



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCES**  
**OCTOBER/NOVEMBER 2019\_2 EXAMINATION**

**COURSE CODE: CHM 309**

**COURSE TITLE: APPLIED SPECTROSCOPY**

**CREDIT: 2 UNIT**

**TIME ALLOWED: 2 HOURS**

**Instruction:** Answer **question 1** and any other three.

Q1. (a) i. What is the fundamental principle behind Mass spectroscopy?

**[6 marks]**

(b) List four (4) uses/applications of NMR spectroscopy **[4 marks]**

(c) Draw the block diagram of a Mass spectrometer and explain its four fundamental parts. **[5 marks]**

(d) Mention some guidelines in interpreting  $^{13}\text{C}$ -NMR spectra.. **[5 marks]**

(e) Give brief accounts of the following

i. The Molecular Ion. **[2 marks]**

ii. The Mass Spectrum **[3 marks]**

Q2. (a) Explain how you can introduce a sample into ionization source using chromatography.

**[2 marks]**

(b) Briefly explain how any three of the following sample ionization methods are employed in Mass spectroscopy: **[2 marks each]**

i. Electron Impact Ionization (EI)

ii. Chemical Ionization (CI)

iii. Fast Atom Bombardment (FAB)

iv. Electrospray Ionization

v. Desorption Techniques

(c) Describe how any two of the following Mass Analysers function. **[3.5 marks each]**

- i. Magnetic Sector
- ii. Quadrupole Mass Analyser
- iii. Ion Trap Mass Analyser
- iv. Tandem Mass Analysers

Q3. (a) i. How does a Detector works under Mass spectroscopy? **[2 marks]**

ii. How can you interpret data from Mass spectrometer? **[3 marks]**

(b) Explain how McLafferty rearrangement occurs in carbonyl compounds. **[5 marks]**

(c) Write on the fragmentation patterns of the following: **[2.5 marks each]**

- i. Aromatic Hydrocarbons
- ii. Halides

Q4. (a) i. Write briefly on Positive Ion Chemical Ionization (PICl) as it affects GC-MS. **[3 marks]**

ii. Why is LC-MS interfacing more difficult than that of GC-MS?

**[2 marks]**

(b) Give a brief account of the following interfaces used in LC-MS: **[2 marks each]**

- i. Thermospray
- ii. Electrospray (ES) Ionization
- iii. Atmospheric Pressure Ionization

(c) Write note on 'Drug Discovery' and Spectroscopy.

**[4 marks]**

Q5. (a) Write short notes on the types of Nuclei (Type 1-3).

**[6marks]**

(b) Outline four reasons why Tetramethylsilane is used as Reference material in NMR spectroscopy **[4 marks]**

(c) Write short notes on the following

- i. Spin-Spin Coupling
- ii. Signal Intensity. **[2.5 marks each]**