The Nature Of The Chemical Bond And The Structure Of Molecules And Crystals An Introduction To Modern Structural Chemistry

The life and chemical sciences are in the midst of a period of rapid and revolutionary transformation that will undoubtedly bring societal benefits but also have potentially malign applications, notably in the development of chemical weapons. Such concerns are exacerbated by the unstable international security environment and the changing nature of armed conflict, which could fuel a desire by certain States to retain and use existing chemical weapons, as well as increase State interest in creating new weapons; whilst a broader range of actors may seek to employ diverse toxic chemicals as improvised weapons. Stark indications of the multi-faceted dangers we face can be seen in the chemical weapons attacks against civilians and combatants in Iraq and Syria, and also in more targeted chemical assassination operations in Malaysia and the UK. Using a multi-disciplinary approach, and drawing upon an international group of experts, this book analyses current and likely near-future advances in relevant science and technology, assessing the risks of their misuse. The book examines the current capabilities, limitations and failures of the existing international arms control and disarmament architecture – notably the Chemical Weapons Convention – in preventing the development and use of chemical weapons. Through the employment of a novel Holistic Arms Control methodology, the authors also look beyond the bounds of such treaties, to explore the full range of international law, international agreements and regulatory mechanisms potentially applicable to weapons employing toxic chemical agents, in order to develop recommendations for more effective routes to combat their proliferation and misuse. A particular emphasis is given to the roles that chemical and life scientists, health professionals and wider informed activist civil society can play in protecting the prohibition against poison and chemical weapons; and in working with States to build effective and responsive measures to ensure that the rapid scientific and technological advances are safeguarded from hostile use and are instead employed for the benefit of us all.

Since the early 1990s, advances in toxicology have allowed scientists to detect traces of adulterant substances in everyday products – even down to parts per billion concentrations. We can now detect the presence of harmful ingredients at levels so low that they actually cause no harm. Nonetheless, we get scared. We are now able to overreact to harmless, negligible sources of contamination and flock to ‘natural’, ‘organic’ and ‘chemical-free’ alternative products at elevated prices instead. This urge is driven in part by a set of interesting psychological quirks called the naturalness preference or biophilia. While exposure to many aspects of nature improves our physical and mental wellbeing, marketers are taking advantage of our naturalness preference by selling us ‘organic’ and ‘natural’ products with no functional advantage, sometimes to the detriment of the environment, and that have the unfortunate added effect of peddling a fear of conventional products that do not make such natural connotations. This fear of chemicals, exaggerated by marketers, has led some of us to seek nature in the form of expensive consumer product, which offer almost none of the benefits of spending time outdoors in real nature (which is free of charge). We thus chase nature in the wrong form. We feel guilt, anxiety and mental stress from being coaxed into paying a hefty premium price for "natural" products that are neither safer nor more effective than conventional ones, and forget to appreciate real nature in the process. This book explores the history of chemical fears and the recent events that amplified it. It describes how consumers, teachers, doctors, lawmakers and journalists can help make better connections with the public by telling stories that are more engaging about chemistry and materials science. Written in a sympathetic way, this book explains both sides of the argument for anyone with an interest in science.

Reproduction of the original: An Introduction to Chemical Science by R.P. Williams

Classic undergraduate text explores wave functions for the hydrogen atom, perturbation theory, the Pauli exclusion principle, and the structure of simple and complex molecules. Numerous tables and figures.

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This revealing study considers the remarkable alliance between chemistry and art from the late eighteenth century to the period immediately following the Second World War. Synthetic Worlds offers fascinating new insights into the place of the material object and the significance of the natural, the organic, and the inorganic in Western aesthetics.

Esther Leslie considers how radical innovations in chemistry confounded earlier alchemical and Romantic philosophies of science and nature while profoundly influencing the theories that developed in their wake. She also explores how advances in chemical engineering provided visual artists with new colors, surfaces, coatings, and textures, thus dramatically recasting the way painters approached their work. Ranging from Goethe to Hegel, Blake to the Bauhaus, Synthetic Worlds ultimately considers the astonishing affinities between chemistry and aesthetics more generally. As in science, progress in the arts is always assured, because the impulse to discover is as immutable and timeless as the drive to create.

The features of chemistry that make it such a fascinating and engaging subject to teach also contribute to it being a challenging subject for many learners. Chemistry draws upon a wide range of abstract concepts, which are embedded in a large body of theoretical knowledge. As a science, chemistry offers ideas that are the products of scientists' creative imaginations, and yet which are motivated and constrained by observations of natural phenomena. Chemistry is often discussed and taught largely in terms of non-observable theoretical entities - such as molecules and electrons and orbitals - which probably seem as familiar and real to a chemistry teacher as Bunsen burners: and, yet, comprise a realm as alien and strange to many students as some learners' own alternative conceptions ('misconceptions') may appear to the teacher. All chemistry teachers know that chemistry is a conceptual subject, especially at the upper end of secondary school and at university level, and that some students struggle to understand many chemical ideas. This book offers a step-by-step analysis and discussion of just why some students find chemistry difficult, by examining the nature of chemistry concepts, and how they are communicated and learnt. The book considers the idea of concepts itself; draws upon case studies of how canonical chemical concepts have developed; explores how chemical concepts become represented in curriculum and in classroom teaching; and discusses how conceptual learning and development occurs. This book will be invaluable to anyone interested in teaching and learning and offers guidance to teachers looking to make sense of, and respond to, the challenges of teaching chemistry.

Classic guide provides intriguing entertainment while elucidating sound scientific principles, with more than 100 unusual stunts: cold fire, dust explosions, a nylon rope trick, a disappearing beaker, much more.

Chemistry and chemical engineering have changed significantly in the last decade. They have broadened their scopeâ€"into biology, nanotechnology, materials science, computation, and advanced methods of process systems engineering and controlâ€"so much that the programs in most chemistry and chemical engineering departments now barely resemble the classical notion of chemistry. Beyond the Molecular Frontier brings together research, discovery, and invention across the entire spectrum of the chemical sciencesâ€"from fundamental, molecular-level chemistry to large-scale chemical processing technology. This reflects the way the field has evolved, the synergy at universities between research and education in chemistry and chemical engineering, and the way chemists and chemical engineers work together in industry. The astonishing developments in science and engineering during the 20th century have made it possible to dream of new goals that might previously have been considered unthinkable. This book identifies the key opportunities and challenges for the chemical sciences, from basic research to societal needs and from terrorism defense to environmental protection, and it looks at the ways in which chemists and chemical engineers can work together to contribute to an improved future.

This inspired book by some of the most influential scientists of our time--including six Nobel laureates--chronicles our emerging understanding of the chemical bond through the last nine decades and into the future. From Pauling's early structural work using x-ray and electron diffraction to Zewail's femtosecond lasers that probe molecular dynamics in real time; from Crick's molecular biology to Rich's molecular recognition, this book explores a rich tradition of scientific heritage and accomplishment. The perspectives given by Pauling, Perutz, Rich, Crick, Porter, Polanyi, Herschbach, Zewail, and Bernstein celebrate major scientific achievements in chemistry and biology with the chemical bond playing a fundamental role. In a unique presentation that also provides some lively insights into the very nature of scientific thought and discovery, The Chemical Bond: Structure and Dynamics will be of general interest to scientists, science historians, and the scientifically inclined populous.

Discusses the reckless annihilation of fish and birds by the use of pesticides and warns of the possible genetic effects on humans.

Radiochemistry or Nuclear Chemistry is the study of radiation from an atomic or molecular perspective, including elemental transformation and reaction effects, as well as physical, health and medical properties. This revised edition of one of the earliest and best known books on the subject has been updated to bring into teaching the latest developments in research and the current hot topics in the field. In order to further enhance the functionality of this text, the authors have added numerous teaching aids that include an interactive website that features testing, examples in MathCAD with variable quantities and options, hotlinks to relevant text sections from the book, and online self-grading texts. As in the previous edition, readers can closely follow the structure of the chapters from the broad introduction through the more in depth descriptions of radiochemistry then nuclear radiation chemistry and finally the guide to nuclear energy (including energy production, fuel cycle, and waste management). New edition of a well-known, respected text in the specialized field of nuclear/radiochemistry Includes an interactive website with testing and evaluation modules based on exercises in the book Suitable for both radiochemistry and nuclear chemistry courses

An insightful analysis of confined chemical systems for theoretical and experimental scientists Chemical Reactivity in Confined Systems: Theory and Applications presents a theoretical basis for the molecular phenomena observed in confined spaces. The book highlights state-of-the-art theoretical and computational approaches, with a focus on obtaining physically relevant clarification of the subject to enable the reader to build an appreciation of underlying chemical principles. The book includes real-world examples of confined systems that highlight how the reactivity of atoms and molecules change upon encapsulation. Chapters include discussions on recent developments related to several host-guest systems, including cucurbit[n]uril, ExBox+4, clathrate hydrates, octa acid cavitand, metal organic frameworks (MOFs), covalent organic frameworks (COFs), zeolites, fullerenes, and carbon nanotubes. Readers will learn how to carry out new calculations to understand the physicochemical behavior of confined quantum systems. Topics covered include: A thorough introduction to global reactivity descriptors, including electronegativity, hardness, and electrophilicity An exploration of the Fukui function, as well as dual descriptors, higher order derivatives, and reactivity through information theory A practical discussion of spin dependent reactivity and temperature dependent reactivity Concise treatments of population analysis, reaction force, electron localization functions, and the solvent effect on reactivity Perfect for academic researchers and graduate students in theoretical and computational chemistry and

confined chemical systems, Chemical Reactivity in Confined Systems: Theory and Applications will also earn a place in the libraries of professionals working in the areas of catalysis, supramolecular chemistry, and porous materials.

The Characterization of Chemical Purity: Organic Compounds focuses on the processes, methodologies, and reactions involved in chemical purity. The selection first offers information on the concept of purity and its bearing on methods used to characterize purity and thermal methods, including general observations on impurity determination, freezing and melting phenomena, and classification of thermal methods of purity control. The manuscript also takes a look at density measurements, refractive index, and vapor pressure and boiling temperature measurements. The book ponders on chromatography and mass spectrometry. Discussions focus on chromatograms, testing of purity, quantitative and qualitative analysis, and liquid chromatography. The text also reviews optical, Raman, and nuclear magnetic resonance spectroscopy. Topics include infra-red (vibrational) spectra, experimental techniques, and nature of the Raman effect. Chemical and physical measurements, calibration of instruments, availability of standard reference materials, and value of human effort are discussed. The manuscript is a dependable reference for readers interested in chemical purity.

Chemical Binding and Structure describes the chemical binding and structure in terms of current chemical theory. This book is composed of 13 chapters, and starts with a presentation of the principles of the old and modified quantum theory and its application. The next chapters cover some basic topics related to chemical binding and structure, including electrons, the periodic table, the electrovalent and covalent bonds, and molecular geometry. These topics are followed by discussions on the nature of the bond in transition metal complexes; electronic and crystal structure; crystallinity; and other states of matter. The concluding chapters are devoted to some analytical techniques for structure determination, such as diffraction and spectroscopic methods. This book is of value to high school and college chemistry teachers and students.

A study of the origins of love probes the human brain for insights into the origins of the sex drive, romance, and attraction, while offering advice on how to channel these desires into healthy pursuits.

Matter has several forms, and these can be changed physically or chemically. This science book will dive deep into the topic of physical and chemical change with the intent of fueling your child’s appreciation of this unique scientific truth. This book has been created to match your fourth grader’s academic needs. Grab a copy today.

Many of the earliest books, particularly those dating back to the 1900s and before, are now extremely scarce and increasingly expensive. We are republishing these classic works in affordable, high quality, modern editions, using the original text and artwork.

Alligator Metabolism: Studies on Chemical Reactions in Vivo presents a summary of research in vivo on the metabolism of alligators. The volume contains updates of earlier investigations which were presented in Biochemistry of the Alligator, a Study of Metabolism in Slow Motion (1964). Since then, with the aid of better equipment and better methods, it seemed time to correlate and summarize the findings of researchers who have used this remarkable experimental animal with profit. The primary purpose of almost all the research was not to determine the nature of the alligator, but to understand biochemical reactions in vivo and the alligator was a means to that end. The book begins with a chapter on natural history for those scientists, wild-life experts, alligator farmers, zoo keepers etc., whose primary interest is in the nature and habits of the intact alligator. This is followed by separate chapters that deal with metabolic rate, anaerobic glycolysis, digestion-growth-protein synthesis, carbohydrate metabolism, amino acid metabolism, respiration and acid-base balance, and kidney function.

Images and text capture the astonishing beauty of the chemical processes that create snowflakes, bubbles, flames, and other wonders of nature. Chemistry is not just about microscopic atoms doing inscrutable things; it is the process that makes flowers and galaxies. We rely on it for bread-baking, vegetable-growing, and producing the materials of daily life. In stunning images and illuminating text, this book captures chemistry as it unfolds. Using such techniques as microphotography, time-lapse photography, and infrared thermal imaging, The Beauty of Chemistry shows us how chemistry underpins the formation of snowflakes, the science of champagne, the colors of flowers, and other wonders of nature and technology. We see the marvelous configurations of chemical gardens; the amazing transformations of evaporation, distillation, and precipitation; heat made visible; and more.

Chemical education is essential to everybody because it deals with ideas that play major roles in personal, social, and economic decisions. This book is based on three principles: that all aspects of chemical education should be associated with research; that the development of opportunities for chemical education should be both a continuous process and be linked to research; and that the professional development of all those associated with chemical education should make extensive and diverse use of that research. It is intended for: pre-service and practising chemistry teachers and lecturers; chemistry teacher educators; chemical education researchers; the designers and managers of formal chemical curricula; informal chemical educators; authors of textbooks and curriculum support materials; practising chemists and chemical technologists. It addresses: the relation between chemistry and chemical education; curricula for chemical education; teaching and learning about chemical compounds and chemical change; the development of teachers; the development of chemical education as a field of enquiry. This is mainly done in respect of the full range of formal education contexts (schools, universities, vocational colleges) but also in respect of informal education contexts (books, science centres and museums).

Molecular surface science has made enormous progress in the past 30 years. The development can be characterized by a revolution in fundamental knowledge obtained from simple model systems and by an explosion in the number of experimental techniques. The last 10 years has seen an equally rapid development of quantum mechanical modeling of surface processes using Density Functional Theory (DFT). Chemical Bonding at Surfaces and Interfaces focuses on phenomena and concepts rather than on experimental or theoretical techniques. The aim is to provide the common basis for describing the interaction of atoms and molecules with surfaces and this to be used very broadly in science and technology. The book begins with an overview of structural information on surface adsorbates and discusses the structure of a number of important chemisorption systems. Chapter 2 describes in detail the chemical bond between atoms or molecules and a metal surface in the observed surface structures. A detailed description of experimental information on the dynamics of bond-formation and bond-breaking at surfaces make up Chapter 3. Followed by an in-depth analysis of aspects of heterogeneous catalysis based on the d-band model. In Chapter 5 adsorption and chemistry on the enormously important Si and Ge semiconductor surfaces are covered. In the remaining two Chapters the book moves on from solid-gas interfaces and looks at solid-liquid interface processes. In the final chapter an overview is given of the environmentally important chemical processes occurring on mineral and oxide surfaces in contact with water and electrolytes. Gives examples of how modern theoretical DFT techniques can be used to design heterogeneous catalysts This book suits the rapid introduction of methods and concepts from surface science into a broad range of scientific disciplines where the interaction between a solid and the surrounding gas or liquid phase is an essential component Shows how insight into chemical bonding at surfaces can be applied to a

range of scientific problems in heterogeneous catalysis, electrochemistry, environmental science and semiconductor processing Provides both the fundamental perspective and an overview of chemical bonding in terms of structure, electronic structure and dynamics of bond rearrangements at surfaces

Many organic chemists will agree with me that the old "electronic theory" has for a long time been inadequate for the interpretation of various new findings in chemistry, particularly for those of reactivity. Considering the outstanding progress which has been made during the past 20 years in the interpretation of these facts, aided by the molecular orbital theory, the time has finally come for a new book showing what is within and what is beyond the reach of quantum-chemical methods. It was therefore highly suitable that Dr. F. L. Boschke of the Springer Verlag suggested to me to make a contribution to a volume in the series "Topics in Current Chemistry" in February 1969. The article was published as Vol. 15, No 1 in June 1970. This new book is an expanded version of the article written in 1970. In this present volume several of the most up-to-date findings which have been gained in organic chemistry since then have been added. It is highly probable that a certain "theoretical" design in the experimenta lists' mind may have been the reason for these developments, whether they themselves are aware of it or not. Theory produces new experimental ideas and conversely, a host of experimental data add another vista to new theories. Due to the mutual beneficial effect of theory and experiment this book will always retain its value, although the quantum-chemical approach to the theory of reactivity is, of course, still in the develop mental stage.

Chemical Pathways of Metabolism, Volume I focuses on the chemical steps involved in the metabolism of the major constituents of living organisms. The selection first elaborates on free energy and metabolism, enzymes in metabolic sequences, and glycolysis. Discussions focus on comparative biochemistry of glycolysis, enzymes of the glycolytic cycle, oxidative conversion of glucose to tetrose, transmethylation, and free energy and its determination. The manuscript then examines the tricarboxylic acid cycle and other pathways of carbohydrate metabolism. The text ponders on the biosynthesis of complex saccharides, including mechanisms of disaccharide formation, syntheses of branched polysaccharides, synthesis of levan from sucrose, and reversibility reactions by hydrolytic enzymes. The publication then elaborates on fat metabolism and acetoacetate formation and sterol and steroid metabolism. Topics include androgens, sterols, phospholipides or phosphatides, path of fat absorption, and theories of fatty acid breakdown and acetoacetate formation. The selection is a dependable reference for researchers interested in the chemical pathways of metabolism.