

the coal burned to liquid water, in one case, at least, results which were published in terms of the fuel burned to vapor of water are given without the necessary correction. On page 106 analyses of natural gas are given which represent it as containing large amounts of hydrogen, although Professor Philips has, apparently, demonstrated¹ that this gas is never present. In the same table marsh gas and methane are given as though they were different substances. The value of the tables would be greatly increased if exact references to the source of the data were given.

While it is evident that the tables must be used with care and discrimination, the book will prove a useful one to engineers and chemists interested in the subject of fuels.

W. A. NOYES.

METHODS FOR THE ANALYSIS OF ORES, PIG IRON, AND STEEL. Easton, Pa.: The Chemical Publishing Co. 1898. 8vo. 131 pp. Price, \$1.00.

This well printed and neatly bound volume contains a symposium of methods of iron analysis, in use in the laboratories of iron and steel works in the region about Pittsburg, Pa., together with an appendix containing various special methods of analysis of ores and furnace products. The methods are given in detail by the chemists in charge of the fifteen laboratories represented and may be considered to represent the general practice of the chief iron and steel works in the principal center of the iron industry in the United States. When one reflects upon the vast commercial and manufacturing interests that are based upon the results of these methods of analysis, they become well worth careful study and comparison by every one interested in iron analysis.

P. W. SHIMER.

TEXT-BOOK OF PHYSICAL CHEMISTRY. By CLARENCE L. SPEYERS. iv + 224 pp. New York: D. Van Nostrand Co. Price, \$2.25.

There is a deplorable lack of continuity in the teaching of science between our universities and the schools preparing for them. While the student continues his study of languages and mathematics on entering college, he generally begins his study of science over again. Many students have had good courses in physics and chemistry in the secondary schools and are fitted to go on with that work in college. To such students as these,

¹*Am. Chem. J.*, 16, 406.

as well as to those who may elect elementary courses in physical science during the first year or so of college, it seems highly desirable to offer a course in elementary physical chemistry. There is a vast body of knowledge lying between physics and chemistry which is of great interest and importance; it has in the main been obtained by what may be termed advanced methods, but its results can be advantageously presented in elementary form. A course presenting these results and the outlines of the methods employed in getting them seems a desideratum. Such a course would prove to be very profitable and beneficial; it would be an excellent "culture course" for those making physical science a minor subject, and a good preparatory course for those taking physics or chemistry as a major. It is a mistake to believe that the study of physical chemistry can be taken up with advantage only after a considerable acquaintanceship with the facts and theories of physics and chemistry has been made; the elements of these sciences are quite sufficient for a good comprehension of elementary physical chemistry. To insure the success of such a course, a text-book on physical chemistry corresponding in difficulty to our best elementary text-books on physics or chemistry is needed. The reviewer had hoped that the book at hand would fill this need, but finds it suited for quite advanced students only; and the need still exists.

This book represents what "the author" has been "in the habit of teaching the senior class in the chemical course in Rutgers College," and "is intended for self-instruction as well as classroom use." "The view that matter is a collection of energies in space" has been adopted; this view, due to a particular German school of physical chemists, gives the book throughout a peculiar complexion. Thus, on page 4 is found: "In ordinary chemical language we say chemical reaction takes place between definite weights of matter. In our language we should say the relation between the intensities of the distance energies (gravity energies) of two or more collections reacting to form another definite collection, is fixed." Another sample of the "energetic" style is this: "when the intensity of the heat energy is not relatively high, the intensity of volume energy is inversely proportional to the capacity only when the intensity of the volume energy is low," (p. 28) which probably means that

at low temperatures and high pressures gases do not obey Boyle's Law.

The author states (p. iv) : " With Ostwald, I feel convinced that the materialistic interpretation has passed its prime and has no promise for the future." This is an extreme and one-sided view. Careful study of Boltzmann's writings cannot fail to convince the fair and conscientious reader, no matter how biased he may be, that materialistic conceptions are necessary and useful ; and as for their help in discovering new truths, reference need only be made to the splendid confirmations by Zeemann, of Lorentz's atomistic views and theories.

The author goes further even than Ostwald in his classification of the kinds of energy. Chemical energy he rejects, because (p. 177) " the assumption of chemical energy is strictly gratuitous and not to be advised at all ;" but he makes up for this by adding internal energy, magnetic energy, and three kinds of radiant energy ; *viz.*, radiant heat energy, radiant light energy, and Roentgen ray energy. It seems rather strange that he has not added *mental* energy.

The book is something more than a text-book ; it is also an essay having for theme the dethronement of matter and the crowning of energy.

Some of the author's definitions are far from being clear and logical. For instance, " a chemical change is one in which the nature of the original body is very much changed," while " a physical change is a change which does not alter the characteristic chemical nature of the body." This amounts to saying : A change is a change or alteration ; a chemical change is a big change, while a physical change is a little alteration.

An original feature of the book is the introduction of numerous problems ; most of these are excellent and help greatly towards elucidating the text. A curious illustration of how facts may be made to fit theories is the following : The author in one of his problems (p. 81) assumes data given by the reviewer to be accurate enough to warrant the conclusion that " the benzene molecule seems to be polymerized nearly three times," while Bancroft (*The Phase Rule*, p. 118) thinks the same data to be at least ten per cent. in error. Both establish their theories, however.

The style of the book is concise and a mathematical treatment predominates. The historical development of any subject is avoided so that the reader hardly knows to whom he may attribute certain views advanced, by no means current among physical chemists. This avoidance of the historical treatment detracts much from the value of the book, for in such a subject where there still exists a conflict of views on many points, the only satisfactory treatment is the historical.

The statement of the author (p. iv) that "whoever works through" the book "conscientiously, paying particular attention to the problems, will get a very fair idea of physical chemistry," is, in the opinion of the reviewer, unwarranted. What the reader will get is a knowledge of a lot of subtle distinctions about energy, some practice in the handling of mathematical equations, and an incomplete acquaintance with some physico-chemical laws. But a "fair" idea of physical chemistry he certainly will not get.

C. E. LINEBARGER.

BOOKS RECEIVED.

Spectrum Analysis. By John Landauer, LL.D. Authorized English edition by J. Bishop Tingle, Ph.D., F.C.S. New York: John Wiley & Sons. 1898. x + 239 pp. Price \$3.00.

The Sugar Beet in Illinois. Bulletin No. 49. University of Illinois, Agricultural Experiment Station, Urbana, Ill. 1898. 52 pp.

The Cost of Production of Corn and Oats in Illinois in 1896. Bulletin No. 50. University of Illinois, Agricultural Experiment Station, Urbana, Ill. 24 pp.

An Ephemeris of Materia Medica, Pharmacy, Therapeutics and Collateral Information. Vol. V, No. 1. January, 1898. By Edward R. Squibb, Edward H. Squibb, and Charles F. Squibb. Brooklyn, N. Y. 1898. 176 pp.

Preparation and Application of Fungicides. Bulletin No. 25. Connecticut Agricultural Experiment Station, New Haven, Conn. 1898. 16 pp.

On the Crystalline Structure of Gold and Platinum Nuggets and Gold Nuggets. By A. Liversidge, LL.D., F.R.S., Professor of Chemistry, University of Sydney, N. S. Wales. 10 pp. 16 plates.

On Some New South Wales and Other Minerals. On the Amount of Gold and Silver in Sea-water. The Removal of Gold and Silver from Sea-water by Muntz Metal Sheathing. By A. Liversidge, M.A., F.R.S., Professor of Chemistry, University of Sydney, N. S. Wales. 42 pp.

Abbreviated Names for Certain Crystal Forms. Models to Show the Axes of Crystals. By A. Liversidge, M.A., F.R.S., Professor of Chemistry, University of Sydney, N. S. Wales. 10 pp.