

BOOK REVIEWS

Chemical Applications of Spectroscopy. Editor: W. WEST. Authors: A. B. F. DUNCAN, WALTER GORDY, R. NORMAN JONES, F. A. MATSEN, C. SANDORFY and W. WEST. **Technique of Organic Chemistry.** Volume IX. Editor: ARNOLD WEISSBERGER, Research Laboratories, Eastman Kodak Company, Rochester, N. Y. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1956. xxiv + 787 pp. 16.5 × 23.5 cm. Price, \$15.00.

In recent years many an organic chemist has had thrust upon him the obligation of becoming at least an empirical spectroscopist, often with little preparation for some of the possible pitfalls he may encounter. In general he has arisen to the occasion, frequently with conspicuous success. Very often he has had the desire to go beyond the purely empirical stage but without convenient facilities for acquiring the background. The present volume may be expected to rectify this situation to a considerable extent and may well be expected to raise the general level of performance in many respects.

An essentially complete coverage of molecular spectroscopy has been attempted as is evident from the table of contents: Chap. I, Introductory Survey of Molecular Spectra, 115 pages (W. West); Chap. II, Microwave and Radiofrequency Spectroscopy, 115 pages (Walter Gordy); Chap. III, Theory of Infrared and Raman Spectra, 59 pages (A. B. F. Duncan); Chap. IV, The Application of Infrared and Raman Spectroscopy to the Elucidation of Molecular Structure, 334 pages (R. Norman Jones and Camille Sandorfy); Chap. V, Electronic Spectra in the Visible and Ultraviolet Regions, 126 pages (Part I, A. B. F. Duncan; Part II, F. A. Matsen); Chap. VI, Fluorescence and Phosphorescence, 52 pages (W. West). Very wisely no space has been sacrificed to the discussion of instrumentation although chapters in previous volumes of this series covering this subject are already somewhat out of date.

Nearly one-half the book is devoted to Chap. IV, a presentation of the more empirical methods and material which the organic chemist finds useful in the identification of compounds and in the determination of structure. Several collections of infrared and Raman data have appeared recently but the present collection is characterized by systematic organization of material for ready reference, completeness in regard to the phases covered (75 pages of hydrocarbon frequencies, 16 pages of CO frequencies) and by more than usual attention to the physical basis for experimental observation which will assist in raising present procedures above the purely empirical level. There is strong emphasis on the utility of precise intensity measurements and an excellent discussion of the requirements for making accurate measurements, which should help organic chemists to avoid errors which have commonly been made in the past.

This reviewer has found the purely theoretical sections of the book somewhat uneven in that it was not always clear just what background was expected of the reader, and this indeed varies from one point to another. Since the book is a collection of monographs rather than a completely coordinated text, there is naturally some loss in economy in the repetition of more elementary concepts, necessitating the presentation of more difficult material without quite adequate preparation. It is quite clear that the reader will be disappointed who expects to start from scratch and to become competent with the theory. In general an intermediate level is maintained and the reader should be expected to possess a reasonable background in mathematics and quantum mechanics and in particular a familiarity with the terminology employed. Without this it is doubtful whether he will make much contact with large portions of Chap. V. With such background he will find this chapter extremely useful in putting him in touch with the literature he must study to acquire real competence. Chapter II should be mentioned as particularly well written and as presupposing a quite definite and reasonable background of the reader. It is very unfortunate that the section on nuclear magnetic resonance, which is of the greatest current interest to the organic chemist, could not have been more fully illustrated by examples of applications.

On the whole one may say that the authors have attempted a task which was virtually impossible in the space allotted, and have succeeded commendably with it.

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The Chemistry and Reactivity of Collagen. By K. H. GUSTAVSON, Garverinäringsens Forskningsinstitut, Stockholm, Sweden. Academic Press, Inc., Publishers, 125 East 23rd Street, New York 10, N. Y. 1956. ix + 342 pp. 16 × 23.5 cm. Price, \$8.00.

Gustavson deals with his subject matter authoritatively from both the fundamental viewpoint of the protein chemist and the applied one of the scientific tanner. The author also blends very successfully the available information on the chemical reactivity and on the physical properties of collagen. Most recent work directly pertaining to collagen is clearly though not always critically reviewed. Naturally of greatest interest, to writer as well as reader, are the sections pertaining to the author's current work. Thus the correlation between hydroxyproline content and hydrothermal stability of the collagens of various species is quite intriguing. Gustavson's hypothesis that the stability of the collagen structure is largely dependent upon interchain hydrogen bonding between the -OH of hydroxyproline and the carbonyl oxygen of the peptide linkage appears very significant. Other possibilities, such as the presence of ester bonds, are also pointed out by him.

The monograph is well printed and handsomely illustrated. It is equipped with an extensive bibliography and thoroughly indexed. It is highly recommended to any one interested in the specific subject matter, as well as in the more general one of protein structure and function.

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Molecular Flow of Gases. By G. N. PATTERSON, Director, Institute of Aerophysics; Chairman, Department of Aeronautical Engineering and Aerophysics, School of Graduate Studies, University of Toronto. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1956. x + 217 pp. 15.5 × 23.5 cm. Price, \$7.50.

"Recent developments in supersonic aerodynamics have emphasized the importance of a molecular approach to the subject of gas dynamics. When only the macroscopic part of the motion of the gas is largely significant, the contribution made by the unseen internal motions of the molecules can be adequately taken into account by a phenomenological "or continuum" analysis. However, when the characteristics of a flow depend more essentially on the random motion of the molecules as in the slip flow of a highly rarified gas, or on the internal structure of the molecules as indicated by the relaxation effects associated with a strong shock wave, then the theory of gas flow must be developed in which much more attention is given the role played by the molecules." So writes the author in the preface to this book. This recalls to the reviewer an occasion in 1946 when he was asked to conduct a series of lectures on low pressure kinetic theory to an aerodynamical research group undertaking the experimental study of problems in this field. There was then little material connecting these two fields and the jump from the physical principles to aerodynamics was great. Progress in recent years has been steady and rapid. The information acquired has appeared in a considerable number of individual contributions both in theory and experiment from a wide diversity of sources scattered through the literature of aerodynamics and physics. Sadly lacking has been any systematic formulation of the various aspects of the subject as a unified development in terms of modern kinetic theory in such forms that the various problems can be analyzed and extended as occasion demands.

This need the author has striven to fill with remarkable success in the book under review. Dealing as it does with a field belonging rather to that of the engineer than to the basic physicist, the approach and viewpoint is colored by these circumstances. Nevertheless, the condensation of the development of the many complicated derivations in a clear, neat, logical and concise fashion in some 217 pages is, in itself, a remarkable achievement. Thus the material does not make light reading, but with the help of excellent references an interested graduate student, or investigator well grounded in basic mathematics, will find all the information he needs.

As to approach—the concisely worded preface presents the content about as clearly and accurately as possible so that again I quote—"In this book characteristics of gas flow are determined from an assumed molecular model and the distribution of velocities of the molecules. The macroscopic properties of a frictionless compressible (isentropic) flow are obtained from a simple spherical molecule and Maxwell's distribution law. A more complicated molecular model (a point center of force) and small order modification of Maxwell's distribution function are required in the corresponding calculation for a viscous compressible (slightly non isentropic), flow. The weak shock transition and boundary layer are examples of this type of motion. The molecular concept permits determination of both equations of motion of a gas and the boundary conditions at the surface of a body. These results lead to the concepts of slip flow and temperature accommodation of the gas. The same basic ideas are used to develop the theory of free molecule flow. At present molecular theory is limited by lack of details regarding encounters between complex molecules. Lacking complete collision information for diatomic molecules, the mathematical development in this book is complete only for a monatomic gas. However, the results apply equally well to a diatomic gas (air), if appropriate changes are made in the values of the ratio of specific heats and the Prandtl number. Some discussion of strong shock waves is included in which effects arising from more complex molecules are considered. In free molecular flow no intermolecular collisions occur and the diatomic gas can be included in the discussion. The molecular theory of turbulent flow which involves encounters between clusters of molecules does not appear to be sufficiently developed for inclusion in this book."

Chapter headings are as follows: 1. The Fundamental Equations. 2. Isentropic Flow. (Maxwell's distribution, transfer equation, a basic parameter of mass motion—the speed of sound, specular reflection, expansion wave in one dimensional unsteady flow, the same in a two dimensional steady flow.) 3. Basic Equations for Non-Isentropic Flow. (Point centers of force, velocity distribution in non-isentropic flow, mean speed and mean free path in non-isentropic flow, rate of flow of molecular momentum and energy, viscosity and heat conduction.) 4. Non-Isentropic Flows. (Experimental studies of viscosity and heat conduction, equations of steady flow in one dimension, the shock transition, diffuse reflection from solid boundary, boundary layer equations, momentum and energy transfer in the boundary layer, experimental investigations, effects associated with more complex molecules.) 5. Mechanics of Rarified Gases. (Flow at low density, effusive flow of free molecules, transfers of mass, momentum and energy by free molecules, momentum and energy exchange at surfaces, drag and heat transfer tests in free molecule flow, effect of Knudsen's number on heat transfer, momentum transfer with slip flow, energy transfer with a temperature jump.)

While all this material is developed in a unified systematic form with consistent notation, obviously much of it is classical kinetic theory which is treated in diverse, now classical sources. Of particular value, however, is that the relations that are developed are specifically adapted to be essential to applications to the aerodynamic problem for the present and the future and that applications to all existing experimental and theoretical data in this field are made wherever possible. The book will be indispensable to workers and students in this field who are indebted to the author for a useful system of analysis applicable to their problems.

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Entwicklung und Gegenwärtiger Stand der Systematik der Transurane. By H. GERLACH. Akademie-Verlag, Mohrenstrasse 39, Berlin W 8, Germany. 1955. vii + 256 pp. 17 × 24 cm. Price, DM 29, —.

This book, from its title, purports to describe the historical development and current status of the actinide hypothesis and the chemistry of the transuranium elements. The volume has little to offer the American reader. While the historical aspects of the subject are treated in an interesting and readable fashion despite the author's strange ideas of the geography of the United States (Appendix), the technical aspects are hopelessly dated. For the most part, the present volume consists of a paraphrase of the several volumes of the "National Nuclear Energy Series" dealing with the actinide elements. Unfortunately, this book was prepared just before the Geneva Conference on the Peaceful Uses of the Atom was held, and as a result, none of the vast amount of scientific material released at that time is included. Thus, there is no discussion of the chemistry of plutonium-fluorine compounds for instance, or the recent chemistry of neptunium and americium. Nothing of the wealth of chemical details relating to the processing of irradiated uranium is discussed.

The book under review can therefore not be recommended. This is regrettable, since a real need exists for a book on a similar level of treatment. The present volume, however, does not satisfy this need.

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The Chemistry of Heterocyclic Compounds. Volume IX. ARNOLD WEISSBERGER, Consulting Editor. Acridines. By R. M. ACHESON, University of Oxford, England. With a chapter by L. E. Orgel, Cambridge University, England. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1956. xii + 409 pp. 16 × 23 cm. Price, \$12.50; \$11.25, Subscription price.

This is the ninth volume to be published in the series Chemistry of Heterocyclic Compounds. It maintains the high standards set by the earlier volumes and will serve to make the series more complete. Although comparisons are said to be odious, the question will arise, "How does this volume compare with that by Adrian Albert published in 1951?" As a matter of fact it compares quite well, as of course it should. Having the previous volume to build on, it is to be expected that the new work would be better organized.

The system of numbering the ring used by *Chemical Abstracts*, is employed by Acheson and an excellent case is made for its adoption. One may take this opportunity, however, to deplore our tendency to rename (or renumber) compounds for technically unimportant reasons. The confusion thus created and the possible errors introduced far outweigh the small technical advantage secured. Since *Chemical Abstracts* adopted the new numbering in 1937, it has become the favorite method and the author is wise, therefore, to have adopted it.

A very unhappy result occurs in naming the benz[b]acridines. In the case of the [a, c and kl]benzacridines the numbering starts with the benz radical, but in the case of the [b] compound numbering starts with the acridine ring itself, Table I, page 7. The Roman numerals for the tables, by the way, seem a bit old fashioned: these might well be reserved for the formulas.

The size of the page (6 × 9) makes for more convenient reading as do the references at the bottom of the page. The larger page used by Albert does have an advantage in permitting more comprehensive tables. The collection of references alphabetically at the end serves as an author index in Albert's book. The present work lacks an author index. The subject index (for at least the two letters checked) also is less complete.

The antimalarial properties of acridines are very thoroughly treated and clearly presented by Acheson. Chapter IV, The Acridine Alkaloids, is probably the best account available of these compounds. In forty-five well written pages the author gives a comprehensive survey of the subject. A good account is given of acridines in cancer therapy and carcinogenesis but the word cancer is not listed in the index.