BOOKS

Quantum Theory of Matter, Second Edition, John C. Slater, McGraw-Hill, New York (1968).

If you would like to own one book on quantum mechanics which is authorative and encyclopedic, you might very well consider purchasing John C. Slater's second edition of the **Quantum Theory of Matter.** It is intended to serve as a text for a one year course for graduate students in physics. However, much of the text is devoted to molecular structure and it is equally well suited to a course for chemistry graduate students. In either case, the professor would have a great deal of freedom in selecting the subject matter from the thirty-three chapters in this book. At the end of each chapter there is a set of problems illustrating the significant features and the range of applicability of the theory.

It is truly amazing how many of the techniques considered were discovered or developed by Slater. He has tackled a wide variety of problems and each time he has persisted until he has found a workable solution. Slater is very intense, forthright, and systematic. His writing is very clear and he tries to explain his derivations point by point so that, with sufficient effort, you will agree with his conclusions.

This book bears no relation to the first edition of **Quantum Theory of Matter** published in 1951. Instead, it is essentially a condensation of the five books which Slater has written since 1960: two volumes on atomic structure and three volumes on the structure of molecules and solids. The first few chapters are similar to the usual elementary quantum mechancial texts. The next group of chapters present a very thorough treatment of atomic structure and the theory of multiplets in complex spectra. Chemists will be particularly interested in Chapters 13 to 15 which give a clear treatment of the interaction of radiation and matter which explains the emission and absorption of light, the breadth of spectral lines, and the nature of spin-orbit interactions. Chapters 18 to 29 give a very thorough discussion of most of the recent developments in molecular structure including the Gaussian orbital calculations of the structure of the ethylene and benzene molecules. Slater does an excellent job of explaining the electron correlations and the nature of the chemical bonds. Indeed Chapters 18 to 29 might very well serve as the basis for a second semester course in quantum chemistry. Chapters 30 to 33 are concerned with the structure and properties of crystals. Since big molecules have many of the properties of crystals, these last chapters should not be ingored by chemists.

This is truly a great book written by a great scientist. You won't find it easy reading, but you will be well repaid for your efforts.

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Handbook of Fuel Cell Technology, Carl Berger, Editor, Prentice-Hall, Englewood Cliffs, N. J. (1968). 607 pages. $18.50.

I can highly recommend this volume to any engineer looking for a good introduction to fuel cells. The first two hundred page chapter by L. G. Austin presents the electrochemical theory of fuel cells. It is written in a textbook, teaching style. A set of numerical examples (which not only give relevant orders of magnitude but make one think about the subject) more than compensate for other minor shortcomings, such as no list of notations and references to past 1965 work. This section can serve as an excellent supplement to Bird, Stewart, and Lightfoot's book on transport phenomena.

The second chapter by Suparmanian Srinivasan and Elizear Gileadi gives a welcome survey of electrochemical techniques and continuation of the discussion of the porous electrode models. Unfortunately, too little space is devoted to the more recent and more realistic models, such as the intersecting micro-macro pore model. The next chapter is devoted to the technology of a fuel cell with carbon electrodes by K. V. Kordesch of Union Carbide.

The fourth chapter deals with an ion exchange fuel cell and is by H. J. R. Maget. In addition to the presentation of problems special to these cells, this chapter summarizes the results of a first-rate study on sectioned electrodes. Unfortunately the presentation is not without blemishes. The heading of Section 3.61 is *Natural Convection.* However, the infinite series solution for the current given by equations (50) or (51) in this section is for the case of no bulk motion at all. It was obtained, as presented in a preprint by Maget and Oster, by solving a Laplace equation for concentration in two dimensions. In this section and the next, there are also a number of typographical errors. One possible error that does not appear to be typographical occurs in Equation (54). A Leveque type solution for convective diffusion with a first-order reaction is presented. Unfortunately, as the rate constant becomes large, the concentration at the wall becomes negative rather than nearly zero.

The last chapter deals with fuel cell economics and commercial applications. It is written by J. Verstraete, D. Lefevre, R. Lefort and J. Henry, all from Belgium.

Although this book is a worthy addition to any personal library, I let the reader judge for himself whether it rates the title of *Handbook* in view of such an unrepresentative contribution from major fuel cell developers.

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Thermodynamics, Second Edition, William C. Reynolds, McGraw-Hill, New York (1968). 496 pages. $11.50.

In this book, written as a first course text for engineers, microscopic arguments are used to provide an intuitive basis for macroscopic postulates. This is done in an understandable way that should be acceptable to the third year student in engineering.

There are fourteen chapters that contain material for one whole year of work, which is more time than can be alloted in our curriculum to general thermodynamics.

Fortunately, a class could stop after Chapter Eleven and still cover all subject matter that is important to the third year engineering student. The last three chapters on Statistical Thermodynamics, Molecular Kinetics, and Irreversible Thermodynamics can be left out of the undergraduate course.

The treatment of nonreacting mixtures in Chapter Ten does not include any mention of fugacity or activity, without which the Chemical Engineer could not handle problems in vapor-liquid equilibria.

In Chapter Eight, the Van der Waals and Beattie-Bridgeman Equations of State are discussed. No mention is made of the Redlich-Kwong and the Benedict-Webb-Rubin Equations of

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