Practical Quantum Mechanics

Introduction to Quantum Mechanics : with Applications to Chemistry
By Prof. Linus Pauling and Dr. E. Bright Wilson, Jr. Pp. xiii +468. (New York and London : McGraw-Hill Book Co., Inc., 1935.) 30s. net.

QUITE a number of books have been written on quantum mechanics with applications to problems of physics. Now, however, we have something new, a book on quantum mechanics with applications to chemistry. It is a field which for some time has needed ploughing ; and the names of the authors guarantee that the job has been well done.

The logical development of the book is extremely good. After the usual introduction and decline and fall of the old quantum theory, it proceeds to show how the Schrödinger equation can be set up for a system of interacting particles. The rigorous solutions for the harmonic oscillator, the hydrogen atom, and the particle in the box are then worked out in considerable detail. By this time the reader is well prepared for solutions by approximations ; and perturbation theory and variation methods follow quite naturally. So far, only one-electron systems have been discussed, and as an introduction to many-electron systems a whole chapter is devoted to the helium atom, mainly with the view of accustoming the reader to spin, Pauli principle and all the other jargon of atomic and molecular structure. The discussion of atoms is rounded off with a difficult chapter on Slater's theory of complex spectra and Hartree's method of the self-consistent field.

About half the book has now been covered. The remainder deals chiefly with molecules, beginning with the rotations and vibrations of diatomic and polyatomic molecules, together with a short account of the selection rules. Then comes a section on calculations of the energy of formation of molecules. Simplest is the hydrogen molecular ion, and next the hydrogen molecule. This section ends with a brief description of Slater's treatment of polyatomic molecules and a few pages on 'resonance'.

At this point the authors, seeing that they are far from home in spite of nearly 400 pages, decide that the pace must be quickened. They select four applications of quantum mechanics to miscellaneous problems and write a few cogent pages on each, bundling them together to make the penultimate chapter. The last chapter is on the same plan, but takes as its subject matter some of the more important methods and principles of general theory. There is an appendix which includes many useful facts, such as physical constants and normalising factors, and this concludes with a fitting tribute to the Greeks in the form of the Greek alphabet !

The book is primarily an introduction to quantum mechanics, and as such necessarily contains a fair amount of material already available elsewhere. For example, the theory of the harmonic oscillator and of the hydrogen atom have already been given in many other places. Perhaps for this very reason they are now dealt with at unusual length. Numerous diagrams are given of the wave functions, and with their help the reader should readily grasp the significance of what might otherwise have remained merely a mathematical formula.

The book is highly recommended as a textbook of practical quantum mechanics. It is well balanced and very readable ; the diagrams are workmanlike and the index good. Each chapter includes about half a dozen problems, and many suggestions are made for further reading. Unfortunately the book, like many others from the United States, is rather expensive. W. G. P.

Physics for College Students :
an Introduction to the Study of the Physical Sciences. By Prof. A. A. Knowlton. Second edition. Pp. xxi +623. (New York and London : McGraw-Hill Book Co., Inc., 1935.) 21s. net.

THE author is to be congratulated on the production of an original and stimulating work which amply justifies the study of physics as a cultural subject. The treatment is based on the doctrine of energy, and, while it is quite elementary, making very little appeal to mathematics, it is closely reasoned, alive and in touch with reality, and calculated to keep the reader's mind constantly on the stretch. The fifty-seven chapters into which the book is divided cover very thoroughly the whole field of elementary physics, and at every step of his progress the reader may test his knowledge by means of well-selected quantitative examples and ingeniously devised topics for discussion.

A notable addition to the elementary literature of the subject. A. F.