

**NATIONAL OPEN UNVERSITY OF NIGERIA**

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

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE & APPLIED SCIENCES**

**2019\_1 EXAMINATION QUESTIONS**

CHM 309 APPLIED SPECTROSCOPY

INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER 3 QUESTIONS

TIME ALLOWED 2 HOURS.

**QUESTION 1**

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

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

1. Monochromator **(1 mark)**
2. 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**

1. State 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)**

1. 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)**

(c) 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:

1. Partition coefficient. **(2 marks)**
2. Solubility of a drug. **(2 marks)**
3. Release of drug from formulation. **(2 marks)**
4. Identification of chromophores in qualitative analysis**. (2 marks)**

QUESTION 5

1. (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)**

1. Write short note on the following compartment of mass spectrometer:
2. Mass analyzer. **(2 marks)**
3. Magnetic sector. **(2 marks)**

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

1. Gases. **(3 marks)**
2. Liquids. **(3 marks)**