

*Analyses.* Calc. for  $C_{18}H_{26}O_3N_6Cl_4$ : N, 11.02, Cl, 18.60. Found: N, 11.09, 11.11; Cl, 18.24.

A similar compound was obtained by boiling the di-(phenylamide) of diglycolamidic acid,  $(C_6H_5NHCOCH_2)_2NH^7$  with acetone for a short time. This substance could be crystallized from acetone, and was thus obtained in large blunt needles, which melted at 166–167° without decomposition. The melting point of the secondary base is 141°.

*Analyses.* Calc. for  $C_{36}H_{40}O_6N_6$ : N, 13.46. Found: 13.47, 13.41.

This reaction will be further investigated with the view of determining its generality, and also the structure of the molecular complexes formed thereby.

### Summary

1. Chloro-aceto-*p*-chloro-anilide, chloro-aceto-*p*-anisidide, and chloro-aceto-*m*-toluidide have been converted into the corresponding isothiocyanates by the method recently described by the writers.

2. These isothiocyanates are so unstable that they rearrange immediately into the isomeric normal' 2-thiohydantoin.

3. The structure of these thiohydantoin has been established and characteristic derivatives prepared.

4. The investigations demonstrate that unstable mustard oils cannot be formed by the action of potassium thiocyanate on the above mentioned chloro-acetanilides, otherwise the final products of the reactions would be normal rather than pseudothiohydantoin.

NEW HAVEN, CONNECTICUT

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### NEW BOOKS

**Valenzkräfte und Röntgenspektren (Valence Forces and X-Ray Spectra).** By Dr. W. KOSSEL. Professor at the University of Kiel. Julius Springer, Berlin, 1921. 70 pp. 11 fig. 22 × 15 cm.

The two sections of this pamphlet are based, respectively, on two articles which the author published in "Naturwissenschaften" in 1919 and 1920. In the first, the author shows how the over-emphasis of the study of the valence of a single element, namely carbon, has led to misconceptions. By coupling Abegg's ideas of homo- and hetero-valence with modern ideas as to the structure of the atom, the author endeavors to prove that the old Berzelius binary theory of molecular structure is valid. He is also able to derive on this basis ideas of valence and molecular structure which harmonize nicely with Werner's theories. In the second part, the author develops the Bohr theory of atomic structure, with particular reference to X-ray spectra, and draws numerous conclusions regarding the structure of atoms.

These essays are wonderfully clear, and are bound to be extremely interesting and stimulating to chemists. They make many complicated matters seem simple, and present many illuminating ideas.

<sup>7</sup> Hill and Kelsey, THIS JOURNAL, 42, 1704 (1920).

We have only two unfavorable criticisms. First, matters have sometimes been made to appear too simple; for instance, the author's treatment of heteropolar valence is convincing and satisfactory, but he unquestionably avoids any thorough study of homopolar valence. Second, Kossel nowhere mentions Parson or Lewis or Langmuir, who anticipated him in many points, and whose studies of polar and non-polar valence, from the standpoint of atomic structure, have been in many respects more thoroughgoing than his own.

ARTHUR B. LAMB

**Isotopes.** By F. W. ASTON, M.A., D.Sc., A.I.C., F.R.S. Fellow of Trinity College, Cambridge. Edward Arnold and Company, London, 1922. viii + 152 pp. 21 figs. 4 plates. 22.5 × 14 cm.

The appearance of this monograph at the present time has a double interest. To those who have intently followed in the journals the work of Aston and others who have so rapidly developed this subject in the past few years, it collects in convenient form the results of these notable researches. To those who have been less keenly interested in isotopes, it affords a ready means of becoming familiar with one of the most, if not the most, important developments in chemistry since the time of Dalton. After very skilfully tracing the history of atomic theory from its beginning to the discovery of isotopes, the author discusses the radioactive isotopes, positive rays of electricity, neon, the mass-spectrograph, the analysis of various elements, the electrical theory of matter, atomic numbers, the spectra of isotopes, and the theory and experimental results of the separation of isotopes. The monograph is very well and abundantly illustrated with plates and figures. About 30 of the common elements have hitherto been examined, about half of which have been found to consist of a mixture of 2 or more isotopes. One of the most interesting problems remaining to be solved is the quantitative determination of the relative proportions of the isotopic members of a given element. Intensity measurements, which should furnish information on the subject, frequently vary from plate to plate and also show wide deviations from the predictions of the known atomic weights.

The separation of isotopes also presents a problem of much interest and of great difficulty. As far as determinations have been made up to the present time, the common elements from different localities, or geological formations, do not appear to vary in atomic weight. This probably indicates that the present proportion of isotopes has existed unchanged since the formation of the earth's crust and that changes, of radioactive nature not detectable by the usual methods, are not proceeding among the common elements. The experimental evidence, however, is as yet very meager, and the results may be open to a different interpretation.

S. C. LIND

**An Introduction to the Chemistry of Radioactive Substances.** By A. S. RUSSELL, M.A., D.Sc., Student and Tutor of Christ Church, Oxford. The Macmillan Company of Canada, Limited, Toronto, 1922. xi + 173 pp. 12 fig. 13 × 159 cm.

This is a welcome summary of the chemist's contribution to radioactivity, easily the best available to the chemist who wishes a foothold in this field and most desirable for the physicist already working there. It supplements Rutherford's standard text, which is now 10 years old and deficient in chemical bearing. Like Fajans' recent work in German, it records compactly the chemical advances of the past 10 years. It discusses the significance of this work to the newer conceptions of atomic structure but avoids the unwarranted extension of these hypotheses to the common elements, dismissing the work of Harkins, Aston, von Hevesy and of Brönsted with the statement that the subject is still in its infancy. The chapters on the chemistry of uranium and thorium, on the chemical separation of the radioactive elements individually, and on the use of these elements as indicators in dealing with extremely minute quantities of isotopic elements are especially timely and valuable. An irritating defect is the constant and indiscriminate use of the word "body" to mean anything from a lump to an atomic species. The author may be pardoned for not using the usual name of the "Fajans-Soddy Law" for a relationship which he was the first to point out, but "Group Displacement Law" seems an unfortunate substitute; indeed the scope of this relation is hardly broad enough to deserve listing among our capitalized laws, however notable its consequences when first it was revealed. In naming the radioelements the newest and simplest practice is followed, regardless of history, but each new book shows the need of a really satisfactory system.

GERALD L. WENDT

**An Advanced Course of Instruction in Chemical Principles.** By ARTHUR A. NOYES, Director of the Gates Chemical Laboratory, California Institute of Technology, and MILES S. SHERRILL, Associate Professor of Theoretical Chemistry, Massachusetts Institute of Technology. Complete revision. The Macmillan Company, New York, 1922. xviii + 310 pp. 19 figs. 22.5 × 14.5 cm.

A very few subjects, mathematics especially, have always been taught by the problem method. Some years ago the case system became the standard for legal instruction. Much more recently business administration has been thus presented with conspicuous success. In "Chemical Principles" a similar plan is proposed for physical and theoretical chemistry.

The problems to be solved "are not merely supplementary or incidental to the text, but they are the feature about which the whole presentation centers. The aim striven for is to make each problem serve a definite purpose, and to have it involve independent thought, yet in such measure as shall not be beyond the mental capacity of college students who have

completed good general courses in mathematics, physics, and chemistry.”

The entire book can scarcely be completed in the average one-year course: but if various paragraphs and problems marked with asterisks are omitted, the remainder, we are assured, should require not more than 90 hours in the classroom. Even the more extended course, however, finds no space for the physical properties of substances in the metallic, crystalline, liquid, and dispersed states, for atomic structure and radiation, or for the newer theories concerning these topics.

The text states formally and concisely the generalizations upon which the problems are based. In many cases these generalizations will have been previously derived, wholly or in part, by the student himself. The data of the problems represent the best products of modern research, and the principles to be illustrated, whether classical or very recently discovered, are all of demonstrable value. The authors show great skill in their transitions from the simple to the complex, and from the obvious to tasks requiring marked initiative and ingenuity. The claim that the problems do not “involve merely substitution in formulas, and mathematical operations, but are such as require clear logical thinking” is amply justified. A student who has intelligently covered the ground of this book will doubtless have real power in the quantitative application of all the physico-chemical principles which it includes.

In attaining such proficiency, however, unless this book is supplemented by other sources of information not a little will have been sacrificed: the historical development of the subject with all its suggestiveness and vivid human interest; the experimental methods by which the very data in the text have been accumulated, with critical discussions of their advantages and inherent errors; the explanation of a part, even a small part, of the processes taking place in living organisms; and finally, some measure of appreciation of the efforts being made to penetrate the mysteries surrounding the basic concepts of the science.

“Chemical Principles” cannot fail to be widely helpful in physico-chemical instruction. Some will use it simply as an auxiliary to lecture courses. Others will rely more upon it, though supplementing it with further explanatory matter and with additional topics. Still others will follow it strictly as the authors indicate, and their success with the average undergraduate in his difficult task will be measured by their scientific vitality, resourcefulness and persistence.

G. S. FORBES

**Leitfaden der Quantitativen Analyse (Manual of Quantitative Analysis).** By Dr. F. HAHN, Privatdocent at the University of Frankfurt A/M. Theodor Steinkopff, Dresden and Leipzig. 1922. vii + 230 pp. 23 × 15.5 cm. Price Sh. 6. Bound, Sh. 7/3.

The author of this volume has responded to what he conceives to be a demand for an introductory treatise on Quantitative Analysis which shall

be broader in scope than the brief practice manuals which represent the content of courses on instruction, but shall not be of the character of those larger texts which are essentially reference books rather than guides to beginners. The subject matter is divided into sections, the first of which deals with general underlying principles and operations which are common to typical analytical procedures, and the others with the working directions for carrying out these processes. The discussion of forms of apparatus and their proper usage is carefully prepared and the exposition of the essential principles of volumetric, gravimetric, electrometric, and colorimetric analyses, particularly the portion dealing with the theory of indicators, is well presented. The range of determinations and separations covers most of the commoner elements and radicals. The author and subject indexes are adequate.

In its general structure and arrangement this volume is of a character quite familiar to users of introductory manuals in the English language, however lacking they may be in Germany; indeed, one could readily believe that one or another of our American texts has served as a model for Dr. Hahn's book, although the subject matter is plainly his own. There is always a question of the real adequacy of manuals which exceed the scope of an ordinary instructional course without taking on the comprehensive character of the larger texts, but the author has succeeded in making possible a considerable degree of flexibility of instruction within the compass of a book of moderate size. The work should be of interest to teachers.

H. P. TALBOT

**Untersuchungen über Kohlenhydrate und Fermente (Investigations upon Carbohydrates and Enzymes). Part II (1908-1919).** By EMIL FISCHER. Julius Springer, Berlin, 1922. ix + 534 pp. 7 figs. 16 × 24.5 cm. Price \$4.50; bound \$5.30.

In October, 1908, Emil Fischer, in the introduction to what is now Part I of his "Investigations upon Carbohydrates"<sup>1</sup> made the following statement. "While the knowledge of the monosaccharides in their systematic relationship is to-day fairly satisfactory, the investigation and, more especially, the syntheses of the polysaccharides still remain in their first beginnings. Although I would most gladly participate in working out the structure of this important group yet, because of my extreme susceptibility to the injurious effects of phenylhydrazine and its derivatives, it is doubtful if I can carry out this project."

The present appearance of Part II, of the "Investigations upon Carbohydrates," which comprises 46 additional papers upon the chemistry of sugars and enzymes published between 1908 and 1919, shows that the fears of Fischer, expressed above, were most happily not realized. "After a few years' pause," as Dr. Bergmann, the Editor, remarks in his preface

<sup>1</sup> THIS JOURNAL, 31, 607 (1909).

to the new volume, "the fountain of those researches, which the great master had initiated, began to flow once more with its accustomed vigor until the disturbances of the war and finally death put an end to its activities."

The investigations of Fischer and his coworkers, included in the present volume, comprise 40 papers from the *Berichte*, 3 papers from the *Annalen*, 2 papers from the *Zeitschrift für physiologische Chemie* and 1 paper from the *Proceedings of the Prussian Academy of Sciences*. They have been arranged by Dr. Bergmann under four general heads: I, Glucosides (218 pp.); II, Acyl Compounds of the Sugars (135 pp.); III, Conversion Products of the Sugars (130 pp.); IV, Ferments (25 pp.).

It was to the study of the new synthetic glucosides and saccharides that Fischer devoted the greater part of his attention during the last year of his study of the carbohydrates. He dwells especially (p. 200) upon the great importance of the aceto-halogen derivatives of the sugars in the building up of new synthetic products and shows (p. 241) how by starting with  $\beta$ -acetobromo-glucose it is possible to form new disaccharides of the type of trehalose. The structure of these higher saccharides was the problem in sugar chemistry which Fischer had uppermost in mind, and had his life been spared he would no doubt have attained the great goal of sugar synthesis,—the coupling of glucose and fructose to form sucrose.

Fischer did not limit himself, however, to the problem of the polysaccharides, and the student of this, as of the other volumes from his pen, is astonished at the breadth and variety of his interests. Even the random by-products of his researches were studied to see whether they did not have a bearing upon some unsolved problem of plant or animal chemistry. An interesting example of this is the identification of his monobenzoyl-glucose (p. 312) with a product obtained by Griebel from cranberries. This correlation of researches is naturally most marked between those branches of organic chemistry which Fischer himself had investigated. His early study of the purines leads naturally to the synthesis of purine glucosides (p. 137), a class of compounds which acquire importance from the work of Levene and Jacobs upon the nucleic acids. Similarly Fischer's investigations upon the tannins lead to the synthesis of galloyl compounds of fructose (p. 340) and other sugars.

Fischer's mind was active to the very last. Two of the researches in the present volume were published after his death, and too much praise cannot be given to Dr. Bergmann for the conscientious manner in which the editing of these and of the other papers has been performed. The typography of the new volume is excellent and a good index makes it convenient for purposes of reference.

The two volumes of Emil Fischer's "Investigations upon Carbohydrates"

with his other works upon the Purines, the Polypeptides and the Tannins form a collection of books which stand unrivalled in the history of organic chemistry. They contain classic syntheses which will always repay study and which chemists of the future will look back upon with wonder and admiration.

C. A. BROWNE

**Forensic Chemistry.** By A. LUCAS, O.B.E., F.I.C., Director of the Government Analytical Laboratory and Assay Office, Cairo, Egypt; Fellow of the Chemical Society; Member of the American Chemical Society; Member of the Society of Public Analysts. Edward Arnold and Company, London, 1921. vii + 268 pp. 14 × 22.5 cm.

In 1920 a somewhat similar but smaller treatise by the same author appeared under the title of "Legal Chemistry and Scientific Criminal Investigation." The present book deals with subjects having chemical interest or requiring chemical knowledge as applied to criminal investigations and is a considerable enlargement of the previous work. The author has wisely refrained from going outside of chemistry in many subjects, such as the chapter on Poisons, and has confined himself entirely to the chemical aspects without encroaching on the medical side.

A large number of subjects including Blood Stains, Bullets, Clothing, Counterfeit Coins, Documents, Explosives, Finger Prints, Firearms, Poisons, Stains, Textile Fabrics, Tobacco are covered in more or less detail. While general methods of analysis that are to be found in the ordinary textbook are omitted, special tests are given in many cases, or special steps or methods of examination are given and their application to the subject matter in hand.

Altogether the book is a decided improvement on the previous one and should be of much interest and value to those engaged in criminal investigations involving the application of chemical knowledge.

R. L. EMERSON

**Women in Chemistry. A Study of Professional Opportunities.** Published by The Bureau of Vocational Information, Studies in Occupations, Number 4, N. Y., 1922. xvi × 272 pp. 15.25 × 23 cm. Price \$1.10.

This very valuable and interesting publication gives information as to the numbers and kinds of positions in chemistry occupied by women, actual and desirable training, salaries, rewards and limitations in the profession—a fairly complete survey of the position of the woman chemist to-day. It also contains much material that is really a study of opportunities in chemistry regardless of sex. It is a distinct contribution, as Dr. Charles H. Herty says in the prospectus, to the economic phase of chemistry, and is of value to young women and young men entering the field, to chemists in general, and to all interested in the professional advancement of women.

The information upon which the study is based was received from women chemists themselves, and from universities, industrial executives and numerous organizations including first the American Chemical Society. A total of 654 women is included—a large number, since probably only 4 or 5% of the 22,000 chemists in the country are women. They are distributed in very diverse fields, the largest group, 199, being in industrial laboratories, and the next largest, 139, in educational institutions, with others in hospitals and medical research laboratories, in the government service and in related fields. "The field of industry is the one in which women chemists have as yet had least experience; on the other hand it is one in which they are expressing the greatest interest," so that much space is given to it with many letters from employers and women employed.

One of the striking and satisfactory features of the monograph is the emphasis upon the need of thorough training for the successful chemist. Graduate work is urged as almost essential to advancement beyond the lower positions. It would have been an added satisfaction if salaries, ages, and training could have been more closely compared and also if more comparison could have been made with men. Were the salaries of \$1800 or less received by 70% of the women who reported their salaries due to youth and inexperience? Is there a logical explanation of the very few salaries of over \$3000 (2.5% or 5 in all)? It is interesting that 4 of these 5 were paid to teachers, the highest amount being to a woman trained in chemistry, now head of a university department of home economics.

The monograph is a stimulating survey of the position of women in an important profession. Decidedly, there is a considerable group of women chemists and while not many of them have yet reached the higher positions, or are receiving the higher salaries, the optimism of the women themselves, the diversity of opportunities offered, and the recognition accorded, furnish an encouraging outlook. The book is a remarkably able contribution to our professional information.

KATHARINE BLUNT