Its most serious shortcoming is that it attempts to cover too many topics in too little space, with the result that many sections are so brief as to be of doubtful value. The section on solutions of gases in liquids, for example, consists of five sentences and includes no specific references for further reading. The variety of topics covered gives it something of the flavor of a book in which each chapter is by a different author.

On the whole, however, the book lives up to its stated purpose. For non-specialists it will provide a timely introduction to the field, and will serve as a useful reference.

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Principles of Photochemistry, by J. A. Barltrop and J. D. Coyle, John Wiley and Sons, Chichester, New York, Brisbane and Toronto, 1979, (214 pages). $12.50.

As recently as twenty years ago, a review of a work that dealt exclusively with photochemistry might have seemed bizarre in these pages; attempts during the 1940s and 1950s to devise photochemically driven processes for the production of bulk chemicals had not been gaudy successes. In the meantime, photochemistry has matured startlingly, aided in no small measure by the invention of the laser which has created new horizons both for scientific and engineering studies and for the chemical industry. As a result, the late 1970s find increasing numbers of chemical engineers using photochemical techniques, for example, in investigations of flames and of fuel combustion; in surface studies of catalysts; in attempts to understand and to increase biomass yields; and in campaigns to create new, solar-driven chemical syntheses.

When Baltrop and Coyle's 376 page monograph "Excited Studies in Organic Chemistry" appeared in 1975, it received a warm critical reception. The authors wrote in their preface that they hoped their work would serve both as a reference for practicing photochemists and an instructional text for undergraduate and postgraduate students. Given the price of that volume (now ca. $41), my guess is that students have not been rushing to the bookstalls for it. The present work is a different matter. Published in a quality, softbound version at about $13, it comprises the first six chapters of the original. These deal, in an exceptionally lucid manner, with the theoretical foundations of photochemistry.

Since adequate summaries of each of the six chapters have already appeared in reviews of the original version (cf. *Nature 260*, 735, 1976; *Science 193*, 670, 1976), they are eschewed here. Note, however, that this is not a "how to" manual although it does provide enough references to the experimental literature to permit a novice to begin laboratory work.

Missing from the present volume are the final five chapters of the original, which provide an uniquely organized and valuable review of the photochemistry of organic molecules. In their stead is a valuable set of problems with solutions to help students (or other photochemical neophytes) determine if they are mastering the material.

A familiarity with quantum chemistry at the level that now exists in many chemistry and chemical engineering undergraduate curricula would be helpful, if not essential, for anyone approaching photochemistry for the first time. The authors of this book, however, have performed a marvelous hat trick in producing a work from which both novice and expert may learn.

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Fluid Flow and Heat Transfer, Aksel L. Lydersen, x + 357 pp., John Wiley & Sons, New York, 1979, $42.50.

This book will be welcomed by engineers concerned with the industrial applications of fluid-flow and heat-transfer principles. It is written from the unit-operations viewpoint, with plenty of worked examples. Those expecting much in the way of differential equations will be disappointed. The overall thrust is best revealed by paraphrasing the table of contents: pressure drop; dimensional analysis; flow measurement; pumping, compression, and expansion; agitation; particle and drop mechanics; filtration and flotation; atomization, dispersion, etc.; steady- and unsteady-state heat transfer; energy economy.

The book is well illustrated, particularly with equipment-related diagrams. A significant sacrifice of depth, particularly in the heat-transfer portion, is inevitable in such a compact book, but this shortcoming is more than compensated by the breadth of coverage. The author's claim that "this text is concerned with the calculation of the major dimensions of equipment and of the consumption of energy" is accurate. So is his assessment that the text would work well in conjunction with Perry and Chilton's *Chemical Engineers' Handbook*. Overall, the book meets its purpose successfully.

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Developments in Heat Exchanger Technology, edited by D. Chisholm, Applied Science Publishers Ltd., London 1980, (300 pages) $65.00.

Any book which promises to present an update on heat exchanger design techniques should certainly be welcomed by many engineers. This work attempts to cover an enormous area, starting with (1) Shell-and-Tube Exchangers in Single Phase, (2) Reboilers, (3) Condensers, (4) Compact Heat Exchangers, (5) Air Coolers, (6) Augmented Surfaces, (7) Heat Pumps, and (8) Waste Heat Recovery, treated by ten authors. The chapters have been written specifically for this book, while in most cases drawing on published work. Some degree of haste in putting this volume together is apparent.

Overall, the treatment of the subjects in the various chapters is extremely uneven, ranging from presentation of well-established relations which have nothing to do with "new developments," to rather highly specialized, detailed aspects requiring a thorough knowledge of the background. Other chapters, especially that on Air Coolers, represent—if not any new developments—a very concise and readable survey of all the important design parameters. The chapters on Compact and Heat Recovery Exchangers contain descriptions of some designs and operational characteristics which are rather hard-to-find otherwise. Enhanced Surfaces are well summarized, based on published material.

Each chapter has its own references with a varied degree of completeness which, in most cases, leaves much to be desired. A separate chapter is devoted to a Bibliography with 526 entries and a Subject Index, which is supposed to supplement material not covered otherwise. Again, the content is very unevenly distributed, e.g., with a single entry under "Design" to 41 entries under "Heat Pumps." Nevertheless, some of the better and original contributions may make the book worthwhile to have as a reference.

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Kinetics and Mechanism 3rd Edition
John W. Moore and Ralph G. Pearson, Wiley-Interscience, New York, 1981, 455 pages, $32.00.

Frost and Pearson's "Kinetics and Mechanism" has been standard fare for more than 20 years, and the appearance of the third edition will whet the appetites of many chemists and engineers.

The book is a clear presentation of the kinetics of homogeneous reactions, written at a level suitable for advanced undergraduates. The subjects considered in depth include experimental methods of reaction kinetics, treatment of data, collison theory, transition-state theory, reactions in solutions, homogeneous catalysis, and chain reactions. The book complements textbooks used for courses in chemical engineering kinetics and reaction engineering, providing numerous examples of reaction mechanisms and helping students develop a chemical sense that they will not extract from the chemical engineering texts.

Whereas the earlier edition had a long final chapter presenting detailed case studies, the

new edition has many new examples integrated into the text, obscuring the statement of principles, which is hardly different from before: The examples add some good physical chemistry (e.g., elementary gas-phase reactions) and physical organic chemistry (acid-base catalysis), but they lack industrial importance and are not optimally chosen for chemical engineers.

One sees in the third edition a glimmer of the contributions of chemical engineers to reaction kinetics. There is a recognition of the advantages of flow reactors in the laboratory, but still little appreciation of the concept of reaction rate or the basis for the "reactor design" equations. Modern computational methods of determining nonlinear rate equations from kinetics data are cited, but the rationale of the methods and guidance in their application are lacking.

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Biomass Conversion Processes for Energy and Fuels, Edited by Samir S. Sofer and Oskar R. Zaborsky, Plenum Press, 1981, 420 pages, price $49.50.

The past decade has seen an explosion of interest and government support in the area of synthetic fuel development. Much of this effort has been directed at gaseous and liquid fuels derived from coal and oil shale. The area of biomass while less prominent than coal and shale has also received considerable interest as a source of alternate energy. This book was written to be an introduction to the field of biomass conversion.

The book is organized in a logical manner of resource identification, conversion technology and economic considerations. This allows the reader to focus on those topics of individual interest without undue searching. The individual chapters are written as stand alone sections including an introduction and summary. The part of the book dealing with conversion processes brings together the main technologies of direct combustion, thermochemical processes and biochemical processes. Each of these areas includes a chapter on basic principals followed by chapters giving commercial or development applications. The authors should be credited with bringing together this diverse subject matter in a very cogent form.

The major inadequacy of this book is the ignoring of the most controversial aspect of biomass conversion: overall energy balance. Do these technologies produce fuels with more energy than is needed to produce them? While it was not the intent of the editors to deal with such topics, the ignoring of the topic was an oversight. The uninitiated reader may well be lead to false impressions of future potential for the field.

The question of product quality is generally overlooked when dealing with fuels production. It is, therefore, very difficult to derive meaningful economic assessments. The treatment of economics and product qualities (and potential markets) are the weakest parts of the book. Chemical engineers will find the material on energy balances, which appears in at least three parts of the book, rather elementary and repetitive. On the other hand the chapter on anaerobic digestion and methanogenesis is quite advanced for most engineers without a biochemical background. This unevenness in level of detail is inevitable in such a book.

The editors have succeeded in their objective of presenting an introductory text in a rather diverse area. It largely ignores, however, the controversial topic of overall energy balance which limits its usefulness. This book may well be an excellent reference for a senior design course and will serve as a good introduction to this field for the practicing engineer.

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Solar Heating and Cooling, Active and Passive Design, Second Edition, Jan F. Kreider and Frank Kreith, McGraw-Hill, 1982, 479 pages, price $29.95.

What a difference seven years can make! The first edition praised solar energy as the wave of the future. An optimistic claim was made that the USA could increase energy consumption by solar energy more cheaply than by other energy sources. In sharp contrast, the present edition declares, "Solar energy is expensive energy".

Early enthusiasts were prone to gloss over the two key drawbacks: sunshine is diffusive, and sunshine is intermittent. Collection and storage of the energy requires a lot of capital. This book gives an excellent treatment of the science and engineering of radiation collection and thermal storage. It concludes that solar energy is competitive with some conventional fuels in some parts of the USA. Photographs show four installations, including one for domestic hot water in author Kreith's condominium in Colorado.

This new edition has 140 pages more than the first, it uses smaller type and smaller margins, and thereby doubles the printed matter. New material is particularly rich in information on designing and sizing domestic hot water systems, solar-heated swimming pools, and passive and active space-heating systems. The careful, detailed cost calculations allow for interest rates up to 25%. The result is an interesting, readable, pragmatic book. It can be used as a college text, although no problems are given. It has value as a reference.

There are no photos for solar cooling. Solar cooling has not achieved success. An absorption system, for example with an aqueous solution of lithium bromide, could be used. Solar energy would be employed to drive off the absorbed water. The chapter on solar cooling also points out that a storage tank used to store solar energy during a heating season can also be used to "store cold" during a cooling season. This requires that the auxiliary heating and cooling system be a heat pump.

Brief sections are devoted to wind turbines, ocean thermal energy conversion, solar ponds, photovoltaic cells, wood stoves, legislation, and tax incentives. Excellent sun-path diagrams, insolation maps, and climatic data are provided.

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