

answer right away or the first or second time through a problem. They can work with these programs until they understand and/or remember the material.

The programs are apparently aimed at the average student who has had the usual general chemistry background needed for a course in organic chemistry. I also feel they can effectively serve other clients. Certainly they can provide enrichment for brief organic courses and the student can delve more deeply into organic chemistry than most brief texts attempt. They may provide teachers with a quick review and ideas on some effective ways to present organic chemistry. This could be especially helpful to high school teachers, new teaching assistants, biology teachers, or others in peripheral areas who have had only a brief exposure to organic chemistry some time ago and are suddenly faced with teaching it. Teachers with access to a large TV monitor may choose to incorporate some sections, especially the graphics on spectroscopy, into their lectures. At our college, these programs have been used by sophomore organic students and by students in our one-year survey of chemistry course aimed at allied health students. An especially appreciative group were the practicing nurses who had had a one-semester chemistry course 5–20 years ago and were plunged into "Aspects of Organic and Biochemistry." They used, liked, and appreciated the programs and the microcomputers.

The student encounters a variety of methods such as drill and practice, tutorial CAI, some problem solving with developing mechanisms and identifying unknowns, and some simulation of experimental results. The utilization of a number of teaching/learning techniques should increase the range of situations in which the programs may be employed and the range of students who can benefit from them.

The graphics provided are excellent. Some of the mechanism illustrations do what a book cannot do—only a movie would provide this type of movement. They show the interaction and movement of atoms in a much more effective manner than a stationary picture can indicate. For example, in the acid-catalyzed H-D exchange adjacent to a carbonyl group, the H_3O^+ is shown moving in, the proton transfers, and H_2O leaves. A water molecule approaches the D as the C-D bond stretches, δ^+ charges are shown, and the H_2OD^+ moves away leaving an enol. The principle of microscopic reversibility is illustrated by showing the opposite sequence of steps for the reverse reaction.

The programs are definitely "user friendly." The documentation is a one-page program index, but all the instructions and indexes are also provided on the disks. The full menu for each disk is available to the user. There are no worksheets provided, but the instructions are detailed enough to use the programs and work out the problems. As described in the general instructions, one can back up to a previous frame or ask for help when desired. The operation requires only that the student know how to turn on the computer and the monitor and insert a disk into the disk drive. From then on the program is self-contained and requires no computer expertise. Generally the inputs are reasonable and often the first letter is all that is necessary. The student can always escape to the section menu and then go back to the main

index. Help is available, although it sometimes consists only of "Try _____," especially in simple cases, rather than a more detailed explanation. There are different audible sounds that indicate a correct or incorrect response. The screen usually states "Getting your lesson . . ." or "One moment please" while loading data or doing lengthy calculations. You are never left to wonder if the computer broke down or if you pushed the wrong key while the computer carries out time-consuming tasks. The program generally gives the accepted answer after the second try, and the student must personally type it in before the program will allow him to proceed. Incorrect entries did not normally cause a program to malfunction. The instructions tell you to use "return" to continue to the next frame, but depressing almost any key will cause it to advance. Unfortunately, if the next frame is a question with a choose "1 or 2" answer, that key will be judged as the incorrect answer. I did not discover any way using common mistakes to cause a program to stop running (lock up the computer) or self-destruct. If a student made an error in inputting a structure (done by entering the number corresponding to a given unit), he had to start all over again since there was no erasing just the last keystroke. (This problem is apparently taken care of in more recent programs by the use of EnBASIC capabilities.)

The programs were sometimes restrictive as to the answers they would accept, e.g., systematic IUPAC for simple alkyl groups was not accepted. A few typographical errors have survived editing, but they are mostly missed letters and not confusing. The presentation of the aldol mechanism involves good graphics, but the kinetic data presentation is somewhat confusing. It is also misleading to say that "added aldehyde does not change the rate constant" when rate of the reaction is meant.

The programs should be usable with any organic chemistry course or course involving organic chemistry. The teacher may suggest certain sections to use or delete, but may not modify the programs on the disks. The programs should be an aid to mastering organic chemistry. There are both elementary and advanced aspects of organic chemistry covered with a variety of approaches. Safety precautions are mentioned when the student sets up a laboratory experiment. The review of organic chemistry with immediate feedback on the student's answers is of course the strength of programmed learning which is available here. It is probably more appealing to the student than a programmed book and may be more economical per student given sufficient usage. The ability to work individually with any number of students certainly saves the teacher some time. I found that I could now concentrate on questions not covered in the programs. The ability of the student to pick from the index a topic he is having trouble with would save him time over coming to a general tutorial-help-discussion session. The effectiveness is due to the programs being done well and interestingly.

Most of our students who tried the programs found them helpful. They spent time working with them. The students who did not use the programs (they were not required) felt that they did not have time to do anything not required and so did not attempt them. The programs did appear to help the

group of nontraditional students who put forth the effort to use them. Many students found them "easy to use, valuable, patient, helpful." One upperclassman commented that working through them would be a good way to review for the MCAT exam. Although some of my colleagues had anticipated that the older students especially would be fearful of the microcomputers, once introduced to their operation these students found them accessible and usable. I found that simply demonstrating turning on the Apple and loading the disk was all that was necessary.

My experience with COMPRESS has been most positive. Shipment was prompt and when a "bug" was found in two of the early disks, they were replaced with thanks from COMPRESS for bringing the problems to their attention.

"Introduction to Organic Chemistry" is well done, easy to use, and comprehensive with the exception of amines and other items mentioned above. There are a few minor input problems. These programs can serve both as a good introduction to organic chemistry and a good introduction to one effective use of the microcomputer in chemical education.

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General College Chemistry, Sixth Edition

C. W. Keenan, D. C. Kleinfelter, and J. H. Wood, Harper & Row, New York, NY, 1980. vi + 880 pp. Figs. and tables. 20.4 × 24.2 cm. \$18.95.

This sixth edition of "General College Chemistry" presents a firm foundation to chemistry for chemistry students, premedical students, and other science majors. There are twenty-seven chapters, three appendices, a glossary, answers to all questions, and an index contained in the 880 pages. Each chapter contains an outline, an introduction, worked out examples, a summary, and exercises.

Some of these contents are new, and a few of these new contents are as follows. Chemical equations and stoichiometry are now covered in the second chapter. Electronic theory and theories of the covalent bond are now treated in less detail. Solution relationships and acids and bases are given increased attention. Thermochemistry is now placed before kinetics and equilibrium. Simple electromotive force diagrams of the Latimer type have replaced the graphs used in the fifth edition. The chemistry of the sulfur and nitrogen families is now in one chapter. Organic chemistry is now presented in one chapter.

There are 90 more examples and 200 more exercises in this edition. There are several more full color illustrations. And there are Special Topics as well as Key Chemicals sections. In short, the book is a fine text which

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has a delightful format. I might add that the problem-solving technique used is the conversion factor method, and the authors pay close attention to significant figures.

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CONTINUING SERIES

Progress in Biomass Conversion, Volume 1

Kyosti V. Sarkanen and David A. Tillman (Editors), Academic Press, Inc., New York, NY, 1979. v + 259 pp. Figs. and tables. 23.4 X 15.3 cm. \$16.50.

List of Contents and Contributors: Living Resources and Renewing Processes: Some Thoughts and Considerations, I. Falkehaug; Wood Fuel Use in the Forest Products Industry, R. L. Jamison; The Economic Values of Wood Residues as Fuel, D. A. Tillman; Pyrolysis of Wood Residues with a Vertical Bed Reactor, J. A. Knight; Methanol from Wood: A Critical Assessment, R. M. Rowell and A. E. Hokanson; A Survey of United States and European Practices for Recovering Energy from Municipal Waste, J. G. Abert and H. Alter; The Silvicultural Energy Farm in Perspective, J. F. Henry.

Coal Science, Volume 1

Martin L. Gorbaty, John W. Larsen, and Irving Wender (Editors), Academic Press, Inc., New York, NY, 1982. x + 293 pp. Figs. and tables. 15.5 X 23 cm. \$32.50.

This is the first in a series devoted to presenting and evaluating selected fundamental scientific areas involved with our understanding of coal structure, reactivity, and utilization. Included will be reviews describing current state-of-the-art knowledge of coal's organic and physical structure, and contributions on plasticity mechanisms and reductive alkylation chemistry covering some important aspects of coal reactivity.

Water Analysis, Volume I. Inorganic Species, Part 1.

Roger A. Minear and Lawrence H. Keith (Editors), Academic Press, Inc., New York, NY, 1982. x + 287 pp. Figs. and tables. 16 X 23.5 cm. \$39.50.

This is the first of three volumes designed

to present both the theoretical and the practical aspects of understanding and determining the trace-level components that are found in all natural, pristine, and polluted waters.

The treatise separately considers the various inorganic and organic components that occur in water, which provides distinct organizational advantages. It is the editors' intent that these volumes will serve as a complete text on state-of-the-art treatments of this complex subject.

Volume I is the first of two focusing on the inorganic constituents in water. It first presents a background on the inorganic constituents found in water.

TITLES OF INTEREST —1980—

BETZ Handbook of Industrial Water Conditioning, Eighth Edition

Betz Laboratories, Inc. (Staff of Editors), Betz Laboratories, Inc., Trevose, PA, 1980. vii + 440 pp. Figs. and tables. 18 X 25.5 cm. \$32.50.

This handbook presents detailed information on external treatment; boiler and cooling water systems, air conditioning, refrigeration and total energy systems; chemical treatment feeding and control; and problems encountered in special industrial processes.

This Eighth Edition now also includes a special section on methods for control water analyses and their interpretations. The test methods presented were chosen because of their suitability to plant control based on simplicity, rapidity and convenience, with minimum sacrifice of accuracy.

—1981—

An Introduction to Atomic Absorption Spectroscopy. A Self-Teaching Approach

L. Ebdon, John Wiley & Sons Inc., Somerset, NJ, 1981. xiii + 138 pp. Figs. and tables. 15.5 X 23.5 cm. PB \$21.95.

Mathematics for Physical Chemistry

Robert G. Mortimer, Macmillan Pub. Co. Inc., New York, NY, 1981. x + 405 pp. Figs. and tables. 15 X 23.5 cm.

—1982—

A Dictionary of Chromatography, Second Edition

R. C. Denney, John Wiley & Sons Inc., Somerset, NJ, 1982. 229 pp. Figs. and tables. 14 X 22 cm. \$39.95.

An Introduction to Crystal Optics

P. Gay, Longman Inc., New York, NY, 1982. ix + 262 pp. Figs. and tables. 13.5 X 21.5 cm. PB \$14.95.

This paperback volume is a re-issue of the original edition of 1966 by the same author. This book has been written with the assumption that the reader has a sound knowledge of the essentials of geometrical crystallography as obtained from one of the books devoted exclusively to elementary crystallography. Optical crystallography is developed assuming only some acquaintance with elementary geometrical and physical isotropic optics; mathematical treatment is minimized in the main text, though more detailed but simple analyses are to be found in appendices. Most chapters are illustrated by exercises that are both practical and theoretical. The materials used in the practical work are generally mineralogical specimens which are commonly available.

A Textbook of Pharmaceutical Analysis

Kenneth A. Connors, John Wiley & Sons Inc., Somerset, NJ, 1982. x + 664 pp. Figs. and tables. 15.5 X 23.5 cm. \$55.00.

This textbook offers a detailed, systematic treatment of modern analytical chemistry. It provides all the necessary background for understanding most analyses in principle and many in detail. This edition emphasizes not only the principles of pharmaceutical analysis but also the practical applications. It features an expanded section on liquid chromatography along with new chapters on immunoassay, derivative formation, and statistical interpretation of data. Practical learning aids include numerous student laboratory experiments along with more than 250 problems, many with answers given. Incorporating traditional techniques with the most current methods, the author offers step-by-step coverage of five major areas: Titrimetric Analysis, Physical and Instrumental Methods, Separation Techniques, Elemental Analysis, and Clinical Reactions in Analysis. He also deals with general topics, such as volumetric techniques and calculations and how to use the analytical literature.

This textbook is specifically geared for undergraduate courses in pharmaceutical analysis; but graduate students and professional pharmacists will find it a useful reference.

Chemical Dynamics via Molecular Beam and Laser Techniques

R. B. Bernstein, Oxford University Press, New York, NY, 1982. vii + 262 pp. Figs. and tables. 15.5 X 23.5 cm. HB \$49.00 PB \$24.95.

This book is the text of the Hinshelwood Lectures given by the author during the Trinity term 1980 in Oxford. The content of the original lectures have been updated since they were given. This volume describes the