BOOK REVIEWS

The Sequestration of Metals. Theoretical Considerations and Practical Applications. By ROBERT L. SMITH, B.Sc., Ph.D., F.R.I.C. The Macmillan Co., 60 Fifth Avenue, New York 11, N. Y. 1959. vii + 256 pp. 16 × 25.5 cm. Price, $8.50.

According to the author's definition which I quote in part, "Sequestration is the suppression of a property of reaction of a metal without removal of the metal from the system or phase by any process, etc." If in this definition, "metallic compound or ion in solution" is substituted for "metal," then it follows that the major portion of this book is concerned with the phenomenon of chelation.

The first half of this book contains a discussion of chelation and lists in table the formulas of various chelates with comprehensive bibliographies. The second part discusses the applications of these "sequestering agents" to various chemical industries, to analytical chemistry and biology.

The value of this work resides in the extensive tables and bibliography rather than in the theoretical treatment of the subject.

DEPARTMENT OF CHEMISTRY
YALE UNIVERSITY
NEW HAVEN, CONNECTICUT
HERBERT S. HARNED

Introductory Nuclear Theory. By L. R. B. ELTON, Ph.D., F. Inst. P., Head of the Physics Department, Battersea College of Technology, London. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. xi + 286 pp. 14.5 × 22.5 cm. Price, $6.40.

This book on nuclear theory has grown out of a lecture course given by Dr. Elton to final honours physics students at King's College in London. Although the material has been extended somewhat beyond the course outline, the main use for this book will be as a text for a course in nuclear physics for advanced seniors and graduate students. In some respects, it can be a very useful reference book on nuclear theory, but it probably will not replace the standard reference in the field, Blatt and Weisskopf's "Theoretical Nuclear Physics."

In general, the contents of the ten chapters in this book are quite conventional for a book on nuclear theory. Also, in general, the various subjects are treated quite thoroughly. The following is a summary of the subjects of the various chapters along with some comments on the strong and weak points. The first two chapters summarize adequately the general experimental information that is known about particles and nuclei. Chapter three covers the two nucleon systems at low energies in a conventional but thorough manner. A particularly strong point about this chapter is that many attempts are made to tie in experimental data with the theoretical discussions. The fourth chapter adequately summarizes what is known about nuclear forces. Nuclear models are considered in Chapter 5. One shortcoming in this chapter is the section on the collective model which is only a very qualitative introduction to it. The discussion of the shell model, on the other hand, is much more complete. The chapter on nuclear reactions (Chapter 6) surveys this immense area quite well. However, more discussion on the decay of the compound nucleus and on direct reaction mechanisms could probably have been profitably included. This chapter does include a short treatment of the optical model which is receiving much attention at this time. Chapter 7 on nuclear disintegration deals mostly with barrier penetration in α-decay. Chapter 8 covers thoroughly the interaction of nuclei with the electromagnetic field, particularly as it applies to the emission of radiation and the photodisintegration of the deuteron. The chapter on β-decay (Chapter 9) presents an up-to-date discussion of β-decay theory including the recent conclusions arising since the parity non-conservation experiments. The last chapter gives a short mathematical discussion of the meson theory of nuclear forces. There is also a short table of nuclear constants in the appendix which includes mostly ground state properties, giving very little information on decay properties.

As one can see from the contents, the choice of topics is quite conventional and involves no radical changes in emphasis. One aspect of the contents on which the book can be strongly recommended is that recent advances in many areas have been included to bring the book up to date.

There are several features about "Introductory Nuclear Theory" that will make it a useful text book. Although a rudimentary knowledge of quantum mechanics is assumed by the author, he includes in the text discussions of the quantum mechanics and mathematics that are needed as they are used. He has refrained from putting the mathematical discussions in appendices and footnotes where they are often ignored by students. His approach may be somewhat annoying to advanced students possessing a strong background in mathematical physics, but it will be very helpful to those who are just getting a feel for these principles. Dr. Elton has also included several problems at the end of each chapter which enhances the book's value as a textbook. Another aspect that is particularly helpful is the effort made to tie in experimental details with the theoretical discussions. In general, the book is well written, giving a clear progression of information. In summary, it deserves serious consideration as a textbook for courses in nuclear theory.

DEPARTMENT OF CHEMISTRY
AND CHEMICAL ENGINEERING
UNIVERSITY OF ILLINOIS
URBANA, ILLINOIS
JOHN P. HUMMEL

Quantum Particle Dynamics. By J. MCCONNELL, Professor of Mathematical Physics, St. Patricks' College, Maynooth. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. xi + 252 pp. 16 × 23 cm. Price, $6.00.

This book covers quantum mechanics and quantum field theory in an elementary way, with application to particle physics, presupposing no previous acquaintance with relativity or quantum mechanics. It is directed toward students and to experimental workers in high energy physics, to serve as an introduction to the theoretical background.

This is a lot to attempt in 250 pages of which 145 are devoted to special relativity and particle quantum mechanics, 60 to quantum electrodynamics and 40 to strongly interacting particles. The treatment is quite traditional, somewhat abbreviated. It is a little disturbing that in general the foundations are laid for a calculation, the result is presented, but the 'mouldy details' in between are omitted; thus the book does not teach "to do." Whereas on the other hand, the available space is so taken up with details, that there is little or no comment on the significance of each result or on its relation to others.

In the latter part, on strongly interacting particles, the treatment is far too traditional, in a parochial manner. I am referring to its emphasis on lowest order perturbation theory calculations. In quantum electrodynamics this is all right, but in the strongly elementary particle interactions it is virtually useless. Further, there is no discussion of symmetries and conservation laws; and this is a part of the present theory which is almost sure to have lasting value. Not only is there no general discussion of the general subject, but as important a conserved quantity as isotopic spin has only a brief mention.

As an example of the hopelessly misoriented, obsolete, and sketchy treatment of topics in strong elementary particle interactions, consider the treatment of pion nucleon scattering. Six of the eight pages are devoted to a sketch of the derivation of the scattering cross section in lowest perturbation order; the resulting formulas are written out exactly. In the remaining two pages, these results are compared with experiment (which, by the way, is misdescribed); there is little resemblance of course, as is usual in the strong interactions. The result of the Heitler damping theory is also compared; it too is far from fitting the experimental cross section. There is no mention that the essential feature which must be explained is the occurrence of a resonance in a single partial wave. Belonging to the Heitler school, the author doesn't use partial waves; this like perturbation theory is all right for electrodynamics, but hopeless in the strong interactions.

Finally, I note that credit is given by name to recent researchers, but this is little aid to the student desiring to investigate the original sources, since no bibliography except textbooks is given. Limited space is perhaps the explanation, but merely the insertion of the year would enable an article to be found easily through the abstract literature.

DEPARTMENT OF PHYSICS
UNIVERSITY OF ROCHESTER C. GOEBEL
ROCHESTER 20, N. Y.

Statistical Theory of Irreversible Processes. By R. EISENSCHITZ, Dr. Phil., D.Sc., F. Inst. P., Professor of Theoretical Physics, in the University of London. Oxford University Press, 417 Fifth Avenue, New York 16, N. Y. 1959. viii + 84 pp. 14 × 21.5 cm. Price, $2.00.

This small volume presents a stimulating survey of important topics in classical and quantum statistical mechanics. Following an examination of the equilibrium theory of gases, liquids and solids, the major part of this monograph is devoted to the study of irreversible processes. The chapters on the non-equilibrium theory include discussions of the Maxwell–Boltzmann integro-differential equation, which is appropriate for dilute gases, and the Fokker–Planck equation, which provides rough estimates for liquids. These basic equations are then applied to the evaluation of the coefficients of shear viscosity and thermal conductivity of fluids. There are sections devoted to topics such as the calculation of the thermal conductivity of solids and the dielectric loss of polar liquids, as well as presentations of the basic concepts of Brownian motion and Boltzmann's famous H-Theorem, which explains the entropy evolution of ideal gases.

The price for compressing this wealth of subject matter into 84 pages is frequent oversimplification of important aspects of the theory. Due to the generous sprinkling of misprints and the various alternative approaches that are being considered these days, the interested reader would be well advised to consult the references in the bibliography. These drawbacks are, however, more than compensated by the lucid explanation in physical terms of a variety of phenomena. This book can be recommended to those who have had an elementary introduction to statistical mechanics.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF ROCHESTER FRANK P. BUFF
ROCHESTER, NEW YORK

Interscience Monographs in Physics and Astronomy. Volume III. **Introduction to the Theory of Quantized Fields.** By N. N. BOGOLIUBOV and D. V. SHIRKOV, Steklov Mathematical Institute, Academy of Sciences, Moscow, U.S.S.R., Joint Institute for Nuclear Research, Dubna, U.S.S.R. Edited by R. E. Marshak, University of Rochester, Rochester, New York. Authorized English Edition. Revised and Enlarged by the Authors. Translated from the Russian by G. M. Volkoff, Department of Physics, University of British Columbia, Vancouver, B. C., Canada. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. xvi + 720 pp. 16.5 × 23.5 cm. Price, $17.00.

Spontaneous emission of a photon by an atom in an excited state, which will occur no matter how well isolated the atom is from external disturbances, may be regarded as demonstrating the existence of the quantized electromagnetic field. Regarding such a field as a collection of oscillators we may say that the quantum-mechanical zero-point fluctuations of these oscillators produce an effect on the atom which leads to the de-excitation of the atom and the excitation of the field. This picture which follows naturally from an application of quantum mechanics to Maxwell's equations has enabled extensive and successful calculations of such things as the photoelectric effect, the Compton effect and so on. The picture may be generalized immediately to give a field theory for electrons and positrons which has a wider validity than the simple "one electron" theory, and similarly for different kinds of mesons and for the various new and strange particles.

The purpose of the present book, one which it most brilliantly accomplishes, is to give a systematic account of the properties of quantized fields and the interactions between them. It is not primarily concerned with the practical matter of calculating cross-sections and lifetimes for various processes, though it does incidentally instruct the reader on many of these things too; instead it gives the mathematical formalism of quantized fields in a completely modern way and equips the reader to face the very great outstanding problems of the subject, problems among the most important of modern physics.

These problems arise from the fact that quantized fields have an infinite number of degrees of freedom. The interaction of electrons with the electromagnetic field is sufficiently weak (characterized by the small number $e^2/\hbar c = 1/137$) that perturbation solutions may be found, the leading terms of which produce the results of practical interest. Even here there enter in the later terms infinities and convergence failures whose significance is only a little understood. For interactions of other fields a perturbation procedure is often hopeless and the problem is then one of enormous complexity.

The first two chapters of the book (200 pages) review the properties of the classical and the quantized fields. The next four chapters (300 pages) discuss for the most part the perturbation solutions for interacting fields. The last three chapters (200 pages) discuss current attempts to handle the problems without resort to perturbation procedures. In every chapter new light is shed on old problems and the new problems are clearly stated and discussed.

The book appears to have been excellently translated; the printing and binding are very fine. It is an absolute essential for the student or research worker concerned with this subject and will be found surprisingly readable by others—a very important book.

FYSISCH LABORATORIUM DER
RIJKSUNIVERSITEIT TE UTRECHT J. B. FRENCH
UTRECHT, NEDERLAND

Treatise on Analytical Chemistry. Part I. **Theory and Practice.** Volume 1. Edited by I. M. KOLTHOFF, School of Chemistry, University of Minnesota, and PHILIP J. ELVING, Department of Chemistry, University of Michigan. With the assistance of ERNEST B. SANDELL, School of Chemistry, University of Minnesota. Interscience Encyclopedia, 250 Fifth Avenue, New York 1, N. Y. 1959. xxvi + 809 pp. 17 × 24 cm. Price, $17.50; subscription price, $15.00.

The purpose of this Treatise, as stated in the opening sentence of the Preface, is "to present a concise, critical, comprehensive, and systematic, but not exhaustive, treatment of all aspects of classical and modern analytical chemistry." It would be difficult to name anyone who could bring to a project of this magnitude greater editorial competence, or more experience over the whole wide field of analytical chemistry, than Professors Kolthoff, Elving and Sandell. If in future volumes these Editors are able to enlist the coöperation of a group of authors as capable in their individual subjects as those who have contributed to the present first volume the ultimate success of this ambitious undertaking will be assured.

It is planned to publish the Treatise in three parts, namely, Part I, Theory and Practice; Part II, Analytical Chemistry of the Elements; and Part III, Analysis of Industrial Products. Each of these parts will have many volumes, and, because it is not feasible to publish each volume and each Part *seriatim*, the various volumes of the three parts will be published one by one as the manuscripts become available to the publisher.

The present volume is the first one of Part I; it is only the beginning and yet comprises 809 pages! Its nineteen chapters and their authors are as follows: Methods of Analytical Chemistry (Ernest B. Sandell and Philip J. Elving);