KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR

SECOND YEAR secondSEMESTER
MAINEXAMINATIONS

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SCH 229

COURSE TITLE: CHEMICAL ANALYSIS AND STRUCTURE
DETERMINATION

DATE: 9/2/2021   **TIME:** 11:00-1:00PM

INSTRUCTIONS TO CANDIDATES:

TIME: 2 Hours

Answer **question ONE**and **any TWO** of the remaining

KIBU observes ZERO tolerance to examination cheating

Question 1(30marks)

a) Define chromatography(1mk)

b) State the of principles of separation in chromatography(2mks)

c) What are theoretical plates(1mk)

c) Substances A and B have retention times of 16.4 and 17.63 respectively on a 30 cm column. An unretained species passess 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(2mks)
    ii)the average number of plates in column(2mks)
    iii)the plate height(1mk)
    iv)length of column required to achieve a resolution of 1.5(2mks)

d) Briefly explain 3 factors that influence line width in atomic absorption spectrophotometry(3mks)

e) Discuss the following terms(4mks)

    i)   electron multiplier
    ii)   Zeeman effect

f)Briefly explain bathochromic and hypsochromic effects in UV spectroscopy(4mks)

g)What are the limitations of UV/Visible as a quantitative analytical technique(2mks)

h)Why is it important to maintain constant magnetic field during NMR analysis(2mks)

i) A compound C, D, E have a molecular formula C_5H_8 and on hydrogenation all yield n-pentane. Their UV spectrashows the following λ_{max}; C(176), D(211nm), E(215nm) and pent-1-ene has (178nm)

    i)   What is the likely structure for C,D and E(3mks)
    ii)   What kind of information might enable you assign a specific structure to D and E(1mk).

Question 2(20marks)

a) Show that the distribution coefficient of acetic acid is not equal to its distribution ratio(3mks)

b) 1g of a solute is contained in 100ml of an aqueous solution. Calculate the amount remaining in the aqueous phase after i) a single extraction with 30 ml of an organic solvent (D=10)(4mks)

c)Differentiate between chemiluminiscence and photoluminescence(4mks)

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 $2,5 \times 10^{-2}$ 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(5mks)

e) Compare and contrast atomic absorption and atomic emission(4mks)

Question 3(20 marks)

a) What factors affect the intensity of fluorescence in a molecule   (3mks)

b) Explain 2 ways of introducing liquid samples into arc or plasma sources in emission spectroscopy(2mks)

c) Explain why atomic emission is more sensitive to flame than atomic absorption or fluorescence(4mks)

d) Explain 4 factors that influence the number of free atoms in flame absorption(4mks)

e)Fifty (50)ml of solution of an organic liquid whose formula was 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   (5mks)
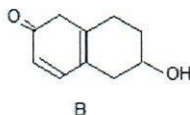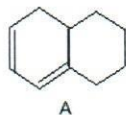
f)State the wavelength range for the UV spectrum(2mks)

Question 4(20 marks)

a) Name 2 optical analysis methods of substance(2mks)

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

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


d) What is the concentration of a sample of abacavir in mg/ml if the UV absorbance measured in a cell with 1.00 cm pathlength is A= 0.93 and the molar absorptivity is 13,260 L/mole(5mks)

e) What is MALDI and how does it work(3mks)

f) With reference to CH_3CH_2OH, sketch an NMR spectrum(3mks)

Question 5(20 marks)

a) Explain how nondestructive IR works and its analytical application(3mks)

b) Why is IR spectroscopy referred to as finger print technique(2mks)

c) Discuss the fourier transform IR and its advantage over the normal scanning IR technique(3mks)

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

4
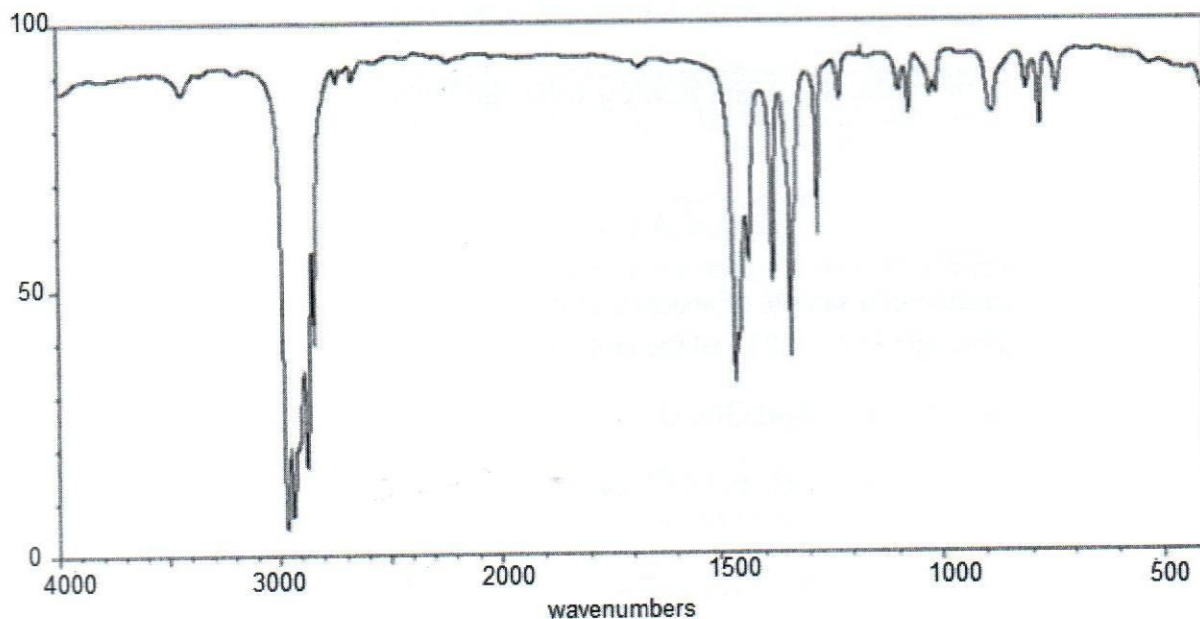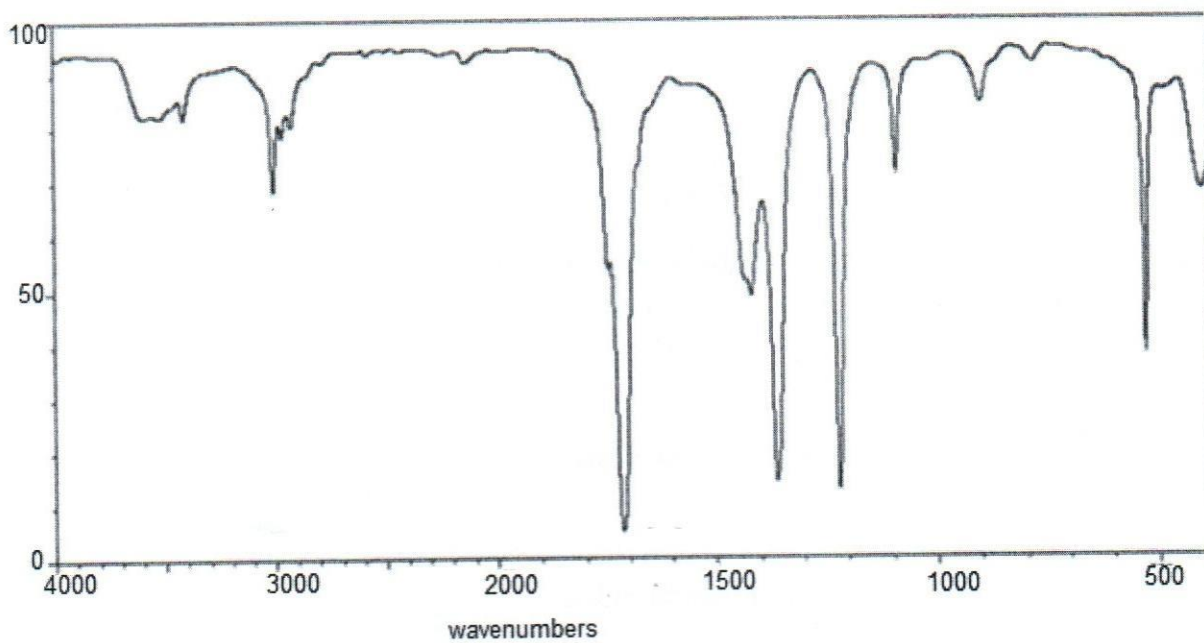
i) identify all functional groups in A (3mks)

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

e) Identify the sample ionization methods for a mass spectrometer(3mks)

f) Below is an NMR spectra of a molecule $C_4H_8O_2$, identify the number of different H atoms (4mks)