

Working Principle of Magnetic Spectrometer



Article Overview

A magnetic spectrometer works by detecting the interaction of atomic nuclei with an external magnetic field, measuring energy transitions caused by radiofrequency radiation to reveal molecular structure.

Principle of Operation

A magnetic spectrometer, such as an NMR (Nuclear Magnetic Resonance) spectrometer, relies on the magnetic properties of atomic nuclei. Certain nuclei, like hydrogen-1 (^1H) or carbon-13 (^{13}C), possess nuclear spin, which generates a tiny magnetic moment, effectively turning the nucleus into a small magnet. When a sample is placed in a strong external magnetic field, these nuclear magnets align either parallel (lower energy) or antiparallel (higher energy) to the field, creating discrete energy levels.

Resonance and Energy Transitions

The spectrometer applies radiofrequency (RF) radiation at a frequency matching the Larmor frequency of the nuclei, which is proportional to the magnetic field strength and specific to each type of nucleus. When the RF energy is absorbed, nuclei transition from the lower to the higher energy state, a phenomenon called resonance. As the nuclei relax back to their original state, they emit RF signals, which are detected by sensitive receivers

Article Content

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What is the basic principle of mass spectrometry? A mass spectrometer generates multiple ions from the sample being investigated,

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Magnetism | Definition, Examples, Physics, & Facts | Britannica

Magnetism, phenomenon associated with magnetic fields, which arise from the motion of electric charges. It can be an

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NMR Spectroscopy Explained: How It Works and Why It Matters ...

NMR Spectroscopy Principles, Interpreting an NMR Spectrum and Common Problems
In this article, we consider how

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12.1: Mass Spectrometry of Small Molecules

Figure 12.1.1: Representation of an electron-ionization, magnetic-sector mass spectrometer. Molecules

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Mass Spectrometry Basics

Mass spectrometers have many applications in a wide range of fields including forensics, environmental analysis, biology, quality

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NMR Spectroscopy Explained: How It Works and Why It Matters ...

Discover the fundamentals of NMR spectroscopy, how it detects nuclear spin, and why it's essential for molecular

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Mass Spectrometry

What mass spectrometry is, how it works, and what the technique is used for in analytical chemistry and other sciences.

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The technique of mass spectrometry began with the work of Thomson, Dempster and Aston in the early 1900s. Since then, the

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5 How the spectrometer works

5 How the spectrometer works NMR spectrometers have now become very complex instruments capable of performing an almost

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Magnetic Resonance Spectrometers | How it works

The operation of Magnetic Resonance Spectrometers is primarily based on the principles of

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Mass Spectrometry 101

As you can see in the interactive tutorial below, the ions enter the first (magnetic) analyzer, where they are

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4.2: Magnetic Sector

Magnetic sector instruments are often used in series with an electric sector, described below, for high resolution and tandem mass

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Magnetic Resonance Spectrometers | How it works ...

Working Principle of Magnetic Resonance Spectrometers The operation of Magnetic Resonance Spectrometers is

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Module 1: Fundamentals of Spectroscopy

RF radiation drives magnetic dipoles in an oscillatory fashion, as any oscillating magnetic field drives a bar magnet. Where possible,

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Magnetic Spectroscopy

Magnetic spectroscopy refers to techniques that characterize the magnetic properties of materials through the interaction of

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How do mass spectrometers work?

In early spectrometers, photographic detectors were used instead, producing a chart of

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NMR Spectroscopy

The principle behind NMR is that many nuclei have spin and all nuclei are electrically charged. If an external magnetic

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Nuclear magnetic resonance (NMR) spectroscopy

Discover how nuclear magnetic resonance (NMR) spectroscopy works, with this series of topics breaking down the fundamental

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Magnetic Spectrometers

Magnetic MASS Spectrometers Physics Aim: attribution of a reaction product to a nucleus $\Rightarrow$ high efficiency over a wide range of

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Understanding NMR Spectroscopy: Principles and Mechanisms

It exploits the magnetic properties of atomic nuclei to provide detailed information about a molecule's structure, dynamics, and

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How Does A Mass Spectrometer Work?

Mass Spectrometer for all other A-Level and Advanced Higher If you're studying Chemistry A-Level syllabus other

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A Comprehensive Guide to Mass Spectrometers: How They Work and ...

Mass spectrometers measure the mass-to-charge ratio of ions. This guide will explain how they work and their many uses. Mass

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How Do Spectrometers Work? Spectrometer vs. Spectrophotometer

Spectrometers can measure various phenomena such as electromagnetic light, mass, or nuclear magnetic resonance. This includes

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Nuclear magnetic resonance

In order to interact with the magnetic field in the spectrometer, the nucleus must have an intrinsic angular momentum and nuclear

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Magnetic Spectroscopy

In spite of the small solid angles that are usually employed the sensitivity of a magnetic spectrograph can be considerably enhanced

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What Is Mass Spectrometry? Principles, Methods & Application ...

How a Mass Spectrometer Works, Types of Instrumentation and Interpreting Mass Spectral Data Mass spectrometry

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Mass Spectrometry: Principles, Applications & Techniques | Danaher

Discover how mass spectrometry works. Compare ionization methods, GC-MS vs LC-MS and applications in pharmacology,

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Nuclear magnetic resonance spectroscopy

Nuclear magnetic resonance spectroscopy, commonly known as NMR spectroscopy or magnetic

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4.7: NMR Spectroscopy

The basic principle behind NMR is that some nuclei exist in specific nuclear spin states when exposed to an external

Contact Us

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