**Principles of Unit Operations,** A. S. Foust, L. A. Wensel, C. W. Clump, L. Maus, and L. B. Anderson, John Wiley & Sons, Inc., New York (1960). $15.00.

As the title would imply, this book is an attempt to organize the study of the unit operations on a fundamental basis. It undoubtedly reflects the present trend in the academic world to reorganize the study of chemical engineering into the study of basic phenomena. This text does not make any radical break with the past. It does however present the material in a different sequence from that found in many of the new texts on this subject. Presentation is broken down into three parts: stage operations, molecular and turbulent transport, and applications to equipment design.

Part one is concerned with stage operations and deals with mass transfer, phase relationships, equilibrium stage calculations, countercurrent multistage operations with and without reflux, and unsteady state stage operations (batch distillation). Every effort is made to try to generalize these concepts so that they will apply to all operations employing distribution of components between phases. It is however restricted to two component systems.

Molecular and turbulent transport are discussed in the second part, starting with the mechanism of molecular transport and its application to the steady and unsteady states. This is followed by two sections on turbulent transport. A final section deals with interphase transfer. Essentially it covers the basic phenomena of heat transfer, fluid flow, and diffusional processes, including some of the analogies for mass, heat, and momentum transfer and the newer film theories.

The final part is headed "Applications to Equipment Design." In reality it is a section on the unit operations as organized in other texts on the subject. Each section however draws the basic material it requires from the relevant sections of parts one and two. There are individual chapters on heat transfer, mass transfer, simultaneous heat and mass transfer, momentum transfer, energy balances, pumps and compressors, and physical separations.

Dimensional analysis and the characterization of particulate solids are discussed in the first two of three appendices; the third appendix gives some physical and equipment design data.

In spite of the fact that one might be inclined to believe from the title that the book is rather theoretical, the authors have managed to keep it at a practical level. There are numerous worked examples, and the relation to commercial operation is brought out quite well, in general.

The illustration of mass transfer operations by means of two component systems with an emphasis on graphical methods would seem to be unfortunate. Most industrial problems involve multicomponent systems, and some consideration of such systems would be appropriate in a text of this nature. Generally speaking however the student should benefit from this newer method of presentation with its emphasis on the scientific principles.

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**Engineering Thermodynamics,** Newman A. Hall and Warren E. Ibele, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1960). 643 pages. $15.00.

It is refreshing to see a new approach to such an old subject as engineering thermodynamics. The authors have not been content to discuss irreversibility qualitatively as it is done in many texts but have assigned a quantitative meaning to it throughout the text. In so doing maximum use of the second law is realized. The nature of the irreversibility as well as its magnitude is fully discussed. However this frequently necessitates the introduction of material not normally found in thermodynamic texts since nonequilibrium states may be involved, such as for example in the transfer of heat by convection.

Other novel features of the book are its treatment of solids and its treatment of forces other than hydrostatic pressure.

The general approach throughout the text is well suited for teaching. Derivations are rigorous and clearly explained step by step, and final relationships are further illustrated by numerous examples. Special areas of thermodynamics are adequately introduced to the student, and further

references to such areas are contained in bibliographies at the end of the chapters.

This text is applicable to all branches of engineering. Division of the text into nineteen chapters permits flexibility in selection of topics for groups at various academic levels and with varied disciplines.

The first four chapters deal with basic concepts and definitions, and this is followed by two chapters on the thermodynamic behavior of fluids and solids. Chapters 7 and 8 introduce the first two laws of thermodynamics and a quantitative approach to irreversibility. The various thermodynamic functions and potentials are treated in the next two chapters. The subject of open and closed systems including various types of flow processes is very clearly presented in Chapter 11. Nonideal, as well as ideal, behavior of solutions is presented in Chapter 12. The next three chapters are of particular interest to chemical engineers, since they deal with phase and chemical equilibria. In general the treatment of these topics is adequate for chemical engineering students. However little or no reference is made to the third law and the use of absolute entropies in calculating free energy and equilibrium constants. Chapters 16 and 17 deal with fluid flow and heat transfer, and the remaining chapters are concerned with various work-producing and work-absorbing systems. These chapters are very well written and include practically all cycles of engineering interest.

This book should serve as a valuable reference text for thermodynamics in addition to being a good classroom text and is recommended for both purposes.

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**Radioactive Wastes—Their Treatment and Disposal,** John C. Collins, editor, John Wiley & Sons, New York (1961). 239 pages. $8.00.

This discussion of ten aspects of radioactivity and radioactive wastes by eight authors seems to be directed toward public health and government officials and toward technical people who have knowledge of one or two of the aspects or who are laymen with respect to the science of radioactivity. For these people and for the novice in this waste field this book is recommended as a useful introduction to most aspects of the problems which arise.

The first half of the book is introductory. It concerns the nature of these wastes, including sources, hazards, measurement, and some relevant English law. (Perhaps the book itself might be called "Radioactive Wastes—Their Nature and Disposal.") The quantitative chapters in this first half, on atomic physics, the effect of radiation on man, and methods of detection, are succinct well-written surveys. The concise organization of these chapters reflects the beneficial effect of having a different specialist write each chapter, as these topics can easily be discussed separately.

The second half of the book is divided into two treatment chapters, physicochemical and biological, and three disposal chapters, liquid, solid, and gas. Except for gas disposal this half is primarily a qualitative description of methods and cases. Whereas having different authors was beneficial for describing the nature of wastes, it detracts from logical arrangement in the second half, for treatment and disposal are closely interrelated. Partly for this reason and partly because the distinction between treatment and disposal is not clearly defined (one is concentration-reaction and the other is storage-dispersal) or consistently followed, needless repetition results. Lack of reference to the introductory part of the book also results in repetition.

Most material seems to be quite valid, although chemical engineers may be wary of the following by the author of liquid effluent disposal: "application of Fick's Law of Molecular Diffusion to the case of eddy diffusion would imply that the rate of eddy diffusion is directly proportional to the concentration gradients. . . ."

For the engineer the discussion of treatment and disposal is most useful for specific applications with known techniques but not as useful for creation of novel designs. Most engineers and scientists having some knowledge of radioactivity should find this book easy to read in a relatively short time.

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