vated adsorption is accompanied by a dissociation into fragments, *e. g.*, $CH_3$ and H from which, by recombination with adsorbed deuterium and subsequent repetition of the several processes, equilibrium concentrations of the deutero-methanes finally result. We are prosecuting this study in a quantitative direction and also catalytically, since we have, in this exchange reaction, an important tool for catalytic research in the important field of saturated hydrocarbon reactions. We are again indebted to Dr. R. B. Barnes of the Palmer Physics Laboratory for the use of his infra-red spectrometer.

FRICK CHEMICAL LABORATORY K. MORIKAWA
PRINCETON UNIVERSITY W. S. BENEDICT
PRINCETON, NEW JERSEY H. S. TAYLOR

RECEIVED FEBRUARY 21, 1935

### THE BETA-PARTICLE FROM ACTINIUM

*Sir:*

Through the use of a screen-wall tube counter [Libby, *Phys. Rev.*, **46**, 196 (1934)] the upper limit of the energy spectrum of the previously undetected actinium electron has been determined. The actinium was shown to be free from members of the radium and thorium series by precipitating lead sulfide from the sample and measuring the decay curve of the gamma activity. This curve was exponential with a half-life of thirty-seven minutes, in excellent agreement with the known half-life of actinium B. A sample sufficient to give a count of approximately 100 electrons per minute was mounted in a very thin layer. The magnetic field strength necessary to bend out the most energetic electrons corresponds to an $H\rho$ of about 1750 gauss.-cm., or an energy of about 220,000 electron-volts. The fact that 60% of the particles are absorbed by an aluminum screen with a thickness of 0.0023 g./cm.$^2$ is in agreement with this value. This energy limit would place actinium on the lower Sargent curve [Sargent, *Proc. Roy. Soc.* (London), **A139,** 659 (1933)].

The actinium sample was prepared by extraction from Colorado uranium residues and is chiefly cerium and other rare earth chlorides. The sample was treated as follows. Small amounts of salts of barium, lead, and thorium were added, as bodies for the precipitation of the decay products of actinium. The precipitation of barium chromate removed actinium X, the actinium B and C was carried down with lead sulfide, and finally the radioactinium was coprecipitated with thorium peroxyhydroxide. The thorium was previously purified to remove mesothorium I and II, to prevent contamination of the sample with the latter, which is isotopic with actinium. The other decay products are so short-lived that their effect disappears before the activity can be observed.

It is planned to measure the energy spectrum of the disintegration electrons by means of an apparatus to deflect beams of definite energy into a counter.

DEPARTMENT OF CHEMISTRY D. E. HULL
UNIVERSITY OF CALIFORNIA W. F. LIBBY
BERKELEY, CALIFORNIA W. M. LATIMER

RECEIVED FEBRUARY 4, 1935

# NEW BOOKS

**A Textbook of Inorganic Chemistry.** By FRITZ EPHRAIM. Second edition, revised and enlarged, translated from the fourth German edition by P. C. L. Thorne. Gurney and Jackson, 33 Paternoster Row, London, E. C. 4, England, 1934. 873 pp. Price, 28s./- net.

This second English edition, based on the fourth German edition, is larger than the first edition by nearly one hundred pages. This is due, not to any major change, since the titles and arrangement of the thirty individual chapters remain unaltered, but rather to the insertion throughout of many items representing the progress in inorganic chemistry achieved in the interim. The new edition, therefore, retains the characteristics and outstanding virtues of the earlier edition and of the German original, namely, a simplified and eminently readable presentation of a great amount of information in a relatively brief compass.

ARTHUR B. LAMB

**Anwendungen der Röntgen- und Elektronenstrahlen, mit besonderer Berücksichtigung** organisch-chemischer **Probleme. (Application of Röntgen and Electron Rays, with Particular Consideration of Organo-chemical Problems.)** By Professor Dr. J. EGGERT, Berlin, and Professor Dr. E. SCHIEBOLD, Leipzig. Akademische Verlagsgesellschaft m. b. H., Markgrafenstrasse 6, Leipzig C 1, Germany, 1934. vii + 190 pp. 101 figs. 16 × 23.5 cm. Price, RM. 18.00; bound, RM. 19.50.

Some lectures delivered at the meeting of the "Deutsche Bunsengesellschaft" in Bonn on May 19, 1934, are here

printed as Volume IV of the "Ergebnisse der Technischen Röntgenkunde." While they are individually interesting and are capably presented, there is no great justification for incorporating them into the body of scientific literature.

The main theme stated in the title is justified by B. W. Robinson's description of the methods and accomplishments of the Davy-Faraday Laboratory of the Royal Institution. It then attenuates into the border field of cellulose chemistry and is finally lost in a medley of reactions that happen to involve x-radiation. K. Hess and C. Trogus presented an extremely well illustrated lecture on the course of reactions, involving cellulose, as followed by x-ray diffraction. Electron diffraction applied to cellulose problems is discussed by H. Mark and J. J. Trillat; to layer lattices, by F. Trendelenberg; and chiefly to surfaces of inorganic materials by F. Kirchner. There are perhaps five accomplishments described in these three lectures that would justify the application of the method to the problems in hand.

W. Gerlach discusses Röntgen's discovery of the "x-ray" and presents illustrations of the types of discharge tubes used by Röntgen. In striking contrast to this are set A. Bouwers' and R. Berthold's descriptions of modern x-ray technique. One is especially impressed by the superior technical development of the European x-ray tube industry compared with that of the United States.

H. Stintzing presents the second part of a paper in which he attempts to find some order in the polymorphism of the elements. There is a short discussion by H. Broili, R. Glockler and H. Kiessig of the "shape" of the carbon and beryllium K "lines."

STERLING B. HENDRICKS

**Précis de Chimie d'après les Théories Modernes à l'Usage des Étudiants des Facultés des Sciences (P. C. B.) et des Facultés de Pharmacie. (Compendum of Chemistry according to Modern Theories for the Use of Students of the Faculties of Sciences and the Faculties of Pharmacy.)** By JOSEPH MARTINET, D. ès-Sci. phys. Gaston Doin & Cie., Éditeurs, 8 Place de L'Odéon, Paris VI$^e$, France, 1934. viii + 934 pp. Illustrated. 13 × 20 cm. Price, fr. 52.

This admirable book gives an extraordinarily comprehensive account of the theories and facts of chemical science, general, inorganic and organic. Among comparatively recent discoveries are mentioned: the transformation of matter into energy and *vice versa;* ortho and para hydrogen; the doubled isotope of hydrogen; rhenium; element 87, with a question. Many others might be given.

The material is divided into: general, 114 pp.; inorganic, 421 pp.; organic, 346 pp. The fundamental laws of chemistry are given as: Lavoisier, conservation of matter, Proust, constant proportions, Dalton, multiple proportions, Richter, proportional numbers (better combining weights), Avogadro and Ampère, Gay-Lussac, number of Avogadro, Mitscherlich, Dulong and Petit, Prout. The periodic table on p. 35 differs at some points from those to which we are accustomed. The exposition of Lewis' electronic theory on pp. 48–51 is excellent and the author recognizes that the union of oxygen with phosphorus in phosphorus oxychloride is half homopolar and half heteropolar. On p. 208, however, he follows Kossel in considering that sulfur is positive hexavalent in sulfuric acid, giving its six valence electrons, two each, to three of the oxygen atoms, the fourth oxygen atom being furnished by a mole of water. This confusion of the Lewis and Kossel systems is rather common in France, Germany and Holland.

The organic portion of the book is arranged logically, with a consideration of hydrocarbons first, followed by halogen compounds, alcohols, aldehydes, ketones, acids, sulfur, nitrogen and heterocyclic compounds.

The book contains a very large amount of details, excellent for use in connection with lectures and to suggest subjects which should be studied further in the literature or in other books. If used alone it would seem to imply that students are expected to cram a large accumulation of facts and theories for an examination without understanding many of the items that they absorb—but such a process is not confined to France.

The subjects included are presented very clearly and concisely.

W. A. NOYES

**Elektronenstrahlen und ihre Wechselwirkung mit Materie. (Electron Beams and their Interaction with Matter.)** By J. HENGSTENBERG and KARL WOLF. Eucken-Wolf, "Hand- und Jahrbuch der chemischen Physik," Band 6, Abschnitt I. A. Akademische Verlagsgesellschaft m. b. H., Markgrafenstrasse 6, Leipzig C 1, Germany, 1935. 236 pp. + index. 18 × 25.5 cm. Price, RM. 24.

This book gives a thorough and reliable survey of the field indicated by its title, including the following topics: the properties of the free and bound electron; the production and measurement of electron beams; the theory of the interaction between moving electrons and matter; and experimental results regarding the interaction of electrons and matter. The theoretical discussions provide clear statements of the assumptions made and the results obtained, the details of complicated arguments being often omitted. The last half of the book is devoted to a complete review of experimental results, especially on the diffraction of electron waves by gas molecules and by crystals, with many excellent reproductions of diffraction photographs.

LINUS PAULING

**The Kinetic Theory of Gases.** By LEONARD B. LOEB, Professor of Physics in the University of California. Second edition. McGraw-Hill Book Co., Inc., 330 West 42d Street, New York, 1934. xx + 687 pp. 15 × 23.5 cm. Price, $6.00.

The first edition of Professor Loeb's book filled a real need, and the second edition, a generous portion of which has been entirely rewritten, is very timely. An appreciation of the importance of the subject to chemistry is growing steadily, and the many references and discussions on the relation between molecular structure and molecular behavior are welcome. The chapter on heat capacities, a subject of great importance to chemists, has been entirely

rewritten from the modern point of view so largely developed since the first edition. The chapter on transfer phenomena has been very greatly improved through the discussion of the effects of molecular forces. The chapter on low pressure phenomena, excellent as it was in the earlier edition, is likewise improved by the inclusion of many of the recent developments. The phenomena connected with the conduction of electricity in gases is a field where the most fascinating applications of the kinetic gas theory are possible. The author's many important contributions in this field provide him with an exceptional background and, while this excellent chapter has been expanded considerably in the new edition, many would have welcomed an even greater extension.

The book is heartily recommended as a most comprehensive and informing work on an important and difficult subject.

F. G. KEYES

**Die Chemie des Pyrrols.** I. Band. Pyrrol und seine Derivate mehrkernige Pyrrolsysteme ohne Farbstoffcharakter. (**The Chemistry of the Pyrroles.** Vol. I. Pyrrole and its Polynuclear Derivatives Other than Pigments.) By HANS FISCHER AND HANS ORTH. Akademische Verlagsgesellschaft m. b. H., Markgrafenstrasse 6, Leipzig C 1, Germany, 1934. xii + 460 pp. 16 × 23.5 cm. Price, RM. 26.50; bound, RM. 28.

It has been evident for some time that in the investigation of blood, plant and gall pigments synthesis is more effective than degradation both for establishing relationships and for elaborating structural formulas. As a consequence it would be difficult to find another special field in which the number of new substances has increased as rapidly as in the pyrroles. The present text comes from the laboratory in which these pigments have been under intensive investigation for many years and in which by far the largest number of new pyrrole derivatives have originated. It is therefore authoritative as well as completely "up to date."

As the present volume is intended to be the first part of a more comprehensive treatise it deals only with the simpler pyrrole derivatives and the purely chemical peculiarities of pyrroles, leaving to a second volume all consideration of pyrrole pigments and the more physiological aspects of pyrrole chemistry. Even with this limitation it contains many compounds that are far from simple and the authors found it expedient, with the approval and assistance of the editor of Beilstein, to devise a more rational nomenclature for pyrrole derivatives.

The organization of the text is excellent. The material is presented in a large number of short chapters corresponding to the special topics to be discussed and the classes of compounds to be described. The descriptive chapters open with a discussion of general methods of preparation and their limitations, continue with a careful analysis of the chemical peculiarities of the class of substances under consideration, and end with adequate descriptions of the individual substances. The admirable introductory discussions by investigators who manifestly have an intimate, first-hand knowledge of the subject, while doubtless useful to others working in the same field are of special value to all other organic chemists because, taken together, they give a complete account of one of the most important groups of organic compounds. The preparation and properties of the individual substances are described in sufficient detail for use by any one skilled in the art of the organic chemist.

The volume is supplied with an elaborate index of subjects and substances. The substances are indexed in accordance with an ingenious classification which is helpful but owing to the length of names which not infrequently extend across the page, and to their complexity, it is generally easier to locate a substance by taking advantage of the index, the excellent organization of the text and the uncommonly liberal provision of structural formulas. The typography is as praiseworthy as the text.

E. P. KOHLER

**Laboratory Manual of Physiological Chemistry.** By MEYER BODANSKY, Director of Laboratories, John Sealy Hospital, Galveston, and Professor of Pathological Chemistry, University of Texas, and MARION FAY, Associate Professor of Biological Chemistry, School of Medicine, University of Texas. Third edition. John Wiley and Sons, Inc., New York, 1935. vii + 274 pp. Illustrated. 15.5 × 24 cm. Price, $2.00.

This is the second revision of a manual first published in 1928, and it will be welcomed by the many teachers who have found the earlier editions useful in their classes.

The course begins with a brief conventional review of acidimetry and alkalimetry, *p*H, indicators, and buffers; then come sections on carbohydrates, lipins and proteins; experiments on milk, on bone and connective tissues, on the digestive juices and bile, and on urine and blood. The last two subjects constitute almost half of the book. Some work on nerve tissue is included in the section on lipins. The authors have omitted the chapter on colloids that appeared in former editions. Otherwise, the changes represent chiefly the including of new and improved methods.

Quantitative methods constitute quite properly the main features of the course as offered; it is pleasing, however, to note that the authors realize the usefulness of a certain amount of qualitative work in teaching chemical physiology.

Theoretical discussion of the physiological implications and use of the experiments is omitted, since these matters are covered in Professor Bodansky's companion volume "Introduction to Physiological Chemistry." However, this manual might profitably include with the quantitative directions more indication of the chemical reasoning involved, and perhaps some notice of the accuracy and probable sources of error in application and interpretation.

No "synthesis" of the methods into coördinated experiments on living subjects is indicated. It is probable that the authors, perhaps wisely, assume that, given directions for the analytical procedures, the fitting of the laboratory exercises into examples of applied biochemistry giving scope for training in interpretation of results can be most easily and best done by the teachers themselves. Adequate material is given for such use, which might give added interest and variety for the students.

The choice of analytical methods is good, and alternative methods frequently are given,—for example, three procedures for the determination of blood inorganic phosphate are offered. The directions are clear, and bibliographic data are included.

The field studied is that of a first course in human physiological chemistry. The work given would approximately cover the subject matter and time allotment of the average biochemical course for first year students of medicine.

EDGAR G. MILLER, JR.

## BOOKS RECEIVED

January 15, 1935–February 15, 1935

A. BÖMER, A. JUCKENACK and J. TILLMANS, Editors. "Handbuch der Lebensmittelchemie. Zweiter Band. Allgemeine Untersuchungsmethoden. Erster Teil. Physikalische Methoden." Verlag von Julius Springer, Linkstrasse 23–24, Berlin W 9, Germany. 536 pp. RM. 66; bound, RM. 69.

A. BÖMER, A. JUCKENACK and J. TILLMANS, Editors. "Handbuch der Lebensmittelchemie. Sechster Band. Alkaloidhaltige Genussmittel, Gewürze, Kochsalz." Verlag von Julius Springer, Linkstrasse 23–24, Berlin W 9, Germany. 604 pp. RM. 76; bound, RM. 79.60.

CHRISTIAN BOMSKOV. "Methodik der Vitaminforschung." Verlag Georg Thieme, Rossplatz 12, Leipzig C 1, Germany. 301 pp. RM. 24; bound, RM. 26.

ARTHUR C. COMPTON and SAMUEL K. ALLISON. "X-Rays in Theory and Experiment." Second edition. D. Van Nostrand Co., Inc., 250 Fourth Ave., New York. 828 pp. $7.50.

C. F. ELAM. "Distortion of Metal Crystals." Oxford University Press, 114 Fifth Ave., New York. 182 pp. $5.00.

HORST ELSNER. "Tollens–Elsner Kurzes Handbuch der Kohlenhydrate." Fourth edition. Verlag Johann Ambrosius Barth, Salomonstrasse 18B, Leipzig C 1, Germany. 627 pp. RM. 39; bound, RM. 41.

A. C. FIELDNER and J. D. DAVIS. "Gas-, Coke-, and By-Product-Making Properties of American Coals and their Determination." Coöperative Work of the U. S. Bureau of Mines and the American Gas Association. Printed by the American Gas Association, 420 Lexington Ave., New York. 164 pp.

EDWARD CURTIS FRANKLIN. "The Nitrogen System of Compounds." American Chemical Society Monograph 68. Reinhold Publishing Corporation, 330 West 42d St., New York City. 339 pp. $7.50.

O. FUCHS and K. L. WOLF. "Dielektrische Polarization." Eucken–Wolf "Hand- und Jahrbuch der chemischen Physik." Band 6. "Elektrizität und Materie." Abschnitt IB. "Elektronenstrahlen und ihre Wechselwirkung mit Materie," Hengstenberg–Wolf. Akademische Verlagsgesellschaft m. b. H., Markgrafenstrasse 6, Leipzig C 1, Germany. 222 pp. + indexes. RM. 27.

O. HASSEL. "Crystal Chemistry." Translated from the German by R. C. Evans. William Heinemann, Ltd., 99 Great Russell St., London W. C. 1, England. 94 pp. 6s./-.

WILHELM KLEMM. "Anorganische Chemie." Walter de Gruyter & Co., Genthiner Strasse 38, Berlin W 10, Germany. 173 pp. RM. 1.62.

ARLINGTON C. KRAUSE. "The Biochemistry of the Eye." The Johns Hopkins Press, Baltimore, Md. 264 pp. $3.65.

AUSTIN M. PATTERSON. "A German–English Dictionary for Chemists." Second edition. John Wiley and Sons, Inc., 440 Fourth Ave., New York. 411 pp. $3.00.

FRIEDRICH RAPPAPORT. "Mikrochemie des Blutes." Verlag Emil Haim & Co., Maria-Theresien-Strasse 10, Wien 1, Austria. 206 pp. RM. 15; bound, RM. 16.80.

F. O. RICE and K. K. RICE. "The Aliphatic Free Radicals." The Johns Hopkins Press, Baltimore, Md. 204 pp. $4.50.

HEINRICH SCHWARZ. "Die Mikrogasanalyse und ihre Anwendung." Verlag Emil Haim & Co., Maria-Theresien-Strasse 10, Wien 1, Austria. 286 pp. RM. 21; bound, RM. 22.80.

N. SEMENOFF. "Chemical Kinetics and Chain Reactions." Oxford University Press, 114 Fifth Ave., New York. 480 pp. $10.50.

ALFRED STOCK and ARTHUR STÄHLER. "Quantitative Analysis." Translated by Winton Patnode and L. M. Dennis. McGraw-Hill Book Co., Inc., 332 West 42d St., New York City. 176 pp. $1.75.

HSIEN WU. "Principles of Physical Biochemistry." Peiping Union Medical College. Yu-Lien Press. Peiping, China. 264 pp.

"Cold Spring Harbor Symposia on Quantitative Biology." The Biological Laboratory, Cold Spring Harbor, L. I., N. Y. Vol. I, 1933, 239 pp., $3.35. Vol. II, 1934. 284 pp., $3.35. Both volumes. $6.50.