BOOKS

Elementary Principles of Chemical Processes by Richard M. Felder and Ronald W. Rousseau, John Wiley and Sons (1978), 571 pp. ($21.95).

The title would indicate this is merely a routine addition to the long line of stoichiometry texts written for beginning chemical engineering students. *Not so.* It is a timely, well reasoned, carefully structured book authored by two chemical engineers who have demonstrated obvious concern for teaching non-reactive and reactive material and energy balances in a manner to both motivate and educate the reader. In the opinion of this reviewer, the style and level of presentation of the content is excellent, and the subject matter represents the ideal body of knowledge which should be imparted to students in the first year of a chemical engineering curriculum.

The six page initial chapter entitled "What Chemical Engineers Do for a Living" is as informative and appetite-whetting a piece as one could hope to find to command the attention of students and generate interest in both the chemical engineering profession and the contents of the book itself. The next three (relatively brief) chapters which deal with systems and conversion of units, processes and process variables, and process data representation and analysis are discretionary dependent upon the prior knowledge of the reader. The authors then proceed to cover the fundamentals of material balances; and when one has mastered the techniques of performing material balances for multiple unit reactive processes including recycle there ensue two excellent chapters on single-phase and multiphase systems. This is then followed by a thorough treatment of energy balance concepts and combined material-energy balance process analyses. A final chapter on unsteady material and energy balances is a superb introduction to the study of transient phenomena.

However, the coup de maître of the book is the presentation of three case study problems: Production of Formaldehyde, SO_2 Removal from Power Plant Stack Gases, and the Kraft Pulping Process. Here the student is given the opportunity to translate word descriptions to process diagrams, utilize the text material to perform detailed material and energy balances, and extend himself to answer questions of practical engineering significance related to the projects.

In noting other features of the book, a reasonable balance has been maintained in the use of SI, cgs, and American engineering system units. The text is readable and at times almost conversational with occasional sprinkles of humor. Illustrative examples are numerous and extremely well presented. Within chapters there are short "test yourself" questions and exercises to keep the reader focused on basic concepts. The nearly 500 end-of-chapter exercises thoroughly cover the important areas of chemical production, separation processes, energy generation, environmental and safety problems, etc. Also included are exercises specifically designated to be solved by numerical-computer techniques—a bonus for those acquiring or having such skills. Tables in the Appendices provide most of the information required to solve the text problems; and the Appendices further contain short presentations of numerical integration techniques, least squares analysis, and solution methods for nonlinear algebraic equations.

There is one minor point of criticism; namely the authors' statement that most of the text can be covered in a one semester course. This seems a bit ambitious, since a one year course would appear more appropriate for the average student. Nevertheless, Professors Felder and Rousseau are to be highly commended for an important and excellently written contribution to the chemical engineering and teaching profession.

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Industrial Organic Chemistry, K. Weissermel and H. J. Arpe, Verlag Chemie (1978), 404 pages, $38.00.

The authors have done an excellent job of reviewing the literature on industrial organic chemistry. The raw materials used, operating conditions (temperature and pressure), catalysts, yields and in some cases the materials of construction are listed. The names of the reaction and companies which

developed the process are listed. The purification methods are given along with the final product purities. The chemical reactions and heats of reaction are listed in some.

The authors list the quantities manufactured and the amount of material consumed in making various finished products for various countries if available.

The book will serve as a valuable reference for research chemists, market research people, process engineers, salesmen and academic people. The material is condensed and organized so as to give many people the information needed without having to go to a library and scan through many volumes.

The authors have placed three types of information at the reader's disposal: (1) The main text, (2) The synopsis of the text in the margin, and (3) Flow diagrams illustrating the inter-relationship of the products in each chapter.

This book will have great value to the student, the academic person, the research person and the market research person. If a plant is contemplated or a by-product is to be purified, people can readily determine the size of the world market, the size of major world markets, the rate of market growth, both negative and positive, in recent years and in some cases the author's ideas on future markets. In some cases the authors state why a process is not favored such as low yields, high raw material costs, excessive by-product production, etc.

This book is valuable and well worth the price as a ready reference book.

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Chemical and Catalytic Reaction Engineering, by James J. Carberry, McGraw-Hill, Inc. (1976), 642 pages, $24.50.

Carberry's is a unique and important addition to a growing number of good books on reaction engineering and catalysis. The diligent reader will encounter a wider breadth and greater depth than with other texts of similar size. The approach is "scholarly" in that one finds access to a vast literature, and research contributions are evaluated critically and with a desirable perspective. However, the thrust is definitely practical. No specialized mathematical background is presumed. The author draws upon his experience with industrial problems to emphasize those aspects of reaction engineering that have the greatest impact on economical, efficient, and safe design of reactors. The pervasive attention to multiple reactions and selectivity in addition to single reactions is one example. The development of quantitative criteria for the importance of the various rate determining steps and other phenomena is another. Therefore, this book is recommended for practicing engineers desiring to modernize and renew their knowledge of reaction engineering or to approach the state of the art with respect to a particular problem.

Of the many features of the book that could be highlighted, the following are offered. By covering the advanced topics with the elementary material which they extend, a compact presentation and rapid progress is achieved. By the end of Chapter 3, p. 142, Carberry has discussed simple and complex reactions in batch reactors, plug flow reactors, and CSTRs; non-isothermal performance; non-ideal flow and the residence time distribution; some data procurement and interpretation problems and the propagation of experimental error; multiple steady states and uniqueness of steady states; and the nature of several simple optimization problems. The last two thirds of the book discusses multiple phase systems. These include gas-liquid and liquid-liquid reaction systems in addition to the fluid-solid catalytic systems for which the author is well-known. The treatment of mass and heat transport between and within each phase is particularly well done. Extensive use of the effectiveness factor idea enhances the quantitative appreciation of the importance of the various mechanisms. Presentation of these effectiveness factors in terms of measurable quantities eliminates the iterative procedure otherwise required. Appropriate use is made of dimensionless groups in order to minimize the number of variables and to facilitate graphical presentation of solutions. Finally, one should mention the short but effective summaries and the annotated references at the end of each chapter.

A book that excells for some cannot be optimum for others. A superficial or elementary view of the subject can be obtained more efficiently elsewhere. Therefore, a discussion of this book as a textbook is appropriate. The book can obviously be highly recommended as a graduate text. Use as an undergraduate text has been tested by the author and by this reviewer, and there is no doubt that the book will "work" at the undergraduate level. However, the less ambitious or gifted students may not spend sufficient effort to achieve satisfaction. This book has about 1200 numbered equations compared to about 600 in both Smith's and Levenspiel's popular texts. The greater number of equations reflects coverage of additional topics rather than simply the inclusion of manipulative details in each treatment. A typical 3 credit course might cover the first 5 chapters and one or two others. If assignments simply list the pages to be read and if students attempt to "understand" the material by confirming the important equations, frustration is inevitable for many average and weaker students, especially at schools where a broad mix of abilities is common. These difficulties can be overcome by carefully prepared lectures. If the instructor paves the way prior to the reading assignment and reviews the highlights afterward, the text, and hence the course, will be a success. The reward for the students will be a more sophisticated appreciation of reaction engineering and a superior base for continued study.

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Statistics for Experimenters, George E. P. Box, William G. Hunter and J. Stuart Hunter, John Wiley & Sons, Inc. (1978), 653 pages, $23.95.

This book describes, at an introductory level, the main statistical methods used in scientific and engineering research. Design of experiments, analysis of data, and building of mathematical models are presented as complementary aspects of the scientific method. The book is well suited for a first course in applied statistics and also for self-instruction by practicing scientists and engineers.

The book is oriented toward experimentation as the motivation for statistical methods. The first two thirds of the book deal with experimental design; the remaining third deals with modeling and data analysis.

The distinctive feature of this book is its problem-oriented approach. Each statistical method is introduced through a practical problem, and elucidated by further examples from industrial process investigations. The scope and assumptions of each method are explained clearly, and the theory is presented with very simple mathematics.

This book is well written and authoritative. It is highly recommended as an introduction to statistics for experimenters, and for directors or interpreters of experiments.

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