

The Physical and Thermodynamic Properties of Helium. Technical Report D-9027. By JESSE T. SIMMONS, Engineering and Research Division, Wm. R. Whittaker Co., Ltd. Wm. R. Whittaker Co., Ltd., 915 North Citrus Avenue, Los Angeles 38, California. 1957. 79 pp. 23.5 × 28.5 cm. Price, \$10.00.

The following properties of helium, expressed in engineering units, are listed over the pressure range 14.7 to 6,000 pounds per square inch absolute and from -440° to +600° F.: density, specific volume, compressibility factor, entropy, enthalpy, specific heats at constant pressure and at constant volume, the ratio C_p/C_v , viscosity, thermal conductivity, sonic properties and diffusion. Graphs of these properties are given. There is also included a limited amount of data on air.¹

In general the properties of helium given in earlier treatises are converted into engineering units and smoothed to even values of the arguments. One would have greater confidence in the tables if he did not read the introduction in which some strange thermodynamic statements appear.

(1) Taken from "Tables of Thermal Properties of Gases" by J. Hilsenrath, C. W. Beckett, W. S. Benedict, L. Fans, H. J. Hoge, J. F. Masi, R. L. Nuttall, Y. S. Touloukian and H. W. Woolley, National Bureau of Standards Circular 564 (1955).

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Experimental Designs. By WILLIAM G. COCHRAN, Professor of Biostatistics, The Johns Hopkins University, and GERTRUDE M. COX, Director, Institute of Statistics, University of North Carolina. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. xiv + 617 pp. 15.5 × 24 cm. Price, \$10.25.

This book is directed at *experimenters* with a fair knowledge of statistical methodology through Analysis of Variance techniques. When the first edition appeared in 1950 it was by far the best treatment of the statistical aspects of experimental design for such an audience. This was still true just prior to the appearance of the edition reviewed here and the case is reinforced by its appearance.

The framework of the book remains the same. The first three chapters treat the relation of statistics to experimentation and, briefly, the statistical notions and techniques requisite for the balance of the book. The wealth of experience and good sense which the authors bring to the discussion is particularly evident in this section. In the remainder of the book the several different classes of experimental designs are treated one-by-one. For each there is presented the computational technique, standard error and missing value formulas, and numerical examples. Of special value are the authors' general recommendations about each of the designs and the comparisons of various designs when this is relevant. Although the great increase in the number of particular experimental plans worked out since 1950 makes the book no longer the complete catalog it was in its original edition, a very large number of plans are included as well as an adequate index to those available but not included.

For readers of THIS JOURNAL it must be remarked that nearly all of the illustrated material in the book is drawn from biological, particularly agricultural, experimentation. Although the desirability, from the reader's viewpoint, of familiar examples is admitted, the quality of the exposition in this book more than compensates for the shortage of examples from industrial and physical science experimentation.

For those familiar with the first edition, and of particular interest to readers of THIS JOURNAL, two sizable additions to the first edition are chapters 6A and 8A on Fractional Replication and methods of Study of Response Surfaces, respectively. Designs in both of these areas have found wide application in industrial experimentation. All new material in the book is clearly indicated, and in addition to the two chapters just mentioned includes the sections described in the following quotation from the preface:

Section 2.22a presents a table for estimating the number of replications needed for comparing two treatments when the data are arranged in two classes, as dead or alive,

sound or defective. Sections 4.15a and 4.27a give the methods of analysis with data of this type for completely randomized block designs. These sections fill a gap in the first edition, which gave methods of analysis only for continuous data.

Sections 4.61a to 4.66a contain a discussion of the use of latin squares in adjusting for residual effects which may be present when the treatments are applied in sequence to the same subject.

Topics that are presented more briefly are sequential experimentation (section 2.23a), the testing of effects suggested by the data (section 3.53), the problem of making several tests of significance in the same experiment (section 3.54a), Yates' automatic method of computing factorial effect totals (section 5.24a), additional standard error formulas for split-plot experiments (section 7.22), the effects of errors in the weights on the recovery of inter-block information (section 10.12a), and the use of balanced incomplete block designs in taste and preference testing (section 11.1a).

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Heterocyclic Compounds. Volume 5. Five-membered Heterocycles Containing Two Hetero Atoms and their Benzo Derivatives. Edited by ROBERT C. ELDERFIELD, University of Michigan. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 1957. vi + 744 pp. 16 × 23.5 cm. Price, \$20.00.

This volume maintains the same high standards which were set by the preceding volumes. As the title indicates volume 5 is devoted to five-membered heterocycles containing two hetero atoms and their benzo derivatives. Accordingly, the eight chapters are devoted to (1) 1,3-Dioxolane and Derivatives (44 pages), (2) Pyrazoles and Related Compounds (116 pages), (3) Indazoles (31 pages), (4) Imidazoles and Condensed Imidazoles (103 pages), (5) Oxazole and its Derivatives (129 pages), (6) Benzoxazoles and Related Systems (33 pages), (7) Isoxazoles (31 pages), and (8) Thiazoles and Benzothiazoles (238 pages). These chapters were contributed by Robert Elderfield and Franklin Short, Thomas L. Jacobs, Robert Elderfield, Edgar S. Schipper and Allan R. Day, J. W. Cornforth (chapters 5 and 6), Roderick A. Barnes, and James M. Sprague and A. H. Land, respectively.

A table of contents for each chapter greatly facilitates the location of a particular topic and extensive literature citations including patent literature are found throughout each chapter. These citations are up-to-date and they include references to some rather uncommon literature sources.

Dr. Elderfield and his co-workers are to be complimented for making the literature dealing with heterocyclic compounds more conveniently available to organic chemists. This is an undertaking of considerable magnitude. The combination of competent authors, editor and publishers in this series deserves the commendation of organic chemists.

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Some Aspects of the Chemistry and Toxic Action of Organic Compounds Containing Phosphorus and Fluorine. By BERNARD CHARLES SAUNDERS, M.A., Ph.D., Sc.D., D.Sc., F.R.I.C., Fellow and Charles Kingsley Lecturer in Natural Sciences, Magdalene College, University Lecturer in Chemistry, Cambridge. Cambridge University Press, 32 East 57th Street, New York 22, N. Y. 1957. xvi + 231 pp. 14.5 × 22 cm. Price, \$6.00.

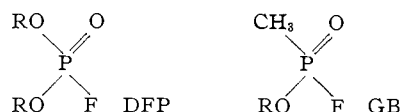
Dr. Saunders in this book has described the work he and his colleagues have carried out at Cambridge since the beginning of World War II. The book is based largely on a course of lectures given in 1950 in the Netherlands, and in 1954 in both the U.S.A. and Canada. The phrase "Some aspects" in the title of the book is important, because the book covers only those areas of phosphorus and fluorine chemistry with which the author had direct contact. In

these restricted fields, however, Dr. Saunders has done an excellent job in putting together pieces of information not hitherto available in textbook literature.

The text comprises a little over 200 pages, three-fourths of which is devoted to phosphorofluoridates and related problems, and one-fourth to the fluoroacetates. There is a chapter on the mammalian nervous system, and a chapter on the medical aspects of the esterases, to assist the reader in the evaluation of the biochemical importance of the phosphorus compounds. These chapters are a distinct asset to the book because most chemists find it difficult to obtain easily comprehended explanations of these biochemical matters in the presently available reference works.

The discussion in the phosphorus section of the book is centered around the synthesis and properties (chemical and biochemical) of diisopropyl phosphorofluoridate (DFP) and related compounds. These compounds do not have a military importance which the novice in this field may ascribe to them from a reading of this book. As a result of the work by Saunders, the DFP series and their anticholinesterase activity were studied in the U.S.A. but the compounds were not seriously regarded as chemical warfare agents. Military interest was only fully aroused with the discovery of tabun (GA) and sarin (GB) by the investigating teams in Germany after World War II; these compounds are given only a few pages in the Saunders book.

In the structures of DFP and of GB (where R = isopropyl), it will be seen that GB has a C-P link, which a



purist in nomenclature would say is a requisite to classifying it as an organo-phosphorus compound. Saunders (and the literature in general) include DFP in that category, whereas they are perhaps more properly organic compounds containing phosphorus.

The DFP type of compound is much less toxic and therefore easier to handle than the GB type in the laboratory. Since most of the properties of DFP are similar to those of GB, and since they could be described in the open literature when studies of GB were still under military secrecy, a rather extensive *open* literature on DFP has developed, which is clearly and thoroughly summarized in the book by Saunders. He has rounded out the text by reviewing recent literature on the properties of some of the more important phosphorus compounds and applications of such principles as phosphorylation, and alkylation with phosphorus-containing esters.

The chapters in that part of the book devoted to fluorine compounds are concerned mostly with the chemical and biochemical activities of the fluoroacetates, fluoroethanol and related compounds. Dr. Saunders has done some impressive work in helping to elucidate the nature of β -oxidation in its relation to the toxicity of ω -fluoro chain compounds, and it is well described in this book. There is a helpful diagram of the Krebs cycle, to serve as a background for the discussion, similar to the esterase essay which supplements the DFP chemistry.

The book is well printed. The relatively few typographical errors are mostly in the names of references. Toxicity by inhalation is given in terms of LC50 instead of the now more usual LCt50, and in a number of cases the author has neglected to cite the exposure time, which makes the LC50 meaningless. On pp. 49-50 it should have been stated that the m.p. of mustard is for a plant-grade sample, since the pure compound melts at 14.5° rather than 11.5°. This reviewer's biochemical colleagues have consistently deplored the use of the pI50 concept (p. 66) with irreversible cholinesterase inhibitors like DFP; provided the inhibitor is not hydrolyzed and the reaction is allowed to go to completion, the I50 is simply one-half the molar enzyme concentration, and the Lineweaver equation (p. 65) is not applicable.

In the interest of historical accuracy, this reviewer deprecates the total absence of credit to Dr. Schrader of Germany for prior research. In the fields of phosphorus and fluorine chemistry it has been rather difficult to determine prior accomplishment because technical papers have been withheld from publication due to military secrecy. In the areas covered by this book such a situation does not now

apply; the Saunders work is cited from Ministry of Supply reports since 1941, and corresponding work by Schrader (*ca.* 1935-1939) is in the B. I. O. S. Final Report 714 listed in the bibliography of this book. The book refers to "independent wartime studies by Dr. Saunders in England and Dr. Schrader in Germany." The studies were independent, but Schrader completed the most significant parts of his work before the war. Dates of accomplishment are now available.

This book is highly recommended as an addition to the library of phosphorus and fluorine chemistry.

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The Chemistry of Organometallic Compounds. By EUGENE G. ROCHOW, Department of Chemistry, Harvard University, DALLAS T. HURD, Lamp Division, General Electric Company and RICHARD N. LEWIS, Olin Mathieson Chemical Corporation. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, New York. 1957. vi + 344 pp. 23.5 × 16 cm. Price \$8.50.

The authors set out to prepare a comprehensive, unified coverage of the theoretical, factual and practical aspects of organometallic compounds in brief, readable form. This they have accomplished most successfully.

The general properties of organometallic compounds are reviewed briefly, after which the theory of the carbon-metal bond and types of bonding are discussed in some detail, including the newly discovered "sandwich" type exemplified by the biscyclopentadienyl-metal complexes. General methods for the preparation of organometallic compounds are described and the compounds are then discussed by major metal groups. Separate chapters are devoted to compounds of the transition metals, special types of organometallic compounds (*e.g.*, fluorinated derivatives, complexes of metals and olefins, metal carbides, hydrides and carbonyls), and the use of organometallic compounds in organic synthesis.

The concepts of electronegativity, bond polarity, covalent and multiple covalent bonding are discussed and utilized to explain the relative stability of various organometallic structures. The distinctive bonding between carbon and the transition metals is described briefly and lucidly. Data for many of the groups are brought up-to-date, particularly the compounds of aluminum, silicon, germanium and the transition metals.

The book is well written, its typography is good and it contains numerous references to the original literature and review texts. It should be especially useful and stimulating to graduate students in inorganic-organic chemistry and to research workers who want a brief, readable, up-to-date review of the fascinating field of organometallic compounds.

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Symposia of the Society of Experimental Biology. Number XI. The Biological Action of Growth Substances. H. K. PORTER, Editor. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. vii + 344 pp. 16 × 25.5 cm. Price, \$9.50.

Number XI in the series of "Symposia of the Society of Experimental Biology" of Great Britain deals with the biological effects attributable to substances—commonly designated growth substances or growth regulators—which exhibit a regulatory effect even when all the normal nutrient requirements for growth are satisfied. This volume is a worthy addition to a series which has attained a recognized place in the biological literature, for its authoritative analytical accounts of important current biological questions.

In this volume, as the title implies, the objective is to present evidence that such chemically induced growth responses occur, rather than to deal primarily with the isolation, purification and chemical characterization of the causative agents, for much of this work is still in the future. To this extent the volume presents a challenge to chemists and biochemists, who will, by its aid, be able to acquaint