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.

R. Smoluchowski
Carnegie Institute of Technology

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 refer-