Transport, solid phase, of glycerol and sodium chloride in resin .. 672
to spheres in Stokes flow, a note on 347, 6S
Tubular Reactor Sensitivity 124
Turbulent Convective Heat and Mass Transfer From Accelerating Particles 254
Turbulent Diffusion in the Core of Fully Developed Pipe Flow ... 53
Turbulent Flow Ballistic Facility for Particle Momentum Transfer Studies 406
Turbulent fluid, drag coefficients of single spheres moving in steady and accelerated motion in a .. 615
gas streams, temperature gradients in: effect of viscous dissipation on evaluation of total conductivity 688
Turbulent Newtonian Flow in Annuli 41
Two-Phase Concurrent Flow in Packed Beds 231

U

Use of Boundary-Layer Theory to Predict the Effect of Heat Transfer on the Laminar-Flow Field in a Vertical Tube with a Constant-Temperature Wall 112
Use of the Mechanical Energy Balance for Two-Phase Flow 174
Utilization of Fission Fragment Energy for the Fixation of Nitrogen, The 329

V

Vapor-Liquid Equilibrium in Ammonia Complex Systems 133
Vapor-Liquid Equilibrium in the *n*-Butane-Nitrogen System 173
Velocity and Temperature Distributions About a Horizontal Cylinder in Free Convection Heat Transfer 352
Velocity distribution, generalized, for non-Newtonian fluids 392, 3D
Vibration, acoustic, the effect of, on forced convective heat transfer 102
the effect of, on natural convective mass transfer 240
Viscometer, falling, an experimentally verified theoretical study of the 6S
Viscosity of Nonpolar Gases at Normal Pressures, The 611
Viscous dissipation, effect of on evaluation of total conductivity: temperature gradients in turbulent gas streams 688
Volumetric properties of Gas Mixtures at Low Temperatures and High Pressures by the Burnett Method: the Hydrogen-Methane System 267

W

Water-gas shift reaction, design of experiments on the kinetics of .. 143
Waves, roll, initiation of 488
Wetted-wall towers, liquid flow and gas phase mass transfer in 463

BOOKS

Mechanics of Solids and Fluids, Robert R. Long, Prentice-Hall, Inc., Englewood Cliffs, New Jersey (1961). 156 pages. Trade edition $9.00, text edition $6.75.

A large part of this book is concerned with stress, strain, and equations of motion in a continuous three-dimensional medium. As an introductory text it is primarily restricted to matter with linear stress-strain diagrams, such as elastic solids and Newtonian fluids. But it is not just another mechanics book. The vector and tensor notation allows the author to devote more space to concepts than to lengthy equations and at the same time describe situations of more than one or two dimensions. The qualitative discussion of plastic solids and plastic fluids is interesting. Theory is emphasized, but applications are clear.

For the chemical engineering student this book would be useful for considering force balances and one-phase motion problems in a general notation. It would be useful for learning some applications of calculus and boundary value problems. But little is said about fluids and even less about real fluids that have viscosity and friction. The author's attitude is expressed in his discussion of the Navier-Stokes equation where he mentions that "In nearly all cases of practical importance the frictional terms are only a very small fraction of the other terms, except in limited regions." Three paragraphs are devoted to turbulent flow. The brief discussion of real fluids is well done however.

This is not a chemical engineering book, but it can provide a link between the mechanics of civil engineering and the fluid flow of chemical engineering. This would, for example, be good preparation for reading new texts such as "Transport Phenomena" by Bird, Stewart, and Lightfoot.

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Physical Chemistry, 2 ed., Farrington Daniels and Robert A. Alberty, John Wiley and Sons, Inc., New York (1961). 744 pages. $8.75.

This book continues to be an outstanding one for its purposes, that is, as a text for comprehensive first course in physical chemistry. The new edition includes several topics and approaches not in the first edition and is substantially reorganized.

Much of the early work in physical chemistry was concerned with the average properties of large parcels of molecules. This deterministic approach, of which classical thermodynamics is an example, has lead to the development of many useful relationships. In recent years however more investigations have been concerned with the properties of molecules themselves; the stochastic approach, involving molecule to molecule variations, is becoming increasingly important. This emphasis on molecular properties has strongly influenced the reorganization of this edition. Classical thermodynamics has been presented first, kinetic theory follows, and then the sections on quantum theory, mo-

(Continued on page 4D)

CEP (October, 1961), p. 102

Equation of Third Degree Polynomial with Three Variables (079)
Piping Flexibility (082)

CEP (November, 1961), p. 76

Analysis of Piping Networks (083)
Hydrocarbon Liquid Specific Gravity vs. °API, °F, and K (086)

CEP (December, 1961), p. 89

Preliminary Distillation (084)
Pressure Drop on the Shell Side of Heat Exchangers (085)

BOOKS

(Continued from page 704)

lecular structure, spectroscopy, and statistical mechanics appear. This reorganization is a substantial improvement; however it does tend to divide up some topics. For example reaction kinetics is divided into "large-parcel" and molecular approaches and placed in different parts of the book. On the other hand some topics are brought together under a better grouping. For example the interfacial phenomena of surface tension, adsorption isotherms, and surface-catalyzed reactions are included in a chapter called *surface chemistry.*

This emphasis on molecular properties is also reflected in the authors' choice of new material. Most of the spectroscopy and statistical mechanics chapters are topics not in the first edition.

Another interesting change in this second edition is the retitling of many chapters, for the new titles represent a different orientation to students using this book as a text. The chapter on Heat, Work, and Heat Capacity is renamed First Law of Thermodynamics; Thermodynamics is now Second and Third Law of Thermodynamics; discussion of vapor pressure is not Liquid State but rather One Component Systems; Colloids is now Macromolecules, and so forth. These changes offer a definite descriptive improvement.

The mathematics required for the text is still primarily elementary differential and integral calculus. However some topics of advanced calculus, such as infinite integrals, have been used in this new edition. The authors indicate that this has been done because of the better mathematical preparation of the students. It should be noted that some other texts in the field have utilized advanced topics more than this text.

Of special interest to chemical engineers are new sections in chapters on gases (Kinetic Theory) and liquids (Irreversible Processes) which give definitions for energy and momentum transport. In contrast to recent texts in chemical engineering however the units chosen for the diffusivities of momentum, energy, and mass are all different. Thus there is little attempt to imply the analogies—even of mathematical form. Furthermore some of the assumptions are treated lightly. For example Fick's first law of diffusion is defined, but no mention is made that this is restricted to the case of equi-molal diffusion.

As in the earlier edition turbulent flow is not discussed, and mention of it is generally restricted to statements saying only that a certain development holds for nonturbulent flow. The text however generally does not even hint at what conditions the flow may become turbulent. Eddy diffusivities of momentum, energy, and mass are not discussed. Also, as in the earlier edition, the behavior of mixtures of real gas is mentioned very briefly and only to the extent of the assumption of Dalton's law.

Comparison of this book with some of the newer chemical engineering texts in transport phenomena indicates different tendencies of these various authors and perhaps different tendencies between engineering and chemistry. Whereas the engineering texts seem to be seeking general expressions containing several effects, the approach of this chemistry book remains one of discussing each effect separately. The discussion of different types of mass diffusion is an example of this difference.

The above comments on turbulent flow and the search for equations which include several effects are not meant as a criticism of Daniels and Alberty's book, but merely as a comment on the areas which are still primarily the concern of engineering courses.

This new edition represents the better preparation chemical engineering students are receiving in the chemistry courses. However the practicing engineer who is not familiar with the developments in molecular and stochastic physical chemistry will find an introductory discussion of these developments in this book.

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