In the case of nickel this was done in order to emphasize the difference between the atomic weights of cobalt and nickel, although in both values there may be possible deviations of ± 0.2. The true atomic weights of bismuth and tin are not correct to a certainty, to within 0.1. The value of hydrogen is 1.008, correct to within 0.001, but the approximation of 1.01 has been regarded as permissible for the requirements of practice, as it involves an error of only one-fifth of one per cent. The values given for the elements marked in the table with interrogation points are not necessarily exact within whole units of the atomic weights assigned.

Ferdinand G. Wiechmann.

JOHN CUMMINGS.

In the decease of Hon. John Cummings, of Woburn, Mass., on the 21st of December, there terminated a life which has been noteworthy for the encouragement it has given to the study and teaching of science. In the early part of his manhood days Mr. Cummings acquired a reputation for honorable dealing and for his success in the manufacture of leather in his native town of Woburn. To that town he was always loyal and generous, but his intelligence and his activity led him into larger circles until he became favorably known and his influence was felt in a large and populous community. He became acquainted with the late William B. Rogers, for whom he always cherished an admiration and a profound regard. He also knew Louis Agassiz, Jeffries Wyman, Asa Gray and others, and he soon became a student as well as a lover of nature. The offices of trust and of business responsibility which he filled make a long and notable list, but his large affairs did not prevent him from cultivatiug a love for science, and they aided him in multiplying his gifts to the cause of education. Through his attachment for William B. Rogers he was interested in the founding of the Massachusetts Institute of Technology, and he became one of its most substantial supporters, contributing to its financial needs and serving as its Treasurer for 17 years. It was through his generosity that the Boston Society of Natural History started its 'Teachers' School of Science,' and it was through his liberality that its botanical collection was developed and that it has received special care to the present day. He was actively and generously interested in the work of public instruction, and he extended his aid to the South after the close of the Civil War. In one instance he purchased a building and supplied teachers, urging them to work for the establishment of free public schools, and when this was about to be accomplished he donated the building to the cause. His gifts and his efforts were never calculated to attract attention to himself, and many of his good deeds were scarcely known even by his friends. He was one of a class of honorable and broad-minded business men who have been magnanimous in their support of science education, and who have found time to participate in the acquisition of knowledge, while aiding others to means for the prosecution of their studies or investigations.

Wm. H. Niles.

SCIENTIFIC BOOKS.

Matter, Energy, Force and Work. By Silas W. Holman, Professor (Emeritus) Massachusetts Institute of Technology. New York, The Macmillan Company.

Lovers of exact science are already indebted to Professor Holman for numerous important contributions to our knowledge of physics and especially for valuable suggestions as to the best treatment of the experimental solution of physical problems. His most pretentious work thus far is that on 'Precision of Measurements,' which is everywhere recognized as a standard and which ought to be in the hands of every

one who is preparing to do something in the way of experimental research. In the volume now under consideration he has entered a different field, and with such success as to deserve and, I have no doubt, to win the approval of all interested in the fundamental principles and concepts of physical science. In addition to an excellent review of current theories of the nature of matter, energy, force, etc., in which the vortex theory and Le Sage's theory of gravitation are exceptionally well presented, the work includes much that is new and original, a few proposed additions to the nomenclature of science and many extremely suggestive discussions.

Professor Holman departs from the usual practice in the very beginning when he defines matter as 'the inert constituent of substance.' By 'substance' he means 'that which is inferred as existing in space, and as endued with powers to affect portions of itself,' and it is made out of matter by the addition of something. 'Continuous, uniform and permanent occupancy of space' is the ultimate and sole property of matter. 'Mass' is defined as 'quantity of matter,' and as matter has really no significance until it becomes 'substance' the word 'mass' is practically banished.

Atoms are 'permanent aggregations of matter differentiated from matter by some mode of motion' (vortex motion), and they combine to make 'substance.' 'Bodies' are limited portions of 'substance.' The 'something' which distinguishes *substance* from *matter* is *energy*. "A designated quantity of substance consists of a definite quantity of matter in permanent association with a definite quantity of energy or motion." The two words 'or motion' render this statement somewhat obscure. What is meant by a 'definite quantity of motion?' Professor Holman's definition of 'motion' is that of nearly all writers, namely, 'change of relative position.' It is a curious but common practice to define it in this way and then to define its 'quantity' by associating with it something (matter, mass) absolutely unlike it in every respect. It is certainly not in this sense that he means to use it in the phrase above quoted.

To all 'substance' he attributes a 'capacity for kinetic energy' and to this capacity he applies the term '*kinergety*,' of which much use is made in all subsequent discussions. Mass is *assumed* to be proportional to *kinergety* and the latter thus affords a means of measuring the former or rather of comparing different quantities of it.

Quantities of substance may also be compared by means of the force called 'weight,' and a quantity thus determined by means of the equal-arm balance is called *weightal*.

The 'International Kilogramme' and the 'Imperial Pound' are spoken of as standards of 'Kinergety' and *weightal* is shown to be proportional to 'Kinergety.' What is commonly known as 'the ether,' the medium by which radiant energy is transmitted, is regarded as a kind of substance, and hence *not* the continuous uniform substratum of 'matter' from which all substance is evolved.

It is impossible in a brief notice to make extensive quotations, but especial attention ought to be invited to the author's remarks on the various forms of energy. They are extremely interesting and suggestive, and particularly so in the exhibit which is made of the importance of the energy of elasticity as an intermediate stage of all energy transformations. The definition of 'force' as related to energy will not fail to attract attention and possibly enable many readers to possess a reasonably satisfying concept of that much-abused word. Reference has already been made to the very full presentation of the vortex theory of matter, in the possibilities of which the author evidently has great confidence. The principal results of the splendid work of Professor J. J. Thomson in the application of this theory to chemical phenomena are here given in clear and simple language, without the mathematical backing upon which it leans. The singularly clear and satisfactory discussion of Le Sage's theory of gravitation as affected by the vortex theory of atoms would alone put the volume on the shelves of every physical library, but the more distinctly original portions of it, the nature of which has only been hinted at in this notice, will fully justify its careful perusal by students of physical science.

I think there can be no impropriety in a brief

word in reference to the circumstances under which this book was written. It is well known among his many friends that Professor Holman's active participation in the work of the Rogers Laboratory of Physics was arrested two or three years ago by the development of an illness from which, unfortunately, he has not yet recovered. During this time he has been confined to a reclining chair, and, in his own characteristic words, 'even the familiar utilization of the convenient gamut of ether waves' has been denied. Although unable to move and unable to see, his courage has never faltered. There has been no loss in his power of thought, and he has gone on thinking the many fine things which he has put into this book, for which, even if it had not been prepared under conditions that would have defeated most men, all physicists, friends and strangers alike, will ever be his debtor.

T. C. M.

A Brief Course in Qualitative Analysis. By Ernest A. Congdon, Ph.B., Professor of Chemistry in the Drexel Institute. New York, Henry Holt & Co. 1898.

The method of treatment adopted in this book consists in giving, first, a clear, concise statement of the most important reaction for each metal and acid, and then tables giving one or more schemes of analysis for each group. The tables are supplemented by explanatory notes. At the end of the book a series of questions, well designed to test the student's grasp of the subject, are given. While the tabular form always has the advantage of presenting the scheme for analysis very clearly, in the opinion of the writer, the same object is better attained by a tabular record prepared by the student. Because of their concise form, tables necessarily omit many details which are essential for the successful execution of an analysis, and the notes which follow do not entirely overcome this difficulty.

The selection of reactions and of schemes for analysis is excellent, and in the hands of good teachers the book will prove a useful one.

A Short Manual of Analytical Chemistry, Qualitative and Quantitative, Inorganic and Organic, following the Course of Instruction given in the Laboratories of the South London School of Pharmacy. By John Muter, Ph.D. Second American Edition. Illustrated. Adapted from the Eighth British Edition. Philadelphia, P. Blakiston's Sons & Co. 1898. Pp. xiii + 228. Price, $1.25.

As the title implies, a very large amount of information is compressed into comparatively little space in this volume. In the qualitative portion the statements giving the deportment of metals and of acids toward reagents are given consecutively and are followed by tables of schemes for analysis. Then follow directions for the identification of alkaloids and of a number of common organic compounds. The quantitative portion includes volumetric and gravimetric analysis, ultimate organic analysis, and directions for the examination of air, water, food, alcoholic liquors, etc. It is in this portion that American chemists will find most to criticise; Gooch crucibles are nowhere described, not even for the cases where they should be used in place of weighed filters. Directions for the determination of 'citrate soluble phosphoric acid' are not given under the analysis of 'manures,' and no reference is made to the 'official methods.' The old uranium acetate method is given for the volumetric estimation of phosphoric acid instead of the more satisfactory methods with a reductor or with a standard alkali. Metaphenylene diamine is recommended for the detection of nitrites in water analysis, although the reagent is not sufficiently sensitive to be of any practical use in many cases. But, while the authors do not appear to be conversant with the best American practice in these and some other cases, and while some of the directions appear to be too much abbreviated for the satisfactory use of a beginner, it would be difficult to find another book which compresses so much information about analysis into so small a space and for so moderate a price.

W. A. Noyes.

Wild Animals I have known. By Ernest Seton Thompson. New York, Charles Scribner's Sons. 1898. Square 12mo. Pp. 359. 200 illustrations. Price, $2.00.

Rarely are the qualities of naturalist, writer and artist combined in one person, but Mr.