



NATIONAL OPEN UNIVERSITY OF NIGERIA
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JABI - ABUJA.

FACULTY OF SCIENCES
DEPARTMENT OF PURE AND APPLIED SCIENCE
2025_2 EXAMINATIONS

COURSE CODE: CHM 309

COURSE TITLE: ORGANIC SPECTROSCOPY

COURSE UNIT: 2

TIME: 2 HOURS

INSTRUCTION: Answer question one and any other two.

- 1a. What is the basic principle behind Infrared (IR) spectroscopy? (2 marks)
- b. What is the purpose of Mass Spectrometry (MS) in organic spectroscopy? (5 marks)
- c. Define 'fingerprint region' in IR spectroscopy, why is it important? (6 marks)
- d. State Beer-Lambert's law (4 marks)
- e. State three (3) factors that can determine the intensity and energy level of absorption in Infra-Red (IR) spectroscopy. (3 marks)
- f. List five (5) factors governing absorption of radiation in the UV/Visible region (5 marks)
- g. Explain why solvents are generally used in NMR spectroscopy (5 marks)
- 2ai. What do you understand by the term "chromophore" (3 marks)
- aii. The distance between two peaks in any wave is called _____ (2 marks)
- b. Briefly describe the different components of a UV spectrophotometer (14 marks)
- c. Promotion of electron from lower to higher energy, leads to _____ (1 mark)
- 3a. What is the uniqueness of calibration curve in UV spectrophotometry (2 marks)
- b. Two organic components X and Y have absorption maxima at 255 and 330 nm, respectively. For a pure solution of X, $\epsilon(255) = 4.60$; $\epsilon(330) = 0.46$; For a pure solution of Y, $\epsilon(255) = 3.88$; $\epsilon(330) = 30.0$; For a mixture of X and Y in a 0.01 m cell, $A(255) = 0.274$ and $A(330) = 0.111$. Calculate the concentrations of X and Y in the mixture. (9 marks)
- ci. State four (4) applications of UV/Visible Spectroscopy (4 marks)
- cii. List five (5) main components of a typical NMR spectrometer (5 marks)
- 4a. Explain the basic principle of Infrared (IR) spectroscopy (6 marks)
- b. What are the applications of Infrared (IR) spectroscopy in the identification of organic compounds (5 marks)
- ci. Give two (2) common solvent used in proton NMR spectroscopy. (2 marks)
- cii. Describe the characteristic features of a typical molecular ion (M^+) peak as presented by mass spectra of a compound (7 marks)
- 5a. Describe molecular ion peak and fragmentation patterns in GC-MS analysis (10 marks)
- b. Give five (5) applications of Nuclear Magnetic Resonance (NMR) Spectroscopy (5 marks)
- ci. How many double bond equivalents (DBE) are present in
a. $C_{10}H_7NO_2$ and b. $C_{11}H_{12}Cl_2N_2O_5$? (4 marks)
- cii. pKa values using UV/Visible spectroscopy are derived using an equation. Write the equation. (1 mark).