

Chapter # 03

→ Atomic Structure

ATOM:

Atom has three fundamental particles which are these:

I. ELECTRON:

Electron carries negative charge the charge on Electron is $1.6 \times 10^{-19} \text{C}$ and the mass of Electron is $9.1094 \times 10^{-31} \text{ Kg}$ or 0.0005 a. m. u.

II. PROTON:

Proton carries positive charge the charge on Proton is $1.6 \times 10^{-19} \text{C}$ and the mass of Proton is $1.6726 \times 10^{-27} \text{ Kg}$ or 1.0073 a. m. u.

III. NEUTRON:

Neutron is a neutral particle.

- Crook's tube experiment shows the presence of electron and protons in the atoms.
- In the Crook's tube experiment rays coming out from cathode are called cathode rays. These are negatively charged rays and consist of Electron.
- Neutron was discovered by James Chadwick.
- According to Rutherford, mass of atom is concentrated at its center called nucleus.
- The central nucleus of an atom is very small. It contains positively charged protons and neutrons.
- which have no charge.
- Goldstein discovered positive canal rays (protons). Canal rays travel in discharge tube from anode towards cathode.

RADIOACTIVITY:

The spontaneous decay of unstable atom with the emission of invisible radiation is called as Radioactivity, discovered by Henri Becquerel.

RADIOACTIVE ELEMENTS GIVEN OFF α , β AND γ RAYS.

- Alpha (α) particles are positively charged.
- Beta (β) particles are negatively charged.
- γ — Rays are neutral.

Research In Atomic Structure Lecture Notes In Chemistry

Sergio Rampino



Research In Atomic Structure Lecture Notes In Chemistry:

Research in Atomic Structure S. Fraga, M. Klobukowski, J. Muszynska, E. San Fabian, K.M.S. Saxena, J.A. Sordo, T.L. Sordo, 2012-12-06 Impressive advances have been made in the study of atomic structures at both the experimental and theoretical levels And yet the scarcity of information on atomic energy levels is evident At the same time there exists a need for data because of the developments in such diverse fields as astrophysics and plasma and laser research all of them of fundamental importance as well as practical impact This project of research in atomic structure consisting of three components formulation computer program and numerical results constitutes a basic and comprehensive work with a variety of uses In its most practical application it will yield a rather accurate prediction of the energy levels of any atomic system of use per se or in the interpretation and confirmation of experimental results On the other hand it will also be of use in the comparative study of the appropriateness of the various levels of approximation and as a point of reference

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Methods in Reaction Dynamics W. Jakubetz,2012-12-06 Methods in Reaction Dynamics is a collection of lectures given at the 1999 Mariapfarr Workshop in Theoretical Chemistry Arranged as a series of detailed reviews it provides an overview of quantum mechanical techniques used to describe and simulate the dynamics and kinetics of elementary chemical reactions The volume provides in depth discussions of selected topics in Theoretical Chemistry such as quantum methods in theoretical and computational reaction dynamics and kinetics time dependent time independent and mixed quantum classical techniques Some of the topics have not been reviewed before in detail

Atomic Physics Paul Ewart,2019-02-28 Atomic Physics provides a concise treatment of atomic physics and a basis to prepare for work in other disciplines that are underpinned by atomic physics such as chemistry biology and several aspects of engineering science The focus is mainly on atomic structure since this is what is primarily responsible for the physical properties of atoms After a brief introduction to some basic concepts the perturbation theory approach follows the hierarchy of interactions starting with the largest The other interactions of spin and angular momentum of the outermost electrons

with each other the nucleus and external magnetic fields are treated in order of descending strength A spectroscopic perspective is generally taken by relating the observations of atomic radiation emitted or absorbed to the internal energy levels involved X ray spectra are then discussed in relation to the energy levels of the innermost electrons Finally a brief description is given of some modern laser based spectroscopic methods for the high resolution study of the nest details of atomic structure

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Reaction and Molecular Dynamics A. Lagana,A. Riganelli,2000-11-27 The amazing growth of computational resources has made possible the modeling of complex chemical processes To develop these models one needs to proceed from rigorous theoretical methods to approximate ones by exploiting the potential of innovative architectural features of modern concurrent processors This book reviews some of the most advanced theoretical approaches in the field of molecular reaction dynamics in order to cope as rigorously as possible with the complexity of real systems *Mathematical Models and Methods for Ab Initio Quantum Chemistry* M. Defranceschi,C. Le Bris,2012-12-06 On the occasion of the fourth International Conference on Industrial and Applied Mathematics we decided to organize a sequence of 4 minisymposia devoted to the mathematical aspects and the numerical aspects of Quantum Chemistry Our goal was to bring together scientists from different communities namely mathematicians experts at numerical analysis and computer science chemists just to see whether this heterogeneous set of lecturers can produce a rather homogeneous presentation of the domain to an uninitiated audience To the best of our knowledgde nothing of this kind had never been tempted so far It seemed to us that it was the good time for doing it both because the interest of applied mathematicians into the world of computational chemistry has exponentially increased in the past few years and because the community of chemists feels more and more concerned

with the numerical issues Indeed in the early years of Quantum Chemistry the pioneers Coulson Mac Weeny just to quote two of them used to solve fundamental equations modelling toy systems which could be simply numerically handled in view of their very limited size The true difficulty arose with the need to model larger systems while possibly taking into account their interaction with their environment Hand calculations were no longer possible and computing science came into the picture

Recollections of a Scientist Norman N. Greenwood, 2012-04-25 *Recollections of a Scientist 1 Boyhood and Youth in Australia 1925 1948* This illustrated book is the first volume of the Memoirs of a distinguished internationally renowned scientist Professor Norman N Greenwood FRS It gives a lively and intimate account of his boyhood and youth in Australia during the nineteen thirties and forties and is divided into thirteen chapters It is a personal account rather than a formal history and describes in refreshing detail his richly diverse experiences Chapter 1 explains how he came to be born in Melbourne although both of his parents as well as his elder sister and younger brother were all born in Northern England his father Professor John Neill Greenwood had just been appointed as the first Professor of Metallurgy in an Australian University The scene is further set by a brief account of the extraordinary events that led up to the founding of the University of Melbourne following the Victorian Gold Rush of the mid nineteenth century and its subsequent development into one of the major Universities of the then British Empire The young family settled in Mont Albert one of the developing eastern suburbs of the expanding metropolis but unfortunately his parents separated soon afterwards and subsequently divorced The children moved with their mother to the neighbouring suburb of Surrey Hills and one of her sisters came out from England to help with the growing family Norman goes on to describe the various schools he attended and has some perceptive comments on his teachers the ethos of the schools and the gradual changes that have occurred in the approach to education in Victoria over the years since the nineteen thirties Initially vacations were spent at a country cottage being built by his father at Kinglake in the densely wooded hills to the north of Melbourne and Norman evokes a childhood view of the exotic plants and animals of the bush the deep secluded tree fern gullies and tumbling mountain streams His father was one of the main protagonists for the development of the Kinglake National Park which he had helped to found Tragically much of the Park was engulfed by the enormous bush fires the worst in Australia s history that wiped out the little township of Kinglake with great loss of life in February 2009 Other holidays were spent on the beaches of Port Phillip Bay or on the cooler slopes of the Dandenong Ranges to the east Norman and his younger brother Eric always known in his youth as Peter or Nipper loved roaming in the Olinda State Forest and Sherwood Forest where the tall mountain ash eucalyptus trees towered above the dense undergrowth of tree ferns and other plants Bush animals abounded as did the raucous cockatoos and multicoloured parrots The great prize however was to sight a lyre bird performing his stately dance and singing his amazing repertoire of all the other birds songs and even the man mad sounds of car horns chain saws and steam engines For the three years 1939 40 41 Norman attended University High School near the city centre and adjacent to the grounds of the University itself It

was a remarkable school with an excellent academic reputation but also known for fostering of musical talent and for its prowess in sport Norman joined the School Orchestra as second flute and they gave concerts in the Melbourne Town Hall and occasionally on the State broadcasting station 3LO He also edited the School Magazine The Record perhaps an early portent of his later prolific output of scientific research papers reviews monographs and textbooks In the summer vacation of January 1940 during which Norman had his fifteenth birthday he went on and extended 1300 mile concert party tour of twenty eight country towns in Western Victoria and over the border into South Australia The trip was organised by the Young Australia League YAL and took the form of a White Minstrels Review of thirty boys with songs i

Atoms, Chemical Bonds and Bond Dissociation Energies Sandor Fliszar, 2013-03-09 Chemical bonds their intrinsic energies in ground state molecules and the energies required for their actual cleavage are the subject of this book The theory modelled after a description of valence electrons in isolated atoms explains how intrinsic bond energies depend on the amount of electronic charge carried by the bond forming atoms It also explains how bond dissociation depends on these charges While this theory vividly explains thermochemical stability future research could benefit from a better understanding of bond dissociation if we learn how the environment of a molecule affects its charges we also learn how it modifies bond dissociation in that molecule This essay is aimed at theoretical and physical organic chemists who are looking for new perspectives to old problems

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Chemistry at the Frontier with Physics and Computer Science Sergio Rampino, 2022-05-16 Chemistry at the Frontier with Physics and Computer Science Theory and Computation shows how chemical concepts relate to their physical counterparts and can be effectively explored via computational tools It provides a holistic overview of the intersection of

these fields and offers practical examples on how to solve a chemical problem from a theoretical and computational perspective going from theory to models methods and implementation Sections cover both sides of the Born Oppenheimer approximation nuclear dynamics and electronic structure chemical reactions chemical bonding and cover theory to practice on three related physical problems wavepacket dynamics Hartree Fock equations and electron cloud redistribution Drawing on the interdisciplinary knowledge of its expert author this book provides a contemporary guide to theoretical and computational chemistry for all those working in chemical physics physical chemistry and related fields Combines a big picture overview of chemistry as it relates to physics and computer science including detailed guidance on tackling chemistry problems from both theoretical and computational perspectives Treats nuclear dynamics and electronic structure on the same footing in discussions of the Born Oppenheimer approximation Includes examples of scientific programming in modern Fortran for problems related to the modeling of chemical reaction dynamics and the analysis of chemical bonding

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Methods in Computational Chemistry Stephen Wilson,2013-12-01 Recent years have seen the proliferation of new computer designs that employ parallel processing in one form or another in order to achieve maximum performance Although the idea of improving the performance of computing machines by carrying out parts of the computation concurrently is not new indeed the concept was known to Babbage such machines have until fairly recently been confined to a few specialist research laboratories Nowadays parallel computers are commercially available and they are finding a wide range of applications in chemical calculations The purpose of this volume is to review the impact that the advent of concurrent computation is already having and is likely to have in the future on chemical calculations Although the potential of concurrent computation is still far from its full realization it is already clear that it may turn out to be second in importance only to the introduction of the electronic digital computer itself

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