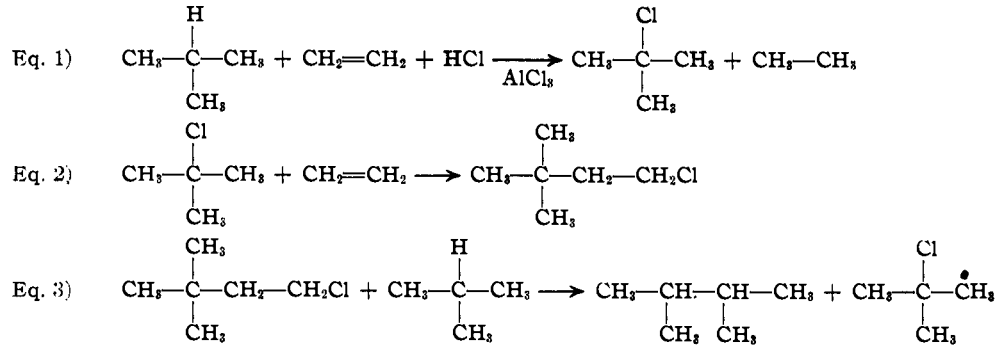

The more pertinent evidence in support of each of the three steps will be briefly mentioned in this communication.

Eq. 1.—This probably occurs via the formation of ethyl chloride. The reduction of an alkyl halide (*e. g.*, ethyl chloride) to the corresponding paraffin by reaction with another paraffin (*e. g.*, *n*-heptane) in the presence of aluminum chloride has been reported.[2] Ethane and propane have been obtained as by products of the alkylation of isobutane with ethylene and propene,[3] respectively. *t*-Butyl chloride was isolated from the products of the reaction of isobutane with vinyl chloride, allyl chloride or 2-chloropropene at temperatures near 0° or below.

Eq. 2.—A 75% yield of 1-chloro-3,3-dimethylbutane (characterized by conversion to neopentylcarbinol) is obtained by the addition of *t*-butyl chloride to ethylene in the presence of aluminum chloride at −15 to −10°. The addition of *t*-butyl chloride to other olefins occurs in the analogous manner.

(2) Nenitzescu and Dragan, *Ber.*, **66**, 1897 (1933).
(3) Unpublished results from These Laboratories.

Eq. 3.—2,3-Dimethylbutane was found to be the major product of the reaction of 1-chloro-3,3-dimethylbutane with isobutane. The condensation of allyl chloride with excess isobutane yields chloroheptane as the chief product if the reaction is carried out at temperatures near 0° or below, while at higher temperatures reduction to heptane occurs.

The rearrangement of the carbon skeleton which occurs in Eq. 3 is not unexpected since the dehydrochlorination involves the hydrogen atom attached to a carbon atom of a neopentyl group. Dehydrochlorination of 1-chloro-3,3-dimethylbutane yielded a mixture of 2,3-dimethylbutene-1 and -2.

A complete discussion of the mechanism as well as of the reaction of isoparaffins with chloroolefins and of alkyl chlorides with olefins will be given in forthcoming papers.

RESEARCH LABORATORIES
UNIVERSAL OIL PRODUCTS CO.
RIVERSIDE, ILLINOIS LOUIS SCHMERLING

RECEIVED JUNE 28, 1944

NEW BOOKS

Handbook of Chemistry. Compiled and edited by NORBERT ADOLPH LANGE, Ph.D., assisted by GORDON M. FORKER, B.S.(Chem.Eng.), with mathematical tables by RICHARD STEVENS BURINGTON, Ph.D. Fifth edition, revised and enlarged. Handbook Publishers, Inc., Sandusky, Ohio, 1944. xvi + 1777 + 271 + 28 pp. 14 × 20 cm. Price, $6.00.

This excellent handbook, a relative newcomer in the field, has proved very popular with users, as is attested by the need for a fifth edition within ten years from the date of the first. The activity of the compiler is shown by the increase in total pages from 1542 in the first issue to the present 2076. Since the handbook contains over 200 *groups* of related tables, any attempt to list them would be superfluous; this latest edition has six new tables, while thirteen others have been extended or completely rewritten, producing an expansion of 174 pages. In the words of the compiler, it is to be hoped "that its resting place will be on the desk rather than on the book shelf" of many students, engineers and teachers.

ALLEN D. BLISS

A Source Book of Agricultural Chemistry. By CHARLES A. BROWNE, Ph.D., Sc.D., Adviser, Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, etc. (No. 1 of volume 8 of *Chronica Botanica*, edited by Dr. Fraus Verdoorn.) Waltham, Mass., the Chronica Botanica Co.; New York City, G. E. Stechert and Co. 290 pp. 32 illustrations. 17.5 × 26 cm. Price, $5.00.

This admirable volume is not precisely what I would have anticipated from the title, "A Source Book of Agricultural Chemistry"—namely, a collection of original literature dealing with agricultural chemistry. It is rather a history of the development of agricultural chemistry frequently documented by quotations from original articles and books, accompanied by brief biographies of their authors.

It is, nevertheless, a "source book" in the sense that it is chiefly concerned with the origins of agricultural chemistry. Six of its seven chapters are devoted to the period ending with Lavoisier and the Chemical Revolution; the seventh and final chapter covers the succeeding half-

century up to Liebig's departure from Giessen in 1852. In the early period, the problems of agricultural chemistry were substantially those of chemistry at large, so that except perhaps for the final chapter, it is in fact a history of the science of chemistry viewed from the agricultural angle.

The book will therefore doubtless find an audience much wider than that afforded by professional agricultural chemists; it will interest all sorts of chemists and all sorts of biologists. Indeed, it will appeal to all those fortunate members of the general public who are gifted with scientific curiosity.

Dr. Browne's style in this latest of his publications is characteristically simple and clear; his discussions discriminating, yet genial. The book is well printed, but it is unfortunate that it could not have been offered to the public in a bound volume rather than in paper covers.

ARTHUR B. LAMB

Chemical Spectroscopy. By WALLACE R. BRODE, Professor of Chemistry in the Ohio State University. Second edition, John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y., 1943. xi + 677 pp. Illustrated. 14.5 × 22 cm. Price, $6.50.

The fact that a second edition of Dr. Brode's "Chemical Spectroscopy" is called for within four years of its first publication is, in itself, an indication that this book meets a very real demand for a textbook covering the practical aspects of both emission and absorption spectroscopy. The reviewer can attest from personal experience with the first edition that it serves this purpose admirably.

The chapter headings and general arrangement have been altered slightly from those of the first edition, and there has been considerable rearrangement of material; the descriptions and diagrams of newer spectrographs and accessory equipment which are included illustrate the advances in instrument design which have taken place in the last few years. Chapter III deals with the instruments for emission work, and in Chapter VII there is a very full discussion of absorption spectrophotometers for the visible and ultraviolet. A comparison of the treatment of ultraviolet absorption spectrophotometry in the first and second editions emphasizes the trend toward photoelectric instruments. The account of infra-red and Raman spectrophotometry in Chapter X has been little changed, and the space devoted to this section of "Chemical Spectroscopy" hardly does justice to its increasing importance both in academic research and in industry. This is perhaps understandable since most of the work in this field has been undertaken by specialists who have designed their own instruments, and commercially manufactured equipment for the measurement of infra-red absorption spectra is only now becoming available.

In Chapters VI and VIII Dr. Brode discusses the relations between ultraviolet absorption spectra and the chemical structure of organic molecules; it is unfortunate that here, as in the first edition, he has chosen to make frequent use of the term *resonance* in a sense which differs from its customary implication in modern theoretical organic chemistry. This is likely to confuse the immature student who, in any case, usually has considerable difficulty in readjusting his mental concepts of molecular structure when first introduced to the quantum mechanical picture of the organic molecule. Such a student can only be further confused when he reads (on page 136) that "When the electronic structure of a compound can exist in two or more forms of nearly equal energy content, resonance is possible and the relative stability of the two forms will determine the distribution in the *equilibrium mixture*," or, on page 229, "One may further postulate a resonating system for benzene as *oscillation* between the two Kekulé formulas." On page 234 quinonoid and ionic equilibria for 4-hydroxy-azobenzene are illustrated, and from these it may be inferred that both represent similar types of equilibria, whereas, in fact, the one involves a proton shift and the other merely an electromeric rearrangement. On page 217 the nitro group is shown with penta-covalent nitrogen.

Although these, and other statements of a similar nature, detract from the value of the book in the eyes of the theoretical organic chemist, it does contain a most comprehensive account of the relation between color and chemical constitution. The use of ultraviolet absorption spectrophotometry in industry has been limited largely to "glorified colorimetry," but the reviewer feels that once the theoretical and semi-empirical relationships between color and chemical constitution, which have already been established, are better appreciated, many new applications of the technique will be found.

The new edition contains more extensive tables of the wave lengths of the principal emission lines of the elements, and the very useful wave length–frequency conversion tables have been extended to cover the range from 200–1200 mμ.

R. NORMAN JONES

BOOKS RECEIVED

June 10, 1944—July 10, 1944

R. B. BRADSTREET. "The Standardization of Volumetric Solutions." Second Edition, Completely Revised and Enlarged. Chemical Publishing Company, Inc., 26 Court Street, Brooklyn, N. Y. 151 pp. $3.75.

J. FRANKFORD. "The Stereometrical Theory of the Structure of Atoms." Published by J. Frankford, College of Agriculture, Lincoln, Nebraska. 67 pp. $0.60.

MORRIS B. JACOBS, Editor. "The Chemistry and Technology of Food and Food Products." Volume I. Interscience Publishers, Inc., 215 Fourth Avenue, New York 3, N. Y. 952 pp. $10.50. (Volume II to appear in September. Set of 2 volumes, $19.00.)

WILLIAM F. LEGGETT. "Ancient and Medieval Dyes." Chemical Publishing Company, Inc., 234 King Street, Brooklyn, New York. 95 pp. $2.25.

JOHN MILLS. "Electronics: Today and Tomorrow." D. Van Nostrand Company, Inc., 250 Fourth Avenue, New York, N. Y. 178 pp. $2.25.

JAMES B. SUMNER AND G. FRED SOMERS. "Laboratory Exercises in Biological Chemistry." Academic Press, Inc., 125 East 23rd Street, New York, N. Y. 169 pp. $2.60.