

others, find a common ground. Characteristically, a major part of the research in the carbohydrate field is pursued by those whose principal interests lie elsewhere. For this reason, general texts dealing with the carbohydrates play a very important role and, since there are comparatively few such texts, the appearance of a new one of substantial proportions may be regarded as a particularly significant and welcome event. The present volume is a translation, rearrangement, and enlargement of the first edition which appeared in the Czech language in 1960; it is issued by the publishing house of the Czechoslovak Academy of Sciences and printed in Czechoslovakia, distribution in Western Europe and the Western Hemisphere being handled by Academic Press, Inc.

As seems inevitable, the area covered by the present volume is more restricted than is the case with most of the earlier general texts; a companion volume dealing with the oligosaccharides has, however, recently appeared (J. Staněk, M. Černý, and J. Pacák, "The Oligosaccharides," Academic Press, Inc., New York, N. Y., 1964). The organic chemistry of the monosaccharides is covered in a thorough fashion, much of the material being commendably up-to-date. As the treatment is primarily descriptive with extensive tables of carbohydrate derivatives as well as generous references to key papers and reviews, the book will certainly prove highly useful to all those seeking factual information concerning the organic chemistry of the monosaccharides.

The rich variety of the interests represented by the carbohydrate field precludes the possibility that any one volume, even one as generous as the present one, could satisfy all users. The biochemist will find only one chapter, "Synthesis and Transformations of Sugars in Living Systems," specifically devoted to his subject; the younger organic chemists who may regard the modern stereochemical and mechanistic concepts as the common language of organic chemistry will likewise be disappointed. Save for an isolated sub-section on the conformation of the monosaccharides and the rare arrows in formulas, the approach is purely descriptive.

Whatever its faults (and there are, inevitably, many minor ones) we should be very grateful to our Czech colleagues for undertaking such a formidable task. The work which they have produced splendidly supplements the existing general texts and fully deserves a place beside them in specialized and institutional libraries.

There is still a definite need for a general text representing a synthesis of the carbohydrate field in strictly modern terms and published at a price which is commensurate with the purse of the average organic chemist.

NATIONAL INSTITUTE OF ARTHRITIS AND
METABOLIC DISEASES HEWITT G. FLETCHER, JR.
NATIONAL INSTITUTES OF HEALTH
BETHESDA, MARYLAND 20014

Gas Phase Chromatography. Volume I, Gas Chromatography. Volume II, Capillary Chromatography. Volume III, Tables for Gas Chromatography. By RUDOLF KAISER, Badische Anilin- und Sodafabrik AG Ludwigshafen. Translated by P. H. Scott. Butterworth, Inc., 7235 Wisconsin Ave., Washington 14, D. C. 1963. 14.5 × 22.5 cm. Vol. I: 199 pp. Price, \$7.95. Vol. II: 120 pp. Price, \$6.95. Vol. III: 162 pp. Price, \$7.75.

As the reader can see by the above titles, Kaiser has pretty well covered the field of gas chromatography (GC). Volume I appears to cover the literature through 1959 with an occasional reference to 1960 literature. Volumes II and III appear contemporary covering material published through mid-1961. Scott has done a commendable job of translating the German although occasional inconsistencies are present. Their infrequency attest to a conscientious effort.

Volume I.—It occurs to this reviewer that the wide acceptance of more recent GC volumes by Purnell, Littlewood, and others, will limit the appeal of Volume I, with its older literature. However, Kaiser notes that his emphasis is on the technique and apparatus of GC and he does achieve this objective. In fact, the material in these areas is almost encyclopedic and perhaps not as critically selected as it should be. His succinct treatment of theory is notable both for the inclusion of the Jones-Kieselbach rate equation for HETP and for the complete lack of discussion of the significance of its terms. This would seem essential to an

understanding of the kinetic column processes. Also, the James and Martin pressure correction (and a modification of it) is said to be of limited validity even though it has been independently derived by Giddings, Kieselbach, Sternberg, and others. An amplification of this statement would have been proper. Kaiser's definition of resolution warrants more general consideration along with an interpretation of its theoretical significance, *i.e.*, its derivation. Also, chromatography and PTGC are considered separate techniques in the current literature so it is unfortunate that no distinction is made in this volume. On the whole, the treatment of GC theory is basic with a minimum of interpretation.

In the chapter dealing with the column, performance is expressed as the number of theoretical plates per meter which leads to some confusion as one works through equations. Kaiser also notes that, as a rule, high-boiling liquids are separated on short columns and low-boiling materials on long columns. This is somewhat misleading since column temperature can enter into this question, to say nothing of HETP. The practical recommendations for the preparation of columns, however, are correct and lucid, again emphasizing the strong experimental aspect of this volume. The treatment of carrier gases, Chapter 2.2, is excellent with regard to the treatment of needle valves and necessary temperature control to achieve constant flow. Perhaps more details of pneumatic sample injectors (drilling plans, etc.) are included than is warranted (Chapter 2.3) although detectors are very well treated indeed (Chapter 2.4). Kaiser's expression for sensitivity includes long term drift (mv./hr.) in the noise term and this seems unnecessary. This represents the only difference between his and Stross' expression for sensitivity. Chapter 2.7 combines discussion of multi-column operation, trapping, trace analysis, preparatory scale, and process GC. The last is brief but quite informative. The other topics are treated as expected from the pertinent literature. The inclusion of a short section on low-pressure instruments is surprising since the author acknowledges the ineffectualness of this mode of operation.

Analytical interpretation of the chromatogram is covered in Chapters 3.0-3.3. Very little new material is contained in this treatment although a criterion for nearly-superimposed peaks is given as $w \sim t_r n^{-1/2}$ (p. 165). The peak width does vary directly as retention, t_r , only if n , the number of theoretical plates, is a constant. The t_r dependence of the rate equation terms demonstrates this is not the case.

Volume I may be summarized as containing much well-presented apparatus and technique material but falls short on relating basic aspects of rate theory to column performance.

Volume II.—As in Volume I, the author indicates his emphasis on the practical aspects of capillary columns which he feels have been neglected because of experimental difficulties. He properly emphasizes the speed and "resolving" power of capillaries. It must be pointed out that resolving power is temperature, length, HETP, and liquid phase (both kind and loading) dependent and is not unique with capillaries. The author erroneously gives Desty credit for the first capillary chromatogram (1958) when in fact Golay clearly compared capillary with packed columns at both high and low speeds at Lansing (1957), and these chromatograms were published in the proceedings (1958) and patent application. The theory is the Golay-Desty treatment with R. P. W. Scott's interpretations included. The statement that sample size should be limited to that producing 90% of maximum n does not take into account the fact that, in many cases, 70, 50, or even 20% of n is all that is needed for adequate resolution. There is some confusion between K and k (p. 17) and Kaiser notes that k and r cannot be predicted so that K should be used. The fact is that K is most easily derived from k and r .

There is an excellent discussion of small flow measurements for capillary columns, and the section on preparation of capillary columns is extensive and extremely well done. It is highly recommended. The same recommendation applies to the discussion of flame ionization with its excellent literature coverage.

Qualitative analysis by color tests, precipitation tests, methylene insertion reaction, and retention indices is well treated as is the quantitative interpretation. The need to ensure a linear response from the ionization-type detectors was not sufficiently emphasized in this reviewer's estimation. This is the real limitation to quantitative work with capillary columns as Halasz has so well noted.

On the whole, this volume is concise and well worth studying for its content. It should be noted that the author has not complied with the wishes of Perkin-Elmer and Golay to have their

columns referred to by the proprietary term "open tubular" columns.

Volume III.—The third volume in this series is a compilation of data and information which the GC worker will find useful. Qualitative analysis is simplified by the use of Kovats' retention indices for many organic compounds as well as some inorganic compounds and complexes. The obvious limitation to such tables is that data are not available for all important liquid phases and solutes. However this compendium is a good start and hopefully will stimulate the use and further expansion of such information. It is certainly to be wished that Kaiser will maintain his position as editor and compiler.

In addition to retention indices, there are tables of liquid phases and adsorbents with temperature limits, names and addresses of suppliers, mesh size conversions, English to metric conversions, German-English glossary of GC terms, etc. Particularly well done is the explanation of the relative molar response values of Messner, *et al.*, and their use. Examples of calculations are highly commended for their clarity.

Kaiser and Scott have performed a real service in making available a handbook of reasonably current data and ideas. It is recommended to all laboratories where GC is an important tool for analysis.

PLASTICS DEPARTMENT

S. DAL NOGARE

E. I. DU PONT DE NEMOURS AND COMPANY
WILMINGTON, DELAWARE 19898

Chemistry in Premixed Flames. By C. P. FENIMORE, General Electric Research Laboratory, Schenectady, N. Y. The Macmillan Company, 60 Fifth Ave., New York 11, N. Y. 1964. ix + 119 pp. 15.5 × 23.5 cm. Price, \$5.00.

In spite of man's long familiarity with flames, it is only in roughly the last decade that he has succeeded in learning much of their chemical kinetics. This little book, which can be read in only a few hours, contains a lucid, concise, and authoritative account of the state of knowledge in this field as seen by an author who himself has been one of its major contributors. In his succinct style, the author has packed a lot of information in this book (in spite of its size) and some opinion. However, in an area in which conjecture has so often been the rule, this reviewer found it refreshing to read an account where the facts are properly labeled.

In the first chapter, it is specified that the flames to be considered are premixed, flat, laminar steady flames. The kinetics of other types of combustion systems may have points in common with the flames under consideration, but to understand flames, one must study flames. The interesting observation is made that some investigators have felt otherwise—flames are so complicated that their study is best undertaken with simpler nonflame systems. Flames in hydrogen-oxygen have been shown to be kinetically similar to the more slowly reacting lower temperature systems, but as the author points out for hydrocarbons, the reactions are sufficiently different that low temperature oxidation studies do not lead to a viable description of flames. Also in Chapter 1 are brief discussions of experimental methods and of the flame equations by means of which data are to be analyzed.

The next two chapters discuss the "post-flame gas," *i.e.*, that region after the main reaction zone in which only a few per cent of the reaction remains to be completed. This region is characterized by a lack of complete equilibrium, but of a nature such that the nonequilibrium states can often be quantitatively described. Methods for so doing are indicated. Illustrations of the use to which this interesting state of affairs can be put are described; and, in particular, results on recombination rates are given.

Chapter 4 contains the results of studies of the faster bimolecular reactions in H_2-O_2-CO flames, including the familiar (to kineticists) chain propagating and branching steps. Comparisons are made with data from low temperature nonflame studies and the agreement is very satisfactory. By the end of this chapter, an essentially complete description of the H_2-O_2-CO system has been given.

Chapter 5 concerns hydrocarbon-oxygen flames. In this case, a complete description is not available. Rather, the state of the art is such that all that can now be said quantitatively is that the initial reaction of individual hydrocarbon molecules is due to reaction with one radical or another, but the immediate products and their fate are not known and can only be guessed at.

The next three chapters are perhaps less complete in their coverage than the preceding four. Chapter 6 is on ionization and excitation in hydrocarbon flames. This area is characterized by an almost complete lack of quantitative data on rate constants, or even mechanisms. Chapter 7 is a brief but useful résumé of some of the facts of soot formation. Chapter 8 considers flame inhibitions, especially that brought about by halogens.

Chapter 9 examines the value of the deduction of rate data from burning velocity measurements. This, of course, is how most flame chemistry was done prior to about 10 years ago. In this connection, various flames, mostly decomposition, are discussed. The author's main conclusion is one long suspected, that the simple measurement of the burning velocity is not very illuminating. At the end of this chapter is a section which might better have been included in Chapter 4, a discussion of the possible importance of HO_2 in hydrogen flames. The last chapter gives special consideration to the reactions of NO in NH_3 , hydrocarbon, and methyl nitrite decomposition flames.

The book is well referenced, but has a rather short index. The main criticism is the lack of a clear preface statement of the scope and completeness of the work. Thus, the index gives 18 citations to elementary flame reactions but the literature contains many more. The point is that the author apparently includes only those for which he feels there is real evidence. While this attitude is to be highly commended, an explanatory section on what was left out and why would have been very useful to those not familiar with the field.

This work is to be highly recommended for those who wish to learn of the recent developments in flame kinetics. Work along this line is now being pursued vigorously, however, and in a fairly short time another review will be needed.

PHYSICAL CHEMISTRY OPERATION
SPACE SCIENCES LABORATORY
GENERAL ELECTRIC COMPANY
PHILADELPHIA 1, PENNSYLVANIA

WALTER KASKAN

An Introduction to Radiation Chemistry. By J. W. T. SPINKS, President, and R. J. WOODS, Assistant Professor, University of Saskatchewan, Saskatoon, Saskatchewan, Canada. John Wiley and Sons, Inc., 605 Third Ave., New York 16, N. Y. 1964. xi + 477 pp. 15.5 × 23.5 cm. Price, \$12.75.

Many universities are now offering formal courses in radiation chemistry. In recent years several books have appeared on more or less specific areas of radiation chemical research but none, with the exception of one in Russian, has been specifically designed as a text. The present book by Spinks and Woods is the first textbook to appear in English, and consequently it is important to examine the good and bad features of the book.

The first four chapters (125 pp.) are devoted to a discussion of ionizing radiation, radiation sources, how energy is lost by the radiation to the medium, and methods of dosimetry. The authors have presented a reasonably concise and readable treatment of these subjects which are basic to the study of radiation chemistry. The next two chapters (65 pp.) are devoted to a rather elementary discussion of the nature of the expected intermediates (ions, excited molecules, and free radicals) and to the types of reactions known for these intermediates.

After this introduction the authors discuss specific systems in radiation chemistry and, I believe, get into trouble. They suggest in the preface that "radiation chemistry stands on the shoulders of a number of earlier disciplines such as chemical kinetics, photochemistry, spectroscopy, radiochemistry and radiology" and yet their book would not appear to require any of these subjects as prerequisites nor are these subjects used much after the introductory chapters. Instead, the authors present us with a series of disconnected studies with little to bind them together other than the fact that ionizing radiation was used in each case to initiate some reactions. Perhaps not much more is possible in our present state of knowledge; however, it might be hoped that the authors would seek out the small threads we do have which correlate the different areas of radiation chemistry.

There is very little use of kinetics in the text. Kinetic analysis, in support or refutation of mechanisms, has been one of the most fruitful tools applied to radiation chemical studies. A student must wonder how radiation chemists go about substantiating the six-step mechanism for oxidation of ferrous ion in aqueous solution. This is probably the most thoroughly studied reaction in radiation chemistry and is incomprehensible without a kinetic