KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2021/2022 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER
SUPPLEMENTARY/SPECIAL EXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 229

COURSE TITLE: CHEMICAL ANALYSIS AND STRUCTURE DETERMINATION

DURATION: 2 HOURS

DATE28/07/2022 **TIME: 11:00AM-1:00PM**

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **5** printed pages. Please Turn Over

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Question 1(30marks)

b) State the of principles of separation in chromatography **(2marks)**

d) Substances A and B have retention times of 16.4 and 17.6 respectively on a 30 cm column. An unretained species passes through the column in 1.3 min. The peak widths at base for A and B are 1.11 and 1.21 min respectively. Calculate

i) column resolution **(2marks)**

ii) the average number of plates in column **(2marks)**

iii) the plate height **(1mark)**

e) Briefly explain 2 factors that influence line width in atomic absorption spectrophotometry **(2marks)**

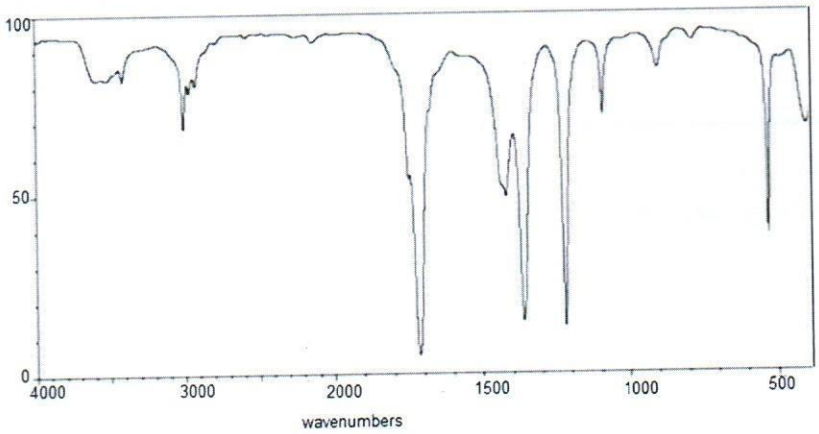
h) What are the limitations of UV/Visible as a quantitative analytical technique **(3marks)**

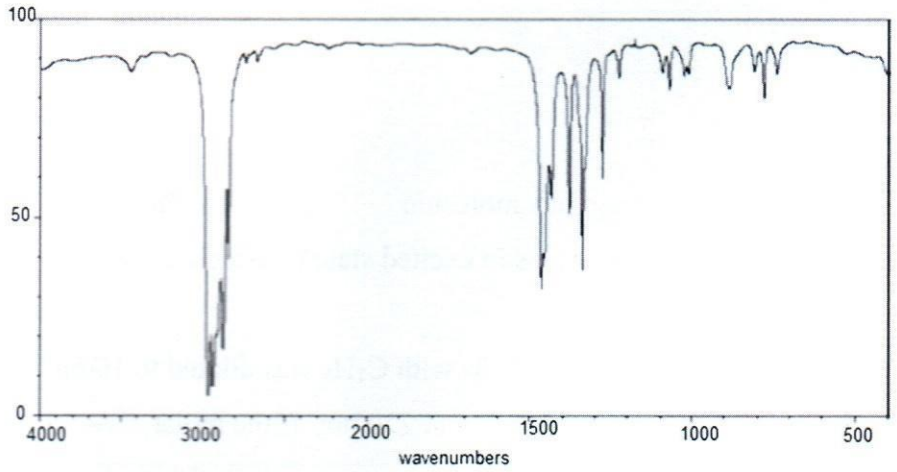
i) Why is it important to maintain constant magnetic field during NMR analysis **(2marks)**

k) The UV of CH_3I, CH_3Br and CH_3Cl were determined. The λ_{max} for the halomethanes were read as 173nm, 204nm and 258nm. Identify the halomethanes for each λ_{max}. state the reasons for your choice **(5marks)**

d) Twenty (20)ml water sample containing unknown amounts of Ca was diluted to 100ml and emission measurement gave a signal of 40 mv. After adding 10 mls of 2,5 $x10^{-2}$ M solution of Ca to another 10ml of the water and diluting to 100ml, the signal increased to 60mv. Calculate the concentration of Ca in water sample **(5marks)**

e) Study the FTIR spectra for A and B respectively and answer the questions that follow





i) identify all functional groups in A **(3marks)**

ii) identify the major differences between A and B **(2marks)**

e) With reference to CH_3CH_2OH, sketch an NMR spectrum **(3marks)**

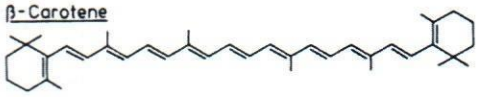
Question 2 (20marks)

b) 1g of a solute is contained in 100ml of an aqueous solution. Calculate the amount remaining in the aqueous phase after a single extraction with 30 ml of an organic solvent (D=10) **(3marks)**

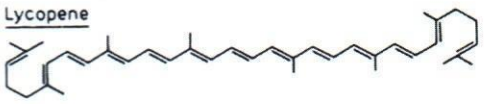
c) Explain why the yellow strip of paint on tarmac roads illuminates when a vehicle shines it light on it **(3marks)**

e) β-carotene and lycopene are responsible for the same red colour in foods like carrots. Explain this occurance **(4marks)**

β-Carotene



Lycopene



f) Briefly explain how the jelly fishes produce different colours of light at night **(5 marks)**

g) Briefly discuss

i) magnetic susceptibility **(3 marks)**

ii) Monochromator **(2 marks)**

Question 3 (20 marks)

a) Give 3 factors enhance the intensity of fluorescence in a molecule **(5marks)**

c) Explain 3 factors that influence the number of free atoms in excited state of atomic absorption **(6marks)**

d) Fifty (50)ml of solution of an organic liquid from an analysis with C_7H_8 was diluted to 100ml using hexane. The resulting solution had an absorbance of 0.485 at 220 nm. If the molar absorptivity of the solution was $2.8 \times 10^4 Lcm^{-1}Mole^{-1}$. Calculate the concentration of the solution in moles per mL **(5marks)**

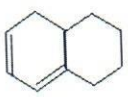
e) Explain MALDI **(4 marks)**

Question 4 (20 marks)

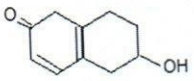
a) Name 2 optical analysis methods of substance **(2marks)**

b) All molecules that absorb radiation are in principle expected to fluorescence but only few do. Explain **(3marks)**

c) Calculate the λ_{max} of the molecules A and B below using the Woodward Fieser rules **(4marks)**



A



B

d) Draw a diagram to show the continuous dynode electron multiplier **(3marks)**

f) Identify four sample ionization methods for a mass spectrometer **(4marks)**

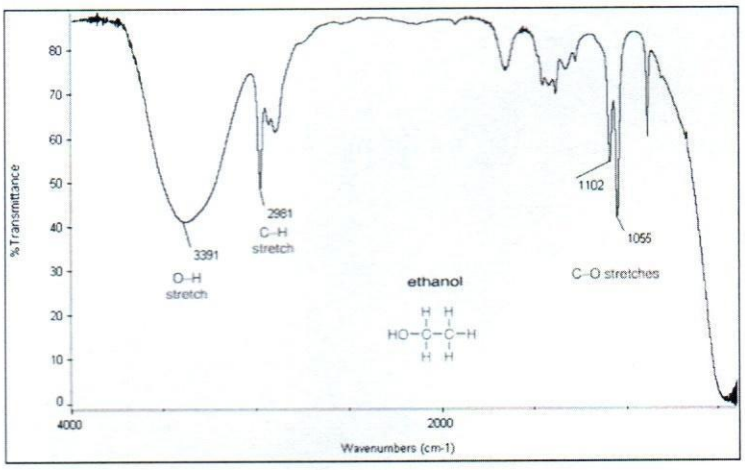
g) Show the difference between the NMR spectra of CH_3OH and CH_3CH_2OH **(4 marks)**

Question 5 (20 marks)

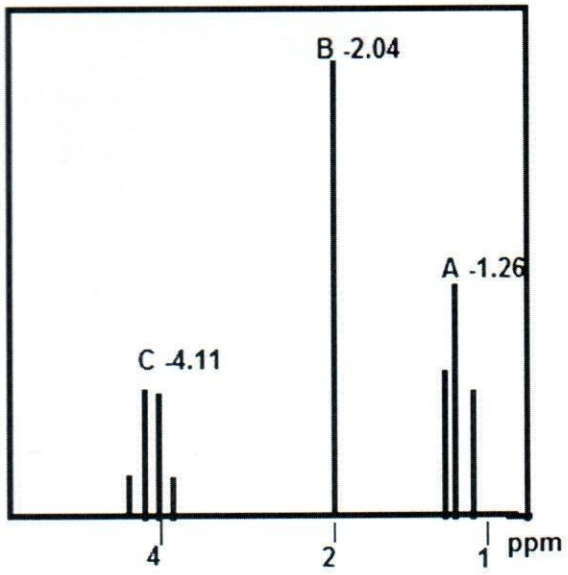
a) i) Why is IR spectroscopy referred to as finger print technique **(2 marks)**

ii) Discuss the fourier transform IR and its advantage over the normal scanning IR technique **(3marks)**

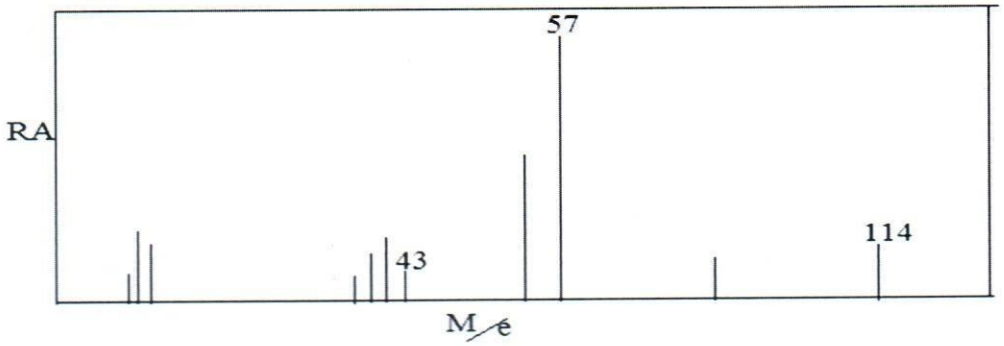
b) Predict the structure of the molecule for the IR spectrum below **(5 marks)**



c) Below is an NMR spectra of a molecule $C_4H_8O_2$, identify the number of different H atoms **(5marks)**



d) A mass spectrum of an alkane is shown below. Use it to answer the questions that follow



i) Determine the molecular formula of the alkane **(2marks)**

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ii) Indicate with dotted lines on molecules the fragments for the m/e 43, 57 and
71 **(3 marks)**