

**NATIONAL OPEN UNVERSITY OF NIGERIA**

PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE & APPLIED SCIENCES**

**JULY 2018 EXAMINATIONS**

**CHM 309 APPLIED SPECTROSCOPY**

**CRDIT UNIT: 2**

**TIME ALLOWED 2 HOURS.**

**INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER 3 QUESTIONS**

**QUESTION 1**

(ii) What is spectroscopy? **(2 marks)**

(ii) What is the function of the following UV/Visible spectrometer?

Monochromator **(1 mark)**

Optics **(1 mark)**

 (b) Discuss the principle behind Infra-Red spectroscopy. **(5 marks)**

(ii) Mention four vibrational modes that occur as a result of IR radiation and methylene group interaction. **(2 marks)**

(iii) Mention three factors which determine the intensity and energy level of absorption in IR Spectroscopy. **(3 marks)**

(c) Briefly discuss the working principle behind Mass Spectroscopy. **(3 ½ marks)**

(ii) Draw a block diagram of a Mass Spectrometer. **(3 marks)**

(iii) List three components of a typical Nuclear Magnetic Resonance Spectrometer**.**

 **(1 ½ marks)**

(iv) Mention three applications of NMR Spectroscopy. **(3 marks)**

**QUESTION 2**

Mention 4 factors governing radiation in UV/Visible region. **(4 marks)**

(ii) Mention two rules for interpretation of mass spectra. **(2 marks )**

 (b) Describe the fragmentation pattern for the following functional groups:

 1. Alcohols. **(3 marks)**

 2. Ethers. **(3 marks)**

 (c) Write an equation for determining the energy level of vibration of a bond and describe its

 parameters. **(3 marks)**

**QUESTION 3**

(i)Write short note on chemical shift in Nuclear Magnetic Resonance Spectroscopy. Compare the chemical shift of 13C and 1H NMR Spectroscopy. **(3 marks)**

(ii) What is the significance of the base peak in mass spectrum of a compound? **(2 marks)**

Briefly describe the chemical method used in ionizing a sample in mass spectrometer.

 **(4 marks)**

(ii) Write an equation for determination of Pka values using UV/Visible. **(1 mark)**

(ci) State the Beer Lambert law. **(2 marks)**

(ii) Show that the concentration of a solution and A = absorbance.

 **(3 marks)**

**QUESTION 4**

 (a)(i) Draw a calibration curve; show that Beer Lambert law is obeyed. **(3 marks)**

(ii). Briefly discuss the application of UV/Visible spectroscopy in quantitative analysis. **(4 marks)**

(b) Describe how UV/Visible spectroscopy can be used to determine the following:

Partition coefficient. **(2 marks)**

Solubility of a drug. **(2 marks)**

Release of drug from formulation. **(2 marks)**

Identification of chromophores in qualitative analysis**. (2 marks)**

**QUESTION 5**

(i) Describe the characteristic features of a typical molecular ion (M+)/ peak as presented by mass spectra of a compound. **(3 marks)**

(ii). Explain why some compounds lack molecular ion peak in their spectra. **(2 marks)**

Write short note on the following compartment of mass spectrometer:

Mass analyzer. **(2 marks)**

Magnetic sector. **(2 marks)**

(ii) Write short note on the preparation of the following samples for IR spectroscopic analysis:

Gases. **(3 marks)**

Liquids. **(3 marks)**