

Chapter 14: NMR Spectroscopy

Learning Objectives:

1. Know how nuclear spins are affected by a magnetic field, and be able to explain what happens when radiofrequency radiation is absorbed.
2. Be able to predict the number of proton and carbon NMR signals expected from a compound given its structure.
3. Be able to predict the splitting pattern in the proton NMR spectrum of a compound given its structure.
4. With the aid of a chart of chemical shifts from ^1H and ^{13}C NMR, be able to assign peaks in an NMR spectrum to specific protons in a compound.
5. Be able to interpret integration of NMR spectra.
6. Be able to use NMR spectra to determine the structures of compounds, given other information such as a molecular formula.
7. Be able to calculate coupling constants from ^1H NMR spectra, and utilize the coupling constants for determining compound structure.*
8. Be able to determine the compound structure based on information generated from mass spectrometry, IR, NMR, and elemental analysis.*

* Supplemental material, not included in the textbook

Sections to be covered (in the order of delivery):

- 14.1 Introduction to NMR Spectroscopy
- 14.2 Fourier Transform NMR
- 14.3 Shielding*
- 14.4 The Number of Signals in the ^1H NMR Spectrum*
- 14.5 The Chemical Shift*
- 14.6 The Relative Position of ^1H NMR Signals*
- 14.7 Characteristic Values of Chemical Shifts*
- 14.8 Integration of NMR Signals*
- 14.9 Diamagnetic Anisotropy
- 14.10 Splitting of the Signals*
- 14.11 More Examples of ^1H NMR Spectra*
- 14.12 Coupling Constants*
- 14.13 Splitting Diagrams*
- 14.15 Protons Bonded to Oxygen and Nitrogen*
- 14.16 Use of Deuterium in ^1H NMR Spectroscopy
- 14.17 Resolution of ^1H NMR Spectra
- 14.18 ^{13}C NMR Spectroscopy*
- 14.20 Two-dimensional NMR Spectroscopy

* Sections that will be focused

Recommended additional problems

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