was dried and evaporated. From the 3° portion 10.2 g. of ester was obtained, m. p. 55–58° (94% yield), and 10.0 g. from the 7° portion, m. p. 53–57.5° (92% yield). The pure ester after several recrystallizations melted at 58–59°.

Calc. for $C_9H_9O_4NCl_2$: Cl, 25.5. Found: 25.4.

The isomeric ester of $\alpha,\beta$-dichlorohydrin was made in a similar fashion from the allyl alcohol dichloride. It melted after several recrystallizations at 35.5–37°.

Calc. for $C_9H_9NCl_2$: Cl, 25.5. Found: 25.7.

A mixture of 90% of the $\alpha,\gamma$-ester and 10% of the $\alpha,\beta$-ester melted at 26–48°. The crude product from the 3° and 7° portions must, therefore, have contained much less than 10% of the isomeric ester. Since the yields of this crude ester were 94 and 92%, the original portions must have contained at least 91% and 89% of $\alpha,\gamma$-dichlorohydrin (assuming the melting points corresponded to 97% purity). Considering the losses in the manipulation, etc., it is probable that the purity is several per cent. higher than this; the relatively high melting point of the crude ester points to the almost complete absence of the $\alpha,\beta$-dichlorohydrin from both portions.

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## NEW BOOKS

**The Phase Rule and the Study of Heterogeneous Equilibria: an Introductory Study.** By A. C. D. RIVETT, D.Sc., Associate Professor of Chemistry in the University of Melbourne. Oxford University Press, American Branch, New York, 1923. 204 pp. 118 figs. 20 × 13 cm. Price $3.50.

This little book by Professor Rivett is a welcome addition to our very limited textbook literature of the phase rule. Outside of Roozeboom's "Die heterogenen Gleichgewichte," which is too encyclopedic for any but a specialist, and Bancroft's "Phase Rule," which has had its greatest use in bringing to the attention of chemists the value of the phase rule at a time when it was but little known, there have been only two readable books on the phase rule, as far as the reviewer knows, which could be put in the hands of a graduate student or an investigator needing an acquaintance with the phase rule for the purposes of his research—namely, Findlay's, "Phase Rule" and Clibbens' "Principles of the Phase Theory." This third book fulfils the requirement of being another readable book—perhaps more so than Clibbens—and at the same time presents, in clear and understandable language much material that is not found in either of the others. The author states that it is not "either a treatise or a book of reference," but is intended as "an introduction to the subject." In the opinion of

the reviewer, it will be most valuable if used in *conjunction* with Findlay rather than as an independent introduction, since each of the texts supplements the other. Findlay, as pointed out by the author in his preface, has confined himself quite largely to the study of condensed systems, and Rivett has repaired that omission by giving us a most excellent development of one- and two-component systems including the vapor phase. The treatment of three-component and four-component systems is also complete to a degree that would hardly be expected in a book of but two hundred pages. It is of course a necessity that these things have been done by excluding some other things—and they are precisely the condensed systems which Findlay has treated so admirably. Each text supplements the other, and the pair give a much more satisfactory introduction than either alone.

Professor Rivett's book is written in a clear and logical style, which never leaves the reader in doubt as to his meaning. Diagrams and typography are also good. The reviewer feels that Professor Rivett would run less danger of losing a student's interest if he had used more specific examples in the text, even at the expense of some of the general discussion. Of the one hundred and eighteen phase-rule diagrams only a half dozen have specific components attached to them, and statistical data are not given for a single system. It would not be necessary to expand the book by very many pages in order to include enough data to convince the student who is being introduced to the phase rule *via* Professor Rivett's book that the rule works for real concrete systems made up of real chemicals.

ARTHUR E. HILL

**Landolt-Börnstein Physikalisch-Chemische Tabellen (Physical-Chemical Tables).** Fifth edition, revised and enlarged. By Dr. WALTHER A. ROTH, Professor an der Technischen Hochschule, Braunschweig, and Dr. KARL SCHEEL, Professor an der Physik.-Techn. Reichsanstalt, Charlottenburg. Julius Springer, Linkstr. 23–24, Berlin W. 9, Germany. Two volumes, xvi + 1695 pp. 1 fig. 20 × 28 cm. Price $45.00.

The new edition of these invaluable tables is very welcome. The last (fourth) edition appeared in 1912; eleven years is a long interim to be covered, at the present rate of growth of physics and chemistry.

The increased size of the present edition reflects this rapidity of growth. The new edition has nearly 1700 pages as compared with the 1300 pages of the old edition. A number of entirely new chapters have been added, dealing with radioactivity, spectrum analysis, electric phenomena in gases, the physics of the atom, and crystal structure, while the old chapters, particularly those dealing with the critical state, with electromotive forces, and with solubility, have been very greatly enlarged. A further addition is a special index covering the properties of the most important and best-known common substances.

Both of the original editors are now dead, so that we owe the present edition to Walther A. Roth, Karl Scheel, and half a hundred German collaborators.

These volumes, like their predecessors, constitute a splendid achievement. At least until our new International Critical Tables shall have appeared, they will be indispensable to every investigator or laboratory engaged upon research in physical or chemical science. To be sure, they do not present all the data for the various constants treated and frequently, extracts only are given of many important modern data, but in the great majority of cases these extracts should be adequate and, if they are not, the references to the original sources are available. The data, too, have not been as critically examined as might be desired, and the index is far too small and too poorly cross-referenced for so large and multifarious a subject matter. However, to have collected and arranged such a colossal number of data so carefully and so well, and to have printed them so clearly and indeed beautifully, merit our admiration and gratitude.

This new edition can also be looked upon as one more forward step in the resumption of the orderly progress of science in Germany.

ARTHUR B. LAMB

**Les Isotopes (Isotopes).** By Professor A. DAMIENS, of the Faculty of Pharmacy, Paris. Gauthier-Villars, Quai des Grands-Augustins, 55, Paris, 1923. ix + 118 pp. 33 figs. 25.5 × 16.5 cm. Price 12 fr.

It may well occasion some surprise, in view of the uniquely authoritative nature of Aston's treatise on this subject, as well as its eminently readable character, that another author has thought it worth while to prepare a book of almost the same size covering nearly the same field, and bearing the same title.

This surprise can only increase when it is learned that Aston's "Isotopes" has recently appeared in French translation. The present author, however, has recognized that since most of the progress in this field has been made by physicists, it is they who have taken in hand the enlightenment of the general scientific public as to the results of their labors. The vast theoretical importance of these results to chemistry makes it desirable that the experimental evidence in the case should be collected and critically examined by an open-minded chemist, and subsequently presented for the examination of others in such detail and with such a marshalling of facts that no critical student need feel the necessity of accepting any longer the ready-made opinions of workers in other fields as to the importance to him of the phenomenon of isotopy.

This task has been well performed. The book in parts is very complete. Many of the crucial experiments, as well as the confirmatory researches which followed them, especially the more recent ones, are reported with a

wealth of experimental detail, cuts, and documentation such as one would hardly expect to find in a summary treatise of this sort. With sound judgment the author has condensed the section on radioactivity and positive rays, probably in view of the excellent accounts of this field already published, and has correspondingly amplified his examination of the atomic weight work, the partial separations of isotopes, and the researches on such properties as melting point, density, index of refraction, etc., which lend themselves to comparative "large-scale" study.

The book seems relatively free from serious errors or omissions, considering the author's lack of experience in these rather special domains of investigation, but the discussion of the radioactivity of the atomic weight samples of active lead (pp. 36–37) is not especially luminous. The non-proportionality between radioactivity and atomic weight, found by Richards and his co-workers, is presumably due (a) in some of the minerals to an admixture of thorium lead; (b) possibly to a partial decay of the radium-D content after the separation of the lead from the mineral; and (c) in some cases perhaps to an accidental admixture of traces of radium-D in the preliminary preparation of the sample. A failure to make the measurements under strictly comparable conditions might also be suspected, except that the activities of differently purified samples of the same mineral show excellent agreement. The author seems troubled by a remark of Richards and Wadsworth to the effect that the radioactivity of their specimens was due to radium-E. It is obvious that the measurable $\beta$-ray activity of a pure radium-D preparation which has been left for 20 or 30 days is always due almost solely to radium-E, however completely this product may have been "removed in the preliminary purification." The length of the half-life of Ra-D (24 years) is hardly a reason for surprise at this conclusion. It does not seem quite true (p. 55) that in attempting to separate isotopes one should always employ at the start only materials of the highest purity. Among minor slips of the pen one notes "plomb" for "baryum" on the last line of p. 1, and $COCl_2$ for COCl on pp. 93 and 111.

In addition to being valuable as a compilation, the book is interesting for the assumption which is its principal excuse for being, namely, that a worker in one field may profitably attempt a comprehensive criticism of the methods and conclusions in another. In this case the author is to be commended for the good will and thoroughness with which this task has been attempted. He does well to emphasize again the axiom that when one tries to display minute differential effects, nothing but the most elaborate recital of precautions, purifications and tests can be convincing. Nor has one very important point escaped him. Two different states of mind have animated the workers in this field,—one group has experimented with a view to the confirmation of preconceived theories, others have only sought to make numerous and precise measurements, with minds freed from the

start, of all premature conceptions. Brilliant and important advances have resulted from both methods of work.

NORRIS F. HALL

**La Technique Industrielle des Parfums Synthétiques (The Industrial Technique of the Manufacture of Synthetic Perfumes).** By RENÉ SORNET. Gauthier-Villars, 55, Quai des Grands-Augustins, Paris, 1923. x + 135 pp. 14.5 × 22.5 cm. Price, unbound, 10 fr.

Although the manufacture of synthetic perfumes is a comparatively new industry a great deal has already been accomplished in this branch of applied science, and it represents a field of research which still continues to attract the attention and interest of chemists in many lands. It is well known that France has long occupied a leading position in the cultivation of flowers from which some of the most delicate perfumes are obtained, and that the consequent development in that country of the art of perfumery has led to the establishment of very large industries. An impetus was thus given to the systematic investigation of these floral products and also of the so-called essential oils from other sources, many of which are used in perfumery. As a result of such studies it has been found possible to produce by synthetical methods many of the more important odorous substances occurring in nature, and these achievements have led to a very great expansion of the perfume industry. It has furthermore been observed that a large number of definite organic compounds which have not as yet been found to occur in nature possess such fragrant properties as to render them of value in the manufacture of perfumes and they are now extensively utilized for this purpose. The literature in this particular domain of chemical science has consequently become very voluminous, and many patents have been issued for the protection of individual products. These considerations appear to have suggested the compilation of the little volume under notice, which is specially designed to supply the technical information that is not to be found in the various textbooks of organic chemistry or in those laboratory manuals which more specifically describe the methods for preparing organic compounds. It may be noted, however, in this connection that it was not the purpose of the author to include any information concerning the composition or manufacture of finished perfumes, which are usually of a complex nature.

The subject matter of the present work is divided into five parts which comprise, respectively, the alcohols, aldehydes, ketones, esters, and substances of diverse character such, for example, as coumarin and musk. Under each of these divisions a number of compounds are described, together with the reactions which take place in their formation, and there are some citations of current literature. The work is concisely written and, although limited in its scope, will doubtless be found of value to those who are interested in the industrial production of synthetic perfumes.

F. B. POWER