as the 360-nm beam, the 254-nm beam being four times more sensitive for detection of 11-cis. Also Waddell et al. carried out their irradiation in methanol, while Wald et al. used ethanol. To check for a possible solvent dependence we irradiated a sample of *all trans*-retinal in methanol. Again all four mono-cis products were detected during the early stage of irradiation. The ratios of 11-cis and 9-cis to 13-cis are 0.56 and 0.19, respectively (350-nm excitation), somewhat different from those in ethanol. Clearly our results show that 11-cis is formed in both alcoholic solvents and the results do not support the wavelength dependent explanation.[18]

Although we have yet to carry out experiments to elucidate the mechanistic details related to the formation of the 7-cis isomer, some comments on excited-state intermediates based on the limited information now available are perhaps appropriate. The formation of the hindered isomers appears to be favored in solvents of high dielectric constant (in which retinal also has low intersystem crossing efficiency).[8a,19] This is consistent with possible involvement of singlet, zwitterionic intermediates, as those suggested by Salem.[20] That the hindered isomers are formed along with 13-cis and 9-cis would further suggest that the twisted dipolar intermediates, once formed, do not interconvert. To confirm these tentative conclusions, and to have a better understanding of the solvent effect, more extensive studies with a large variety of solvents will have to be conducted.

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Book Reviews*

Handbook for Chemical Technicians. By H. J. STRAUSS (Gould, Inc.). Edited by M. KAUFMAN (Electronic Writers and Editors, Inc.). McGraw-Hill Book Co., New York, N.Y. 1976. vii + 454 pp. $19.50.

The amount of information available to the chemist and chemistry technician is often overwhelming. In many cases, the usefulness of the data is limited by a lack of understanding as to how to use the data to arrive at a practical answer. The purpose of this handbook was to collect some of the most practical information and present it in a format intelligible to the average chmistry technician. The book includes ten chapters and a short subject index. The first two chapters present a detailed discussion of units and measurements, including extensive tables of data. Chapters 3 and 4 present a review of chemical fundamentals of organic chemistry. Chapter 7 discusses metals and alloys; Chapter 8 considers fluid mechanics, and Chapter 9 reviews a number of engineering operations. The last chapter is devoted to a discussion of safety practices for all types of operations. Each chapter is filled with useful information in the form of tables and graphs. Throughout the book, examples are provided as to typical problems which can be solved using the data included in the handbook. These examples are an especially valuable part of the book since they show precisely how to use the data presented in the numerous tables scattered throughout the book.

The author has prepared a highly practical handbook. Since it is a handbook, the material is highly condensed and must be read carefully. The handbook will prove of great value to the practical chemist as a one-volume source for most information of routine interest, although it will not replace the use of the larger reference volumes.

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Negative Ions. Third Edition. By H. S. W. MASSEY (University College London). Cambridge University Press, New York and London. 1976. xvii + 741 pp. $69.50.

This monograph contains a detailed and orderly account of the formation, stability, and properties of negative ions in gases; the methods, both experimental and theoretical, for investigating them; and the results of these investigations. Since the publication of the second edition in 1950, there has been great advancement, both theoretical and experimental, in the study of negative ions, and these are covered thoroughly in this edition. For example, the third edition has an extensive discussion of the formation of negative ions by radiative attachment and polar photodissociation, the use of lasers in negative ion formation, the study of autodetaching states of negative ions, collision processes involving negative-ion production and destruction, and the application of the most recent negative-ion data to problems of gases in planetary and stellar atmospheres as well as to trace analysis of halogenated pesticides.

The development of each theoretical model, such as those used for the prediction of negative ion formation and stability, is initiated at a level appropriate to allow readers without great expertise in the area, but having a good background in atomic structure, quantum chemistry, and physics, to appreciate the model and follow its development.

A large body of experimental information regarding the electron affinities of atoms, diatomic molecules, and polyatomic molecules and the energy states of atomic and molecular negative ions is presented. The presentation is consistently accompanied by a detailed description of the best current method for obtaining such information including diagrams of the apparatus used for the measurements.

The monograph is generally well organized and well written and a comprehensive source of information regarding electronegativities and energy states of gaseous negative ions.

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Electron-Solvent and Anion-Solvent Interactions. Edited by LARRY KEVAN (Wayne State University) and BRIAN WEBSTER (Glasgow University, Great Britain). Elsevier Scientific Publishing Co., Amsterdam, The Netherlands. 1976. xiv 360 pp. $57.50.

Although the title of the book implies a discussion of both electron-solvent and anion-solvent interaction, the major emphasis is on the former. Over the past 30 years a number of widely different experimental and theoretical methods have yielded information concerning the properties of electrons in fluids and solids. The nine chapters of the book, each written by a different author, are to a degree each a review article centered about one approach to the study of electrons or anions in condensed matter.

The first chapter appropriately introduces the reader to two basic states of electrons in fluids, the quasi-free state and the localized state. The author then shows how these states can be described in terms of theoretical models. The theoretical approach is continued in a later chapter where the dynamics of electron-solvent interaction are used to describe electron tunneling, electron trapping, and dielectric relaxation in polar media. Some knowledge of quantum mechanics and potential theory is necessary for an understanding of the methods used in these two chapters.

Most of the remaining chapters discuss the major experimental methods that are presently being used to study electrons in condensed matter. The methods emphasized are: magnetic resonance, fast photoabsorption, photoelectron emission, mobility measurements, and optical properties. The last two chapters of the book are concerned with anion-solvent interaction with some attention paid to the comparison of anion and electron behavior.

Overall, the book is interesting and informative and should be of particular benefit to the reader not experienced in the field. The topics are developed in a concise fashion with numerous references for the individual who wishes to pursue further study. Despite the fact that the chapters are written by different authors, the book has a coherence which is not always found in this type of volume. A number of the writers have taken care to point out the limitations of their interpretations. This is of importance when studying a topic as imprecise as our present knowledge of electron-solvent interaction.

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Theory and Practice of Emulsion Technology. Edited by A. L. SMITH (Unilever Research). Academic Press, London. 1976. vi + 352 pp. £14.50.

This volume contains 19 papers presented at the Symposium on Theory and Practice of Emulsion Technology held at Brunel University in September 1974. Most of the papers report experimental studies of the formation, stability, and breakdown of various emulsions with various stabilizing agents. There are two review papers dealing with the use of emulsions in the application of pesticides and the formation and manufacture of wax emulsions. The modeling and interpretation of data attempt, for the most part, to consider the fundamental physical chemistry, kinetics, and thermodynamics of the interfacial region between the two phases.

Topics include anionic and cationic emulsifiers, proteins at interfaces, centrifugal techniques, rheological and interfacial properties, oil-water emulsions related to crude oil slicks, block copolymer emulsifiers, liquid crystals, and bitumen emulsions. Transcripts of the "discussion" periods at the symposium also are included. There is a short subject index.

Some background in the terminology of emulsions, micelles, and two-phase systems is desirable for the reader, since there are no introductory papers for the newcomer.

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Handbook of Chemical Lasers. Edited by R. W. F. GROSS and J. F. BOTT (The Aerospace Corp.). John Wiley & Sons, Inc., New York, N.Y. 1976. x + 744 pp. $39.95.

The study of chemical lasers requires an interesting mixture of knowledge of the chemical kinetics of nonequilibrium reactions, the gas dynamics of reactive flows, and the laser physics of high-gain media. Gross and Bott have edited a collection of 13 articles, written by active researchers in the field, in an ambitious attempt to provide an encyclopedic reference work, which surveys "all available literature and research work" dealing with chemical lasers through 1974. They have succeeded admirably.

Although one might expect such a work to be dominated by chemical reaction studies, since a chemical laser is, by definition, a laser operating on a population inversion produced, directly or indirectly, in the course of an exothermic chemical reaction, the book covers all facets of chemical lasers including the optical design of unstable resonators, numerical modeling of the operation of chemical lasers, and statistical and dynamical models of population inversion. Detailed discussions of the theory and current technology of hydrogen halide, carbon monoxide, iodine, and metal-atom oxidation lasers are emphasized.

Each article is well written and includes introductory material as well as a detailed discussion of the most recent developments. Literally hundreds of references accompany each article. For an engineer or scientist considering the use of chemical lasers, for students or researchers beginning work in this area, or for the seasoned workers in the field, this handbook will provide a comprehensive compendium of the current state of theory and experiment in a rapidly developing and exciting field.

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Recent Contributions to Geochemistry and Analytical Chemistry. Edited by A. I. TUGARINOV (U.S.S.R. Academy of Sciences). Halsted Press (John Wiley & Sons), New York-Toronto. 1976. vii + 687 pp. $57.50.

This volume is in commemoration of the 75th birthday of academician A. P. Vinogradov, a major figure in Soviet geochemistry in the 20th century. The book was originally published in Russian in 1972, and this particular version was prepared by the Israel Program for Scientific Translations. The volume contains five major sections dealing with geochemistry, ranging from Cosmochemistry and Meteoritics to Biogeochemistry and Hydrogeochemistry, and one section on general and analytical chemistry. The geochemical sections are composed of a wide variety of papers, most less than ten pages, dealing with both general review subjects, e.g., "Derivation of the Continents", and rather specific items, e.g. "Tin Content in the Water of Saale River". These various papers were contributed primarily by eastern European authors and are typical of the quality of papers seen in the translated Russian journal, *Geochemistry International*. Unfortunately, the time involved in accumulation, publication, and translation has essentially rendered the entire book quite dated and of little value as a review of either Eastern European or worldwide geochemical research over the past ten years.

In addition to the five sections and 597 pages devoted to geochemistry, a sixth section dealing primarily with analytical chemistry is included in the volume as a testament to Vinogradov's interest in this subject. The papers in this section are not dedicated to problems of analytical geochemistry, but like the first five sections, have a wide variety of topics ranging from a review of "Chemical Transport Mechanisms" to "Statistical Data on the Distribution of Radioactive Matter".

In general, the volume covers a wide variety of topics in geochemistry and a much narrower range in analytical chemistry. All of the papers, however, must be considered out of date in that they appear to have been written in late 1969 or early 1970. Tremendous progress has been made in geochemistry since that time, and this suggests the volume's most valuable asset is as a survey of the style of geochemical research in eastern Europe in the sixties rather than as a documentation of recent advances in the science.

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