

Book Reviews

Carbonium Ions. Volume I. General Aspects and Methods of Investigation. Edited by GEORGE A. OLAH, Department of Chemistry, Case Western Reserve University, Cleveland, Ohio, and PAUL VON R. SCHLEYER, Department of Chemistry, Princeton University, Princeton, N. J. Interscience Publishers, John Wiley and Sons, Inc., 605 Third Ave., New York, N. Y. 1968. xiii + 462 pp. 16 × 23 cm. \$18.95.

This is the first of four volumes which will undoubtedly constitute the definitive work on carbonium ions for some time to come. When the last word in this series is written and published, 54 minds and pairs of eyes will have scrutinized every aspect of the private lives of these particles, and will have told all in 41 chapters. We owe them all, and especially the editors, a debt for their effort.

The first volume, with 12 chapters, is devoted mainly to methods of investigating carbonium ions. Subsequent volumes will deal more with the different types of carbonium ions and their reactions. The authors are in the main well-known experts and active contributors of new knowledge in the field about which they have written.

The introductory chapter in Volume I, by Professor Nenitzescu, is a delightful and perceptive history of the subject. In readable fashion, the author traces the increasing sophistication with which probing questions have been asked and answered in this field, beginning with the discovery of triarylcarbonium ions at the dawn of this century and proceeding to the debates concerning highly delocalized and strained ions of the last decade. It should be particularly instructive for graduate students and young investigators, who sometimes seem to be adrift without any sense of history, to read Professor Nenitzescu's account of early work by Meerwein, Ingold, and Whitmore on the first postulation of carbonium ions as reactive intermediates in molecular rearrangements. (I recall from graduate student days that when Volume 54, 1932, of the *Journal of the American Chemical Society* in the Penn State chemistry library was set on its spine and allowed to fall open, it automatically came to page 3274, the Whitmore paper on "The Common Basis of Intramolecular Rearrangements." Few students now have read that classic paper, though they commonly use its ideas.) Professor Nenitzescu's chapter could well serve as a guide to a graduate course on carbonium ions.

Perhaps I found Clair Collins' chapter (9) on "Isotopic Tracers in the Investigation of Carbonium Ions" next most enjoyable to read because it deals so lucidly and critically with very subtle questions. Collins seems to be among the more dispassionate workers involved in the classical-nonclassical ion embroilment (incidentally, all of Volume III in the series will be devoted to this subject).

Thermodynamic aspects of carbonium ions are discussed by J. L. Franklin (Chapter 2) and by E. M. Arnett and J. W. Larsen (Chapter 12). Franklin's chapter includes information from both gas-phase (mass spectrometric) and solution studies, and includes a fine discussion of the problems associated with interpreting appearance potentials. Chapter 12, written while the rest of the book was in proof, is a summary of Arnett's recent work on heats of formation of carbonium ions in "magic acid." The editors lead the reader to Chapter 12 after Chapter 2, and indeed this is one monograph where there are many signs that the editors have done more than just entice authors to write.

"Cryoscopic and Conductimetric Measurements in Sulfuric Acid" are discussed with care by R. J. Gillespie and E. A. Robinson (Chapter 3), and "Electrolytic Conductivity" in other solvents, especially liquid SO₂, is handled by N. N. Lichtin (Chapter 4). There is some unnecessary duplication in Chapters 2 and 4, although on the whole the editors have been careful in this regard.

George Olah, Charles U. Pittman, Jr., and Martyn C. R. Symons have done a beautiful job in their chapter (5) on "Electronic

Spectra" of carbonium ions. Data have been exhaustively collected and assembled in tables which all workers in the field will find useful, and the difficulties encountered in some of Symons' early work in sulfuric acid are gracefully set in perspective.

Vibrational (Chapter 6) and nmr (Chapter 7) spectra are treated adequately by J. C. Evans and by Gideon Fraenkel and D. G. Farnum, respectively, although in the latter chapter the emphasis is on aromatic and other π -carbonium ions, whereas one might have hoped for a more complete survey. This is promised by the editors in a later volume.

"Mass Spectrometric Investigations of Gaseous Cations" are treated authoritatively in Chapter 8 by M. M. Bursley and F. W. McLafferty; special emphasis is given to the chemistry of hydrocarbon ions. Although some new material is discussed, this subject has perhaps been too frequently reviewed during the last five years. Chapter 11 is a reprint from *Science* of an article by J. D. Baldeschweiler on "Ion Cyclotron Resonance Spectroscopy." The chemistry which this new tool enables one to study is fascinating, and the chapter should expose organic chemists to material of which they might not otherwise be aware. Finally, in Chapter 10 H. P. Leftin discusses in a very critical and competent fashion his own and other work on "Carbonium Ions on the Surface of Acidic Catalysts." This looks like a tough field experimentally, but one of obvious commercial significance.

The book is carefully assembled. Each volume will contain its own subject index, and we are promised a cumulative author and subject index at the end of Volume IV. References appear at the ends of chapters, sometimes in alphabetic order and sometimes in order of appearance in the text. Formulas are carefully drawn and typographical errors are few. Those noted appear on page 188 (Carr-Price, not Care-Price), page 204 (there is an incorrect reference on line 7), page 329 (one set of equations is confusingly misplaced), page 331 (norbornyl is misspelled twice), page 371 (some equations seem to be differently numbered at the left and right, and this creates some confusion in the text), and page 443 (Arnett's calorimeter is precariously displayed—upside-down).

The editors and publishers deserve our thanks for undertaking this work, and the authors also do for their uniformly high quality efforts. I look forward to reading the subsequent volumes.

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Quantum Mechanics. An Introduction. By HERBERT L. STRAUSS, University of California, Berkeley, Calif. Prentice-Hall, Inc. Englewood Cliffs, N. J. 1968. xiii + 192 pp. 15.5 × 23.5 cm. \$9.95.

This short book is an introduction to quantum mechanics. It presents the principles in a straightforward fashion and, considering its length, contains much useful information. It represents what should be minimum requirements for students taking a Ph.D. in physical chemistry and is at a level that should be useful to all quantitative molecular scientists. It does not seem quite detailed enough to do the whole job for graduate students, and yet most of them will not find the time to take a second course. It represents one more choice in the numerous collection of acceptable quantum mechanical texts.

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