gives an incorrect value for the permissible concentration of radon—instead of 10^{-8} curie per liter, it should be 10^{-11} curie. Permissible water concentrations given in this table do not specify the unit of volume measurement. "Blanket" levels, such as these, are better omitted since, even for specific radioactive materials, levels are still controversial.

There are throughout the book many general statements which should be qualified, or the fact that they have not been definitely established should be noted. For instance, on page 53 it is stated that the neutron has great power of penetration without specifically noting that the discussion refers to fast neutrons. On page 74 it is stated that reversibility or irreversibility of radiation effects depends on the radiation dose. This is not always true since it is fairly well agreed, for example, that point mutations are irreversible independent of the size of the dose. On page 123 it is stated that in an individual exposed to radiation, "nothing may be noted for long periods and then with great dismay one may find he is irretrievably damaged and perhaps doomed". It is generally believed, however, that such a phenomenon can occur only if no attempt is made to detect early changes and that, in the vast majority of cases, early radiation damage which does not doom the individual can be detected without excessive difficulty. On page 135 it is mentioned that "since it is probable that the human race already has quite a large burden of unfavorable recessive mutations, any addition is to be distinctly avoided". The opposite point of view, however, can be taken—that, since every individual does have a large number of unfavorable recessive mutations, a small increase in this number will probably not be of practical significance. Incidentally, the dose rate from cosmic radiations is said to be a few hundredths of a milliroentgen per day but in general at sea level it reaches 0.2 milliroentgen per day. On page 135 one finds the statement that "changes in the chromosomes tend to be permanent and reproduce themselves" without specifically mentioning that chromosome aberrations, and of course dominant lethals, may be rapidly lost in natural populations. On page 139 it is stated that lung carcinoma in the miners in Bohemia and Saxony has been attributed to exposure to uranium, whereas in fact it has rather been attributed primarily to radon and radium exposure. This distinction is of considerable practical importance because in the atomic energy industry there are exposures to uranium without necessarily any exposure to radon or radium.

While the above discussion indicates that the reviewer is highly critical of this book, nevertheless he feels that there is a large amount of useful information in it. There are excellent descriptions of the pathological and hematological changes resulting from radiation and a large portion of the fundamental physics and the description of instrumentation is excellent. The chapters on radioactive isotopes and tracer methods should be extremely helpful to those concerned with these aspects of atomic medicine. A valuable step forward has been taken by the editor and authors in attempting to gather together in one volume a large body of scattered information and to present it in interesting and understandable fashion.

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Two on Heat

HEAT TRANSFER, VOLUME I. By Max Jakob. 758 pp. John Wiley and Sons, Inc., New York, 1949. $12.00.

A TEXTBOOK ON HEAT. By J. H. Awbery. 302 pp. Longmans, Green and Company, Inc., New York, 1949. $3.00.

The first impression one has of Jakob's *Heat Transfer* is of the immense amount of work it represents—a thick volume with 240 figures, 91 tables, and two thousand-odd equations. The second is a feeling of satisfaction—to this reviewer at any rate—at the appearance of the third book in as many years largely concerned with the subject of heat conduction. This is more attention than this subject, which may seem a bit old-fashioned in comparison with its more up to date sisters, such as electronics, has had in the preceding decade. Heat conduction, however, takes up only half the present volume, the balance being devoted to convection and to the general basic equations, while Volume II, which is in preparation, will be concerned mostly with radiation and fields of application.

The author is more than just another authority on the subject of heat transfer. When it comes to fulfilling one of the principal aims set forth in the preface, which is to make more readily available the European work, mainly German, of the last quarter century, it would probably be impossible to find another as well fitted for this task. The half a hundred references under his name in the bibliography—a circumstance for which he quite unnecessarily apologizes—evidence the truth of this statement. The extent to which the above aim is carried out is indicated by the fact that some forty percent of the references are German.

The author develops the basic theory of heat conduction and makes many of the customary applications, but with surprisingly little overlapping with other recent books on this subject. The treatment of methods of measuring conductivity and the discussion of crystalline and amorphous bodies are among the many topics which will appeal to the physicist, while the thoroughgoing consideration of a large number of technical applications—one of the most extensively treated is that of cooling *fins*—will appeal to the engineer. The discussion of special mathematical methods and of numerical and graphical solutions is also very good. In the part on convection the reader will like particularly the description of optical methods, i.e., schlieren and interferometry, especially if he has been hunting for a good condensed description of these important techniques.

It seems to be expected of a reviewer that he point out some flaws, even if, as in the present case, they are of small importance. In deference to this tradition then it is suggested that the author has occasionally developed some feature to an extent which seems a bit out of proportion, that more use might profitably be made of the line source integral of page 707, and that the problems would be more

useful if answers were included. These, however, are almost negligible defects in an exceedingly well written and well printed book. All its readers will join with the reviewer in looking forward to the appearance of the second volume.

In Awbery's *Textbook of Heat* we likewise have a book written by an acknowledged authority. The author's standing as a physicist and his long connection with the National Physical Laboratory and other English scientific research organizations give this assurance. The book is also very readable and while it does not have the bulk of many similar treatises it is reasonably complete and few subjects which one would expect in a book of this character are untouched. However the balance of the different parts may not be what one usually finds, because, as the author remarks in the preface, he has not hesitated to "jettison traditional material" if he does not consider it of real importance.

The usual subjects of thermometry, calorimetry, heat transfer, change of state, and similar topics are treated with some emphasis, as might be expected, on the experimental side. The chapters on properties of gases, liquids, and solids seem particularly well done and the two on statistical mechanics and on the applications of thermodynamics to chemistry form a welcome and up to date, if all too brief, addition, by no means always present in even the most recent books of this character.

The reviewer has few criticisms. One might perhaps ask for a little fuller discussion of the laws of thermodynamics and also more kinetic theory. While much of the treatment is almost nonmathematical, the mathematics in a few cases slow down the reading more than would seem necessary. The treatment of conduction is a case in point. While the use of Fourier Series is all to be praised, one or two of the illustrative problems are unnecessarily complicated.

The book is well printed on light nonglossy paper and is adequately but by no means over illustrated with fifty line drawings. Its small bulk and weight are points in its favor in the eyes of one who, like the reviewer, likes to carry a book around with him.

In the introduction the author regrets that he has never been a teacher. This lack of pedagogical experience is by no means evident in the book, which commends itself to all who are looking for a text on heat to follow the general college physics course—assuming, of course, that the student has some knowledge of calculus, as would almost always be the case.

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Good Reference

THERMODYNAMICS. **By E. A. Guggenheim. 394 pp. Interscience Publishers, Inc., New York, 1949. $6.50.**

This is a very authoritative book, and although the emphasis is on applications, Guggenheim does not lose sight of the necessity for mathematical rigor. One may well use the book as a reference whenever at a loss to understand the thermodynamical principles. It is too advanced and sophisticated for use in an undergraduate course, but it would be excellent for instruction on a graduate level. Guggenheim covers in great detail all of the general aspects of thermodynamics, including systems of one and two components with and without chemical reactions, extremely dilute solutions, electrolytes, electrochemical systems, gravitational fields, magnetic and electrostatic systems, and radiation.

Guggenheim presupposes the knowledge of statistical mechanics. This is very refreshing as most thermodynamics books infer that statistical mechanics is a thing apart or does not exist. He states the third law as the ability to calculate absolute entropy by the use of statistical mechanical methods. His treatment of the absolute entropy of a substance containing a mixture of isotopes is somewhat involved but so is the phenomenon which he is trying to describe. His treatment of two component systems is detailed and excellent. The sections on solutions and electrolytes are particularly good, which is understandable since Guggenheim is recognized as the grand master in this field.

Unfortunately, there are very few references to modern literature, so that this treatise cannot be represented as complete or up to date. As a matter of fact, in many respects it is the same as his 1933 text, *Modern Thermodynamics by the Method of Williard Gibbs*. There are still many research aspects in thermodynamics, such as the development of an adequate equation of state for liquids and solutions, and no book in thermodynamics can treat these subjects in an altogether satisfactory fashion until the fundamental problems are clarified. Nevertheless, this reviewer is glad to have a copy of Guggenheim's new book and believes a great many physicists and chemists would feel the same.

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Books Received

THE MATHEMATICAL THEORY OF COMMUNICATION. By Claude E. Shannon and Warren Weaver. 117 pp. University of Illinois Press, Urbana, Illinois, 1949. $2.50.

AN INTRODUCTION TO LUMINESCENCE OF SOLIDS. By H. W. Leverenz. 569 pp. John Wiley and Sons, Inc., New York, 1950. $12.00.

SOUND ABSORBING MATERIALS. By C. Zwikker and C. W. Kosten. 174 pp. Elsevier Publishing Company, Inc., New York, 1949. $3.00.

TRILINEAR CHART OF NUCLEAR SPECIES. By William H. Sullivan. John Wiley and Sons, Inc., New York, 1949. $2.50.

PROCEEDINGS OF THE AMERICAN PHILOSOPHICAL SOCIETY. Pages 521–548. American Philosophical Society, Philadelphia, Pennsylvania, 1949. $0.50.

L&N BIBLIOGRAPHY OF POLAROGRAPHIC LITERATURE. 103 pp. Leeds and Northrup Company, Philadelphia, Pennsylvania, 1949. Free copies on request.

SPECTROPHOTOMETRY. 48 pp. National Bureau of Standards Circular 484. Government Printing Office, Washington 25, D. C., 1949. $0.25.