Books

Quantum Chemistry. By Kenneth S. Pitzer. 529 pp. Prentice-Hall, Inc., New York, 1953. $10.00.

Quantum mechanics, originally confined to physics, has now penetrated to such an extent into the various branches of chemistry and other sciences that a rudimentary knowledge of its principles and methods is now considered absolutely necessary for a research chemist. In teaching elementary quantum mechanics to nonphysics students, it is unfortunately often forgotten that their primary interest is to *use* its results and its tools rather than to *add* to the theory. Thus the stress ought to be laid on the simpler methods, on their application and on development of a quantum mechanical "feel" and "intuition" rather than on an analysis, however profound, of the mathematical methods and approximations. Pitzer's book is an excellent example of how this should be done although the reviewer is inclined to doubt whether any book could live up to the following quotation from the preface—"the rigorous treatment of even a few topics gives the reader a foundation for the critical examination and real understanding of most of the applications of chemical interest".

About one third of the book is an exposé of general fundamentals of quantum mechanics without reference to any special applications. The amount of material which is covered in the seven chapters and in a few appendices is enormous and the treatment excellent. The approach is so general that it is perfectly suitable as an introduction to any more advanced course in quantum mechanics. A particular virtue of this part of the book is a good balance between mathematically rigorous treatments and a qualitative conceptual interpretation. Certain subjects such as operators, variation method, elements of radiation theory, etc., which are usually omitted in similar treatments, receive here a perfectly adequate, though naturally very condensed, description.

The next two chapters on "chemical bonds and valence" and on "molecular spectra and thermodynamic properties of perfect gas" totalling some 150 pages are the real core of the book. Here all the various aspects of quantum mechanics, which are of particular significance for chemistry, are applied to specific problems. As an example of the thoroughness of the treatment one may cite the theory of the hydrogen molecule for which, besides the "classical" Heitler-London theory, the book gives a satisfactory summary of the James-Coolidge approximation and (in an appendix) of the various significant improvements due to Wang, Weinbaum, Rosen, Gurnee and Magee, and Hirshfelder and Linnett. Of particular interest to a physicist may be such subjects as the hybridization of atomic orbitals, the resonance in mesomeric molecules and the connection between electronic states in dye-like molecules, and the application of quantum mechanics to solids. These subjects are seldom mentioned in books for physicists.

A substantial chapter is devoted to crystalline solids, another to imperfect gases and liquids and one to miscellaneous topics such as magnetic susceptibilities, polarizability, statistical theory of reaction rates, etc. The book closes with a brief chapter on nuclear phenomena followed by twenty-four appendices on subjects varying from exchange integrals between orthogonal functions and the virial theorem to second order perturbation theory and collision theory. These last few chapters are very brief and naturally readers will have varied reactions to the choice of topics which are included or left out and to the manner of treatment. For instance, the reviewer is inclined to differ from the author in the appraisal of the relative value of the bond orbital method and the molecular orbital method as applied to metals. Most of the recent advances in this field seem to be connected with a refinement and improvement of the band theory rather than with a continuation of the shared-electron picture. Similar criticisms may be invited by other parts of these final chapters (for instance, the statement that the theory of the ordering in metals is simple or omitting the significance of the freedom of *direction* of axes of rotation of molecules in solids as compared to the freedom of *rotation* or not calling the Wigner-Seitz method by its accepted name, etc.) but it should be kept in mind that these descriptions serve mainly as illustrative material rather than as an abbreviated text of these highly specialized fields.

A very agreeable and useful feature are problems appended to each chapter and a few basic general references which avoid the loading of a book of this kind with numerous detailed annotations. The book should prove to be of great value not only to students of chemistry, for whom it is admirably suited, but for many other scientists who want to get acquainted with quantum mechanics. It is also an example of a book well-written from the purely pedagogical point of view.

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Nuclear Theory. By Robert G. Sachs. 383 pp. Addison-Wesley Publishing Company, Inc., Cambridge, Massachusetts, 1953. $7.50.

This volume is a welcome addition to the small number of up-to-date text and reference books on nuclear theory. It is well-written and easily read, with a maximum of description in physical terms of the phenomena that are discussed. Most of the results of experimental observations that lie within the scope of the book are described with the aid of tables and graphs, and references are given to original or summary papers. The theoretical development of most of the topics treated is reasonably complete, and pains have been taken not to omit difficult transition steps in the analysis.

The plan of this book follows that which has become virtually standard in both verbal and written presentations of theoretical nuclear physics. Part I, consisting of two chapters, describes the approach to the subject matter and the character of the information concerning nuclear structure and forces that can be obtained from the general properties of nuclei. Part II consists of five chapters, and is a good, adequately detailed discussion of the two-nucleon problem in all of its ramifications. Part III includes the remaining four chapters, and deals with the structure, electromagnetic interactions, and nuclear reactions of heavier nuclei, with one chapter on beta decay. There are also five short appendices on special problems.

The book seems admirably suited to a short course in nuclear theory, preceded or accompanied, as the author suggests in the preface, by a second semester course in quantum mechanics. The modest size of the book (less than 400 pages) makes itself felt partly in the omission of several specialized topics such as fission and angular correlations, and partly in the relative lack of detail in Part III. While these qualities will detract somewhat from its value as a reference work, they should if anything enhance its value as a text book, where formidable size and price are often a disadvantage.

In addition to being clear, the treatment is authoritative throughout, as would be expected from an author who not only has a high scientific reputation but has also contributed much to the clarification of this field.

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The Revolution in Physics. By Louis de Broglie (translated by R. W. Niemeyer). 310 pp. The Noonday Press, New York, 1953. $4.50.

The jacket of this book calls it "a survey of quanta for the layman", but it doesn't say what kind of "layman". The book can be recommended to graduate students in physics preparing for general oral doctor's examinations and to bright undergraduates specializing in physics; it can be suggested as stimulating fare for the serious reader who is already somewhat familiar with the vocabulary of physics and who is willing to work; but it is not for the general reader with little scientific background. It is not the equivalent of the popular books of Eddington or of Banesh Hoffman (*The Strange Story of the Quantum*) or of Gamow (whether this is a compliment or a criticism will be left to the reader).

But these comments are really only a criticism of the book's jacket. The book itself is a readable, usually lucid review of the fundamental developments which have taken place in physical theory in the last century. The first third of the book gives the background of classical physics, ending with relativity; the middle third on the developments from Planck to Sommerfeld and the last third to a discussion of the "standard" or "classical" quantum mechanics. Much of the book was written more than ten years ago, but sections have been inserted on nuclear physics, second quantization and other recent developments. In the main it discusses, clearly and logically, those developments of the past fifty years which can now be considered to be "noncontroversial".

In company with Einstein and others, de Broglie is not too satisfied with the probabilistic interpretation of wave mechanics. He discusses some of the recent suggestions of Bohm, together with some earlier ideas of his own, in this connection, though it is rather doubtful whether a "layman" could make much out of the whole argument.

The book, in fact, illustrates the dilemma involved in making modern physics understandable to the nonphysicist; either the wording is so vague that the real concepts are not got across or else so many specialized words and parenthetic definitions are thrown at the reader that he becomes confused before he gets to the concepts. This reviewer feels de Broglie's book errs somewhat in the latter direction, but it is a worthy and readable effort. More thought and hard work should be spent by more physicists on the job of persuading people that there is more to physics than making H-bombs.

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An Introduction to Symbolic Logic (Second Revised Edition). By Susanne K. Langer. 368 pp. Dover Publications, Inc., New York, 1953. Clothbound $3.50, paperbound $1.60.

The preface to this edition explains that the only changes from the first (1937) edition are a few corrections, some bibliographic additions, and an appendix on truth tables. The author believes that her book is still alone in its class; and in the following respect, at least, that is true. Mrs. Langer is eager to impart to her readers her enthusiasm for symbolic methods; to accomplish this, she at each stage tries to win the reader over with persuasive words before she starts operating with the symbols. If you are a layman unused to symbols, you may find this discursive treatment helpful. If you are a physicist, you will sometimes wish that the lecture would end and the demonstration begin.

For example: "Yet nothing we have stated is *abstract;* a house, no matter how little we say about it, or how generally we say it, is still something perfectly concrete". At this linguistic level, a debate can continue for some time before the participants find out that they are talking about different things: that such words as *abstract* have different connotations to different persons. I think it would be better to introduce the symbols first. In algebra and in physics, we do not try to develop each law in words and then translate it into symbols; we try to develop it in symbols and then, perhaps, interpret it in words. After a tentative symbolic