fused by the use of the microfarad with its numerical factor of 10^6. As a matter of fact, the kilogram itself is too large for convenience in most scientific work. Both Dr. Campbell's proposal and that of the writer lose what was considered an advantage of the C.G.S. system, that the density of water is approximately equal to unity; so there is no choice on this point. A great convenience of the writer's proposal is that energy, power, force, mass and other quantities directly derived from them all have units larger than the C.G.S. units by the same factor 10^7. This would result in great convenience in referring to existing tables of physical data, since the reader would only have to decide whether to introduce this single factor; whereas with Dr. Campbell's proposal factors of 10^{-2}, 10^{-3}, 10^{-5} and 10^{-7} are given in his Table I, and other factors would enter with subordinate quantities, such as pressure and density. It is believed by the writer that these conveniences far outweigh the inconvenience of a large unit of mass.

USE OF THE TRUE OHM

Dr. Campbell's proposal to use the international ohm, coupled with the use of the mechanical watt, requires many of the electrical quantities to be expressed in units which have never heretofore been employed. While it is true that these units differ to a very slight degree from either the international units or the true (practical) units, nevertheless it is felt that the results would be decidedly confusing. The writer's proposal is to use the true practical electrical units throughout, which is consistent with the mechanical watt. These units are all related to the C.G.S. electromagnetic units by factors which are exactly powers of 10; so that conversion from the C.G.S. electromagnetic system would be greatly facilitated. For engineering purposes, of course, the differences between the international electrical units, the practical electrical units and the electrical units proposed by Dr. Campbell are insignificant.

The units proposed by the writer seem to require a minimum of change from existing practice and yet to have the broad advantages of definitive units as expressed by Dr. Campbell. With the exceptions of the units for force and mass and their derivatives, these units are all in wide use at present. The complete system has for several years been employed by the writer in his electrical engineering classes[2] and for his own computation in fields where electrical and mechanical quantities continually occur together in a variety of ways.

In the writer's opinion, the most important consideration in the introduction of a system of definitive units, assuming the units to be consistent and of *reasonable* magnitudes, lies in *the convenience of the transition from present practice.* The system proposed permits of a gradual adoption of the few new units, as fast as their advantageous features become appreciated; whereas Dr. Campbell's proposed system requires more radical changes.

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[2] See L. A. Hazeltine, "Electrical Engineering," The Macmillan Company (1924).

TIME MEASUREMENTS

THE fact that a watch keeps correct time over a period of twenty-four hours is not a sufficient indication of its accuracy in the measurement of short time intervals where the second hand is used. A slight misplacement of the watch dial may cause the pivot of the second hand to be located "off center," thus causing an error of as much as two seconds in measuring an interval of twenty, or twenty-five seconds. Readings on one half of the dial will be too short and those on the other half correspondingly too long.

A similar source of error may be looked for in any dial-reading instrument where particular care has not been taken in fixing the dial position.

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ARTIFICIAL CULTIVATION OF FREE-LIVING NEMATODES

IN SCIENCE, N. S. Vol. 60, No. 1548 (Aug. 29, 1924), pp. 203–204, under the above title, Asa C. Chandler describes a method dependent on the standard culture-methods of bacteriology. So far as developed, this method does not apparently differ from that described by me in the *Trans. Amer. Mic. Soc.*, Vol. 24, pp. 89–102, 1 pl., 1903.

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SCIENTIFIC BOOKS

The Story of Early Chemistry. By JOHN MAXSON STILLMAN, late professor emeritus of chemistry, Stanford University, xiii + 566 pages, $5\frac{1}{2} \times 8\frac{1}{2}$ inches. D. Appleton and Co., New York, 1924, Price $4.00.

THE amiable author of this scholarly volume (whose recent death was lamented by a host of friends) has long been known as a contributor to the history of medieval chemistry—more particularly of that transitional Paracelsian epoch which was contemporary with various other great movements of exploration, renaissance and reform. It was only natural, therefore,

that Professor Stillman in his present "Story of Early Chemistry" should focus the reader's attention upon Paracelsus as the dominant figure in chemistry before the foundation of the modern science by Lavoisier. The historian's estimate of the relative importance of personages or events is indicated by the amount of space which he gives to their consideration and if this be our standard the following series will indicate the comparative stress which Professor Stillman has placed upon the life and work of a few names in early chemistry—Boerhaave (2 pages), Glauber (4), Helmont (5), Zosimus (7), Cavendish (7), Scheele (8), Albertus Magnus (9), Agricola (10), Boyle (12), Roger Bacon (15), Priestley (15), Paracelsus (19), Lavoisier (25). While there may well be an objection, from our present viewpoint, to the historian of chemistry giving as much attention to Zosimus as to Cavendish, or to Roger Bacon as to Priestley, it must be remembered, as Professor Stillman so clearly indicates, that personal influence can not always be measured by the number of original discoveries.

The history of chemistry may be presented from either the descriptive, biographical, philosophical or literary points of approach. The first of these treatments will describe the important discoveries of chemistry, the second will depict its leading personalities, the third will unfold the development of its basic principles, and the fourth will review its documentary sources of information. The first two of these methods will appeal to the young student, while the last two will attract only persons of mature mind. While sharing somewhat in all these choices of treatment it is principally to the fourth, or literary, type of history that the present "Story of Early Chemistry" belongs. Professor Stillman, following the lead of Kopp, Lippmann, Sudhoff, Berthelot and other foreign investigators, makes a very critical examination of the original records. The authenticity of the chemical texts ascribed to Democritus, Aristotle, Geber, Avicenna, Lully, Basil Valentine, Paracelsus and other early writers is considered more exhaustively by him than by any other writer in English. Without showing the polemical and nationalistic temper of certain European historical scholars he has given a well-balanced estimate of the various conflicting opinions.

In a volume which deals so largely with questions of authorship, much of the material that would be considered by historians of other schools must necessarily be omitted. We may pardon, therefore, in Professor Stillman's volume the omission of any reference to the Pneumatika of the Greek mechanician Hero (the precursor of the pneumatic philosophers named in Chapter xii) or to the discovery of the principle of specific gravity by the Greek geometer Archimedes—the most important contribution to the methods for studying the properties of matter that was made in ancient times. In the apparatus described by Hero and in the method of research devised by Archimedes the alchemists unknowingly possessed an infallible means for determining the character of their fictitious gold, and had they only applied this knowledge the world might have been spared that colossal waste of effort which played so long and so large a part in the story of early chemistry.

Professor Stillman passed away before the first proofs of his book were received from the publisher. This was doubly unfortunate, for had his life been spared a few months longer he might have been able before the final printing to round out his rather incomplete treatment of Arabian chemistry by citations from the important recently published "Arabische Alchemisten" by Julius Ruska. He would also have been enabled to devote that attention to proofreading and indexing which an author of Professor Stillman's meticulous care could only give. The book in consequence contains a considerable number of typographical errors, such as pennance (107), Euripedes (131), notorius (355), and many others. The nouns of German book titles are not capitalized and the endings os and us are used indiscriminately for Greek proper names. In the bibliography the Papyrus Graecus Holmiensis is incorrectly listed as a work of Bernard Palissy. Certain slips of composition would also undoubtedly have been detected by Professor Stillman in the proofreading, such as the statement (p. 136) that the name Chemeia was probably "derived from the *Greek* word chemi signifying black," where *Egyptian* was no doubt intended. Such errors as these, however, are of minor significance in comparison with the general excellence of the volume as a whole.

"The Story of Early Chemistry" is told by Professor Stillman in a particularly pleasing and interesting way. He unfolds before his readers a great drama of ideas in which the successive followers of Hermes, Paracelsus and Stahl are shown hopelessly groping for centuries in the dark until a final burst of light is shed upon the scene by the efforts of Lavoisier.

The many friends of Professor Stillman will appreciate the brief biographical sketch which has been added to the volume as a foreword by Professor S. W. Young, who gives a most delightful picture of the personality and many-sided activities of his departed colleague.

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