

tions are chosen to illustrate the principles and methods involved in the various types of chain processes. The most interesting section of the book deals with the mathematical treatment of chain reactions including nonsteady state conditions. The rigorous mathematical representation may at first appear to be an exercise in the solution of complex differential equations. However the labor is well justified in the application of the theoretical results to an analysis of the characteristics of spontaneously explosive reactions, such as the hydrogen-oxygen reaction and the oxidation of carbon monoxide. The final chapter is devoted to the kinetics of an unbranched chain reaction as encountered in addition polymerization of unsaturated compounds.

In general this book serves the very fine purpose of examining the theoretical principles of the kinetics of chain reactions, including the interplay of mass transport and chemical interaction. The treatment is not directed at the specialist engaged in research in chemical kinetics, rather it is a brief account of a rapidly expanding field of scientific endeavor. The keen interest in combustion processes and polymerization reactions coupled with the availability of modern computing devices promises major advances in chemical kinetics during the next twenty years.

An Introduction to Junction Transistor Theory. By R. D. Middlebrook. 296 pp. John Wiley & Sons, Inc., New York, 1957. \$8.50. Reviewed by R. Hobart Ellis, Jr., New York City.

As engineers take over radar's microwaves and the nuclear chain reaction, the physicist's frontier seems to be shifting to the study of solids. The ten-year-old transistor is the most useful contribution to come from this study. It is still so young that to most physicists it is just a tiny substitute for a vacuum tube. This book will serve as a simple path to a more subtle understanding.

For convenience we can divide transistor study into semiconductor physics, electrical action of transistors, and transistor circuitry. Dr. Middlebrook aims at the second. He offers some semiconductor theory as a foundation, discusses electrical function thoroughly, and leaves circuitry to others. In terms of minority carrier density and migration he describes transistor action for us and develops in detail the equivalent circuit on which he has worked at Stanford University.

The nonpragmatic scientist, curious about the nature of things for the fun in it, may be a little unhappy at the physics in the book. The relationships among electron orbitals, holes, and conduction electrons are not clearly delineated. One hard-to-take model pictures hole migration in terms of a cluster of negative mass electrons that moves as a unit in a direction opposite to the force of the electric field and carries the hole along in the center. But the author frequently refers his reader to Shockley's basic *Electrons and Holes in Semiconductors*, in which such matters are treated exactly. He assumes the Fermi-Dirac population formula with-

out derivation and discusses Brillouin zone conduction in only a cursory manner.

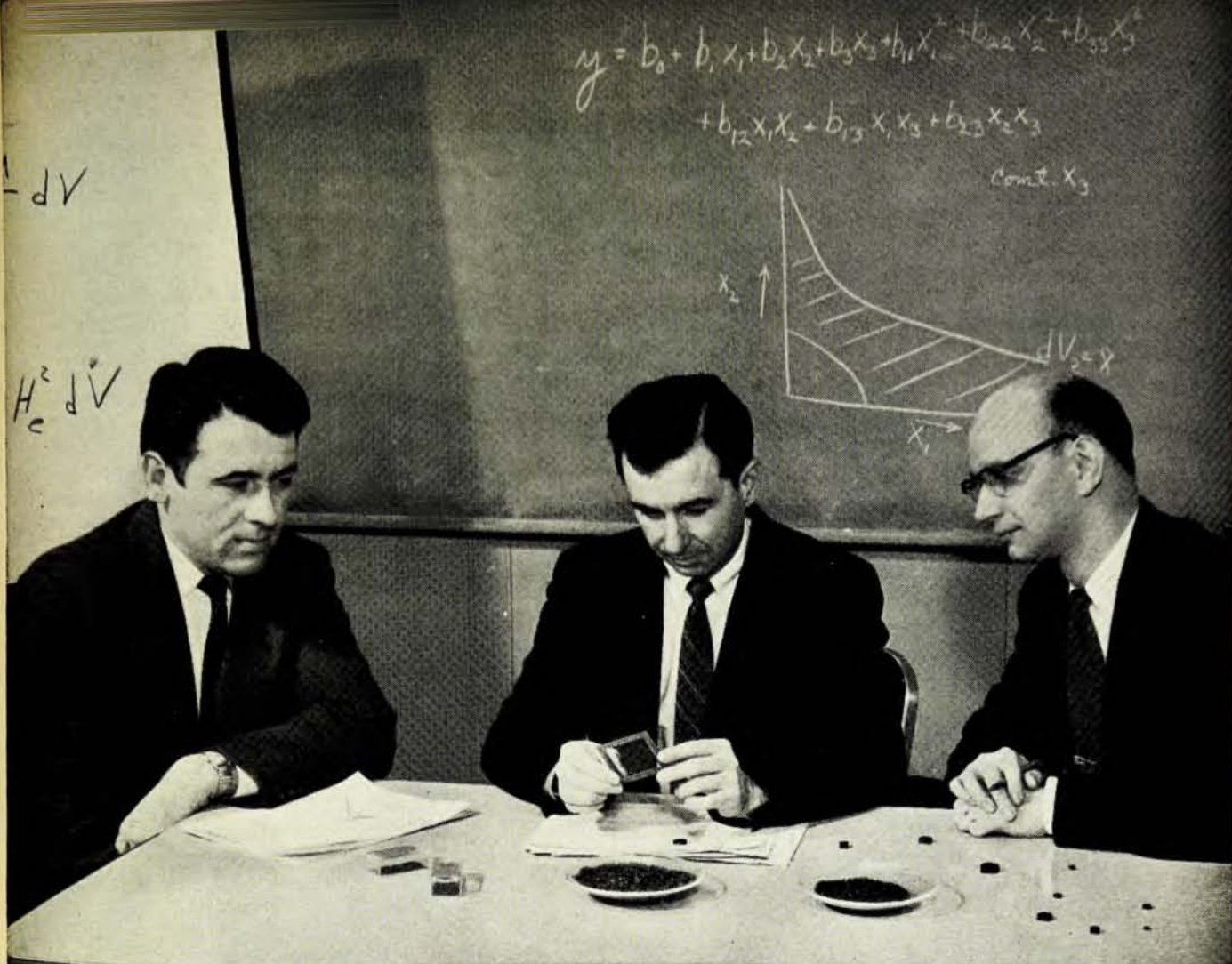
We must compliment author and editor on the planning of the book. It has been wisely said that the way to teach a subject is to describe it completely in a page, then do it over again in a complete chapter, then at book length, and so on. This book follows this plan. Quantitative descriptions follow qualitative ones, and the reader is kept constantly aware of what is ahead of him.

In a few years the term "circuit design" will not imply only vacuum-tube circuits as it does in current book titles. People will learn to use the transistor for its unique properties as a current amplifier, and this book will help them learn.

Statistische Thermodynamik. By Arnold Münster. 852 pp. Springer-Verlag, Berlin, Germany, 1956. DM 138.00. Reviewed by T. Teichmann, Lockheed Aircraft Corporation.

While statistical and mechanical thermodynamics remain among the most basic and unifying aspects of modern science, the development of new techniques and their application to new problems lead to an inevitable change of emphasis and approach. Professor Münster has recognized this in his work which essays to satisfy the needs of the practicing physicist and physical chemist while yet retaining some of the aspects of a textbook and providing the student with a thorough foundation. Naturally such an ambitious approach has necessitated certain restrictions in topics and methods—for example, only equilibrium states of matter are considered and while the basic methods are thoroughly described, many possible variants are omitted—but the book remains the most comprehensive and palatable account presently available. In order to make this great mass of material more accessible to beginners, the more advanced topics for application are "starred" and can be omitted at the first reading.

The book consists of four sections dealing with the foundations of statistical mechanics, the theory of gases, the theory of crystals, and the theory of liquids. It is, of course, impossible in a review of this length to list all the significant subjects described but certain features of the treatment seem of particular interest. There are included a very thorough treatment of Gibbs' method and a discussion of the ergodic problem, and an extended discussion of phase transition including the new methods of Lee and Yang, a description of the general theory of condensation, and discussion of the Born-Green theory of molecular distribution function. In the section on crystals, a detailed description of the Kramers-Wannier theory is given and Onsager's solution of the two-dimensional Ising problem is presented in the form first given by Montroll and Newell. The implication of this method for three-dimensional problems is touched on, though not as thoroughly. The electron conductivity of metals and the Nernst heat theorem are also given thorough consideration in this section. The



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final section on the theory of liquids deals with the problems of melting and of solutions of weak and strong electrolytes and more of solutions of macromolecules.

The book is distinguished by many recent references and by the inclusion of most of the significant modern work in this field. In particular, the author has given careful attention to the work of Kirkwood and his collaborators and has even included references to such an exotic item as Kirkwood's "Princeton notes of 1947". Great effort seems to have been made throughout to make the presentation both comprehensive and perspicuous and at the same time to avoid overwhelming the reader with inessential mathematical minutiae. The book has the excellent typographic format which the readers are led to expect from this series and is a worthy addition to the Springer collection.

Annual Review of Nuclear Science. Vol. 6. Edited by J. G. Beckerley, M. D. Kamen, L. I. Schiff. 471 pp. Annual Reviews, Inc., Palo Alto, Calif., 1956. \$7.00. Reviewed by S. F. Singer, University of Maryland.

The present volume is the sixth in the series and takes in nuclear physics from its astrophysical aspects to its biological aspects. The variations of primary cosmic rays are discussed by Sarabhai and Nerurkar with particular emphasis on the special interest of the authors, the solar diurnal variation. No universally accepted explanation exists, but the accumulation of data on the time variations, particularly during the forthcoming International Geophysical Year, should advance our understanding of their causes. The polarization of fast nucleons is discussed by Wolfenstein with emphasis in the region 100 to 400 Mev. The article develops a formalism which may be used in the analysis of experiments with polarized nucleons. Heydenburg and Temmer treat the Coulomb excitation or electric excitation due to a passing charged particle of low-lying nuclear excited states. Excitation by electrons is briefly touched upon but the main portion of the article is devoted to heavy particle excitation and includes a brief discussion of the theory as well as an account of experiments in the field. In particular the interpretation of the experiments in terms of the electric quadrupole moments of nuclei is described. Mack and Arroe give a brief discussion on the isotope shift in atomic spectra. Way, Kundu, McGinnis, and Lieshout have a lengthy paper on the properties of medium-weight nuclei giving much tabular material on their ground state, spins, magnetic moments, quadrupole moments, levels, and gamma-ray lifetimes. Horne, Coryell, and Goldring present a short paper on generalized acidity in radiochemical separations. Mattauch, Waldmann, Bieri, and Everling give a detailed discussion with much tabular material on the masses of light nuclides. Brooks gives a very topical and comprehensive paper on nuclear radiation effects in solids. It discusses the theory of atomic displacements and includes such items as thermal spikes due to intense heating in a region of atomic dimensions, phase changes, and cold working. The rest of the chapter

deals with particular materials, such as graphite, uranium. The final portion discusses damage to various solids: semiconductors, metals, valence crystals, and alkali halides. Taube discusses some applications of oxygen isotopes in chemical studies. Oxygen unfortunately has no radioactive isotopes which makes the problem rather difficult. Recent advances in low-level counting techniques is the subject treated by Anderson and Hayes and deals with advances in the techniques for beta counting (C^{14} and H^3), gamma-counting, double beta-decay, and the problem of detecting the neutrino. One of the longest chapters is on nuclear reactors for electric power generation by Davidson, Loeb, and Young. It discusses a great variety of power reactor designs, 27 of them. Of interest is the economic discussion at the end of the chapter which compares the cost per kilowatt for different installations. Values as low as \$250 per kilowatt are mentioned. The longest chapter is on cellular radiobiology by Gray. Over 380 papers are reviewed, most of them published in 1955, indicating the tremendous activity in this field. The review covers the radiobiology of the cell including the influence of various environmental factors and the genetic damage problem. The second part deals with the radiobiology of various tissues. O'Brien has a chapter on vertebrate radiobiology which deals with the effects of ionizing radiations on the embryonic development of fish, amphibia, birds, and mammals.

Relaxation Spectrometry. By E. G. Richardson. 140 pp. (North-Holland, Holland) Interscience Publishers, Inc., New York, 1957. \$5.75. Reviewed by J. G. Castle, Jr., Westinghouse Research Laboratories.

In this pleasant little book, printed on soft white paper, Professor Richardson surveys the experimental spectrometry of acoustical relaxation. His historical discussions of experimental work, including much of his own, serve to outline the bibliographies and to occasionally describe the cardinal sample configurations, but are not often detailed enough to support the author's conclusions. Certainly the discussions serve well to outline the work in the various areas.

After an appropriate introduction of concepts of relaxational behavior and their illustration by models, the author covers in order spectra in the infrasonic, sonic, and ultrasonic regions. He points out the use of analog simulation of the physical sample's relaxation processes as a considerable aid in the parametric interpretation of observed relaxation phenomena. Then under Dielectric Relaxation he describes the strong similarity between viscoelastic behavior and dielectric behavior, concluding with graphs showing the "concurrence" of the dielectric and acoustic relaxation spectra of glycerin at -28°C . In the final chapter, on Spectrum Analysis, he points up some of the roadblocks and useful detours on the way toward resolution and shape studies on relaxation spectra.

The book was read without conscious inspection for accuracy because the reviewer is not an expert in the