BUCKINGHAM'S THERMODYNAMICS.

Theory of Thermodynamics. By EDGAR BUCKINGHAM, Ph.D. New York, The Macmillan Company, 1900. xi + 205 pp. Price, $1.90.

OLDFASHIONED, or, rather, elementary, thermodynamics deals mainly with the relations of heat and mechanical energy. It considers purely physical changes, including changes from any one to any other of the three states, solid, liquid and gaseous, but does not undertake to discuss chemical changes or such chemico-physical changes as occur in solution. Accordingly, from the purely mathematical point of view, elementary thermodynamics is shamefully simple. What possibilities of interest for the mathematician can be found in a beggarly array of only five variables, p, v, T, ϵ and η, subject to one characteristic equation and two general laws, so that only two of them at a time are capable of arbitrary variation? But from the standpoint of physical interpretation and application the study of thermodynamics, even in its elements, presents respectable difficulties, and is likely to be regarded by the beginner, however mathematical he may be, as something of a mystery.

On the other hand, when we undertake to deal with chemical changes, and find ourselves confronted by "i phases" of matter, each phase containing "a mixture of K substances," the variables, "normal" and "inverse," "internal" and "external," independent and dependent, begin to manœuver in regiments at the will of the commander, and the born mathematician finds himself in his proper element.

The book before us is intended for the help of those not very rare individuals who have some difficulty with both the physics of elementary thermodynamics and the mathematics of its broader generalizations. It is not for the beginner, although it deals with the very elements and discusses the two general laws at length. It is too circumspect, too precise, too thoroughgoing, in its examination for the student who is taking his first look at the field with which it has to do. It is rather for him who, after some months of growing acquaintance with the elementary facts and laws of thermodynamics, finds himself in doubt as to whether he fully understands, for example, the