



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**  
**FACULTY OF SCIENCES**  
**DEPARTMENT OF PURE & APPLIED SCIENCE**  
**2021\_2 EXAMINATION**

CHM 309 APPLIED SPECTROSCOPY

COURSE CREDIT : 2 UNIT

TIME ALLOWED 2 HOURS

INSTRUCTIONS: ANSWER QUESTION 1 AND ANY OTHER 3 QUESTIONS

**QUESTION 1**

- (a) List four (4) uses/applications of NMR spectroscopy **[4 marks]**
- (b) What is the fundamental principle behind Mass spectroscopy? **[7 marks]**
- (c) Draw the block diagram of a Mass spectrometer and explain the condition of it operation **[8 marks]**
- (d) Give brief accounts of the following
  - i. The Molecular Ion. **[5 marks]**
  - ii. The Mass Spectrum **[5 marks]**

**QUESTION 2**

- (a) Explain how you can introduce a sample into ionization source using chromatography. **[2 marks]**
- b) Briefly explain how 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 one of the following Mass Analysers function. **[3 marks each]**

i. Magnetic Sector

ii. Quadrupole Mass Analyser

iii. Ion Trap Mass Analyser

iv. Tandem Mass Analysers

### QUESTION 3

- (a) 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: [5 marks]  
i. Aromatic Hydrocarbons ii. Halides

### QUESTION 4

- (a) i. Write briefly on Positive Ion Chemical Ionization (PICI) 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: [6 marks]  
i. Thermospray ii. Electrospray (ES) Ionization  
iii. Atmospheric Pressure Ionization  
(c) Write note on 'Drug Discovery' and Spectroscopy. [4 marks]

### QUESTION 5.

- (a) Write short notes on 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. [5 marks]