GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR TWO FIRST SEMESTER EXAMINATION

SCHOOL BIOLOGICAL AND PHYSICAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: CHE 201e

COURSE TITLE: CHEMICAL ANALYSIS AND STRUCTURE DETERMINATION

EXAMINATION DURATION: 3 HOURS

DATE: 07/12/17 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of SIX (6) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

(a) Define the following Analytical Chemistry terms of Analysis **[8 marks]**

i. Adjusted retention time (t_r'):

ii. Spectrophotometry

iii. Fluorescence and Phosphorescence

iv. Resolution in chromatography

(b) Give 2 practical application each of the following techniques of analysis: **[8 marks]**

i. Potentiomentry

ii. Voltammetry

iii. GC-MS

iv. NMR

(c) A 5.00 x 10^{-4} M solution of an analyte is placed in a sample cell that has a cell pathof 1.00 cm. When measured at a wavelength of 490 nm, what is the absorbance if analyte's molar absorptivity at this wavelength is 676 cm^{-1} M^{-1}**?** **[3 marks]**

(d) State 6 points that should be considered when choosing an instrument for any measurement or analysis? **[6 marks]**

QUESTION TWO

(a) Name three different interphases of analytical techniques of chemical analysis **[3 marks]**

(b) Name three most commonly Calibration methods in an analytical analysis **[3 marks]**

(c) Why are electrochemical methods of analysis preferred more as compared to other techniques like spectroscopic and chromatography **[1 mark]**

(e) Name 4 electro-analytical techniques of Chemical analysis **[2 marks]**

(f) Name the 3 different ionization modes in mass spectrometry and illustrate with examples of each **[6 marks]**

QUESTION THREE

(a) Look at the mass spectra of benzoic acid (C_6H_5COOH)(Figure 1) and identify the ions responsible for the major peaks **[8 marks]**

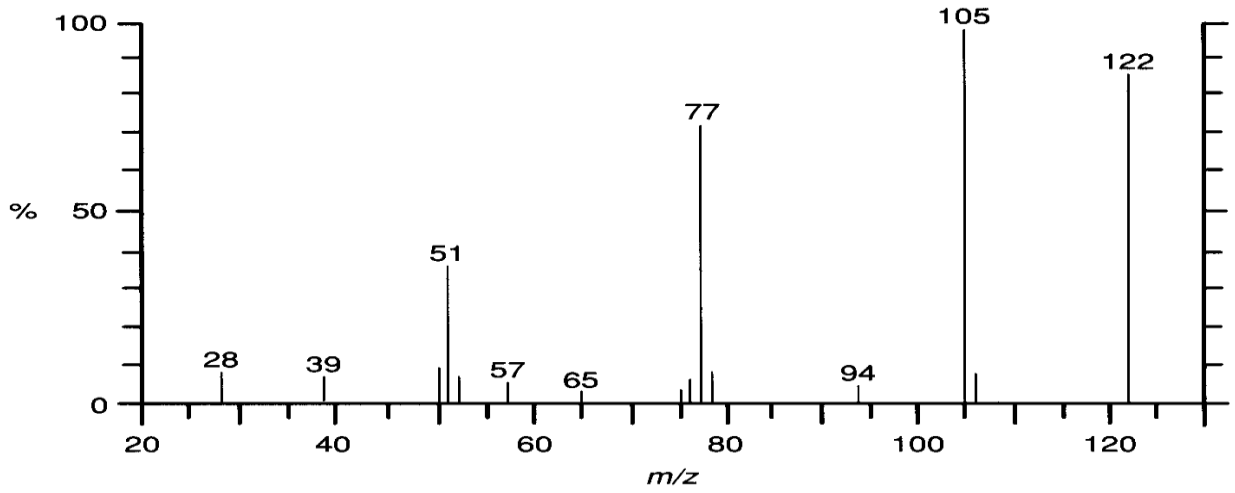

Figure 1

(b) Look at the mass spectra of methyl benzoate ($C_6H_5COOCH_3$) (Figure 2) and identify the ions responsible for the major peaks. **[7 marks]**

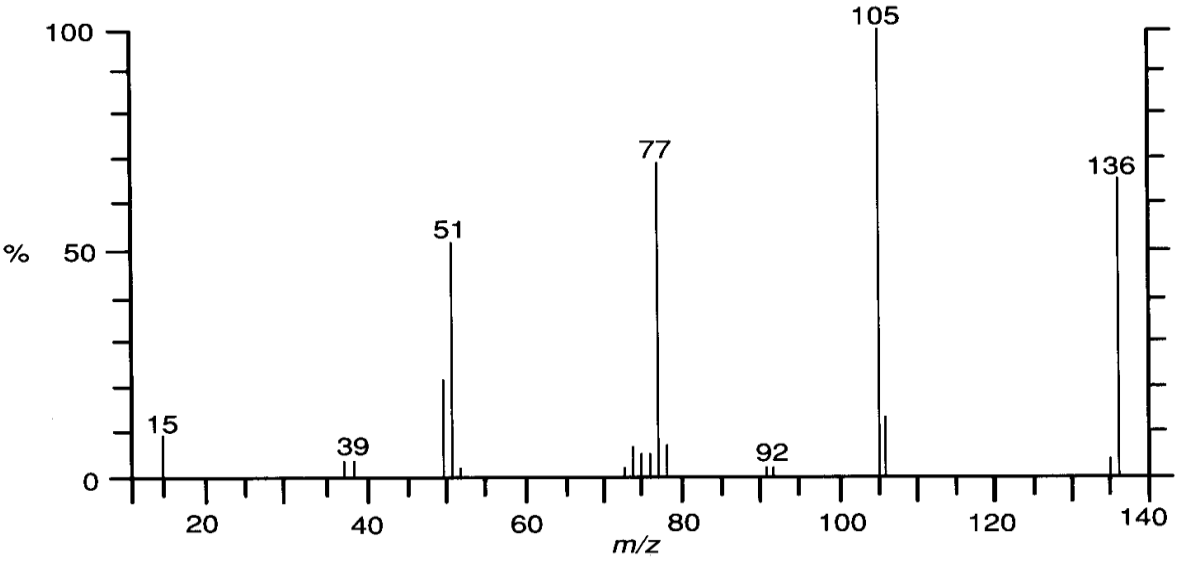

Figure 2

QUESTION FOUR

Using the below low-resolution NMR spectra and information given, suggest a possible structure for each substance. Figure 3 shows the ^{1}H NMR spectrum of a hydrocarbon **[15 marks]**

Chemical shift	Integral	Ratio
7.4 δ	23 mm	5
2.8 δ	9 mm	2
1.4 δ	14 mm	3

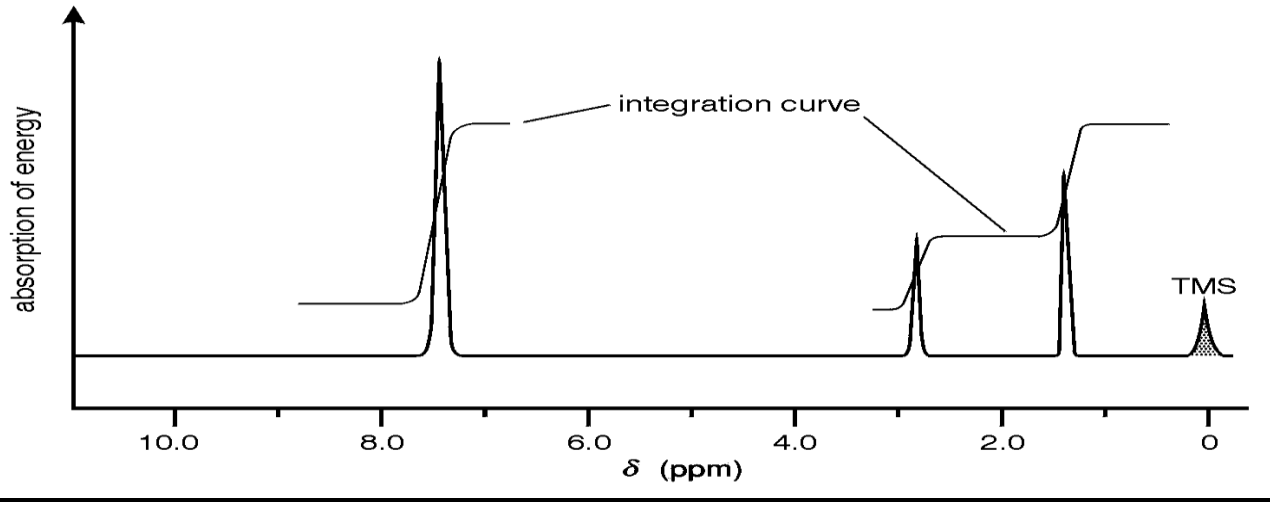

Figure 3

QUESTION FIVE

The spectra below are IR of ethanoic acid, CH_3COOH (Figure-4), and ethanoic anhydride, $(CH_3CO)_2O$ (Figure-5). Draw the full structural formulas for both compounds and then determine, giving reasons, which spectrum is due to which compound. **[15 marks]**

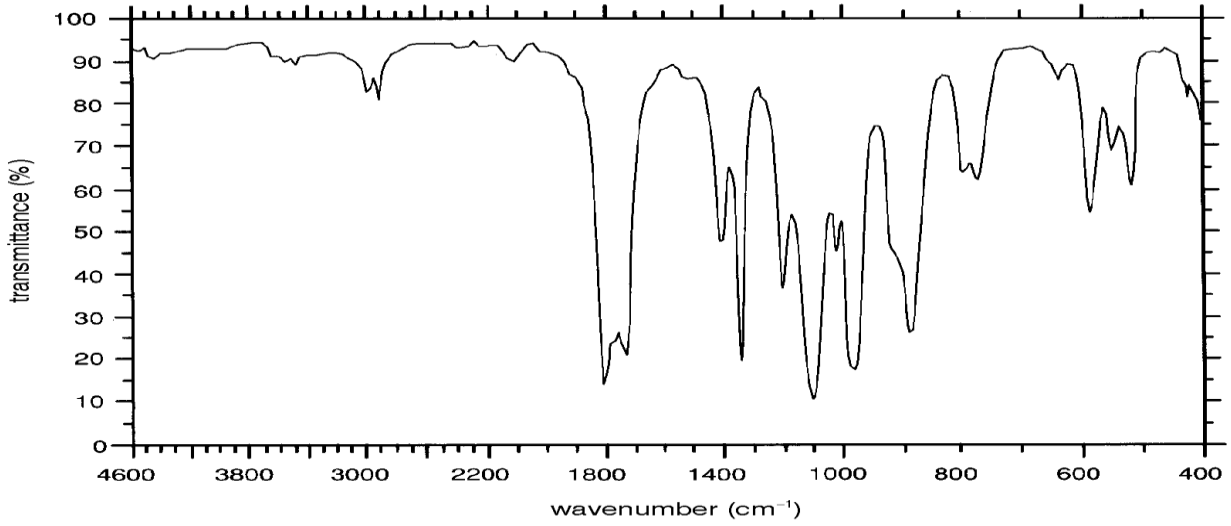

Figure 4

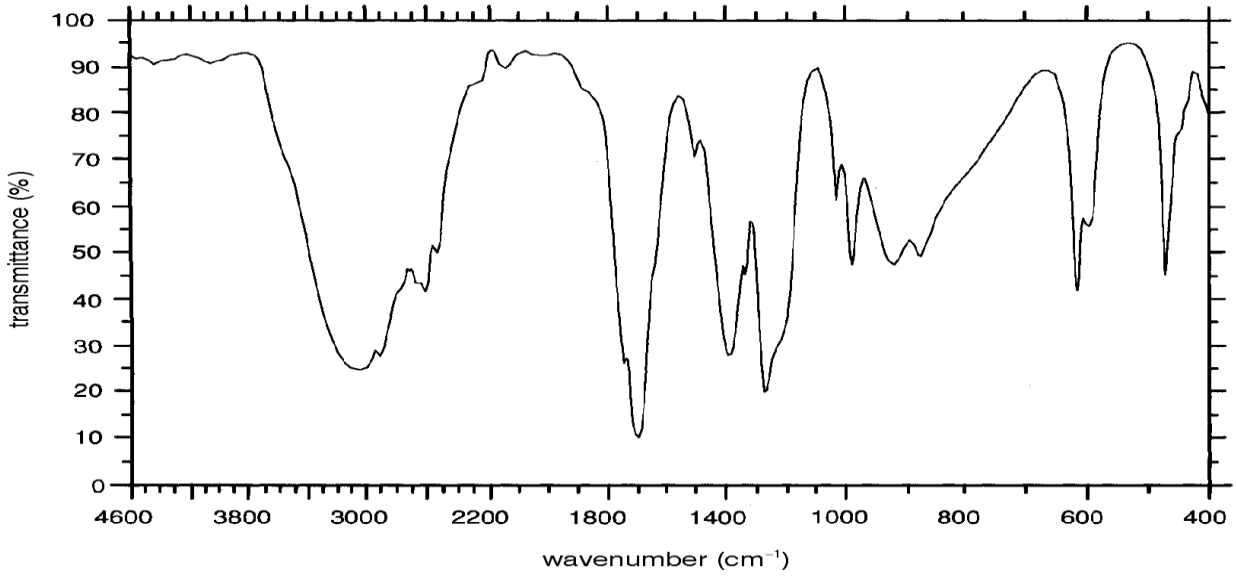

Figure 5

QUESTION SIX

(a) The following data were obtained for four compounds separated on a 20-m capillary column.

Compound	T_r(min)	W (min)
A	8.04	0.15
B	8.26	0.15
C	8.43	0.16

i. Calculate the number of theoretical plates for each compound and the average number of theoretical plates for the column. **[3 marks]**

ii. Calculate the average height of a theoretical plate. **[3 marks]**

(b) State 3 factors that affect Height Equivalent of a Theoretical Plate (H) **[3 marks]**

(c) With schematic diagram differentiate between a single beam spectrophotometer and double beam spectrophotometer **[6 marks]**