Kirschke and Jolly[4] showed that the equilibrium constant for the reaction $0.5H_2 + NH_2^- = NH_3 + e_{am}^-$ is 2×10^{-5}. It is understandable, therefore, that Yb(II) and Eu(II), being stronger reducing agents than hydrogen, should produce the ammoniated electron by interaction with amide ion. The oxidation potentials are further enhanced by the exceedingly low solubility of the resulting rare earth triamides. The over-all reaction might be represented: $Yb_{am}^{2+} + 3NH_2^- = Yb(NH_2)_3 + e_{am}^-$. We do not yet have the equilibrium constants or potentials which apply.

(4) E. S. Kirschke and W. S. Jolly, *Inorg. Chem.*, 6, 855 (1967).

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Book Reviews

Interpretation of Mass Spectra. An Introduction. By F. W. McLafferty, Purdue University. W. A. Benjamin, Inc., 1 Park Ave., New York, N. Y. 1966. xvii + 229 pp. 14.5 × 21.5 cm. $9.00.

Organic chemists are now able to obtain mass spectra routinely, either from their own instruments or from commercial or National Institutes of Health sponsored mass spectrometry centers. The enthusiasm with which the American Chemical Society's Short Courses on Mass Spectrometry have been received attests the fact that these chemists wish to interpret their own data, rather than to rely on the interpretations of specialists. Dr. McLafferty has responded to this wish by writing an introduction to the interpretation of the mass spectra of organic compounds, intended for individual study and for use as a supplemental textbook. He states that the incentive for writing "Interpretation of Mass Spectra" was his opinion that mass spectrometry is for scientists, not just for mass spectrometrists.

The main purpose of the book is to help the scientist relate the positive ions formed by electron bombardment to the molecular structure of the sample. To achieve this purpose, the author suggests that the readers, who he assumes have no prior knowledge of mass spectrometry, follow a "Standard Interpretation Procedure." The Procedure is applicable to the "average" mass spectrum and is the basis upon which the book is organized. The author's approach is illustrated by his discussion of the mass spectra of many common types of organic compounds. The Standard Interpretation Procedure is a useful structure upon which the novice can develop his skill. However, as this skill increases, he may find the Procedure too confining and, therefore, abandon it in favor of his own approach.

The book is devoted to interpretation of low-resolution mass spectra, *i.e.*, those for which data are available to the nearest mass-to-charge unit. High-resolution mass spectrometry is discussed in three pages and high-resolution data are given for only one or two of the examples. The usefulness of "metastable" peaks is emphasized, and data of this type are included in the illustrations. Perhaps too much emphasis is given to determination of elemental formulas from natural isotopic abundances. Such determinations are most successful for low molecular weight compounds and require accurate peak-intensity measurements, often not found in routinely determined mass spectra.

Approximately 100 unknowns, most of them simple organic compounds containing combinations of C, H, S, N, O, and/or halogen, are included in bar graph, as well as tabular, form. Consequently, Chapter 10, "Solutions to Unknowns," is especially valuable since it contains the author's interpretation of each mass spectrum in addition to the structure of the unknown. Except for five unknowns for each of which one infrared absorption band is given, they are to be identified from their mass spectra alone. Some are too difficult for complete identification, but the reader should proceed as far as possible before turning to the solution in Chapter 10. These unknowns and solutions are the core of the book.

The longest chapter is entitled "Mechanisms of Unimolecular Ion Decomposition Reactions." Dr. McLafferty occasionally seems to depart from presenting an introduction to interpretation of mass spectra and, instead, seems to be reviewing the use of the "localized charge" concept. A number of mechanisms are presented "because the author finds them useful to correlate a sizable body of data that has not been previously treated in a general fashion." Only in passing does he warn that the arrows, fishhooks, and localized charges are "merely a system of electron bookkeeping that some have found convenient."

In my opinion, Dr. McLafferty has written an excellent, well-timed book. He has been a pioneer in the application of mass spectrometry to organic chemistry, and one can sense this in the authoritative manner in which he presents the material. A prime objective of the book was to show the "fun" of mass spectrometry by comparing interpretation of mass spectra to fitting together jigsaw-puzzle pieces. The author has been successful in maintaining this spirit throughout the book.

Perhaps the most impressive commendation of "Interpretation of Mass Spectra" is the enthusiastic response it has received from participants in academic and industrial courses on mass spectrometry and in the American Chemical Society's Short Courses on Mass Spectrometry. I recommend it to anyone who wishes to, or needs to, become as proficient in interpretation of mass spectra as he is in the interpretation of data from other spectroscopic methods of identification.

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Theory of Elementary Gas Reaction Rates. By Don L. Bunker. Pergamon Press Inc., 44-01 21st St., Long Island City, N. Y. 1966. xii + 115 pp. 15.5 × 23.5 cm. $5.50.

This book deals with fundamental aspects of gas kinetics, a subject which according to the author has experienced a resurgent interest starting roughly in 1959. Studies of this type have commanded new attention since they are aimed at uncovering the basic dynamic aspects responsible for a chemical reaction.

The author considers not formal theoretical problems, nor elegantly detailed experimental approaches, but rather the intersection of theory and critical experiments and the way one sheds light onto the other. The large growth in practical theoretical techniques and sophisticated experimental apparatus capable of getting at elementary, interpretable steps of a chemical reaction has provided the basis on which it again has become practical to ask questions about the nature of a chemical transformation. The author focuses attention on a broad range of those useful aspects of theory and experiment which have led to cross fertilization between the two. Hence he covers not only molecular beam experiments, but many of the other sophisticated novel approaches.

The author gives a critical survey of this new resurgence through 1964. Thus, unfortunately three of the seven important last years are not covered. This seems to be part of the inevitable lag of hard-

cover publications and makes one think that such a rapidly exploding field is more properly covered in quickly publishable paperbacks or review articles. Unfortunately no such approach has been used. The various review series have only done a very spotty coverage particularly of the theoretical approaches of practical significance to experimentalists.

Hence this book is probably the best critical survey available of this important modern area of the hows and whys of chemical reactions. It covers most aspects of this problem, in which the author has also been an active contributor. In so doing, however, this book is only a survey, and the reader will not find in it the necessary details to perform many of the theoretical calculations, but rather only hints thereto, and references, in which the reader must turn for further details, a formidable job in its own right. Special subjects are more extensively covered in the books by Nikitin and Slater, the latter being particularly exemplary at leading one through the mathematical details. Bunker's book covers a broader range of topics, most useful for the experimental kineticist or the nonspecialist who wishes a broad treatment, not a guide to detailed subjects.

Hence, I think that this book has become an essential work for all who wish to be informed about this rapidly exploding new field looking into the *modus operandi* of the transformation of chemical species, a fundamental aspect of our understanding of chemical kinetics.

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