Book Reviews

Introduction to atomic physics. (Rev. ed.) Henry Semat. New York: Rinehart, 1946. Pp. xi + 412. (Illustrated.) $4.50.

The increased need for training and understanding in atomic and nuclear physics brought about by the spectacular advances in "atomic energy" makes most timely this revised and enlarged edition of *Introduction to atomic physics*. The title refers to "atomic" not solely in the classical sense but in the modern sense in which the nucleus plays a major role.

The book is obviously written by a careful teacher with both the instructor's and the student's viewpoints in mind. The typography and illustrations are attractive, and there is at least one figure for every two pages of text. As a concise, one-semester, college-level introduction to the world of atomic physics, the book is admirable. It quickly leads the student into the realm of the infinitesimally small by an exposition that is attractive, yet surprisingly thorough. As a survey, the book is comprehensive and lends itself to self-study for the scientist in other fields. In each chapter there are problems which illustrate well the magnitudes of various factors involved and references to excellent texts which contain more subject detail. There is a nice balance between development of theory and illustration by experiment. Calculus is used in the theory only occasionally and then at an elementary level. When a mathematical proof is long, it is removed to the appendices.

The text does not unfold in the customary historical manner, which too often confuses the student, but breaks naturally into three general parts by category. "The Extranuclear Structure of the Atom" and "The Nucleus" are preceded by a section on "Foundations of Atomic Physics," which occupies roughly half the book. This section is logically divided into an essential short résumé of classical electricity and magnetism, which is immediately put to practical use to interpret both the wave and particle manifestations of atomic structure. These follow under the three headings: "Elementary Charged Particles," "Electromagnetic Radiation," and "Waves and Particles." Alpha particles, cathode rays, electrons, ions, and even the mass spectrograph and stable isotopes are discussed under the first heading; photoelectric effect, Zeeman effect, and X-rays are embraced under the second; and the duality concept of waves and particles, electron diffraction, Heisenberg's uncertainty principle, and Schrödinger's equation are masterfully treated in the third.

The hydrogen atom is discussed from the viewpoints of both quantum and wave mechanics, in the portion devoted to the extranuclear structure, and is followed by sections on atomic spectra and electron distribution.

Part III, "The Nucleus," consists of chapters on "Natural Radioactivity," "Disintegration of Nuclei," and "Nuclear Energy." This part has been brought up to date to include concise but adequate treatment of nuclear reactions produced by various bombarding particles, radioisotope production and properties, nuclear transitions, fission, photofission, transuranic elements, chain reactions, and even an atomic bomb! Future editions will no doubt contain an expanded Part III.

There is the unorthodox but effective separation of Rabi's magnetic resonance method from the Stern-Gerlach experiment. The theory of the betatron is not juxtaposed with that of the cyclotron and electrostatic generator but is included as a new and different type of X-ray source in the discussion on X-rays. The latter was done not without recognition of the development of the betatron as a means of nuclear and cosmic-ray study, but probably to introduce early in the book an application of electromagnetic principles in a useful modern device.

This reviewer found both the arrangement and the content stimulating. The book is recommended without reservation for starting the college-level student on his way to a technical understanding of the atomic age.

PAUL C. AEBERSOLD
Isotopes Branch, U. S. Atomic Energy Commission, Oak Ridge, Tennessee

Explosion and combustion processes in gases. Wilhelm Jost. (Trans. by Huber O. Croft.) New York-London: McGraw-Hill, 1946. Pp. xv + 621. (Illustrated.) $7.50.

For those unable to read German, the translation of this important work should serve a useful purpose. Those at home with German, or moderately so, will derive a distinct advantage from the German edition in an appreciation of the spirit behind the original documentation—something that the reviewer considers lacking in the translation. While the translator performed a faithful and creditable work, the worker in the field of flame and combustion must be disturbed by the awkwardness of expressions, which make reading and sometimes comprehension difficult. For example, the following sentence occurs on page 22: "According to whether the surface in question introduces or breaks off reaction chains especially vigorously, the surface will begin to be effective at particularly low or only at very high temperatures." If one substitutes the accustomed word usage of the field of chain reactions—"initiates" for "introduces," "terminates" for "breaks off," and "efficiently" for "especially vigorously"—the sentence then becomes meaningful. The usual term, "Faraday dark space," is translated as "Faraday dark section."

We again find incorrect translation in the definition of the auto-ignition process (p. 1). The translator has written: "Auto-ignition processes include all those phenomena based upon the fact that, in an explosive mixture heated to an infinitesimal degree, the rate of reaction as the result of the infinitesimal change increases beyond all bounds." Jost says (correctly): "Auto-ignition processes are all phenomena based on the principle that in an explosive mixture heated to onset of barely noticeable reaction, the reaction velocity ultimately increases beyond all limits as a consequence of this primary small chemical change."

The reviewer does not know the extent of trivial errors in the book, but a brief random search revealed the following: the date "1935" instead of "1939" (p. vii); "methane yields" instead of "methanol yields" and "O_3" instead of "O_2" (p. 415); and "$C_{14}H_{66}$" instead of "$C_{34}H_{66}$" and "substance" instead of "substances" (Table 12, p. 581).

The author index appears incomplete, but mathematical equations seem to be reproduced faithfully and well, and the arrangement and typography are excellent. A conversion table from c.g.s. to f.p.s. has been added by the translator.

Apparently, in his zeal to couple Jost's book to the much-publicized and fetching term, "jet propulsion," the publisher has misstated on the cover page that the book is "A translation of the classic German work on jet propulsion." This, Jost's book is not—the term "jet propulsion" does not even appear.

Despite the above, this translation should fill a needed gap for those who, for one reason or another, have been deprived of reading Jost's book in the German.

BERNARD LEWIS

Explosives Division, Bureau of Mines, U. S. Department of the Interior

Basic mathematics for technical courses. Clarence E. Tuites. New York: Prentice-Hall, 1946. Pp. xiv + 309. $5.00.

This book covers the material usually treated in trigonometry and precollege algebra courses. The approach is standard but is in some respects better suited to the needs of the technical man than most existing texts. The author is to be commended on the representative choice of problems from all fields of engineering, the inclusion of Kirchhoff's laws in his discussion of linear equations, as well as the use of j for $\sqrt{-1}$ instead of i, so easily confused with electric current. On the other hand, the viewpoint is not rigorous. The author tends to talk around his subject instead of saying exactly what he means. By the addition of four or five pages the presentation could be made mathematically correct without detracting from the clarity of the subject.

Needless to say, the average elementary textbook on mathematics is in some respects a hundred years behind the times, each author copying over the errors of the preceding. Thus, Tuites introduces the "axioms" of equality as "self-evident truths," a notion long outmoded but still persisting in the textbook literature. The treatment of number is incomplete, although more of the logic is included than in many comparable works.

It is assumed here that the reader is familiar with the operations of multiplication, division, addition, and subtraction. Many excellent short cuts for performing these operations in special cases are given, such as adjoining two zeros and dividing by 4 instead of multiplying by 25. Although these short cuts are in common use, they are seldom listed for the student. Significant figures, the checking of computations, and other arithmetical topics are brilliantly explained.

The book begins with a discussion of the slide rule, so that if the reader does not reach the chapter on logarithms, he will at least know about this application. From arithmetic the reader is led to polynomials, radicals, and imaginary numbers. The latter are explained geometrically through rotations, a popular viewpoint. With this background the reader is introduced to the solution of algebraic equations. Since this subject is not carried very far, the extremely useful process of synthetic division is not attained. The book closes with some chapters on plane trigonometry which leave little to be desired. Five-place tables of logarithms and trigonometric functions are given at the end.

Written by an instructor at the Rochester Institute of Technology, this book was intended for industrial and extension schools, as well as for technical institutes and junior colleges. The book is particularly well suited to the man who has forgotten his algebra and trigonometry or who has never studied these subjects and wishes a clear, elementary, and practical presentation. Except for questions of rigor, which would normally not bother the average reader, this work is admirably adapted to the purpose for which it was written.

RUFUS OLDENBURGER

Illinois Institute of Technology, Chicago

Physical chemistry. H. Hunt. New York: Thomas Y. Crowell, 1947. Pp. x + 610. (Illustrated.) $4.75.

In the preface to this text, the author states, in part: "Since one cannot be sure what the future chemist will need to know, all the fundamental topics of physical chemistry are presented with proper regard to their relative importance." It would be difficult indeed to find a topic of interest to physical chemistry which is not at least mentioned. Many topics are given a more thorough and precise treatment than is customary in the usual text for beginners in physical chemistry. Among these topics are: kinetic properties of gases, crystal structure of solids, atomic spectra and structure, chemical kinetics, and theory of electrolytic solutions. The large number of tables of data, the many illustrations, and numerous problems add much to the value of the book.

Specific objections can be made to details of treatment of some of these topics, but in general a fairly successful compromise is made between a completely rigorous and a descriptive treatment. The compromise would be much more successful if a more orderly presentation had been made. It was the announced plan of the author to make each chapter as nearly as possible an independent unit. As a result of this plan, concepts are frequently introduced which are not explained until several paragraphs or even chapters later. This requires considerable search on the part of the student and instructor to find the necessary background for a given deduction. This search might in itself be a good thing in the case of a large reference work, but in this text it leads to excessive repetition of concepts and equations. Preferably, the material of a text should be presented in a unified, logical order. The extent to which a given topic is to be pursued could be left to the instructor, as it must be in any case.

The treatment of elementary principles of thermodynamics is confusing and is the part of the text most open to criticism. Many formulas which are true only for the ideal gas are given without this qualification. The inexperienced student will no doubt believe that the relations have general validity. An example of this can be seen on page 90, especially the latter part of equation (3–2), and several unnumbered relations near by. Several equations in this section are in error or are misprinted. The statement of the second law as $\Delta F = \Delta H - T\Delta S$ (p. 98) may not be helpful to the student, since the entropy, aside from a complicated "definition" on page 93, is not discussed and explained until page 112. The function F is