

to understand, has by now been rectified.

So much for the major benefits of this book. There may also be a minor one: Does it not reinforce the slowly growing and rather welcome view that relativists and cosmologists are a little useful after all?

* * *

The reviewer is a professor at the Southwest Center for Advanced Studies in Dallas, which has cosponsored the series of international Texas Symposia on Relativity and Astrophysics in recent years.

Two textbooks without teachers

PROGRAMMED PHYSICS, PART 4: KINETIC THEORY AND THERMODYNAMICS. By Alexander Joseph, Daniel J. Leahy. 208 pp. Wiley, New York, 1967. Paper \$4.95

PROGRAMMED PHYSICS, PART 5: TOPICS IN MODERN PHYSICS. By Alexander Joseph, Daniel J. Leahy. 269 pp. Wiley, New York, 1967. Paper \$4.95

by Gerald L. Pollack

These two books are the concluding texts for a one-year programmed course in physics. They are intended for senior high-school students and for liberal-arts majors in the first year of college. The mathematics does not go beyond intermediate algebra.

Part IV of this series is an elementary introduction in two chapters to the kinetic theory of gases and to heat and thermodynamics. The first chapter starts with definitions of density, pressure and temperature, and, with these as a base, it works up to problems in Boyle's law and Charles's law. The postulates of kinetic theory are then put forth, and the development goes through discussions of Boltzmann's constant, the van der Waals equation and the Joule-Thomson effect. The second chapter is an elegant, simple introduction to thermodynamics. It contains a careful discussion of the first law in the form $\Delta U = Q - W$, and includes numerical examples and treatment of adiabatic and isothermal processes. The second and third laws are also stated and discussed, but not as thoroughly.

The authors have an ingenious talent for teaching the student to solve rather complicated problems by leading him through a series of easier problems. In this way one is taught to find the equilibrium for problems in which two bodies with different specific

heats, masses, temperatures and phases are mixed. In the same manner the student learns how to solve several problems in thermal conduction and radiation. The problems are good ones, and well constructed tables give the student a good idea of what the appropriate magnitudes are for different materials. There are also good discussions of thermodynamic processes in the p-V plane, including isobaric and isochoric paths, cyclic processes, and finally a thorough treatment of the Carnot cycle and efficiencies of heat engines. There is an interesting section on entropy in terms of order and probability, and there is also practice in the use of the expression $\Delta S = Q/T$. This book is highly recommended to its intended audience, but it is only an introductory account. Some of the subjects that must be omitted at this level are free energies and other thermodynamic functions, chemical potential, temperature dependence of most thermodynamic quantities, and the Maxwell relations.

Part V is an introduction to modern physics in three chapters: wave-particle duality (blackbody radiation, photons, quantized energy), atomic physics (Rutherford atom, hydrogen energy levels, spectroscopy) and nuclear physics (radioactivity, nuclear reactions, binding energy, K capture). This is a book with a lucid presentation, a reasonable balance of emphasis and, like its predecessor, many other strong points. The presentations of the Compton effect, the detailed development of spectroscopy, and of nuclear reactions are all excellent. The treatment is somewhat old fashioned; for example, there is little mention of modern developments of solid-state or particle physics.

Both of these are books from which an interested student could really learn a good bit of physics without a teacher. At the beginning of each chapter the authors outline the objectives precisely, and at the end of each chapter there are good reviews and problems to test further mastery of the material. The bulk of the books is a well ordered presentation of the material in the form of narrative-question-answer. The questions are well chosen, precise and form a continuous story; the narratives are lucid and to the point. Difficult ideas are repeated, but the repetition is unfortunately not sufficiently spread out over the book. Many ideas are made clearer by fre-

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A German Source Book in Physics

By K. B. BEATON, *University of Sydney*; and H. C. BOLTON, *University of Monash*. Designed as an aid for undergraduate or postgraduate students learning to read scientific literature in German, the selections in this volume are from original papers and important books published during this century that are significant in the development of physical ideas. The text has been annotated so that the linguistic complexities should not prove a hindrance to the understanding of the scientific content. Cloth, \$11.20; paper, \$5.60

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Edited by B. T. M. WILLIS, *University College, Cardiff*. Recent research on the magnetic and nuclear elastic scattering of thermal neutrons is reviewed by leading workers in the field based on papers presented at an international summer school held at Harwell in July 1968 on Accuracy in Neutron Diffraction. This work has led to new information on the electronic and nuclear charge distributions in solids, and the book should be of interest to crystallographers, solid-state physicists, and chemists. 130 text figures. \$9.60

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quent reference to good figures (fold-out panels) at the backs of the books. Better use is made of these figures than in standard textbooks since many detailed questions are asked about them and the student develops a taste and habit for seeking out the details of a figure.

Some of the weaknesses of the books are inherent in programmed texts. It would be nice if the narrative sections were a little longer and told the student a lot more than he needs to know to answer the questions. As it is, the questions come with an uncomfortably high frequency. It would also help if there were some really difficult qualitative questions so that the student would have deep problems on which to sharpen his imagination.

* * *

Gerald Pollack, a professor at Michigan State University, often teaches freshmen and sophomores who are either science or liberal-arts majors.

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