to obtain a pure product melting at 43.5°. A yield of 390 g., or 80%, resulted.

Summary.

1. It has been found that butyl mercaptan in comparatively large yields is obtained on distilling a solution of sodium sulfide with sodium butyl sulfate.

2. It has been shown that no butyl mercaptan is obtained when a large excess of sodium hydroxide is used.

3. It has been found that butyl sulfide can be obtained by the interaction of butyl mercaptan and sodium butyl sulfate in the presence of sodium hydroxide.

4. A method for the preparation of dibutyl ether is given.

5. An improved method for preparing butyl sulfide has been described. Average yields of 72% can be obtained.

6. It has been found that the oxidation of butyl sulfide to butyl sulfone with fuming nitric acid, results in a product difficult to purify and that the method cannot be depended upon to give constant yields.

7. It was found impossible to oxidize butyl sulfide efficiently to butyl sulfone by means of nitrogen dioxide.

8. The conditions have been determined which permit the oxidation of butyl sulfide to butyl sulfone by means of sodium permanganate in yields which average 80%.

We are indebted to Miss Ethel Schram, Mr. Erle M. Billings, and Mr. Luther M. Curtice for their assistance in carrying out parts of the experimental work in this paper.

ROCHESTER, N. Y.

NEW BOOKS.

Coal-Tar Dyes and Intermediates. 1st edition. By E. DEBARRY BARNETT, B.Sc. Lond., A.I.C., Consulting Chemist to Bagley, Mills and Co., Ltd., formerly Research Chemist to Levinstein, Ltd., and Works Manager to the Stockton-on-Tees Chemical Works, Ltd. D. Van Nostrand Co., New York, 1919. xvi + 213 pp., 14.5 × 22.5 cm. $3.50 net.

This is the first of a series on Industrial Chemistry edited by Samuel Rideal.

"Each volume will be complete in itself, and will give a general survey of the industry, showing how chemical principles have been applied and have affected manufacture.

* * *

"An attempt will, in fact, be made to get away from the orthodox text-book manner, not only to make the treatment original, but also to appeal to the large class of readers already possessing good text-books, of which there are quite sufficient. The book should also be found useful by men of affairs having no special technical knowledge, but who may require from time to time to refer to technical matters in a book of moderate compass, with references to the large standard works for fuller details on special points if required.

* * *

"It has long been a drawback of our technical education that the college graduate, on commencing his industrial career, is positively handicapped by his academic knowledge because of his lack of information on current industrial conditions."

It is quite evident from the above quotations that the series will be most useful to busy people who desire a brief description of well-known processes.

Many people will not agree with the last quotation for in America it has been found no drawback to our graduates to be unfamiliar with industrial processes. Plant research laboratories generally prefer a well trained laboratory chemist. The plant experience comes quickly when desired.

The book in question is accurate in places and gives a number of good commercial processes in a brief and readable way but it will be very misleading in a great many respects, for many of the methods are not in commercial use that are better known and are in operation. Among a few of these replaced processes may be mentioned those for amino G acid, α-naphthylamine, Laurent's acid, m-phenylenendiamine. The method for G-acid is antiquated and American practice will not regard as commercial a process requiring a large mass to stand one week with frequent agitation as is stated in the description of crocein acid.

It is true that much work has been published on the cyanine (quinoline) dyes in 1919 after the date of the author's preface, but even so there was not much justification for the statement: "Their constitution is not known but they are probably triphenylmethane derivatives." They are methane derivatives but certainly not triphenyl.

The old sulfuric acid process described for the manufacture of phthalic anhydride is being replaced by the new method consisting of the vapor phase, catalytic, air oxidation of naphthalene.

The author's remarks in the preface regarding patents, the writing in the technical press and the research procedure from laboratory to plant are particularly pertinent.

Not much is to be expected of a book treating of commercial processes for dyes and intermediates in 207 pages, but it is unfortunate that so much readable matter is clouded with misleading information so that the ordinary reader cannot distinguish the good from the bad. H. D. GIBBS.

The Realities of Modern Science. By JOHN MILLS. 320 pp. The Macmillan Company. $2.50.

Studying this book leaves the general reader, for whom it is written, with a feeling that it is "different" and worth while. It covers a certain range in physics which might be called semi-mathematical, semi-molecular. The preface seemed to promise an excessive up-to-dateness. It includes the following boldness: "The existence of electrons and their determining effect in the composition of the chemical elements are easily demonstrable facts, compared to which the indestructibility of matter is a speculative assertion and the independence of mass and speed an exploded theory."

It was a little surprising to the reviewer to have to start far back of the real realities of modern science, and among the author's fancied visions of the most ancient of prescience. Earliest man, or that ancestor who first enjoyed the warmth of an accidental fire, or dug roots for his nourishment, is given a lot of attention. This linking up of science with prehistoric time destroys much of the effect of moderness. The average Boy Scout probably already knows pretty well the useful facts represented by the first 6 chapters.

The Molecular Composition of Matter is treated in Chapter VII much as in general text-books on physical chemistry, and with Chapter VIII we arrive at the period of the electron. In this chapter we read, "An atom, we have reason to believe, always consists of a number of electrons and another part which is called the 'nucleus.' These electrons are little bits of electricity." And of the electron, in part we read, "But as to the electron itself, no explanation can be given, etc.," and, later, "But what is the nucleus? That we do not as yet know."

Of course, there is more on this subject, and better. It is unfair to give the impression that much of what is known about such things is not included in the Chapter, for it is. The ether is brought in, but no use made of it beyond such statements as that electrons must push on one another through a medium, and that a vacuum is full of ether, according to the ideas of the modern physicist. Thus for the general reader seeking the realities of modern science, the hypothetical is scrambled with the real. It seems as though the word "space" could have accomplished the desired end so far as that end is clear. I believe this chapter would have seemed less didactic and would have been more comprehensible if the author had introduced at this point some of the historical facts which led to the passage from our previous different and indivisible atoms to the universally identical negative protyle, the electron. The following can hardly seem sufficiently encouraging and helpful, and might have been made clearer by related historical facts: "For convenience and for reasons connected with the history of the science, we call the electricity of the electron negative."

If vacuum tube or arc experiments could not have been used in this chapter to give the general reader some conception of the properties of electrons, surely Dr. Millikan's wonderful and widely known oil-drop experiments could have been here introduced instead of being postponed to the back of the book.

The reviewer prefers the book which pictures briefly the facts which led scientists to accept new viewpoints, and follows such introductions with as wide general exposition of what it all means as is desirable. The trouble with the old atoms themselves was that, in the hands of some writers, they grew too hard and round, too petrified, indivisible, and impenetrable.

In an attempt to write for the general reader, the justifiable desire to be clear has called for much space. The book is full of references to things, perfectly familiar to any probable reader, which have apparently to be explained at length, and some of this matter takes the place of that which could have been used for telling about actual experimental observations of modern time. The parachute, for example, need hardly have been described, and an explanation that an automobile does not have to complete 30 miles in order to be going at a 30-mile rate is overdone, even in a laudable attempt to make calculus easy. On the other hand, as supporting certain fundamental principles, illustrations are given which lack the convincing property of obvious certainty, as, for example, the statement that substances absorb the same frequencies as they naturally emit and so heated red glass gives off a blue light. A boy who tried this might doubt the general principle.

We are told concerning matter that we must always bear in mind its granular and electrical composition, but we are scarcely shown the reasons. As they may be more real than the conclusions, the average reader will want them.

A chapter on Some Uses of Mathematics was a disappointment under this title. There are few uses in the chapter unless they are a reference to Newton's mathematical method and Maxwell's assumption that light is an electrical phenomenon. The chapter seemed to the reviewer a clear appeal for considering all phenomena mathematically or symbolically for economy's sake, and a good start to orderly conceptions.

The chapter on Rates is concerned with Galileo and with abstract definitions of rates, and not with modern science or its application, and much the same applies to the chapter on Force. Modernity is not a characteristic of them, but mathematics is.

The chapter on Molecular Motions and Temperature compares gaseous molecular motion to the flight of gnats, and draws the usual conclusions as to effect of concentration, etc. It adds very usefully the illustration of a small piece of paper tossed about by the motion of the gnats as an introduction to Brownian movement. The application of the old observations of Brown (1827) has truly become a reality of modern science and one of much value. The rest of the chapter is an elementary discussion of Boyle's Law and of the derivation of thermometry. This leads to a brief consideration of the absolute zero, —273° C., which is left to us as something "probably never to be reached experimentally." As a footnote states that helium was liquefied at —271.3°, the general reader might well ask support for the assumption that at least —1.7° may not still be subtracted in some way.

Motion of Electrons. This chapter, in the middle of the book, begins to describe some modern realities of science, if by modern we mean something developed within the past century.

On p. 204 is a cloudy statement. In reference to magnetic properties we read (after reference to iron and nickel and cobalt), "In most other substances it is practically negligible. The substances in which there is any effect whatever are called 'paramagnetic,' while those like iron are known as 'magnetic'." One might question whether "any effect whatever" covers "practically negligible effects," and whether diamagnetic effects have disappeared?

In general there is a forced, or stilted impression created by the desire to foresee all effects on the basis of present theories. The extent to which such theories should predominate over simple and coördinated statements of observed facts is a question of judgment and a matter of opinion, but to the reviewer, it would seem more acceptable to read about the phenomena as observed and later the coördination which has become possible, for example, through the conception of electrons. One can hardly be sure what future developments may be made of electrons, but the phenomena themselves in which they seem to take part are quite regular and determinable. On the other hand, we do not like to read: "About the conductor there is said to be a magnetic field." We actually *know* there is a magnetic field there, but we may not be through our guessing as to its composition in terms of other concepts, which may have to be eternally pictured anew.

The chapter on The Continuity and Correspondence of Molecular States is clear and condensed.

"Molecular Mixtures" begins with partial gas pressures and proceeds through the usual development of osmotic pressure measurements, the rise in boiling point and reduction of freezing point, due to dissolved substances, etc. This is quite condensed and leads directly to the chapter on Electrolytic Dissociation. This subject is treated first from the modern electronic viewpoint, as though it would have been possible to guess the phenomena of conductivity of solution from electronics. Later on, the historical development is explained as it took place, but the impression made by such arrangements, which are common in the book, is that the electron is being forced to explain "before the fact" more than is good for the understanding.

"If the reader obtains a correct concept of molecules, atoms, and electrons, many important laws will appear to him as deducible." This may all be true, but it is first through some clear, concise statements of experimental observations that correct concepts are reached. Possibly also, even then the reader will learn that some of the important laws only appear, but are not actually deducible, owing to the apparent errant nature of Nature.

In the lengthy discussion of the LeChatelier-Braun principle, some of the illustrations seem of a kind little suited to elucidating the point. The statement that a stretched wire is cooled on account of the principle, or that it resembles the organic faculty of accommodation, did not make it clearer to the reviewer, because these in themselves are no clearer. Reference to the wire experiment as a fact, would have saved the reviewer the trouble of searching for it.

Under Molecular Magnitudes, Perrin's work on colloidal particles is briefly but clearly given and is convincing. Here again Millikan's work is referred to and description seems necessary at this point. This is still postponed, however, to the back of the book. Discussion of the molecular and the mercury vacuum pump contributes to this chapter.

In the chapter on Molecular Energy there is a fine effort at coördinating the question of specific heats in general. The conception of quanta is interestingly introduced and properly left "in the hands of the future," but a more complete description of this idea might be in place in such a book.

We do not like introducing new symbols, and as most physicists are learning to use the "h" and "nu" these particular letters have probably come to stay.

The chapter on Electronic Magnitudes is by far the most interesting one. The impression gained from it is that it deals with relatively simple experiments of the utmost significance. Nothing is said about what ought to occur because of previous conceptions, but rather what did occur under the conditions of Dr. Millikan's classical experiments, those of C. T. R. Wilson (not mentioned) and Moseley. It repeatedly seemed to the reviewer that this chapter should have formed a much more prominent and an earlier part of a new book on the "Realities of Modern Science." Chapters on Machines of the Ancient World, Weights and Measures, The Beginning of Knowledge, the Beginnings of Science and the Beginnings of Experimentation, while constituting material "adapted to the future citizen rather than the future scientist," do not contain that quality of our modern physical facts which encourages the future citizen to "carry on" until he can reach the wonderful, instructive, and interesting Realities of Modern Science.

W. R. WHITNEY.