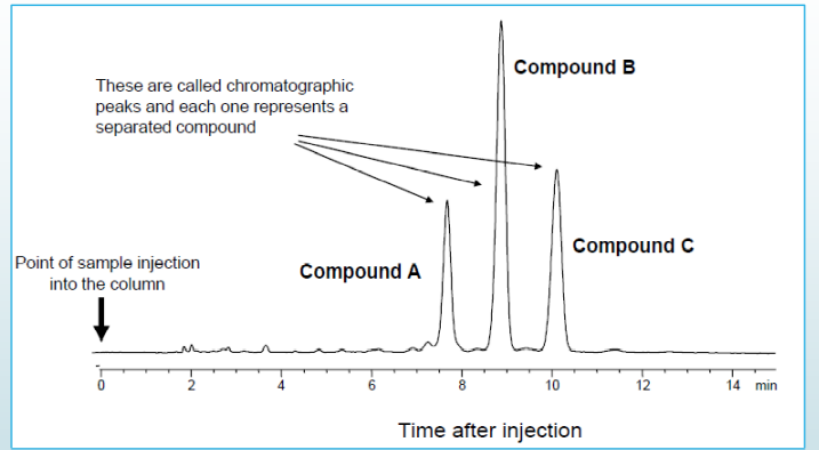
b) Given the following chromatogram. Calculate the capacity factors for benzene and toluene and the selectivity factor for the separation. **(4mks)**



c) The retention time for compound A and B is 16.40 and 17.63 min, respectively in a 30.0cm column. The peak width is 1.11 min (A) and 1.21 min (B). Calculate the resolution between the two compounds and comment on the value obtained **(4mks)**

d) Explain band broadening by non equilibrium mass transfer **(2mks)**

e) Chromatography can be applied for quantitative analysis, qualitative analysis and for preparation of pure compounds. Explain based on the chromatogram below **(6mks)**



QUESTION TWO (15mks)

a) Describe in detail the electron ionization sources applied in mass spectrometry **(5mks)**

b) Describe the steps undertaken in the mass spectrometer **(10mks)**

QUESTION THREE (15mks)

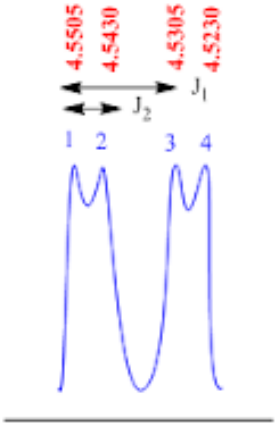
a) What type of information is obtainable by ^{1}H NMR spectroscopy **(4mks)**

b) Account for the generation of an NMR signal **(3mks)**

c) Calculate the energy of radiation absorbed to enable a spin transition given that, $\beta_N = 5.5050 \times 10^{-27} JT^{-1}$, g = 5.85 for a hydrogen nucleus and $B_z = 2.3487$ T **(3mks)**

d) Calculate the ratio of the populations of nuclei in two energy states separated by the energy obtained in (c) above for hydrogen nuclei(protons) at 300 K given that the Boltzmann constant, $k = 1.38 \times 10^{-23} JK^{-1}$ **(3mks)**

e) Calculate the coupling constant for the doublet of doublet shown below if NMR recorded in 400MHz machine **(2mks)**



QUESTION FOURTH (15mks)

a) Discuss the principle of IR Spectroscopy **(5mks)**

b) Describe the process of atomic absorption **(5mks)**

c) Explain UV spectroscopy **(5mks)**

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