pirical techniques are used to good advantage for a very understandable treatment. The number of problems presented is generous.

In addition to analytical treatment of steady and transient conduction, numerical techniques are also presented. For both forced and natural convection, an integral analysis is given, followed by presentations of empirical results. The nature of thermal radiation is discussed and exchange analysis is by the network method. An introduction to two phase heat transfer systems is given in Chapter 9 on condensation and boiling. The treatment is more abbreviated than one would perhaps wish, but serves as a good starting point. Heat exchanger design presents both the log mean temperature difference and the NTU effectiveness methods. The mass transfer chapter (Ch. 11) is far too brief to be effective. Special topics in Chapter 12 give a helpful introduction to several topics and the final chapter on Heat Transfer in the Environment is timely and undoubtedly will provoke student interest.

The primary set of units used is the SI, with conversion tables given to the English units for those of us who still "think" in the old system.

To restate my initial appraisal: this is an excellent, well put together introductory text on heat transfer. I recommend it.

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Thermochemical Kinetics, 2nd. Ed., Sidney W. Benson, Wiley Interscience, 320 pp., $22.50, New York, 1976.

This book has a subtitle: *Methods for the Estimation of Thermochemical Data and Rate Parameters.* This is more descriptive than the somewhat arcane title and almost directly suggests that the book represents an effort to make accessible to the chemical engineer and the industrial chemist the vast resources of chemical kinetics to predict, understand and control a host of phenomena.

In chemical engineering, group additivity methods have been used for many years to estimate thermochemical quantities dealing with equilibrium systems. Professor Benson has perfected such methods but his originality has been to use these for the estimation of entropies and heat capacities pertaining to the most elusive species of all: those dealing with the so-called activated complex or transition state of chemical kinetics. Many examples are discussed in this book to illustrate the sometimes embarrassing agreement between estimated and experimental quantities. The treatment of S. W. Benson is unique in its scope and it reflects a lifetime of expertise in the field.

Two limitations must be mentioned. First, the treatment is limited to ideal gas phase reactions excluding specifically all reactions with ionic or adsorbed intermediates. Of course, the wealth of processes covered is nonetheless impressive: oxidation, combustion, atmospheric and stratospheric chemistry, pyrolysis etc. The second limitation is more serious: the methods described do not apply to the estimation of activation energies. For the calculation of the latter, Benson and Alfassi have proposed some special semi-empirical rules, the generality of which remains to be tested.

Perhaps the success of this book which amply deserves this second edition, is that its author is not primarily an applied kineticist but a leading theoretical one whose previous work *Foundations of Chemical Kinetics* has been a lasting monument since 1960. This being said, it seems entirely fair to this reviewer to point out an error on page 2 of the present book. For a reaction with a general stoichiometric equation, it is not generally correct to state [eqn. (1.3)] that the ratio of rate constants forward and reverse is equal to the equilibrium constant for the reaction. This was already pointed out years ago by several authors including Denbigh in his classical book on Thermodynamics and discussed again recently [M. Boudart, *J. Phys. Chem.*, **80,** 2869 (1976)].

In spite of this venial sin, Professor Benson's little book is too valuable to be left on library shelves: it belongs to the desk of anyone dealing with thermodynamics or kinetics and who doesn't?

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LETTERS TO THE EDITOR

To the Editor:

In a recent article LeVan and Newman [*AIChE J.*, **22,** 695 (1976)] are critical of boundary layer methods [D. A. Saville, *Chem. Eng. J.*, **5,** 251 (1973); J. F. Harper, *Q. J. Mech. Appl. Math.*, **27,** 89 (1974)] when applied to estimate the distribution of soluble surfactant in the interface around a small gas bubble rising through a liquid. Here the distribution of surfactant fixes the variation of interfacial tension around the periphery and the resultant change in stress changes the terminal velocity of the bubble.

Since boundary layer solutions for problems of this sort are asymptotic representations, the question is mainly one of deciding whether or not the Peclet number is large enough for the desired accuracy. LeVan and Newman used a numerical method to solve the full conservation equation for a Peclet number of 60 and found that the terminal velocity of a small bubble is lower than the Hadamard-Rybczynski velocity by an amount $\kappa C_\infty U_0$. Here C_∞ is the surfactant concentration far from the bubble, U_0 is the Hadamard-Rybczynski velocity and κ is a numerical factor, 1.9×10^8 cm^3/g-mole according to their numerical solution. Boundary layer theory gives precisely the same functional form and κ, calculated using Eq. 16 of Saville (1973), turns out to be 2.1×10^8 cm^3/g-mole.

It is true, as pointed out by LeVan and Newman, that a boundary layer model neglects (in the first approximation) diffusion in the θ-direction along and near the surface. However, the qualitative features of the concentration field are very similar to those predicted by the full numerical solution except near the rear stagnation point. There, although the boundary layer solution exhibits weakly singular char-