applicability, and especially cannot be used with difficultly reducible substances.

Since the above work was done, C. H. Maryott[1] published the results of his work on Stefanov's original method. His results appear similar to ours on Bacon's modified method. He found, however, that potassium gave good results. He did not try Bacon's modified method.

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NEW BOOKS.

Physical Chemistry; its Bearing on Biology and Medicine. By JAMES C. PHILIP, M.A., Ph.D., D.Sc., Assistant Professor in the Department of Chemistry, Imperial College of Science and Technology. London: Longmans, Green & Co. 306 pp. Price, $2.10.

Since the appearance of Cohen's "Physical Chemistry for Physicians and Biologists" many advances have been made in the application of physical chemistry to biological problems, and a distinct need exists for a work which explains these applications, and the principles which underlie them, in terms intelligible to the ordinary medical student and student in biology. This need is very satisfactorily filled by the present work; the language is clear, and the experimental illustrations are well chosen.

No description is given, however, of the application of concentration cell measurements in the elucidation of biological problems, nor are the principles underlying the development of potential in concentration cells discussed. In view of the extensive applications which have been made of these principles in the past ten years in the investigation of such problems as the neutrality of the blood and the combining capacity of proteins for acids and bases, this omission is serious and robs the book of much of its usefulness.

On page 306 the discovery that the temperature coefficient of the conduction of a nervous impulse is of the same order as that found for chemical reaction velocities is attributed to Lucas[2] instead of to S. S. Maxwell.[3] T. BRAILSFORD ROBERTSON.

Essentials of Chemistry. By RUFUS PHILIPS WILLIAMS, Instructor in Chemistry in the English High School, Boston, Mass. 8vo. Cloth, 421 pages. Price, $1.25. Ginn & Co., Publishers.

In the preface the author points out 22 "innovations and departures * * * from current texts" which "are believed to be especially desirable features of the present book." Many teachers will feel inclined

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[1] *Chem. News*, Jan. 6, 1911; *Am. J. Sci.*, **30**, 378 (1910).

[2] *J. Physiol.*, **37**, 112 (1908).

[3] *J. Biol. Chem.*, **3**, 359 (1907).

to take issue with the author relative to some of these "desirable features," however, especially when he speaks of "Preparation, Properties and Tests" being "the really essential matters" while "History, Occurrence and Uses" may be omitted by classes limited for time. The average student is not going to be a chemist, neither will he in his daily routine make tests; but the *humanistic* side of chemistry showing how man has learned to utilize substances for his welfare and comfort is of greater interest and probably of as great value to the educated man in the community as anything in chemistry.

The present book attempts to modernize an earlier work, but the spirit has not changed. This is evidenced by the fact that the main discussion of atoms and molecules is still introduced in the first chapter. The treatment of catalysis (page 46), hydrolysis (page 292) and the explanation of the alkaline reaction of sodium carbonate (page 140) accord better with the teaching of twenty years ago than of to-day. Several questionable statements and errors are found. The style is interesting and pleasing; the treatment of industrial topics is wide-awake. The book contains a great many facts of interest and value, but it is not clear that the student will gain an understanding knowledge of chemical principles and their application to life. W. C. MORGAN.

Leitfaden der graphischen Chemie: Erläuterung einiger wichtiger Schulbeispiele mit fünf zusammenlegbaren Raummodellen. R. KREMANN, a. o., Professor der allgem. u. physik. Chemie an der Universität Graz. Verlag von Gebrüder Borntraeger, Berlin, 6 M. 60 Pfg.

The advantages of graphical representations, or at least of graphs combined with tables, over lengthy written descriptions is very marked, even in such simple cases as the pressure-temperature diagram for a one-component system and the melting-point diagram for a two-component system. These familiar diagrams are beginning to appear in chemical books of reference, and a knowledge of them will soon be indispensable for a chemist. In more complex systems, graphical methods of representation are, of course, still more important, but here the chemist is confronted with the serious difficulty of visualizing a three-dimensional figure. With the aid of space models this difficulty can easily be overcome, but sufficient time must be taken to examin in several cases the relation between the space model and its projections in different planes. Such individual work is now greatly facilitated by the simple and novel cardboard models designed by Kremann.

The five models, when enclosed with the 36-page explanatory note in a folding cover, occupy a space only two centimeters in thickness. Each of them consists of several pieces of cardboard securely fastened together in such a way that, by folding, and tying strings, the flat model may be quickly transformed into the space model. Each model represents a definit heterogeneous equilibrium, and is constructed to scale to correspond as closely as possible to the experimental data given in tables in the text. The quantities plotted along each coördinate axis are clearly marked, and the projections are printed on the two axial planes which form the basis of a model. The significance of each area is also given, and the connection between the spacial figure and the projections is emphasized by the use of the same letters with different subscripts.

The following examples of heterogeneous equilibria are considered: I. The two-component system, silver nitrate + water. The two axial planes represent temperature-vapor pressure, and temperature-composition of the liquid phase. II. The three-component system, potassium sulphate + magnesium sulfate + water. Each axial plane represents temperature and the concentration of one of the salts in the liquid phase. III. The three-component system, lead + tin + bismuth. Temperature is represented by the vertical axis, and composition is plotted in the horizontal plane in the well known symmetrical triangular diagram. The projections on the horizontal plane and on the vertical tin — bismuth — temperature plane are also shown. IV. The four-component system, ammonium nitrate + ethyl alcohol + methyl alcohol + water. The compositions are represented by means of a symmetrical tetrahedron. The projection on the ammonium nitrate — ethyl alcohol — methyl alcohol plane, and that on a plane parallel to both the methyl alcohol — ethyl alcohol axis and the water — ammonium nitrate axis are shown on another sheet of cardboard. V. The four-component system, water + the four salts, sodium chloride, ammonium acid carbonate, ammonium chloride and ammonium acid carbonate: a reciprocal salt pair. The model in position represents an inverted pyramid, whose horizontal cross section is a square; the projections on the horizontal plane and on a vertical plane parallel to one of the diagonals of the square are given. In the final chapter of the text, Jänecke's method of representing a reciprocal salt pair is illustrated by means of the example, water + the four salts, potassium chloride, magnesium sulfate, potassium sulfate and magnesium chloride.

WILLIAM C. BRAY.

Die Brown'sche Bewegung und die wahre Existenz der Moleküle. VON PROF. DR. J. PERRIN, Paris. (Deutsch von Dr. J. Donau, Graz.) Sonderausgabe aus Kolloidchemische Beihefte. Monographien zur reinen und angewandten Kolloidchemie. Herausgegeben von Dr. Wolfgang Ostwald. Dresden 1910, Verlag von Theodor Steinkopff, pp. 84. Price M. 2.50.

In this monograph of 84 pages, Professor Perrin presents an account of his interesting investigation of the Brownian movement as exhibited by colloidal suspensions of gamboge and of mastic in water. The lucidity and attractiveness of the author's style have been well preserved in the translation and the reader's attention and interest are held throughout with a power not usually displayed in scientific literature of this character.

The contents of the volume are divided into four parts. Part I deals with the description and history of the Brownian movement and its relation to the Second Law of thermodynamics. This is followed by an interpretation of the phenomenon in the light of the kinetic theory and an outline of the methods by which a study of the phenomenon leads (1) to a demonstration of the correctness of the fundamental postulates underlying the kinetic theory and (2) to a determination of the numerical value of Avogadro's constant, N, the number of molecules in one gram-molecular weight of any gas.

In his use of the term *osmotic pressure*, on pages 21 and 22, the author follows the almost universal practice of employing this term indiscriminately to denote two quite distinct quantities, (*a*) the *thermal pressure* of the solute molecules, and (*b*) the *osmotic pressure* properly so-called. This general practice is largely responsible for much of the confusion which exists in many quarters regarding the concept of osmotic pressure and its importance in our solution theory. The first of these quantities, the thermal pressure of the solute molecules, is the pressure corresponding to their mean translatory kinetic energy. For a sufficiently dilute solution, it is equal to two-thirds of the mean translatory kinetic energy per unit volume. The second quantity, the osmotic pressure, is the difference in the external pressures which must be applied to a solution and to the pure liquid solvent respectively, in order to produce equality in the vapor pressures (or in more general terms, the activities or thermodynamic potentials) of the solvent from each. This is a definit physical quantity, capable of direct measurement and connected with the freezing point, boiling point, vapor pressure, etc., by purely thermodynamic relations.

The thermal pressure and the osmotic pressure resemble each other superficially in that as the solution approaches infinit dilution they both approach the limit expressed by the familiar equation $PV = NRT$. As the solution becomes infinitly concentrated, however, the thermal pressure approaches the finite limit which corresponds to the mean translatory kinetic energy possessed by the solute molecules in the pure liquid solute, while the osmotic pressure increases without limit as the composition of the solution approaches the pure liquid solute. It is obviously with the first of these quantities, the thermal pressure, that Professor Perrin's experiments are directly concerned. The solutions with which he worked, were, however, so extremely dilute that their thermal and osmotic pressures were numerically identical.

In Part II, a kinetic equation is derived for the distribution of the particles of a uniform colloidal suspension under the influence of gravity. In order to calculate N from this equation, determinations of the volume and density of the spherical colloidal particles and measurements of the number of particles in a cross section at different levels are necessary. The remainder of Part II deals with the description of the experimental methods employed in these measurements and the results obtained. Prof. Perrin considers $70.5 . 10^{22}$ as the most reliable value for N. This corresponds to $4.11 . 10^{-10}$ c. g. s. electrostatic units, for the value of the elementary electrical charge, while Millikan's most recent value for this constant is $4.9016 . 10^{-10}$. The cause of this discrepancy has not yet been discovered.

Part III is the description of an experimental test of Einstein's formulas for the mean translatory and rotatory displacements of a molecule in a given time. The experiments show that a change of 100,000-fold in the mass of a colloidal particle is without an appreciable effect upon its mean translatory kinetic energy. The largest particles studied correspond to a solute with a molecular weight of 200 billion. One of the basic postulates of the kinetic theory, namely, the assumption that the mean kinetic energy of a molecule is independent of its mass and dependent only upon the temperature seems therefore to have received experimental confirmation *for a range of mass from that of the electron to that of a colloidal particle several hundred trillion times as heavy.*

Part IV comprises a brief survey and comparison of the various methods which may be employed to obtain the value of N. The monograph closes with a table of the values given by each method. The striking agreement among so many methods of such widely different character forces the reader to agree with the author's conclusion that the actual existence of atoms and molecules must be regarded as conclusively proved.

As one result of this conclusive evidence we may expect to see a radical change in some of our pedagogical methods in the next few years. Following the lead of Ostwald, it has been the custom with many authors of text books of general and physical chemistry to avoid, as far as possible, the use of the atomic theory and kinetic hypothesis in the presentation of the laws and principles of chemistry. The reasons for this method of presentation no longer exist. The kinetic and atomic principles should, in the future, serve as the *starting point* for the development of the laws of chemistry instead of merely the *hypothetical explanations* of these laws.

E. W. WASHBURN.

The Mineralogy of Arizona. By F. N. GUILD. Professor of Chemistry and Mineralogy, University of Arizona. 1910. The Chemical Publishing Co. 103 pp. Price, $1.00.

This small book aims to give "a fairly complete description of Arizona's minerals with some reference to their mode of occurrence, associations and chemical composition." The very general descriptions have been largely compiled from the literature, to which references are freely given, though the value of such a one as "Dana: Text-Book," may be in doubt.

Typographical errors are not scarce: "United Geological Survey" (p. 14); "Tuscon" (p. 15); "according to informations furnished him" (p. 17); "Moisson" (p. 22); "U. G. S." (p. 26); "$(Pb,Cu_2)_3S.Sb_2S_3$" (p. 30) instead of $3(Pb,Cu_2)S.Sb_2S_3$; "Chrysophase" (p. 40); "Limonite, $Fe_2O_3 3H_2O$" (p. 45); "loboradorite" (p. 57); "Caronado mine" (p. 76); etc. Mineral names (in the body of the text) are capitalized in some places and not in others. Copper stained chalcedony, known by the trade name of "blue chrysoprase" is erroneously called chrysoprase (p. 40); dumortierite was not analyzed by Diller as stated on p. 67; copiapite is not an "unusually rare" mineral (p. 90); limestone, marble, caliche, graphitic clay and cement clay are included in this "Mineralogy." Some of the descriptions concern minerals from Mexico and an analysis of descloizite from the Argentine Republic is given (p. 77). A description of the method of analysis of this mineral covers more than a page. The accounts of the meteorites, of the various forms of silica, of the ice caves and of the caliche or calcareous deposits are much more interesting than the remaining paragraphs. While the book may be of value to those desiring a very general knowledge of the mineralogy of Arizona, it seems to the reviewer that with a little more effort and care, a book could have been produced that would have been far more creditable both to the author and to Arizona.

WALDEMAR T. SCHALLER.

Mineralogie de la France et de ses Colonies. Volume 3, Part 2 (1909), Volume 4, Parts 1 and 2 (1910). A. LACROIX. Librarie Polytechnique, Ch. Beranger, Editeur, Rue des Saints-Peres, 15, Paris. Price, Vols. 1–3, 30 francs each; Vol. 4, 35 francs.

This monumental description of French minerals, the first part of which appeared in 1893, is now completed, the publication of the last parts being delayed by the author's studies of vulcanism. The second part of volume 3 deals largely with the carbonates, of which calcite naturally takes the largest share, extending over about 170 pages and illustrated by 267 crystal drawings and photographs. Then follow descriptions, replete with crystal drawings, of the other rhombohedral carbonates. The descriptions of aragonite and azurite are very full and richly illustrated. Ctypeite is still regarded as a third modification of $CaCO_3$.

The first part of the fourth volume starts in with the manganites and plumbites. Psilomelane is described under the formula $xRO.yMnO_2.zH_2O$, of which the cobalt-bearing variety, asbolite, has an important economic value as a cobalt ore. Rancieite is a calcium-bearing variety of psilomelane. Then follow descriptions of the anhydrous sulfates and chromates; mascagnite, thenardite and metathenardite, which is the name given to a polymorphic form of Na_2SO_4, stable above 235° and differing in its crystallin and optical properties from thenardite. It was found at a secondary fumarole (temp. 500–590°) of Mt. Pélee and had evidently formed from fusion. There are then described glauberite, anhydrite, the barite group with many photographs and crystal drawings, the alunite group in which an occurrence of natroalunite from Martinique may be noted, and the rare compound lead and copper sulfates. The list of hydrous sulfates is an extensive one and includes mirabilite, gypsum (nearly 50 pages) and most of the vitriols. The rarer complex sulfates form an extensive list. Of the molybdates and tungstates there are wulfenite, scheelite and the wolframite group. Molybdite from Corsica showed qualitatively the presence of iron and water. The aluminates, ferrites, and chromites comprise the spinel group, the various members of which are fully described and illustrated. Only three borates are given, hambergite and rhodizite from Madagascar, and ulexite.

The second part of the fourth volume takes up the phosphates and related salts, the niobates and tantalates, and the organic mineral substances, such as the hydrocarbons, fossil resins and coals. The latter half is a supplement containing the new data on all French minerals. Of particular interest may be mentioned the various manganese phosphates and the full descriptions, with many illustrations, of the French phosphorites. The phosphorites are composed of minerals of great interest, economically as well as scientifically. These minerals are the amorphous colophanite $x(Ca_3(PO_4)_2$ or $x(CaF)_2Ca_8(PO_4)_6 + yCaCO_3 + zH_2O$; the hexagonal dahllite $2Ca_3(PO_4)_2.CaCO_3 + {}^1/_2H_2O$ (see, however, *Am. J. Sci.*, (4th ser.) **30**, 309 (1910)); francolite, $(CaF)_2Ca_8(PO_4)_6.CaCO_3 + H_2O$, of which the fibrous variety is called staffelite and an unidentified fourth mineral, differing optically from dahllite and francolite but similar to them in chemical composition. Quercyite is the name given to those phosphorites which consist of the amorphous colophanite and one or more of the other three minerals just mentioned. If only dahllite and francolite (both optically negative) are present, we have α-quercyite; if the fourth unidentified mineral (optically positive) is also present, we have β-quercyite. A number of new mineral names are introduced in this volume and the entire work, in four volumes, is a lasting tribute to both the author and to France. It is an indispensable mineralogical reference work of the highest order. WALDEMAR T. SCHALLER.

Municipal Chemistry. A series of thirty lectures by experts on the Application of the Principles of Chemistry to the City, delivered at the College of the City of New York, 1910. Edited by CHARLES BASKERVILLE, PH.D., F.C.S., Professor of Chemistry and Director of the Laboratory, College of the City of New York. New York and London: McGraw-Hill Book Company. 1911. pp. ix + 526. Price, $5.00 net.

The thirty chapters comprising this volume present the substance of an equal number of public lectures on topics relating to the welfare of urban communities from the standpoint of chemistry applied to municipal affairs. The topics treated by the eighteen lecturers include the Sanitation of the City (Baskerville), Drinking Water Supplies and Their Purification (Mason, Flinn), Milk (Darlington), Food Adulteration and Inspection (Wiley, Hamor), Drugs and Their Adulteration (Coblentz, Kebler), The Construction and Sanitation of Streets and Roads (Cushman, Edwards, Very), The Disposal of Wastes and Sewage (Very, Winslow), The Making and Valuation of Illuminating Gas (Elliott), the Smoke Problem (Parsons), Ventilation (Moody), Personal Hygiene (Storey), Textils (Olney), Combustibles and Explosives (Breneman), Paints, Metal Corrosion, Cement and Concrete (Toch), and Parks and Playgrounds (Britton).

The editor, in his preface, presents an earnest appeal for an increase of intelligent and aggressive interest in municipal affairs, which is quite in harmony with the subject matter of this series of lectures. The topics are, in general, treated in a way to reach the reader who has no accurate scientific knowledge and to appeal to his common sense and his civic pride; and chemists who are not closely in touch with this field of work can hardly fail to find much of interest in these pages. This is particularly true of the teacher who desires to utilize the applications of chemistry to affairs of everyday life in order to enforce his instruction in the principles of the science. A few of the chapters, notably those on the New York water supply, on the detection of adulteration in drugs, corrosion of metals, cements and concretes, and textils are necessarily more technical than those on general questions of sanitation, or food and water supplies, and in some of the former, especially that on textils, the writers seem to have wandered rather far afield from the general topic, to the probable discouragement of the layman to whom the rest of the book will appeal. An elaborate index makes reference to special topics an easy matter.

As an example of the publisher's art this volume falls so far short as to call for unfavorable comment. The print is not clear on many of the pages, there are many imperfect letters and in at least two instances (pp. 122 and 327) entire lines have been misplaced. The paper (at least in the copy submitted for review) has been badly soiled in passing through the press and shows imperfections of structure. The cuts have in many cases not been fortunately chosen and in many more they are badly blurred in reproduction. For the price demanded, a more finished volume could well have been supplied.

Although these mechanical imperfections somewhat mar the reader's enjoyment of the book, it will still be found to be a most interesting collection of monographs upon timely subjects and should serve an excellent purpose in directing public attention to municipal needs and individual duty, and to emphasize the vital importance of the service which chemistry and its followers can render for the public weal.

H. P. TALBOT.

Das Oedem—Eine experimentelle und theoretische Untersuchung der Physiologie und Pathologie der Wasserbindung im Organismus. DR. MARTIN H. FISCHER, Professor of Physiology in the University of Cincinnati. In deutscher Sprache herausgegeben von Karl Schorr und Wolfg. Ostwald. Dresden, 1910. Verlag von Theodor Steinkopff. Pp. 223. Price, 6 M.

This monograph is described in an introductory chapter by Dr. Wolfgang Ostwald as representing the most important advance in the solution of one of the fundamental problems of general biology and pathology that has been experienced since the application of the theory of osmosis. For the chemist the primary interest in the book lies in the rather ingenious attempt to explain a series of physiological and especially pathological phenomena on the basis of the behavior of colloids. After an introductory consideration of these somewhat indefinit states of matter from the standpoint of modern physical chemistry, the author reviews his experimental studies of the conditions under which the swelling of fibrin and gelatin—a typical colloid phenomenon—takes place. He proceeds to compare this with the retention of water in the colloid (protoplasmic) structures of which tissues are built. Changes in the reaction of the medium, *e. g.*, the development of acidity, may suffice to alter greatly the "affinity" of the tissue for water. The antagonistic influence of various anions and cations in this change is illustrated. The author critically reviews the earlier theories which postulated variations in blood pressure, dilution of the blood, etc., as the essential factors in the causation of oedemas. He maintains that the phenomenon must be associated primarily with the tissues themselves. Local changes such as, for example, the development of acid incident to oxygen starvation, may make possible the retention of water in the colloid tissue structures in the manner already indicated. Thus, also, the (acid) sting of insects induces a local edema of the skin. Further specific illustrations are developed in detail.

One must admit that the application of theory to actual biological conditions is in places rather overdrawn; and it is more than doubtful if any single group of factors can account for all the phenomena discussed. The treatment is in harmony with the current interest in the chemistry of the colloids. The book is suggestive, even if not everywhere convincing; and it will appeal to any one interested in this trend of biochemical investigation. In its original English form the monograph was awarded the Hatfield prize of the College of Physicians in Philadelphia, in 1909.

LAFAYETTE B. MENDEL.