Nuclear Magnetic Resonance Oxford Chemistry Primers

Nuclear magnetic resonance (NMR) is a technique that is extensively used as a means of obtaining clinical images. In the form of magnetic resonance spectroscopy (MRS), the technique can also be used to study tissue chemistry. In this revised and updated second edition, the technique of NMR isintroduced, and the ways in which MRI and MRS can be used to study living systems are discussed, with an emphasis on applications in man. There are chapters which illustrate applications of magnetic resonance spectroscopy (MRS) and imaging (MRI), including the new methods of functional imaging. Chapters also cover the basic principles of the techniques, the parameters that characterize NMR signals, instrumentation, and pulsesequences.

This book presents a critical assessment of progress on the use of nuclear magnetic resonance spectroscopy to determine the structure of proteins, including brief reviews of the history of the field along with coverage of current clinical and in vivo applications. The book, in honor of Oleg Jardetsky, one of the pioneers of the field, is edited by two of the most highly respected investigators using NMR, and features contributions by most of the leading workers in the field. It will be valued as a landmark publication that presents the state-of-the-art perspectives regarding one of today's most important technologies.

Principles of Nuclear Magnetism has, over the years, established itself as the classic single volume treatise which gives a comprehensive account of all the concepts, theories, and results associated with the study of nuclear magnetism.

Modern NMR Spectroscopy

Understanding NMR Spectroscopy

A Recognition of E.L. Hahn

Nuclear Magnetic Resonance Studies in Plant Science, January 1984-October 1988

A Workbook of Chemical Problems

Nuclear Magnetic Resonance (NMR) spectroscopy is the most important characterization technique in synthetic chemistry today. By giving a simple overview of the relevant theory, in non-mathematical terms, and avoiding the 'pattern recognition' approach frequently adopted, this book demystifies NMR. It contains examples from many different areas of Inorganic Chemistry which are closely related to the theory described.

Magnetic resonance (MR) measures the tiny radio frequency signals emitted by the nucleus of the atom when living or inanimate material is placed in a magnetic field. On the one hand, these signals allow scientists to picture the architecture of molecules too small to be seen under the most powerful microscope, while on the other hand they give medical doctors a detailed picture of the internal structure of the human body without resorting to surgery of any kind. These two applications (high-resolution NMR spectroscopy and the MRI scanner) seem to be worlds apart, but the underlying physical principles are the same, and it makes sense to treat them together. Chemists and clinicians who use magnetic resonance have much to learn about each other's specialities if they are to make the best use of magnetic resonance technology. Many in the medical fraternity will benefit from a general appreciation of how high-resolution NMR has advanced our understanding of human biochemistry, diagnostic medicine, and the search for new drugs. A broad general understanding of magnetic resonance should prove of interest to doctors who make use of the MRI scanner, and to those of their patients who wish to learn more about these daunting machines, even if it is only the question of their own personal safety. At the other end of the spectrum, chemists and biochemists who use high-resolution NMR spectroscopy in their everyday investigations will benefit by broadening their horizons to cover the exciting new developments in MR imaging and in vivo spectroscopy, as one justification for their research is the eventual benefit to health care. Finally, anyone interested in how the human mind works (cognitive neuroscience) will find a chapter devoted to the exciting new developments in functional magnetic resonance imaging of the brain. Each disparate group has something useful to learn from the others. The treatment is pictorial rather than mathematical. Written by one of the world's leading NMR research teams, this monograph presents the most comprehensive and up-to-date treatment of nuclear magnetic resonance spectroscopy available. In the course of the last two decades, nuclear magnetic resonance spectroscopy has undergone a dramatic renaissance, and the authors provide a unified review of the entire field, covering basic principles and techniques for the study of solutions and solids, with emphasis placed on methods of one- and two-dimensional spectroscopy. The material is presented in an intuitive manner, with a large number of illustrations and a rigorous mathematical framework that should satisfy a wide audience.

Solid-State NMR

Multinuclear Solid-State Nuclear Magnetic Resonance of Inorganic Materials

A Guide for Chemists

Some Applications of Nuclear Magnetic Resonance to Chemical Problems

A Handbook of Nuclear Magnetic Resonance

Applications of Nuclear Magnetic Resonance Spectroscopy in Organic Chemistry, Second Edition focuses on the applications of nuclear magnetic resonance spectroscopy to problems in organic chemistry and the theories involved in this kind of spectroscopy. The book first discusses the theory of nuclear magnetic resonance, including dynamic and magnetic properties of atomic nuclei, nuclear resonance, and relaxation process. The manuscript also examines the experimental method. Topics include experimental factors that influence resolution and the shapes of absorption lines; measurement of line posit...

Nuclear Magnetic Resonance Spectroscopy is the only "tool" available for the determination of high-resolution biological molecule structure in solution. This volume includes methods for expeditiously analyzing the vast amount of data produced by the new 3D and 4D NMR techniques and for generating structures from the data and for assessing the quality of those structures. Application to various classes of important proteins and protein-ligand complexes illustrate uses of the methodology presented. Examination of techniques to explore the dynamic nature of proteins complete the volume.

Magnetic resonance (MR) makes use of tiny radio signals emitted by the nucleus of the atom. There are two important applications -- chemistry, where MR allows us to visualise the architecture of molecules, and medicine, where it provides a clear picture of human anatomy without the need for invasive surgery. This is the first unified treatment of Nuclear Magnetic Resonance (NMR) in chemistry and Magnetic Resonance Imaging (MRI) in medicine, written for a broad non-specialist readership by one of the world's foremost NMR spectroscopists.

NMR Spectroscopy in Inorganic Chemistry

Some Chemical Applications of Nuclear Magnetic Resonance Spectra

Nuclear Magnetic Resonance Studies in Chemistry

Principles of Nuclear Magnetic Resonance Microscopy

NMR and MRI of Electrochemical Energy Storage Materials and Devices

The renowned Oxford Chemistry Primers series, which provides focused introductions to a range of important topics in chemistry, has been refreshed and updated to suit the needs of today's students, lecturers, and postgraduate researchers. The rigorous, yet accessible, treatment of each subject area is ideal for those wanting a primer in a given topic to prepare them for more advanced study or research. Moreover, cutting-edge examples and applications throughout the texts show the relevance of the

chemistry being described to current research and industry. The learning features provided, including questions at the end of every chapter and online multiple-choice questions, encourage active learning and promote understanding. Furthermore, frequent diagrams, margin notes, and glossary definitions all help to enhance a student's understanding of these essential areas of chemistry. Nuclear Magnetic Resonance offers a concise and accessible introduction to the physical principles of liquid-state NMR, a powerful technique for probing molecular structures. Examples, applications, and exercises are provided throughout to enable beginning undergraduates to get to grips with this important analytical technique. Online Resource Centre The Online Resource Centre to accompany Nuclear Magnetic Resonance features: For registered adopters of the text: * Figures from the book available to download For students: * Multiple-choice questions for self-directed learning * Full worked solutions to the end-of-chapter exercises
Hahn is one of the outstanding physicists of the second half of the twentieth century. From his original discovery of spin echoes and his demonstration of nuclear free induction decay stem the most important methods of modern nuclear magnetic resonance. The wide impact of these methods in physics, chemistry, biology, and medicine is fully acknowledged. In addition, his fundamental contributions in nuclear quadruple echo phenomena, level crossing techniques, selfinduced transparency and laser physics have been of paramount importance. This book has been designed as a tribute to Hahn at his seventieth birthday. The articles present astimulating, challenging and, perhaps, controversial contribution to the scientific literature which will be read advantageously by students and research workers from the fields of nuclear magnetic resonance in physics, chemistry, biochemistry, and medical imaging together with electron spin resonance and laser optics. The contributors include the foremost researchers in magnetic resonance, among them A. Abragam, M. Bloom, R.R. Ernst, R. Freeman, M.P. Klein, P. Mansfield,M. Mehring, W.B. Mims, R.E. Norberg, A. Pines, A.G. Redfield, R.E. Richards, C.P. Slichter, and J.S. Waugh.
Nuclear Magnetic Resonance (NMR) spectroscopy is a powerful and theoretically complex analytical tool. Basic 1H- and 13C-NMR Spectroscopy provides an introduction to the principles and applications of NMR spectroscopy. Whilst looking at the problems students encounter when using NMR spectroscopy, the author avoids the complicated mathematics that are applied within the field. Providing a rational description of the NMR phenomenon, this book is easy to read and is suitable for the undergraduate and graduate student in chemistry. Describes the fundamental principles of the pulse NMR experiment and 2D NMR spectra Easy to read and written with the undergraduate and graduate chemistry student in mind Provides a rational description of NMR spectroscopy without complicated mathematics
315 Citations
Pulsed Magnetic Resonance--NMR, ESR, and Optics
Basic Principles and Practice
NMR
Nuclear Magnetic Resonance

An understanding of spectroscopic techniques in the analysis of chemical structures is essential to all chemistry degree courses. This new addition to the Oxford Chemistry Primers series provides the essential material needed by undergraduates, in a compact form. It will be beneficial to postgraduates in organic chemistry as reference material in their daily research.

Techniques of solid state nuclear magnetic resonance (NMR) spectroscopy are constantly being extended to a more diverse range of materials, pressing into service an ever-expanding range of nuclides including some previously considered too intractable to provide usable results. At the same time, new developments in both hardware and software are being introduced and refined. This book covers the most important of these new developments. With sections addressed to non-specialist researchers (providing accessible answers to the most common questions about the theory and practice of NMR asked by novices) as well as a more specialised and up-to-date treatment of the most important areas of inorganic materials research to which NMR has application, this book should be useful to NMR users whatever their level of expertise and whatever inorganic materials they wish to study.

The Assignment of the Absolute Configuration by NMR using Chiral Derivatizing Agents: A Practical Guide briefly explains the theoretical aspects necessary for understanding the methodology of new research in the field of Nuclear magnetic resonance spectroscopy (NMR).

NMR - The Toolkit
Some Chemical Applications of High Resolution Nuclear Magnetic Resonance
A Practical Guide
High-Resolution NMR Techniques in Organic Chemistry
Some Chemical Applications of Nuclear Magnetic Resonance

This book is designed to introduce the reader to the field of NMR/MRI at very low magnetic fields, from milli-Tesla to micro-Tesla, the ultra-low field (ULF) regime. The book is focused on applications to imaging the human brain, and hardware methods primarily based upon pre-polarization methods and SQUID-based detection. The goal of the text is to provide insight and tools for the reader to better understand what applications are best served by ULF NMR/MRI approaches. A discussion of the hardware challenges, such as shielding, operation of SQUID sensors in a dynamic field environment, and pulsed magnetic field generation are presented. One goal of the text is to provide the reader a framework of understanding the approaches to estimation and mitigation of low signal-to-noise and long imaging time, which are the main challenges. Special attention is paid to the combination of MEG and ULF MRI, and the benefits and challenges presented by trying to accomplish both with the same hardware. The book discusses the origin of unique relaxation contrast at ULF, and special considerations for image artifacts and how to correct them (i.e. concomitant gradients, ghost artifacts). A general discussion of MRI, with special consideration to the challenges of imaging at ULF and unique opportunities in pulse sequences, is presented. The book also presents an overview of some of the primary applications of ULF NMR/MRI being pursued.

This book demonstrates the usefulness of NMR spectroscopy for a wide variety of applications in environmental science and technology. It contains a wealth of information relating to instrumentation,

sample preparation, and data interpretation. The book is divided into three sections discussing contaminant interaction, solution and condensed-phase characterization, and nutrients and natural organic matter characterization. In addition to these in-depth chapters, an introductory overview provides the basic principles of solution and solid-state NMR spectroscopy. Each section also contains a discussion of advances in each area directly attributable to NMR spectroscopy. A final chapter suggests future directions for the deployment of this powerful technology in environmental science.
Energy storage material is a hot topic in material science and chemistry. During the past decade, nuclear magnetic resonance (NMR) has emerged as a powerful tool to aid understanding of the working and failing mechanisms of energy storage materials and devices. The aim of this book is to introduce the use of NMR methods for investigating electrochemical storage materials and devices. Presenting a comprehensive overview of NMR spectroscopy and magnetic resonance imaging (MRI) on energy storage materials, the book will include the theory of paramagnetic interactions and relevant calculation methods, a number of specific NMR approaches developed in the past decade for battery materials (e.g. in situ, ex situ NMR, MRI, DNP, 2D NMR, NMR dynamics) and case studies on a variety of related materials. Helping both NMR spectroscopists entering the field of batteries and battery specialists seeking diagnostic methods for material and device degradation, it is written by leading authorities from international research groups in this field.
High-resolution NMR Techniques in Organic Chemistry
Biological NMR Spectroscopy
Nuclear Magnetic Relaxation
Basic 1H- and 13C-NMR Spectroscopy
The Principles of Nuclear Magnetism

The power of nuclear magnetic resonance, NMR, for characterizing molecules dissolved in solution is widely acknowledged and NMR forms an essential component of undergraduate chemistry degrees. However, the application of NMR to the solid state is much less well appreciated. This text sets out the fundamental principles of solid-state NMR, explaining how NMR in solids differs from that in solution, showing how the various interactions of NMR can be manipulated to yield high-resolution spectra and to give information on local structure and dynamics in solids. This book aims to take some of the mystique out of solid-state NMR by providing a comprehensible discussion of the methodology, including the basic concepts and a practical guide to implementation of the experiments. A basic knowledge of solution-state NMR is assumed and is only briefly covered. The text is intended for those in academia and industry expecting to use solid-state NMR in their research and looking for an accessible introduction to the field. It will also be valuable for non-experts interested in learning how NMR can be usefully applied to solid systems. Detailed mathematical treatments are delayed to a chapter at the mid-point of the text and can be skipped. Introductions to experiments and numerical simulations are provided to help link NMR results to experimental practice. The different aspects of solid-state NMR, from basic pulse-and-acquire experiments to sophisticated techniques for the measurement of anisotropy information are presented. Examples illustrate the wide variety of applications of the technique and its complementarity to other solid-state characterization techniques such as X-ray diffraction. Various aspects of NMR crystallography are covered as are topics of motion in solids.
High-Resolution NMR Techniques in Organic Chemistry, Third Edition describes the most important NMR spectroscopy techniques for the structure elucidation of organic molecules and the investigation of their behaviour in solution. Appropriate for advanced undergraduate and graduate students, research chemists and NMR facility managers, this thorough revision covers practical aspects of NMR techniques and instrumentation, data collection, and spectrum interpretation. It describes all major classes of one- and two-dimensional NMR experiments including homonuclear and heteronuclear correlations, the nuclear Overhauser effect, diffusion measurements, and techniques for studying protein–ligand interactions. A trusted authority on this critical expertise, High-Resolution NMR Techniques in Organic Chemistry, Third Edition is an essential resource for every chemist and NMR spectroscopist.
Erros I have made; Interpretation of spectra; Symmetry and exchange; Structure determination using NMR alone; Structure and mechanism; Hints; Solutions.
NMR and Its Applications to Living Systems
Magnetic Resonance in Chemistry and Medicine
Some Applications of Nuclear Magnetic Resonance to Inorganic Chemistry
Some Chemical Applications of High-resolution Nuclear Magnetic Resonance
Chemical Applications of Nuclear Magnetic Resonance

The renowned Oxford Chemistry Primers series, which provides focused introductions to a range of important topics in chemistry, has been refreshed and updated to suit the needs of today's students, lecturers, and postgraduate researchers. The rigorous, yet accessible, treatment of each subject area is ideal for those wanting a primer in a given topic to prepare them for more advanced study or research. NMR: The Toolkit describessuccinctly the range of NMR techniques commonly used in modern research to probe the structures and properties of molecules in liquids. Emphasis is placed throughout on how these experiments actually work, givinga unique perspective on this powerful experimental tool.

From the initial observation of proton magnetic resonance in water and in paraffin, the discipline of nuclear magnetic resonance has seen unparalleled growth as an analytical method.

Modern NMR spectroscopy is a highly developed, yet still evolving, subject which finds application in chemistry, biology, medicine, materials science and geology. In this book, emphasis is on the more recently developed methods of solution-state NMR applicable to chemical research, which are chosen for their wide applicability and robustness. These have, in many cases, already become established techniques in NMR laboratories, in both academic and industrial establishments. A considerable amount of information and guidance is given on the implementation and execution of the techniques described in this book.

Nuclear magnetic resonsance (NMR) spectrocopy is the most powerful research tool used in chemistry today, but many chemists have yet to realize its true potential. Recent advances in NMR have led to a formidable array of new techniques - and acronyms - which leaves even the professional spectroscopist bewildered. How, then, can chemists decide which approach will solve their particular structural or mechanistic problem? This book provides a non-mathematical, descriptive approach to modern NMR spectroscopy, taking examples from organic, inorganic, and biological chemistry. It also contains much practical advice about the acquisition and use of spectra. Starting from the simple 'one pulse' sequence, the text employs a 'building block' approach to lead naturally to multiple pulse and two-dimensional NMR. Spectra of readily available compounds illustrate each technique. One- and two- dimensional methods are integrated in three chapters which show how to solve problems by making connections between spins through bonds, through space, or through exchange. There are also chapters on spectrum editing and solids. The final chapter contains a case history which attempts to weave the many strands of the text into a coherent strategy. This second edition reflects the progress made by NMR in the past few years; there is a greater emphasis on inorganic nuclei; some two-colour spectra are used; the treatment of heteronuclear experiments has moved from direct to 'inverse' detection; many new examples and spectra have been included; and the literature to early 1992 has been covered. An accompanying text, Modern NMR spectroscopy: A workbook of chemical problems, by Jeremy Sanders, Edwin Constable, and Brian Hunter, is available from OUP. Using a combination of worked examples and set problems, this workbook provides a practical guide to the accurate interpretation of NMR spectra, which will be of value to students and professional scientists alike.

How Pulse Sequences Work

The Assignment of the Absolute Configuration by NMR Using Chiral Derivatizing Agents

Principles of Nuclear Magnetic Resonance in One and Two Dimensions

The Toolkit

Biomolecular NMR Spectroscopy

This text is aimed at people who have some familiarity with high-resolution NMR and who wish to deepen their understanding of how NMR experiments actually ‘work’. This revised and updated edition takes the same approach as the highly-acclaimed first edition. The text concentrates on the description of commonly-used experiments and explains in detail the theory behind how such experiments work. The quantum mechanical tools needed to analyse pulse sequences are introduced set by step, but the approach is relatively informal with the emphasis on obtaining a good understanding of how the experiments actually work. The use of two-colour printing and a new larger format improves the readability of the text. In addition, a number of new topics have been introduced: How product operators can be extended to describe experiments in AX2 and AX3 spin systems, thus making it possible to discuss the important APT, INEPT and DEPT experiments often used in carbon-13 NMR. Spin system analysis i.e. how shifts and couplings can be extracted from strongly-coupled (second-order) spectra. How the presence of chemically equivalent spins leads to spectral features which are somewhat unusual and possibly misleading, even at high magnetic fields. A discussion of chemical exchange effects has been introduced in order to help with the explanation of transverse relaxation. The double-quantum spectroscopy of a three-spin system is now considered in more detail. Reviews of the First Edition “For anyone wishing to know what really goes on in their NMR experiments, I would highly recommend this book” – Chemistry World “...I warmly recommend for budding NMR spectroscopists, or others who wish to deepen their understanding of elementary NMR theory or theoretical tools” – Magnetic Resonance in Chemistry

Nuclear magnetic resonance spectroscopy : basic theory and background / Heike Knicker, Mark A. Nanny -- Sorption processes in the environment : nuclear magnetic resonance spectroscopy as a new analytical method / Mark A. Nanny -- The developmentof p13 sC labelin and p13 sC NMR spectroscopy techniques to study the interaction of pollutants with humic substances / Jacqueline M. Bortiatynski, Patrick G. Hatcher, Robert D. Minard -- Proton and p19 sF NMR spectroscopy of pesticideintermolecular interactions / Sharon J. Anderson -- A p19 sF and p2 sH NMR spectroscopic investigation of the interaction between nonionic organic contaminants and dissolved humic material / Bruc e E. Herbert, Paul M. Bertsch -- Adsorptionisotherms and p13 sC solid-state NMR study of hazardous organic compounds sorbed or coal fly ash / Daniel A. Netzel ... [et al.] -- Solution and condensed phase characterization / Rog er A. Minear, Mark A. Nanny -- NMR studies of the reaction ofamino acids with aqueous chlorine / Frank E. Scully, Jr. ... [et al.] -- Comparative results of p27 sAl NMR spectrometric and ferron colorimetric analyses of hydroxy aluminum hydrolysis products in aged, mildly acidic, aqueous systems / DavisonV. Vivit, Kevin A. Thorn, John D. Hem -- p27 sAl NMR study of the hydrolysis and condensation of organically complexed aluminum / Fabien Thomas ... [et al.] -- Cation and water interactions in the interlamellae of a smectite clay / AndreaLabouriau, Cliff T. Johnston, William L. Earl -- p2 sH NMR and gel formation of the ultrafine solids fraction associated with the Athaba sca Oil Sands fine tails / John A. Ripmeester ... [et al.] -- Characterization of natural organic matter bynuclear magnetic resonance spectroscopy / Jerry A. Leenheer -- p31 sP FT-NMR of concentrated lake water samples / Mark A. Nanny, Roger A. Minear -- Use of p31 sP NMR in the study of soils and the environment / Leo M. Condron ... [et al.] --Characterization of nitrogen in plant comp.

Nuclear magnetic resonance (NMR) is an enormously powerful and versatile method for investigating the structure and dynamics of molecules. This book provides the conceptual and theoretical tools needed to understand the inner workings of modern NMR experiments. The approach is relatively informal, accessible and concise.

A New MRI Regime

Nuclear Magnetic Resonance Spectroscopy in Environmental Chemistry

Ultra-Low Field Nuclear Magnetic Resonance
Introduction to Organic Spectroscopy
Applications of Nuclear Magnetic Resonance Spectroscopy in Organic Chemistry

The technique of nuclear magnetic resonance (NMR) spectroscopy is an important tool in biochemistry and biophysics for the understanding of the structure and ultimately, the function of biomolecules. This textbook explains the salient features of biological NMR spectroscopy to undergraduates and postgraduates taking courses in NMR, biological NMR, physical biochemistry, and biophysics. Unlike other books in the general field of NMR (except the advanced treatises), the approach here is tointroduce and make use of quantum mechanical product operators as well as the classical vector method of explaining the bewildering array of pulse sequences available today. The book covers two- dimensional, three- dimensional, and four- dimensional NMR and their application to protein and DNA structure determination. A unique feature is the coverage of the biological aspects of solid- state NMR spectroscopy. The author provides many selected examples from the research literature, illustratingthe applications of NMR spectroscopy to biological proteins.

This new edition has been thoroughly revised to bring the handbook up-to-date.

This highly successful book, details the underlying principles behind the use of magnetic field gradients to image molecular distribution and molecular motion, providing many examples by way of illustration. Following excellent reviews of the hardback edition the book is now available in paperback.