

Book Review

Elementary Radiation Physics. By G. S. Hurst and J. E. Turner. John Wiley and Sons, Inc., New York (1970). 152 pp. \$7.95.

Despite its rather broad title, this book basically considers only those topics of radiation physics related to health physics, with some discussion of the latter. Slightly more than half the book treats radioactivity and related phenomena along with the physical interaction of particles and waves with matter. The other half of the book is almost equally divided among four chapters on the biological effects of radiation, dosimetry (principally neutron), x-ray technology, and some practical applications of radiation and radioactive materials.

As the book contains only 152 pages, including several pages of problems and several large pictures, obviously one can not expect a too detailed coverage of individual topics. However, for the book to meet its avowed aim of providing a good introduction to the subject and thus be suitable for college or short-course use, one can reasonably expect it to consider essentially all aspects of its subject and to treat the various topics equitably and at a reasonably consistent level. Unfortunately, none of these conditions appears to be met effectively.

Most of the topics germane to the general subject are mentioned, but too briefly in many instances to be of much value, and calculus should be included in the "limited knowledge of mathematics" needed (according to the Preface). A general unevenness in topic treatment is probably the book's greatest weakness. For example, the chapter on dosimetry considers the tissue-equivalent ionization chamber and the fast-neutron proportional counter in considerable detail, but barely mentions film meters and omits even naming various other useful and commonly used devices. The physical basis for radiation detecting units using ionization methods is mentioned, but instrumentation based thereon is omitted. Many of the more useful nuclear reactions for health physics are given, but radioactive series are not identified, much less detailed.

The short section on radiation biology, particularly as related to overall effects on man, mentions many of the high-level radiation-caused effects, but almost in a summary style that is frequently so sketchy as to require considerable amplification to be of much value. Dose-effect relationships are generally qualitatively presented, although a table relating dose to the acute radiation syndrome is included, as are several graphs, mostly of specific experiments. No mention is made of information obtained at

low-dose levels and, similarly, many other useful dose-effect relationships are not included.

The descriptions of the applicability of radiation are excellent, although limited almost entirely to radioisotope use. About the only description of practical radiation protection concerns x rays, including some interesting historical information on the early University of Kentucky x-ray equipment and activities, but it is not mentioned that the general methods, rather briefly and sketchily described, can be useful under other conditions. A table of 1965 ICRP recommendations for external exposure is the only radiation protection "standard" specifically given. Almost no attention is paid to internal doses, much less determinations thereof, and the concept of a "body burden" is not even mentioned. However, the existence of MPC values for air and water is stated, without any specific values and with little indication of their importance, and some radiobiological information on a few radioisotopes is tabulated for medical, not health physics, reasons.

Several sections, particularly those on absorption and penetration, are rather confusing. Mass absorption coefficients are graphed, but actual absorption is almost exclusively treated by linear coefficient concepts. What the authors call "good" geometry and "poor" geometry for absorption with scattering would probably be better expressed as related to narrow-beam and broad-beam absorption, and "total," "true," and "scattering" absorption coefficients are certainly far from universal terms!

The sections on atomic and nuclear physics are adequate and reasonably complete. Neutron physics is particularly well described, even though the concept of a nuclear cross section is introduced as a nucleus interaction with gamma rays and is barely mentioned with respect to neutrons. Gamma-ray attenuation is treated as a photon (particulate) phenomenon whereas the inverse square law is invoked only for particles having a range, and its practical application is not even mentioned.

Several somewhat disturbing errors were noted, such as the generalized graph indicating the α line in x-ray spectra as having a shorter wave length than the β or γ lines. The writing style is readable, but a statement that "Alpha particles are produced with enormous cross section (3800 barns) when thermal neutrons interact with ^{10}B " is rather startling.

Throughout, the authors describe risk vs benefit as the criterion for radiation use, but nowhere is there an indication of how such a criterion may be applied nor of conditions where such a balance has been attempted. Similarly,

the authors generally refer to any effect of radiation on living material as being radiation damage.

The Appendix includes an interesting historical outline and the Index is adequate. Very few bibliographical references are given, and none of a general nature that would give a source for further investigation of the subjects treated in this volume. The problems at the end of each chapter are instructive in themselves as are the graphs of specific experiments.

Overall, the uneven and sketchy treatment of the subject matter in depth and level of difficulty, and the absence of some matters generally considered important to the subject, tend to limit the usefulness of this book. Contrary to the aim expressed in the Preface, it would be unsatisfactory as a text for college or professional short courses without concurrent heavy dependence on other references. It probably would not be a particularly informative introduc-

tion to the general subject for the lay reader, and there are better books available for those with greater interests.

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