pneumatic tubes and tyre life; heat conduction in rubber-like polymers; synthetic elastomers as plasticizers for polyvinyl resins; infra-red spectroscopy in analysis of liquid hydrocarbons; determination of aromatics and naphthenes in complex mixtures containing olefins; Deniges reagent test for *tert*butyl and *iso*propyl alcohols; short-cut methods of infra-red analysis; and determination of antioxidants in gasoline. The book includes a challenging essay on the stake of business in American education, and closes with the mention of ninety-five other publications published in 1947 by members of the group.

Journal of the Institute of Metals

Vol. 76, 1949–50. Editor: N. B. Vaughan. Pp. xxvi+796+113 plates. 30*s*. Vol. 77, 1950. Editor: N. B. Vaughan. Pp. xxiv+676+83 plates. 30*s*. (London: Institute of Metals, 1950.)

THESE two volumes contain fifty papers and (Vol. 76) a symposium of eight papers on metallurgical aspects of the hot working of non-ferrous metals and alloys, together with the presidential address, and the Autumn and May Lectures of the Institute of Metals. The range of subjects is wide, and all those connected with the science of metals will find much of interest.

It is instructive to examine the sources of the papers, which may be summarized as follows: British Non-Ferrous Metals Research Association, fourteen; universities of Great Britain, ten; Commonwealth Dominions, six; industrial, six; National Physical Laboratory, four; other British government laboratories, three; and research institutions, two. The symposium contains six papers from industrial sources, and one from the British Non-Ferrous Metals Research Association. When compared with the volumes of pre-war years, the increased output of this last-named Association is remarkable. The growth of the Dominion schools is encouraging, but the relatively small number of papers from British government laboratories is regrettable and may well affect the recruiting of first-class men for these institutions. The universities have maintained their position in difficult circumstances; but I feel that the Institute is failing to secure its proper share of papers dealing with the real fundamentals of the science of metals.

W. HUME-ROTHERY

Smithsonian Logarithmic Tables to Base e and Base 10

Prepared by George Wellington Spenceley, Rheba Murray Spenceley and Eugene Rhodes Epperson. (Smithsonian Miscellaneous Collections, Vol. 118: Publication 4054.) Pp. xiii+402. (Washington, D.C.: Smithsonian Institution, 1952.) n.p.

THIS volume is divided into two equal parts, each consisting of two hundred pages. Every page is divided into three parallel columns containing, respectively, the logarithms of n, $1 + n.10^{-7}$ and $1 + n.10^{-11}$, where n ranges through all integers from 1 to 10,000. Those to base e (denoted by ln) appear in the first part, and those to base 10 (denoted by log) in the second part, all entries being given to twenty-three decimal places. In the tables of common logarithms the characteristics are omitted.

A four-page introduction exemplifies the methods of factorization which are most convenient for use in looking up the logarithm or antilogarithm of any given number. To quote a typical example, in which it is assumed that the computer has access to a calculating machine, one can express π, correct to twenty-three decimal places, as

$$3141 \times 1.0^{3}1886 \times 1.0^{7}8307 \times 1.0^{115}638,\ 28195,\ 88209 \times 10^{-3}.$$

The first three factors can be converted into logarithms immediately, and the fourth factor is dealt with by replacing $\ln(1 + x)$ by $x - x^2/2$, and converting, if necessary, to a common logarithm in the usual way. By this method a result for $\ln \pi$ or $\log \pi$ is obtained which contains an error of one unit only in the twenty-third decimal place. In computing antilogarithms, it is, broadly speaking, only necessary to reverse the above procedure.

Finally, it may be said that the book is well bound and that the printing, though sometimes a little irregular, is always legible; there seems little doubt that, in the words of the preface, "the tables should be a welcome addition to those already in existence".

J. H. PEARCE

Tensor Analysis

Theory and Applications. By Prof. I. S. Sokolnikoff. (Applied Mathematics Series.) Pp. ix+335. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1951.) 48*s*. net.

IN the first two chapters of this book, Prof. I. S. Sokolnikoff proceeds by way of vectors, linear transformations and matrices to the theory of tensors. The third chapter fulfils a dual purpose: it applies tensor methods to differential geometry, thus enabling the reader to assimilate the technique by applying it in a familiar field, and also collecting geometrical results which will be needed in the last three chapters. These deal with general dynamics, relativity and the mechanics of continuous media. The general dynamics is treated fully; the relativity is intentionally merely a sketch, since so many good accounts are already available. The author's deep interest in the theory of elasticity makes the final chapter exceptionally valuable. First he gives an analysis of deformation, based on the work of Brillouin and Murnaghan; but then, instead of assuming a linear stress–strain relation, he uses thermodynamical ideas to infer a general theory in which the classical linearized theory appears simply as a special case. A very brief note on fluid mechanics ends the chapter.

The exposition is clear and readable, and some exercises for the reader to work on are included.

A New School Biology

By Dr. F. J. Wyeth. Part 1. Pp. viii+310+xvii. 9*s*. Part 2. Pp. viii+311–587. 8*s*. 6*d*. (London: G. Bell and Sons, Ltd., 1952.)

THESE two volumes are stated to be for pupils taking the Ordinary level of the General Certificate of Education; but it is to be regretted that the author has not considered the content nor the spirit of the syllabus, the time allocation nor the age of the pupils.

A book full of heavy type and italics is to be deprecated, since it indicates what must be learnt without reference to understanding. Facts abound, from the mechanism of the jaws of a snake to the minute structure of a diatom; digestion in some detail (with formulæ of proteins) but not a word about diet; everywhere there are details of structure and function, but little attempt to link any of it up with human affairs or make it stimulating.

On the whole, this book provides too much and too strong meat for children.

D. M. REID