



UNIVERSITY OF EMBU

2017/2018 ACADEMIC YEAR

SECOND SEMESTER EXAMINATIONS

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
ANALYTICAL CHEMISTRY, INDUSTRIAL CHEMISTRY

SCA 302: INSTRUMENTAL METHODS OF ANALYSIS II

DATE: APRIL 5, 2018

TIME: 8:30-10:30AM

INSTRUCTIONS:

Answer Question ONE and ANY other TWO Questions

QUESTION ONE (30 MARKS)

- a) Differentiate between the following terms
- i) Scan mode and selected ion monitoring (sim) mode (2 marks)
 - ii) Isotope and Molecular ion (2 marks)
 - iii) Half life and radioactive element (2 marks)
 - iv) Soft ionization and hard ionization (2 marks)
- b) i) Briefly explain NMR working principles (3 marks)
- ii) List three types of radiochemical methods (3 marks)
- iii) What is the importance of molecular ion (parent ion) in mass spectrum interpretation? (2 marks)
- c) i) Limonene is a volatile compound added in cosmetic products. List one
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ionization technique that can be used for the ionization of limonene during mass spectrometry analysis. Give a reason for your choice (3 marks)

ii) Compare and contrast electron ionization and chemical ionization techniques (3 marks)

iii) Describe two advantages of using synchrotron X-ray radiation over X-ray radiation from a conventional X-ray tube. (2 marks)

d) i) List four types of mass analyzer, two for pulse type and two for continuous type. (2 marks)

ii) Describe the compounds that can be analyzed using electron spin resonance (ESR) spectroscopy. (2 marks)

iii) Give radiation source for NMR and ESR. (2 marks)

QUESTION TWO (20 MARKS)

a) Including appropriate illustrations, explain Auger electron spectroscopy (10 marks)

b) Compare ^1H NMR and ^{13}C NMR (6 marks)

c) Describe two limitations on NMR (4 marks)

QUESTION THREE (20 MARKS)

a) Draw a schematic diagram of a mass spectrometer (4 marks)

b) Briefly describe the mass spectrometry principles (5 marks)

c) i) Give two ion sources for each, that are used in GC-MS and LC-MS explain why. (6 marks)

ii) Using appropriate illustration, explain the mechanism of ion formation in electron ionization technique (5 marks)

QUESTION FOUR (20 MARKS)

a) Using an example, describe radiometric analysis. (5 marks)

b) Illustrate using a diagram the process of neutron capture. (6 marks)

c) i) Briefly describe isotopic dilution technique and its application in analytical analysis (5 marks)

- ii) Discuss the advantages and disadvantages of using electron ionization technique as an ion source in mass spectrometry. (4 marks)

QUESTION FIVE (20 MARKS)

- a) Give six reasons why TMS (Tetra methyl silane) is most commonly used as internal standard for measuring the position of ^1H , ^{13}C in NMR spectroscopy (6 marks)
- b) Using appropriate illustrations, distinguish between X-ray fluorescence and X-ray diffraction (6 marks)
- c) Describe how quantitative and qualitative analysis can be carried for a plant extract. Mention instrumental methods involved with explanation why (8 marks)

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