cordingly, carbon dioxide has a carbonyl bond polarity much smaller than that of ketene. Again the cumbrous resonance description is neither necessary nor desirable. The organic isocyanates of course occupy an intermediate position. Carbon suboxide, with all its carbon atoms in the "digonal" state must have a carbonyl bond polarity close to that of ketene. Accordingly its chemical properties resemble those of ketene.

LABORATORY OF PHYSICAL CHEMISTRY
CAMBRIDGE, ENGLAND A. D. WALSH

RECEIVED OCTOBER 7, 1946

NEW BOOKS

Physical Methods of Organic Chemistry. Vol. II.[1] ARNOLD WEISSBERGER, Editor. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y., 1946. vii + 631 pp. $23^1/_2 \times 15$ cm. Price, $8.50.

With this second volume, the editor has completed a work which will be of considerable value to organic chemists. The subjects covered in it are as follows: XVII, Spectroscopy and Spectrophotometry; XVIII, Colorimetry, Photometric Analysis and Fluorimetry; XIX, Polarimetry; XX, Determination of Dipole Moments; XXI, Conductometry; XXII, Potentiometry; XXIII, Polarography; XXIV, Determination of Magnetic Susceptibility; XXV, Determination of Radioactivity; XXVI, Mass Spectrometry.

The quality and value of the several chapters varies greatly. The chapter on polarimetry is quite complete and appears to the reviewer to be the best modern monograph on the subject. The chapter on dipole moments is the shortest in the book (22 pages) and is hardly more than a qualitative description of a method of determining the dipole moment.

The chapter on the measurement of radioactivity is good as far as it goes. The discussion of the measurement of soft beta rays, however, is definitely inadequate in view of the fact that the most important activities for organic chemists, namely, C^{14} and H^3 are both very soft beta emitters. It is almost certain that special treatises on this subject will appear soon.

For most of the subjects discussed in this volume there already exist quite complete monographs.

The general impression one gets on reading this volume is one of pleasure and interest in the unfamiliar subjects and disappointment in the familiar ones. This would seem to indicate that the book will only partially fulfill its purpose of " . . . relieving him (the chemist) of much of this burden . . . to search through periodicals and specialized books."

It is undoubtedly a valuable book to have on ones desk primarily for the purpose of becoming generally familiar with a heretofore unfamiliar physical method, but for actual laboratory use it will still be necessary, in most cases, to go to the specialized literature which is quite amply documented in this book.

(1) Vol. I is reviewed in THIS JOURNAL, **67**, 2278 (1945).

MELVIN CALVIN

Semi-Micro Quantitative Organic Analysis. By R. BELCHER, F.R.I.C., Scientific Officer, British Coke Research Association, and A. L. GODBERT, M.Sc., Ph.D., Scientific Officer, Safety in Mines Research Board. Longmans, Green and Co., Inc., 55 Fifth Avenue, New York, N. Y., 1946. viii + 168 pp. 42 figs. 14.5 × 23 cm. Price, $3.00.

The book presents in orderly fashion quantitative semimicro methods for the determination of the more common elements and groups, as well as molecular weights of organic compounds. The chapters on the various analyses are preceded by a rather thorough treatment of the ordinary analytical balance. Thus detailed directions for assembling, dismantling, cleaning and testing are given as well as procedures for the determination of its sensitivity and precision and the calibration of weights. The "swing method" of weighing is utilized and for the average sample size of 20 milligrams employed throughout, a balance with a precision "not worse than 0.04 mg." is recommended.

The analytical methods are followed by description of a few physical tests (determination of density, melting and boiling points (Mulliken, Emich and Siwoloboff methods)). This is followed by appendices containing procedures for the purification of small amounts of organic solids and liquids and directions for the preparation and standardization of the various standard solutions used (0.025 *N* hydrochloric acid, sodium hydroxide, barium chloride, potassium dichromate, ferrous ammonium sulfate, sodium thiosulfate and 0.05 and 0.02 *N* silver nitrate solutions). In addition to this, the book contains a list of 46 references and a short index.

The determination of carbon and hydrogen, for which an accuracy of $\pm 0.2\%$ is claimed and which is one of the few gravimetric methods (the others being the determination of residues and of phosphorus) presented, employs the principle of removable combustion tube fillings. The apparatus dispenses with the usual bubble counter, but employs a suitable flow-meter instead. With the exception of the larger combustion tube (57 cm. length instead of 52 cm. and 1–1.2 cm. diameter, instead of 0.8 cm.) the rest of the apparatus, as well as the procedure, is exactly the same as in the corresponding micro-method. The removable combustion tube filling consists of a platinum wire gauze, a mixture of copper oxide, lead chromate and ceric oxide wrapped in copper gauze and lead super oxide contained in a porcelain boat. The latter is good for about 15 combustions. The combustion boat is placed between the two metal gauzes. Combustion is carried out in an atmosphere of oxygen only. The absorption tubes, the construction and the filling of which are again exactly the same as in the conventional micro method, are weighed without replacement of the oxygen by air.

The determination of nitrogen, gasometric (Dumas) as well as volumetric (Kjeldahl) procedures are available, patterned after the corresponding micro methods. The nitrometer is graduated up to 8 ml. with subdivisions into 0.02 ml. instead of the usual 1.5 ml. with 0.01 ml. subdivisions. For the volumetric determination of sulfur and the halogens (chlorine, bromine and iodine) the dry combustion method is employed. The accuracy claimed for all these determinations is again $\pm 0.2\%$.

In the structure analytical methods, for which accuracies varying from $\pm 0.3\%$ (methoxyl) to $\pm 0.5\%$ (carboxyl and acetyl) are claimed, no new principles are employed, while in the chapter dealing with the determination of molecular weights, the methods of Sucharda–Bobranski (ebullioscopic), Rast (cryoscopic) and Bratton and Lochte (vaporimetric), with accuracies of $\pm 5\%$, are given.

The book, the individual chapters of which follow the by now well acclaimed arrangement of subdivision into principle, apparatus, reagents, method and calculation, is primarily intended for teaching purposes. It appears, however, that the volumetric methods might well lend

themselves to industrial application for routine control analyses of substances previously tested to give correct results under the given reaction conditions. Although the claim of replacement of the microchemical balance by an ordinary analytical balance of proper precision, which formerly constituted the major advantage of semi-micro methods over the corresponding micro methods, can no longer be made, since such substitution is already common micro-analytical laboratory practice, the book certainly fulfills the rather modest claims of the authors, that it contains "a complete course" and that it will serve as "a useful stepping stone" in the subsequent acquisition of the classical micro methods.

JOSEPH B. NIEDERL

Qualitative Organic Microanalysis. By FRANK SCHNEIDER, Ph.D., Assistant Professor of Chemistry, Queens College, New York. John Wiley and Sons, Inc., 440 Fourth Ave., New York, N. Y., 1946. iv + 218 pp. 14.5 × 21.5 cm. Price, $3.50.

The importance of microtechniques in all branches of chemistry is indisputable and has become apparent in the advances made in recent years. In the development of the chemistry of many compounds of biological importance, these methods of working with minute amounts of material have proved indispensable. That the micromethods have played a major role in the chemistry of vitamins and of antibiotics of recent interest is a fact with which the reviewer is acquainted from his association with this work, and it is his opinion that much of the knowledge concerning such compounds would have remained long uncovered but for the use of microtechniques.

In this neat and comprehensive little volume, the author has collected some of the most useful published microtechniques and has fitted them into a systematic scheme of qualitative organic microanalysis which he has developed over a number of years.

In the first chapter the author describes the general methods and the use of the tools of the microanalyst, such as the capillary tubes and pipets, centrifuge cones, fiber balance, etc. The second chapter is devoted to tests of purity and to methods of preparation of pure samples. Such methods include fractional, vacuum and steam distillation of volumes from a few cu. mm. containing a relatively large percentage of the chemical component to milliliter quantities where the ratio of total volume to volume of the desired component is very large. Methods of recrystallization of a few milligrams of material in capillary tubes and on microscope slides are described as well as recrystallization of larger quantities by methods that minimize the number of transferals of material. Extraction of solid and liquid samples and sublimation of various quantities are described extensively as means of purification. The chapter closes with a description of methods of drying small quantities of material.

Chapter Three concerns itself with the detection on the microscale of the elements usually encountered in organic compounds, *e. g.*, carbon, oxygen, nitrogen, sulfur, halogens and phospliorus and with these the detection of water is also included.

The fourth chapter covers the determination of the physical constants such as melting point, boiling point, density of solids and liquids, refractive index of solids and liquids, molecular weight and specific rotation.

The fifth chapter is of particular significance in this book, for, in the author's own words: "Inasmuch as the procedure of Mulliken and Huntress and those of Kamm or Shriner and Fuson differ only in that the latter include the determination of solubility in certain specified solvents, the inclusion of a chapter on solubility determination makes it possible for the microtechnique to be applied to any one of these procedures."

The sixth, seventh and eighth chapters of the book deal with the actual qualitative scheme of analysis, covering compounds of Orders I, II and higher, respectively, according to their elementary composition. The order of tests follows that of the scheme of Mulliken and Huntress and, according to the author, the techniques are based on methods described in a new edition of *A Systematic Course of Instruction in the Identification of Organic Compounds* by Mulliken and Huntress. Some of the crystallographic terms in Table 8 of chaper VI (erroneously referred to in the text as Table 7) could well have been defined, although reference is made to the original article. A list of apparatus in individual kit form and for general class use is appended.

The book is clearly and legibly printed and the figures are admirably done. Since the book is intended more or less to be a laboratory manual, it is unfortunate that a more durable binding was not used.

The book is recommended to those working with natural products and precious compounds in limited amounts and to those with more liberal quantities available but who would save time and patience. As far as schematic analysis is concerned, the book is intended by the author for use with the texts of Kamm, and of Shriner and Fuson, or of Mulliken and Huntress. The possibility of presenting a course of instruction in qualitative organic analysis with a simultaneous introduction to micromethods is an attractive and interesting one. Dr. Schneider's book should serve the means of doing so.

JULIAN R. RACHELE

BOOKS RECEIVED

September 10, 1946–October 10, 1946

JAMES M. CORK. "Radioactivity and Nuclear Physics." J. W. Edwards, Ann Arbor, Mich. 175 pp. $3.50.

MALCOLM DIXON. "Nomograms for Manometer Constants." The Macmillan Company (Cambridge University Press), 60 Fifth Avenue, New York 11, N. Y. Price, Sixpence.

C. B. GNADINGER. "Pyrethrum Flowers. Supplement to Second Edition, 1936–1945." McLaughlin Gormley King Co., 1715 Fifth St., S.E., Minneapolis 14, Minn. 309 pp. $5.00.

RAYMOND M. HANN and NELSON K. RICHTMYER. "The Collected Papers of C. S. Hudson." Volume I. Academic Press, Inc., 125 East 23rd St., New York, N. Y. 898 pp. $15.00.

HERMANN MOHLER. "Elektronentheorie der Chemie." Verlag H. R. Sauerländer and Co., Aarau, Switzerland. 192 pp.

HERMANN MOHLER. "Optische Methoden des Chemikers." Verlag H. R. Sauerländer and Co., Aarau, Switzerland. 131 pp.

M. H. PIRENNE. "The Diffraction of X-Rays and Electrons by Free Molecules." The Macmillan Company (Cambridge University Press), 60 Fifth Avenue, New York 11, N. Y. 160 pp.

JOHN ROGER PORTER. "Bacterial Chemistry and Physiology." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1,071 pp. $12.00.

EUGENE G. ROCHOW. "Introduction to the Chemistry of the Silicones." John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 137 pp. $2.75.

SAMUEL SCHMUCKER SADTLER. "Chemistry of Familiar Things." Eighth Edition, Revised. J. B. Lippincott Company, East Washington Square, Philadelphia, Pa. 310 pp. $4.00.

D. WRIGHT WILSON, A. O. C. NIER and STANLEY P. REIMANN. "Preparation and Measurement of Isotopic Tracers." J. W. Edwards, Ann Arbor, Mich. 108 pp. $1.80.

"Abstract Bulletin N. S. Nos. 6 + 7. Abstracts of Current Information on Insect and Rodent Control." Insect Control Committee Coördination Center, National Research Council, Washington 25, D. C. 34 pp. + 46 pp.

"Extractives from Northeastern Woods." Bulletin No. 9, August, 1946. Northeastern Wood Utilization Council, P.O. Box 1577, New Haven, Conn. 62 pp. $1.00.