Book Reviews

Aspects of Physics

The Encyclopaedic Dictionary of Physics. vols. 1, 2, and 3. J. Thewlis, Ed. Pergamon, New York, 1961. $298 (per set of 9 volumes, announced for publication during 1961–1962).

This review covers the *Encyclopaedic Dictionary's* first three volumes, with entries ranging from "Abbe Refractometer" to "Intermediate Image." The amount of material contained in these three volumes, covering over 2500 pages, is very considerable indeed. The main purpose of such a compilation is presumably to serve as a guide and reference work to a variety of users: teachers, research workers and other practicing scientists and engineers, and college and possibly high school students. It seems that the pertinent criteria for judging this work are: How useful is it to how wide a group of readers; how accurate and up to date is the information offered; is it presented clearly and at a level accessible to a scientifically minded or educated person? And last, is there a reasonable balance in the space allotted to various subjects?

It must have been an unenviable task for any editor to define the boundaries of what we call physics. How much of mathematics, chemistry, and all branches of engineering—from electronics and aeronautics to metallurgy and hydraulics—is it proper and desirable to include? The editors have done well not to restrict this work to something one might call "pure physics," but have deliberately included "applied" physics in all fringe fields substantially based on physical reasoning. This includes in particular: geophysics (including meteorology), astrophysics, physical chemistry (including description of elements and a selected list of compounds), electronics, physical metallurgy, and even such topics as hydraulics, ballistics, air conditioning, and the like. Not forgotten is the arsenal of instruments, from eye and ear to flow-meters and electronic counters.

As said before, the wealth of information spread out is marvelous; yes, physics is so many, many things. Is it, indeed? I could not help being disturbed to see how physics is here chopped up into small pieces and, in this maze of detail, transformed almost beyond recognition; all that survives are a set of rules and laws and the sum of their applications. Part of this appearance is certainly due to the fact that an alphabetical rather than thematic arrangement of topics does not easily lend itself to a clear and impressive presentation of the conceptual unity of physics as a science. To counteract this would have been worth a special effort; instead, it appears that time and again occasions to do so are missed. For example, under "Electron" we read about the discovery of its wave properties; it is said that this led to a new branch (!) of theoretical physics," . . . which has led to fruitful advances in all fields of the subatomic world, and has also affected our ideas on the solid state of matter." Fruitful advances, indeed, but why such an understatement? Even in a dictionary, with all the inevitable attention to detail, one might expect some discrimination between the essential and the unessential. It is disturbing to see ½ page given to "Boltzmann equation" or "Fermi-Dirac statistics" but 2½ pages to "Buckling" of structures. And "Humidity control" should not control more space than "Conservation of energy," (with $E = mc^2$ mentioned *en passant*), at least not in a dictionary of physics. As a result of this, the work has, by and large, the character of a handbook, tailor-made for the ever-more abundant species of "scientifically" oriented engineers; indeed, in all likelihood it is exactly to this afore-mentioned group of professional people—concerned with the application of rather advanced physical concepts to practical engineering and research problems—that such a handbook would be most particularly useful. But the serious student of science, if he hopes to get some insight from this source, may get somewhat shortchanged. He may easily find out what an electric dry cell is made of (if he cares), the central carbon rod, manganese dioxide mantle, and so forth; he will have a much harder time finding out on what principle it works and where the 1.5 volts really come from.

Well, these remarks deal with the "spirit" of the presentation of material, and a few words must be added to deal with the coverage of subjects. This is quite complete, with no visible omission, and almost everything—from "Electroplating" (3 pages!) to "Feynman diagram," from "Hamilton-Jacobi theory" to "Huygens' principle," from inertial guidance to Maxwell's equations—may be found. It must be said that there are very many excellently written contributions, and by and large the classical fields are very well covered and presented. On the other hand, however, not all articles are equally accessible even to the scientifically educated. There is an article on "creation and annihilation operators"; the "commutator" of two such operators is mentioned there; but there is no way of finding out what a commutator is, let alone what it means. This points out the limitation of any such project. A dictionary is not a substitute for a textbook. It is a valuable feature of this present work that most leading articles are supplemented by a list of references to textbooks, review articles, and basic research papers.

The number of individual contributors is impressive; this adds another curious feature—perhaps intentional—that a variety of authors have contributed to very closely related subjects, with very substantial overlap at times. There are, for example, over 20 entries on "Diffusion . . . ," showing a great spread in lucidity, level, outlook, and very considerable duplication. An editor's strong hand might have been able to do some good here. One is also offered an opportunity to learn Coulomb's law over and over again. Looking up "Cross section," one has

the choice of "Cross section for collision" and "Cross section for scattering" trying to say the same thing again, without succeeding quite as well.

Whatever such flaws may be, this work is a serious and monumental endeavor, and will be a very useful addition to the "first aid" kit of any library in colleges, schools, and industrial research labs. Its price will probably put it outside the reach of most individuals. Printing and presentation are excellent.

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Mankind in History

The Story of Man. From the first human to primitive culture and beyond. Carleton S. Coon. Knopf, New York, ed. 2, 1962. xxxviii + 438 pp. Illus. + plates. $7.50.

The anthropologist's view of history is a different view that covers a million-year span, most of it before the written record began. The anthropologist's history is concerned with major changes in the ways of life, in the arts and the sciences of living. To the anthropological mode of thought the potato was more important to Ireland than Parnell, taro more world-shaking than the Council of Trent, and the Polynesian sampan shares equal glory with the *Santa Maria.*

But such a world view demands a unique guide, fitted with twenty-league boots, a curator's eye, and an adventurer's spirit of adventure. It demands personal familiarity with archeology and experience in human biology, minus the usual circumlocutions. And this job description perfectly fits Carleton Coon, who, in numerous books (including at least one novel), has prepared himself to tell *The Story of Man.*

Within 425 pages and a 10-page glossary the history of man is compressed, from the protohominids that deserve cogeneric billing with us to the age of the working atom. Halfway through the book, man (and Coon) are still in the Neolithic. Not until perilously near the end does he come to the "rise of America." This is a proper and important antidote to the parochial view of world history.

This handsomely illustrated and beautifully printed second edition is a Christmas book and a birthday book, ideal for grandparent and niece. Besides, it is a useful nucleus for a general education course, and downright interesting reading. One can read about, and see pictured, advances in man's conquest of the world, from the axes and scrapers of the Paleolithic to the mass-production of power.

True, one can question Coon's acceptance of the Improbable Snowman, and his stop-press delight with a "still undescribed fossil from Jordan." One may ask why Coon, leader in showing climatic adaptation as a cause for racial differentiation, has not given equal time to malarial selection (responsible for hemoglobin S and GSH polymorphisms) and smallpox selection (probably responsible for regional variations in ABO frequencies). But praise be to Coon for picturing Neanderthal, not as a stoop-shouldered slouch, but as an intelligent man as sapient as we, plagued with arthritis (and submissive to surgery). And good for the discussions of important and controversial problems, like the origin of maize and the distribution of the yam, that involve half of the peoples of the world.

This is an excellent book for spouse, progeny, or colleague to read in bed, by the fire, or at sea. But it is deceptive. The scientific reader may not realize, until he has put it down, that *The Story of Man* is neither popularization nor oversimplification but an expert, if selective, account of the story of man.

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Corning Glass Monographs

Analyses of Ancient Glasses, 1790-1957. A comprehensive and critical survey. Earle R. Caley. Corning Museum of Glass, Corning, N.Y., 1962. 118 pp.

This is an excellent book, which lives up to its title and subtitle. The chapters are "Early investigations," "Investigations of the past half century," "Egyptian glass," "Near and Far Eastern glass," "Roman glass," and "Altered or decomposed ancient glass."

The discussion is critical and scholarly, both of the analyses themselves and the provenance of the samples. The question as to where glass was made first, in Egypt or in Asia Minor, "is a question that cannot be answered decisively at present." Specimens from Abu Shahrein (Iraq) and from Tell Asmar, both dated about 2600 B. C. "are certainly the oldest known specimens of glass," except possibly a few Egyptian beads claimed to be of earlier date but not proved to be so. However, there is no actual proof that either of these specimens was composed of glass manufactured in Mesopotamia. It is interesting to note that the first analyses of an ancient glass were made by Kloproth, in 1801, on three samples of Roman glass.

This is volume 1 of "The Corning Museum of Glass Monographs". It is to be hoped that the succeeding monographs will live up to the high quality of this one.

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Basic Axioms and Theory

Quantum Mechanics for Mathematicians and Physicists. Ernest Ikenberry. Oxford University Press, New York, 1962. xii + 269 pp. Illus. $8.

This book, which should prove to be a valuable contribution to the literature of physics, is written on a level intended for first-year graduate students. The author is primarily interested in giving a clear, logical presentation of the mathematical foundations of elementary quantum mechanics. The basic axioms are presented; the theorems which follow from them are clearly stated and are either proved in the text or are relegated to a series of problems of gradually increasing complexity. (There are 352 of these problems throughout the book, and they should prove of immense value to one who is trying to understand and learn the subject matter.) Particularly good are the chapters on the mathematics of linear operators, the solution of the harmonic oscillator by factorization, eigenfunctions and eigenvalues, matrix representations, and above all the chapter on measurement theory, in which the basic theorem on the relation between commuting operators and compatibility of observables is discussed.