

Thermodynamic Properties of the Elements. Number 18 of the *Advances in Chemistry Series* Edited by the Staff of *Industrial and Engineering Chemistry*. By D. R. STULL AND G. C. SINKE. American Chemical Society, 1155 Sixteenth Street, N.W., Washington 6, D. C. 1956. v + 234 pp. 15.5 X 23.5 cm. Price, \$5.00.

This publication contains two parts, tables of the thermodynamic properties of the elements, and a discussion of the experimental data. It supersedes a privately distributed publication of the same title, which should no longer be used because significant improvements have been made.

The tables occupy the larger part of the book. Each table lists the state of the element at the top, and then the temperature (in 100 degree increments from 300 to 3000°K.), C_p° , $H^\circ_T - H^\circ_{298.15}$, S°_T , $-(F^\circ_T - H^\circ_{298.15})/T$, ΔH°_f , ΔF°_f , and $\log_{10} K_p$ at each temperature. At the left are listed $H^\circ_{298.15} - H^\circ_0$ and data for the melting point, the boiling point, the transition points and the critical point. The choice of 298.15°K. as the reference temperature is a good one from the standpoint of high temperature scientists who work with substances whose heats of formation are known at this temperature rather than at 0°K.

It is indeed unfortunate that the authors declined to give an indication of the uncertainties of the tabulated values. Their evaluation would have been extremely useful for the serious user.

For every element up to atomic number 92, a table for the reference state is given, and for many elements additional tables are given. The authors have chosen the reference state for each element to be "the crystalline solid from room temperature to the melting point at one atmosphere, the liquid from the melting point to the normal boiling point, and the most representative ideal gaseous species in the temperature range from the normal boiling point to 3000°K." They have realized that in many instances, the gaseous reference state will not be the predominant gaseous species over the entire temperature range, but their chosen reference state is always clearly indicated, and no confusion need arise. One consequence of the choice of the reference state is that the vapor pressure of an element, even if there is only one gaseous species, is not easily obtained above the normal boiling point.

The other tables that appear are for various gaseous species or crystalline modifications. For example, four tables are given for carbon: C (graphite, reference state), C(g), C₂(g) and C₃(g). There are five for phosphorus: P (reference state), P₂(g), P₄(g), P(g), and P(white).

In the other part of the book, the authors have noted all measurements, previous compilations and prior estimates that they considered for their evaluation. Their literature work extends through 1955. Lacking a definite indication of uncertainties in the tables themselves, a user will be obliged to evaluate the uncertainties himself. For this task he can use to good advantage the discussion and references in this part of the book.

Any compilation of such information demands a selection of the quantities to be tabulated and a choice of values for certain physical constants. To make the first selection, the authors must weigh the opposing factors of permanence and convenience, and to make the second choice they must balance the opposing factors of consistency with previous compilations and with contemporary developments. With respect to the first selection, the authors have chosen, probably wisely, to list the thermodynamic properties rather than these values divided by R . They have thus sacrificed permanence slightly and have achieved considerable convenience for the current scientist. With respect to the second choice, they have straddled the issue. Except for R , the constants they used were those recommended by Rossini, Gucker, Johnston, Pauling and Vinal in 1952. The value for R , which was taken as 1.98726 instead of 1.98719, was obtained from the 1952 value of the standard volume of an ideal gas and the new value for the ice point, 273.15°K. Although the authors do not list the value of the second radiation constant, c_2 , their values of h , c and k lead to a value of 1.438620 instead of 1.438676 cm. deg. That the authors have chosen these particular constants instead of those of RGJPV (1952) or those of Cohen, DuMond, Layton and Rollett (1955) can be neither strongly criticized nor vigorously defended. Because this compilation employs constants different from most others, one should not expect to find perfect agreement. Anyone required to convert

values based on one set of constants to those based on another can easily do so.

This compilation is more limited in scope than the NBS "Selected Values of Chemical Thermodynamic Properties, Series III," but it is easier to use because it is smaller, complete, and bound. The agreement between the values and those in the NBS tabulation is good in most instances. Despite this fact, all such tables must be used with great caution. That such caution is necessary is illustrated by the fact that the two publications give significantly different values for B(s) and N(g). The use of these tables will be increased enormously if a companion work concerning compounds, consistent in all respects with the present work, is forthcoming.

The authors have done a splendid job, and the publication is a worthwhile and valuable contribution to the scientific literature. The Dow Chemical Company is to be commended for its enlightened encouragement and support of such valuable, fundamental work. It is to be hoped that some way will be found to keep the publication up to date.

The Preface by Prof. Brewer and the Introduction by the authors add substantially to the usefulness of the book, and the reader should not fail to study them.

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Relaxation Spectrometry. By E. G. RICHARDSON, B.A., Ph.D., D.Sc., Professor of Acoustics, King's College, University of Durham, England. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. viii + 140 pp. 15.5 X 23.5 cm. Price, \$5.75.

This is a most difficult book for a reviewer to assess without his appearing to be unfair to the author. The book is stated to be the experimental counterpart of another which is to expound the theoretical aspects of acoustic relaxation. Many portions of the present book would be unintelligible without further theoretical amplification.

If the present book is to be judged as a work on the experimental aspects of acoustic relaxation methods, then it fails miserably. Certainly some experimental methods are described, but many of these accounts are so contracted and so worded, as to be more or less useless. Frequently diagrams of experimental apparatus are given and the labelling is so woefully inadequate, as to make the sketches worthless. Examples are Figs. 21 and 31. These are diagrams with parts of the apparatus labelled with numbers and letters, but no indication of the meaning of these symbols is given.

The collections of experimental data and graphs in the book are also unsatisfactory. Many graphs are given without the meanings of the ordinates or abscissas being given (e.g., Fig. 22), and at other times (e.g., Figs. 26 and 70) only the abscissas are given.

The range of material covered in the book is good, but the whole thing gives one the impression that it was rather hastily put together. The author is a recognized international authority in this field and if he and his publishers, who are likewise distinguished, really care about their reputations, they will quickly issue a more carefully revised edition of what could be a most interesting and useful book.

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Organic Reactions. Volume IX. By ROGER ADAMS, Editor-in-Chief. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. viii + 468 pp. 16 X 23.5 cm. Price, \$12.00.

All chemists concerned with organic reactions look forward to the publication of each new volume of this well-known work. In Volume IX the literature on seven important reactions is summarized by experienced authors.

Chapter 1, "The Cleavage of Non-enolizable Ketones with Sodium Amide. The Haller-Bauer Reaction," by K. E. Hamlin and Arthur W. Weston, deals with the scission of ketones to amide and hydrocarbon; 36 pages, 96 references. It does not discuss the alkylation of ketones.

Chapter 2, "The Gattermann Synthesis of Aldehydes," by William E. Truce, is limited to the hydrogen cyanide synthesis and does not include the carbon monoxide synthesis, which usually is called the Gattermann-Koch reaction; 36 pages, 100 references.

Chapter 3, "The Baeyer-Villiger Oxidation of Aldehydes and Ketones," by C. H. Hassall, summarizes results on the conversion of aldehydes to acids and of ketones to esters or lactones by means of hydrogen peroxide or peroxy acids; 34 pages, 64 references.

Chapter 4, "The Alkylation of Esters and Nitriles," by Arthur C. Cope, H. L. Holmes and Herbert O. House. The authors limit themselves to the carbon alkylation of malonic esters, cyanoacetic esters and mononitriles by all alkylating agents except amines and ammonium salts. It does not include the alkylation of β -keto esters. This chapter is an excellent example of the extent to which the aim to treat the subjects exhaustively has been fulfilled. Despite the above limitations, it covers 225 pages and lists 1080 references.

Chapter 5, "The Reaction of Halogens with Silver Salts of Carboxylic Acids," by C. V. Wilson, covers the Hunsdiecker, Simonini and Prevost reactions; 56 pages, 103 references.

Chapter 6, "The Synthesis of β -Lactams," by John C. Sheehan and Elias J. Corey, reports procedures developed since the preparation of the first β -lactam in 1907; 21 pages, 43 references.

Chapter 7, "The Pschorr Synthesis and Related Diazonium Ring Closure Reactions," by De Los F. De Tar, covers not only phenanthrene syntheses, but also the synthesis of other cyclic compounds such as derivatives of fluorene, dibenzofuran, dibenzothiophene, phenanthridone and aporphine; 54 pages, 225 references.

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Symposium on Techniques in Polymer Science. Lectures, Monographs, and Reports 1956. No. 5. Introduction by C. H. Bamford, M.A., Ph.D., Sc.D., A.R.I.C. The Royal Institute of Chemistry, 30 Russell Square, London, W C 1, England. 1956. 79 pp. 24 X 15.5 cm. Price, \$1.15.

This book consists of eight short chapters which outline most of the principal physical techniques employed in polymer science. The chapter by P. F. Onyon on light scattering and osmometry is rather elementary but the main ideas and general references are presented. The chapter on chromatographic fractionation by S. R. Caplan includes frontal analysis, gradient elution, crystallographic chromatography and paper strip chromatography, as they apply to high polymers. These polymer fractionation methods have rarely been utilized by American chemists. The chapter on infrared techniques by A. Elliott discusses the effect of crystallinity on the spectra and the use of polarized light. The mechanical properties of polymers is outlined by R. B. Beevers in a neat fashion and dynamic methods of mechanical testing are described. The results of conventional surface film techniques as applied to hydrophilic polymers form the main portion of the chapter by P. F.

Holt. Some applications of tracer techniques to polymer chemistry are presented by J. C. Bevington, but no references are given. The chapter by A. D. Jenkins on kinetic techniques describes some of the new British methods for automatically following the course of polymerization reactions especially when the degree of conversion is small.

Altogether, this is a fine collection of reviews of topics of interest to all physical chemists and high polymer specialists. The literature cited is mainly of European origin but this is advantageous for the American reader.

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Fundamentals of Chromatography. By HAROLD GOMES CASSIDY, Associate Professor in Chemistry, Yale University, New Haven, Connecticut. Technique of Organic Chemistry. Volume X. Edited by ARNOLD WEISSBERGER, Research Laboratories, Eastman Kodak Company, Rochester, New York. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1957. xvii + 447 pp. 23.5 X 16 cm. \$9.75.

Fundamentals of Chromatography is the latest volume of a well known and useful series. It is an extension and expansion of that portion of Volume V which covered chromatography, although it is not to be considered a revision but rather a new book.

The first four chapters consist of a treatment of the definitions and theories involved in the various methods which are presented in the following chapters. The depth of the theoretical development varies from a simplified explanation of chemical bonds to a formal mathematical treatment of the chromatographic process.

The next seven chapters cover discussions on particular methods of chromatography. The section on gas-liquid partition chromatography is not as complete as the present state of development of the subject would seem to indicate, but this is understandable in view of the considerable amount of work which has appeared in recent publications. The chapters on paper partition chromatography and adsorption chromatography are the most extensive ones, especially in their presentation of some practical information that a newcomer to the field would be interested in. The last four chapters are concerned with the qualitative and quantitative evaluation of zones, the relationship between distribution and molecular structure, and with simple rules and examples on how to select the proper chromatographic system in order to solve the various problems which may be encountered.

There are over one thousand literature references cited by the author including some forty-five papers originating from 1955 or 1956.

The book is a helpful review of the various chromatographic methods now available. It should be useful to anyone who wishes to attain a certain proficiency in the field before undertaking an extensive search of the original literature.

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