



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCES**  
**JULY 2017 EXAMINATION QUESTIONS**

**CHM309: ANALYTICAL CHEMISTRY II**  
**COURSE UNIT: 2 Units**

**TIME: 2 HOURS**

**INSTRUCTION: ANSWER QUESTION ONE & ANY OTHER THREE QUESTIONS.**

**QUESTION ONE**

- a) Differentiate between near, middle and far IR regions of the electromagnetic radiation (4 ½ MARKS)
- b) State the basic difference in the operational principles between dispersive instruments and fourier transform instruments in Infra-red spectrophotometry (4 ½ MARKS)
- c) Briefly explain the three factors that determine the intensity of absorption in IR-Spectroscopy. (6 Marks)
- d) What is the analytical relevance of fingerprint region in infrared spectroscopy? (2 Marks)
- e) Describe any four applications of IR-spectrometry. (4 Marks)
- f) Outline Four limitations of Beer-Lambert law. (4 Marks)

**QUESTION TWO**

- a) State Beer- Lambert law. (3 Marks)
- b) Discuss any Four factors that governs absorption of radiation in uv/visible region. (6 Marks)
- c) List and four physico-chemical properties of drugs molecules that can be monitored in terms of formulation and formulation using uv/visible spectroscopy. (6 Marks)

**QUESTION THREE**

- a) Describe the principles of mass spectrometry (5 Marks)
- b) Outline the four fundamental parts of mass spectrometer (4 Marks)

- c) Briefly explain the three main types of ionization techniques used in GC-MS. (3 Marks)
- d) Calculate the absorbance of a substance with molar absorption coefficient  $50 \text{ m}^2/\text{mol}$ , concentration  $10 \text{ mol/L}$ . (3 Marks)

#### QUESTION FOUR

- a) A solid samples contained C 75.5%, H 7.5% and N 8.1 % by weight. What is the empirical formula of the samples? (5 Marks)
- b) i. What is meant by the term Double Bond Equivalent? (2 Marks)  
ii. Estimate the double bond equivalent of  $\text{C}_8\text{H}_5\text{N}_3\text{O}_2$  (3 Marks)
- c) Describe three applications of NMR techniques. (5 Marks)

#### QUESTION FIVE

- (a) An electromagnetic wave incident on a point forms a number of peaks per second, if the distance between two successive peaks of the wave is  $6 \times 10^4 \text{ m}$ . Calculate the frequency of the wave. (5 marks)
- b. The energy of an electromagnetic radiation is  $6.4 \times 10^{12}$ . Evaluate the wavelength? (5 marks)
- (Speed of light  $= 3.0 \times 10^8 \text{ ms}^{-1}$  , Planck's constant  $= 6.626 \times 10^{-34} \text{ Js}$ )
- C) Write short notes on the following; (5 marks)
- i. Deuterium Exchange
- ii. coupling constant