of their electron optics, employing electrostatic and/or magnetic lenses, together with various technical forms of image converters and amplifiers are schematically presented, and some special applications are discussed (115 references, with titles!).

A similarly schematic treatment acquaints the reader with the uses of "Photocells in Television Technique" in Chapter X (51 pages, 75 references with titles!) and with "Special Applications of Secondary Electron Multipliers" in Chapter XI (19 pages, 158 references with titles!), both chapters written by F. Eckart.

The final chapter, XII (28 pages), by W. Leo and H. Simon, again on "Special Applications of the Photocell," concerns itself with technological applications in sound film, in control devices, and in monitoring of X-ray dosimetry (48 references).

In summary, this reviewer feels that the authors' attempt to be all-inclusive detracts from the main purpose. This age of specialization has provided excellent monographs on vacuum techniques, electrical and electronic measuring devices, electron optics, quantitative spectroscopy, and other subjects which either could have been omitted here or treated more selectively. The publisher's effort toward this volume reflects the usual excellent tradition of the Springer-Verlag.

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Progress in Metal Physics. Volume 7. Editors, BRUCE CHALMERS, D.Sc., Ph.D., Division of Engineering and Applied Physics, Harvard University, Cambridge, Massachusetts, and R. KING, Ph.D., Assistant Director, Davy Faraday Research Laboratory, The Royal Institution, London, W. 1. Pergamon Press, Inc., 122 East 55th Street, New York 22, N. Y. 1958. viii + 408 pp. 16 × 25.5 cm. Price, $16.00.

This book is another volume in a well established series and, consistent with the trend, larger than its predecessors. There are four chapters on subjects not covered in previous volumes and one chapter extending a previous presentation of the properties of metals at low temperatures.

This latter discussion written by H. M. Rosenberg emphasizes the studies of thermal conductivity of metals below 90°K. Of particular interest is the material on the thermal conductivity of superconductors. The reader will find here a clear discussion of the "thermal switch."

Two presentations in this volume may be considered to be outstanding from the point of view of their clarity. One is an article by J. N. Hobstetter on "Equilibrium, Diffusion and Imperfections in Semiconductors." The other is a very thorough discussion of Martensitic transformations by L. Kaufman and M. Cohen.

The chemist will be interested in Hobstetter's summary of the mass action treatment of the solubilities of impurities in semiconductors. This is the only source known to the reviewer where this theory is summarized and a complete set of references given. The discussions of diffusion and dislocations in semiconductors are short and not as clearly presented as the one on equilibrium properties.

Both the thermodynamics and kinetics of Martensitic transformations are thoroughly discussed by Kaufman and Cohen. The reader will find a wealth of data in the form of free energy diagrams for a number of iron alloys together with empirical equations giving the changes in free energy for the various phase transformations as functions of the temperature. The article also gives a clear presentation of both the classical nucleation theory and the Knapp–Dehlinger treatment of the formation of Martensite. Some of the data and ideas presented in this article are original and have not appeared in print before.

The two remaining chapters deal with the metallurgy of titanium alloys and the concept of stored energy of cold work.

The discussion of the process of cold working by A. L. Titchner and M. B. Bever is very pertinent in view of the amount of current interest in this subject. The authors have compiled a truly fine bibliography and summarized nearly all the known experimental data in an extensive table. This summary will be very valuable to anyone interested in the subject.

In his presentation of the current status of the physical metallurgy of titanium alloys, R. I. Jaffee has compiled an extensive set of phase diagrams for titanium systems. The article is a rich source for the equilibrium data of such systems. It also gives a good summary of the plastic deformation properties of titanium alloys.

For the specialist in the field this volume contains an excellent summary of experimental data and an extensive bibliography on each subject.

DEPARTMENT OF CHEMISTRY
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Cahiers de Synthèse Organique. Méthodes et Tableaux D'Application. Volume V. Degradations. By JEAN MATHIEU and ANDRÉ ALLAIS. Published under the direction of Leon Velluz. Masson et Cie., 120, Boulevard Saint-Germain, Paris, VI, France. 1959. 394 pp. 16 × 22.5 cm. Price, broché, 7.800 Fr.; relié, 8.500 Fr.

This fifth volume of a proposed set of ten volumes on organic synthesis is concerned with degradative methods and is divided into two chapters. Chapter twelve deals with one carbon degradations involving terminal functional groups. Chapter thirteen deals with cleavage of carbon chains and opening of rings. The presentation in each chapter is organized in the same way as in Volume IV.[1]

An excellent summary of degradative methods in organic chemistry is present in this volume. A table at the back of the book lists the various functional groups and combinations of functional groups that are discussed in the book. The system of indexing and cross-indexing is complete but simple so that it is easy to find specific information about various types of compounds and reactions. References appear to be adequate through 1957 with an occasional date in 1958. Some references refer to earlier volumes in the series, but the lack of their availability should not impair the usefulness of this book as a unit by itself.

This volume is recommended for all organic chemists. The style, content and organization are such that it will be of considerable value to those learning, practicing or reviewing chemical French. Although other volumes in the series were not available for examination by the reviewer, it appears from the present volume that this set should be a valuable complement to those "standard" sets ("Organic Reactions, Organic Syntheses") now in use.

(1) R. L. Shriner, THIS JOURNAL, **80**, 6468 (1958).

DEPARTMENT OF CHEMISTRY
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Nuclear Magnetic Resonance. Applications to Organic Chemistry. By JOHN D. ROBERTS, Professor of Organic Chemistry, California Institute of Technology. McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1959. viii + 118 pp. 16 × 23.5 cm. Price, $6.00.

In the opening sentence of his short exposition, Professor Roberts states "The development of nuclear magnetic resonance spectroscopy subsequent to the initial discoveries by Purcell and Bloch in 1946 is now recognized as one of the most important events in the last fifty years for the advancement of organic chemistry." Many organic chemists in this country have recognized the truth of this statement, and anyone who can pretend to any degree of knowledge in this field is asked again and again "Where can I find an intelligible introductory article explaining the principles of NMR and describing its applications to problems in organic chemistry?" Until now no satisfactory single answer could be given. "Nuclear Magnetic Resonance" was written to fulfill this urgent need.

The author begins by discussing briefly nuclear spin, and its relation to other nuclear properties, the behavior of magnetic nuclei immersed in magnetic fields, the origin of the resonance phenomenon, and the nature and effects of relaxation processes. By liberal use of physical models and analogy, the phenomena observed are presented in a clear and understandable way with a minimum of mathematical analysis. (The most important relations concerning the resonance phenomena are derived from the Bloch equations in Appendix A.) Both in the introductory chapter and in

Appendix A free use is made of colored illustrations which make the phenomena described absolutely and unmistakably clear.

In subsequent chapters are discussed: the chemical shift, its origins and some generalizations; spin–spin splittings; applications to reaction kinetics; and the effects of the presence of nuclear quadrupoles on the appearance of NMR spectra. Three appendices (The Bloch equations, a short bibliography, and 20 spectra for practice in interpretation), a name index, and a subject index complete the book.

The chapters dealing with chemical shift, spin–spin coupling, kinetics and quadrupole broadening are liberally provided with well-chosen illustrative examples (some eighty-five spectra are reproduced in the book). Most of the important concepts are covered in each case, though necessarily very briefly, and occasionally sketchily. Topics which could profitably be covered in somewhat greater detail include remote dipolar shielding, solvent effects and complete analysis of spectra by use of the high resolution Hamiltonian.

Considering the formidable problem which the author set out to master, *i.e.*, the brief description in elementary terms of a process inherently complex and subtle, it is truly remarkable that the book is practically free of errors, and that essentially no compromise with accuracy has been allowed to creep in for the sake of lucidity of expression. There is one case. At the top of p. 18, it is stated that the first peak of a plot of signal strength *vs.* magnetic field represents the point at which the precession frequency of the nuclei is equal to the oscillator frequency. This is not true for any finite sweep speed. One might wish that the expression on p. 55 for the intensity ratio in "non-equivalence quartets" had been given in a simpler form, *e.g.*, $R = (\delta_{obs} + J)/(\delta_{obs} - J)$. These are minor quibbles, however, and the book will be hailed as admirably fulfilling the purpose for which it was written.

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Colorimetric Determination of Traces of Metals. Third Edition, Revised and Enlarged. By E. B. SANDELL, Ph.D., Professor of Analytical Chemistry, University of Minnesota. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1959. xxii + 1032 pp. 16.5 × 23.5 cm. Price, $24.00.

The growing interest in the determination of traces of metals by colorimetric techniques is evidenced by the fact that the third edition of this treatise is fifty per cent. larger than the previous edition, although the latter is only nine years old. The aims and general plan of treatment is the same as in the earlier editions. The book is divided into two parts: Part I (213 pp.) consists of four chapters which deal with the general aspects of inorganic colorimetric trace analysis, methods for the separation and isolation of traces of elements, colorimetry and spectrophotometry in trace analysis, and a general discussion of colorimetric reagents, both inorganic and organic. Part II (765 pp.) begins with some practical notes that are of a general nature in photometric analysis; then follows forty-six chapters, each devoted to a metal and arranged alphabetically as follows: aluminum, antimony, arsenic, barium, beryllium, bismuth, cadmium, calcium (and strontium), cerium, chromium, cobalt, copper, gallium, germanium, gold, indium, iridium, iron, lead, lithium, magnesium, manganese, mercury, molybdenum, nickel, niobium and tantalum, osmium, palladium, platinum, potassium, the rare earth elements, rhenium, rhodium, ruthenium, scandium, silver, sodium, thallium, thorium, tin, titanium, tungsten, uranium, vanadium, zinc and zirconium.

In general, methods of separation are given for each metal, followed by several or more selected methods of determination and then a limited number of representative applications, such as the analysis of steels, non-ferrous metals and their alloys, ores, silicate rocks, soils, water, air, coal, gasolines and naphthas, and bio-materials.

From the mass of material on the separation and colorimetric determination of traces of metals that has appeared in the literature since 1950, the author has selected a number of methods for detailed treatment, either to augment or to replace the older methods. The aim has been to present those methods which are believed to be the most generally useful in applied analysis. If "some meritorious methods have been overlooked or not given the prominence they deserve. . . literature references will be found listed for most methods likely to prove useful in practice." Indeed, the book is replete with references, conveniently placed at the bottom of the pages plus a number of references inserted at the ends of some of the chapters to call attention to work published after the manuscript had been submitted to the publishers in 1957, though no attempt was made to compile a comprehensive list of recent publications. The book concludes with an appendix, which includes a table of four-place logarithms, a transmission–absorbance table, a table of international atomic weights, and author and subject indexes. Printing, paper and binding are good.

This monograph and its companion volume, "Colorimetric Determination of Nonmetals" (edited by D. F. Boltz, 1958), make a useful reference source for anyone interested in trace analysis, the importance of which is being recognized in a wide diversity of fields, including agriculture, biology, medicine, geology, mineralogy and industry, as well as in many phases of chemistry and physics.

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Colorimetric Methods of Analysis Including Photometric Methods. Volume IIA. By FOSTER DEE SNELL, Ph.D., President, Foster D. Snell, Inc., and CORNELIA T. SNELL, Ph.D., Research Chemist. Assisted by CHESTER ARTHUR SNELL, Ph.D., Director of Analytical Department, Foster D. Snell, Inc., D Van Nostrand Company, Inc., 120 Alexander Street, Princeton, New Jersey. 1959. x + 793 pp. 16 × 23.5 cm. Price, $15.00.

In 1921, F. D. Snell published "Colorimetric Analysis," a small book of 150 pages, which included procedures for 34 constituents. In 1936–37 the second edition, by F. D. and C. T. Snell, appeared as "Colorimetric Methods of Analysis" in two volumes of 1581 total pages. A third edition, published in 1948–54, required four volumes and 2407 pages. Volume II of this edition (916 p.) covered inorganic systems. Now, in 1959, Volume IIA has been issued as a supplement to bring Volume II up-to-date. Actually the material has been covered only through 1955. A third author, C. A. Snell, has been added.

The general form of the third edition has been followed. For copper, for example, a brief introduction on selected chromogenic agents is followed by directions for the preparative treatment of samples for 44 kinds of inorganic or organic substances. Next comes the operating procedures for applying each of 16 chromogenic agents covered. Then follow a flame photometric method and some six pages of miscellaneous material referring briefly to a variety of other methods. Altogether 177 references are cited in this section.

Such a compilation is of great service to one wishing to refer quickly to published methods for the 68 constituents covered. In using this type of source the novice must experience uncertainty in some cases. For example, of the 16 methods described for copper, which is best in a given situation?

The reviewer would not have included flame photometric methods in a colorimetric compilation. To him flame photometry is one kind of emission spectrometry, in which the elements susceptible to such determination are excited at the relatively low temperature of the flame used. This is in contrast to the high temperatures of arcs and sparks so widely employed in emission spectrometry.

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