

## BOOK REVIEWS

**The Handbook of Solvents.** By LEOPOLD SCHEFLAN, Ph.D., Technical Manager, B. Scheflan, Ltd., Formerly Assistant Chief Chemist, the Pyrene Company, Inc.; and MORRIS B. JACOBS, Ph.D., Director of Laboratory, Dept. of Air Pollution Control, N.Y.C. D. Van Nostrand Company, Inc., 250 Fifth Avenue, New York, N. Y. 1953. .viii + 728 pp. 18 × 25 cm. Price, \$10.00.

According to the publishers this handbook is intended to cover various theoretical and practical attributes of solvents, solvent recovery and the physical properties of over 2700 liquid organic compounds. The first eight chapters, amounting to seventy-eight pages, deal with the topics of statistics, safe practices, solvent action and power, vapor pressure, dilution ratios, inflammability, and solvent recovery. The remaining six hundred and fifty pages consist of tabular data on commercial solvents and liquids which may become important solvents in the future.

The book appears to be generally uncritical, superficial as regards the introductory chapters and somewhat out of date. Thus, statistics of the solvent industry are limited to estimates for production and usage in 1935 and a tabulation of the 1950 figures of the U. S. Tariff Commission for synthetic organic chemicals. Similarly, in the chapter on solvent action and power no mention is made of the more recent work on solubility with the concept of solvent energy density and its usefulness, for example in predicting high polymer swelling and solubility. No reference could be found to the work of Magat or Huggins, while the reference to Hildebrand's classic "Solubility" is to the 1924 edition, rather than that of 1936 or the still later revision of Hildebrand and Scott in 1950. Indeed, with one exception all references in this chapter are before 1950, while the majority are before 1940. In the succeeding chapters the treatment appears to be similar; for example, the handling of evaporation rates also leaves something to be desired. The fundamentals are nowhere clearly stated and the references are again old.

The data on individual solvents are handily arranged for reference by the industrial chemist, an index of synonyms for those unfamiliar with chemical terminology being included. For the research chemist the tables will be of little utility since no specific references are given for the values cited. While a list of sources is appended, no attempt has been made to key these to the individual solvents. Further, no effort appears to have been made to be selective and critical in the values quoted. Thus, under benzene, one finds: "Melting Point: 5.4 to 5.5°C. Surface Tension (dynes per cm.) 28.9 at 20°C. 29.0 at 20°C." Reference by the reviewer to one liquid commonly used as a solvent for nitrocellulose in molecular weight determinations, revealed no value for the viscosity of the pure ester although peculiarly enough the viscosity of a 10%  $\frac{1}{2}$  sec. RS nitrocellulose in ethyl lactate solution was given. On the other hand, a check of the "cellosolve" series of solvents indicated general completeness.

The book should have utility for those desiring rapid reference to the formulas and common physical properties of a wide variety of organic liquids.

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**Gmelins Handbuch der Anorganischen Chemie.** Eighth Edition. By E. H. ERICH PIETSCH (Editor). Verlag Chemie, G.m.b.H., Weinheim/Bergstrasse, West Germany. System No. 9, Sulfur, Section A2. 1952. Pp. 61-510. 17.5 × 25.5 cm. Price, \$35.30. System No. 9, Sulfur, Section B1. 1953. xi + 368 pp. 17.5 × 25.5 cm. Price, \$29.40.

In addition to the sections mentioned above, A1 (historical) first appeared in 1942 and was reprinted in 1952; A3 on physical and chemical properties of the element is now ready;

B2, which covers the remaining compounds of sulfur, is due late in 1954.

No reviewer could approach his task without a feeling of humility in view of the monumental scholarship and labor everywhere in evidence. In preparation of these sections the staff "reviewed and analyzed more than 25,000 original publications, extracting information of essential nature, comparing and evaluating data from thousands of authors, and eliminating erroneous and superficial views." Obsolete references are mentioned in separate paragraphs, while the systematic arrangement of valid items makes it easy to find any desired detail. In addition, the Gmelin Institute offers to supply data published from 1950 on, also progress reports and answers to individual questions.

A comparison with the four hundred pages on sulfur and its compounds found in the seventh edition (1907) accentuates not only the vast amount of new work on these particular substances but the rebirth of inorganic chemistry through its integration with the rest of science. The current status of physics, astronomy, geology, geochemistry, mineralogy and metallurgy is mirrored wherever these are related to the chemistry of sulfur.

Section A2 is written primarily for the industrialist. It begins with the occurrence of the element and of its compounds, all the way from stars to organisms, and it includes statistics from every country. Then follow three hundred pages on technology, mainly of sulfur, sulfur dioxide and trioxide, sulfuric acid. In spite of drastic condensation, one gets the impression that all the worthwhile variations in procedure are sufficiently outlined, and interpreted in the light of fundamental principles. The corresponding patents are listed and briefly abstracted. Lastly, there is a valuable chapter on colloidal sulfur, and a brief résumé of physiological hazards.

Section B<sub>2</sub> meets the requirements of investigators and teachers. Every type of measurement and generalization is woven into the exposition of properties. Molecular structures and mechanics are set forth in great detail. Reactions are described in terms of mechanisms, kinetics, equilibria and energetics. The complicated chemistry of SO and S<sub>2</sub>O<sub>3</sub>, not to mention S<sub>2</sub>O<sub>7</sub> and SO<sub>3</sub>, is clearly summarized. Especially detailed, of course, is the treatment of sulfur dioxide—its oxidation-reduction reactions including carbon and metals; the liquid as a non-aqueous solvent and as a coolant—also many other features.

Here and there in the wealth of detail, gaps will be perceived by the discerning eye, so that no small number of future investigations is likely to originate through study of this comprehensive work.

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**The Furans.**—American Chemical Society Monograph Series. By A. P. DUNLOP, Assistant Director, Chemical Research, The Quaker Oats Company; and F. W. PETERS, Vice President, The Quaker Oats Company. Reinhold Publishing Corporation, 330 West 42nd Street, New York 36, New York. 1953. xix + 867 pp. 17 × 23.5 cm. Price, \$18.00.

This book is intended to fill the "need for more or less encyclopedic coverage of furan compounds with particular attention to the behavior of the furan nucleus." Its scope includes primarily compounds with the aromatic furan nucleus and excludes condensed systems (benzofuran, etc.) and hydrogenated monocycles. The text is divided into Parts I, Chemistry, and II, Industrial Applications.

Part I comprises fifteen chapters which cover structure, physical properties, nomenclature, synthesis of homologs and functional derivatives and their reactions, cleavages, and hydrogenation of the furans. A comprehensive, critical review is presented with the apparent attempt to mention every known furan, the method of its synthesis, and in most cases its reactions and the physical properties which

have been reported. Each chapter and section are provided with an introductory paragraph stating its scope and giving cross-references. The synthetic methods are discussed in detail, followed by mention in smaller type of simple homologs or by extensive tabulation.

This book will be indispensable to anyone working actively in the field and virtually eliminates the need for literature searches through December, 1950, and, for many purposes, for reference to the original literature. Discussion is quite detailed and attention is given to experimental method. Many suggestions for improvement of yields and extensions appear in the text. Some previously unpublished work done in the Quaker Oats laboratories or plants is principally related to process or development research on furfural. A few elucidations or improvements of synthetic methods appear.

Part II (and much related material on furfural in Part I) emphasizes the industrial importance and potentialities of furans. It is authoritatively written and includes physiological properties, uses as an intermediate, solvent applications, and derived resins. An appendix lists resin patents by composition and application.

Little serious criticism need be leveled at the book. The style is excellent and the organization and cross-referencing carefully done. Although coverage is quite complete, the later papers of Morel and Verkade (*Rec. trav. chim.*, **68**, 619 (1949); **70**, 35 (1951)) providing experimental basis for the  $\delta$ -sultone synthesis of furans (reference to the preliminary announcement appears on p. 38) should be mentioned. The text is relatively free from typographical errors and occasional mistakes in formulas (*e.g.*, furylydantoin, p. 598) will cause no difficulty. It is surprising to see contributing structures for furan called "mirror images" (p. 6), and a decarboxylative nitration explained as involving a "vinylog of a  $\beta$ -nitrocarboxylic acid" (p. 158), in contrast to the original reference. The reviewer feels that much of the discussion is unnecessarily detailed and that a more consistent emphasis of the relationships of chemistry and theory with other aromatic systems would have been more valuable. These limitations seem to decrease the instructional value of the monograph. Many of the postulated intermediates, though taken from or analogous to the literature, lack experimental support and are often speculative. Author and formula indices would have been useful although the subject index is effective.

The typography and binding are excellent although the heavy paper makes the book unwieldy. It is regrettable that it is priced beyond most individuals.

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*Colloides et Gels.* By J. DUCLAUX, Chef de Service, à l'Institut de Biologie Physico-Chimique (Fondation Ed. de Rothschild). Gauthier-Villars, Libraire du Bureau des Longitudes, de l'Ecole Polytechnique, Quai des Grands-Augustins, 53, Paris, France. 1953. vi + 292 pp. 16.5 × 25 cm. Price, 2,000 fr. (U. S., \$6.03).

In his introduction the author states that the purpose of this book is to present to the reader a broad understanding of colloid chemistry from the point of view of the available experimental facts, making only indirect reference to theories, and giving little attention to mathematical formulas. The author believes that his book would be useless if it merely repeated the form and content of others.

The author has accomplished his purpose, and this volume presents the essential phenomenology of colloids, especially of the gels, in an interesting manner, and can be read profitably by both beginners and more mature students of the subject. The scholarly treatment is permeated with the author's long experience with the subject dealt with, and with numerous philosophical points of great interest to those who have given considerable thought to the field but, perhaps, not detectable to the beginner. Very few references are given, but this is intentional on the part of the author who does not desire to interrupt the course of his treatment. This is the type of book which can be written only by one who has made the subject his life study.

It is possible to point out a few minor flaws which do not in any way alter the value of this scholarly work. The

author calls specific attention to the correct usage of electrophoresis, but continues to use the term "cataphoresis" for both cataphoresis and anaphoresis. The title of the book implies that colloids are distinct from gels, but the reviewer is certain that the title was chosen to emphasize that gels are given special treatment in the text. The use of the formula  $Fe_2(OH)_6$  for precipitated ferric oxide seems somewhat old-fashioned, but this should be the prerogative of any author.

The format of the paper-bound book is excellent, and typographical errors are unnoticeable. However, the publisher of a book on the "glue-like" materials, might be expected to exhibit some knowledge of the subject, and provide better glue to secure the paper cover.

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*Technique of Organic Chemistry. Volume VIII—Investigation of Rates and Mechanisms of Reactions.* By S. L. FRIESS AND A. WEISSBERGER (Editors). Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1953. xxiii + 760 pp. 16.5 × 23.5 cm. Price, \$12.50.

It is generally conceded that no single individual can keep up with the literature of modern organic chemistry, and it is becoming more and more fashionable to have advanced works written as collaborative efforts by groups of specialists. The editor of the present series of volumes on the technique of organic chemistry has been particularly successful in coordinating the efforts of a large number of authors, and in the past eight years he has induced about one hundred specialists to turn out eight volumes totaling more than 4,000 pages.

In the opinion of the reviewer, what we might call "common" knowledge as far as most organic chemists are concerned, is that which is obtained from books rather than from the original literature. The need, therefore, is for elementary and advanced books which cover more and different literature rather than what has already been covered by other books. Some collective works like Adams' "Organic Reactions" achieve a remarkable uniformity of scope and style through the efforts of a large and vigorous editorial board. Friess and Weissberger, using more of a catch-as-catch-can approach, have produced an uneven work, which includes everything from somewhat dull abstracts or condensations of other books to superb expositions of material which would require very substantial digging to obtain from the original literature. Furthermore, the chapters range in style from general discussions to detailed and specific directions for special operations.

The book begins with a chapter on the general theory of rate processes which leads into sections on methods of carrying out fundamental operations and special experimental techniques for difficult cases. After consideration of a variety of homogeneous gas- and liquid-phase processes, there is a long section on biological reactions. The book concludes with a chapter on methods for determination of rates of very rapid reactions. As might be expected from a slate of fifteen authors, all of whom are concerned with homogeneous reaction rates and mechanism, there is some duplication among the various chapters. From the standpoint of making available information not readily found except in the original literature, the reviewer was most impressed by the section written by Burnett and Melville on determination of active intermediates in photochemical reactions by the rotating-sector method, the superb section by Leffler and Grunwald on general methods for determination of mechanisms of organic reactions in the liquid phase, and the section on determination of rates of rapid reactions by Roughton and Chance. The chapters by Livingstone on general theory of rate processes, fundamental operations, and evaluation and interpretation of rate data, are of considerable importance and will be of substantial help to research workers beginning in the field. However, the viewpoint is that of the physical chemist, and the reviewer thought the author did not fully realize that the modern physical organic chemist almost invariably wants to have more detailed information about organic reaction mechanisms than knowledge of rate laws can afford. Unfortunately, the section which deals with one of the most rapidly expanding of special experimental techniques, isotopic tracer