

in vacuo; the latter yields about 50% of its weight in distillates. These have been fractioned *in vacuo* and await further examination.

CHARLES F. MABERY.

CASE SCHOOL OF APPLIED SCIENCE,
CLEVELAND, O.,
January 28, 1915.

NEW BOOKS.

Essays and Addresses. By the late JAMES CAMPBELL BROWN, D.Sc. (Lond.), LL.D. (Abdn.), Professor of Chemistry in the University of Liverpool. With a portrait and twenty-two illustrations. J. & A. Churchill: London, 1914. vii + 208 pp. Price, \$2.00 net.

This book has been published in response to the request of many of the former pupils and friends of Dr. Campbell Brown for copies of addresses, either never published, or at present out of print. Five of the twelve numbers were delivered before the student chemical society of the University College, Liverpool, and two others before a joint meeting of the societies of the same college, while three were delivered before the Liverpool Section of the Society of Chemical Industry, two of them being addresses as Chairman of the Section.

Perhaps the most interesting papers are the translation of an autobiographical sketch of Liebig, originally published in the *Deutsche Rundschau*, and a reminiscent sketch of Hofmann. Speaking of the long hours kept by students, assistants, and Hofmann himself, in the little group at the Royal College of Chemistry, he adds: "That is the kind of work that tells. An eight-hour day may be all very well for working men who have no ambition and who are content with daily bread (and beer); but a gentleman has to work much harder." Other essays on technical education and chemistry as a profession, discuss perennial problems in an interesting manner, while the papers on Ethics of Chemical Manufacture, and a French View of German Industries, are far from being out of date. The only strictly scientific paper is one on Aquiculture: a Study of Deposits in Pipes.

The book as a whole is pleasant reading, and will be especially welcome to the old students and many friends of the genial Liverpool professor.

JAS. LEWIS HOWE.

Zur Lehre von den Zuständen der Materie. By P. P. VON WEIMARN. Vol. I, 183 pp. Vol. II, 100 photographic illustrations. Theodor Steinkopff, Dresden & Leipzig. Price M. 7 unbound, M. 9 bound.

This is a reproduction of the author's articles in the *Kolloid Zeitschrift*, 1908-9, without much of the theoretical matter then published.

Proceeding on the idea that every insoluble substance is capable of assuming the colloidal state by sufficient subdivision, he devotes much of the experimental work to the forms of barium sulfate. This and

aluminum hydroxide are the basis of a thorough study of the conditions of matter in the colloidal solution and solute states, and the author has carried his studies very far beyond the work of others on the general subject. His photographs show barium sulfate as perfectly colloidal, resembling gelatin, and also in all stages of crystalline growth. He supports the theory that there are no really amorphous substances and that every substance may be made to assume either amorphous or crystalline states at will.

To produce the amorphous colloidal state, the substance must be produced under conditions of very low solubility.

He ascribes to the substance a coefficient of form of precipitate (N). This determining factor he places proportional to the concentration of the four compounds in equilibrium in the metathesis which produced it, and to the quantity of the precipitating substance which must ultimately separate from the solution in granular phase, inversely proportional to the solubility of this compound and proportional to the viscosity of the solution. That is, the coefficient is the product of these factors.

The two volumes contain much interesting work. The second is devoted entirely to microphotographs. The experimental work is largely original and the whole forms an interesting suggestive addition to the more specific subject of colloids rather than to the title, "Zustand der Materie."

W. R. WHITNEY.

Handbuch der Arbeitsmethoden in der anorganischen Chemie. Edited by DR. ARTHUR STÄHLER, Privatdozent in the University of Berlin. Vol. III, first half. Veit & Company, Leipzig, 1913. 682 pages, 354 fig. Price, bound, 25 marks.

Vol. I, published in 1912, 786 pages, 1064 fig., bound 28 marks, treated of the laboratory and its equipment—mechanical operations. Vol. II, not yet published, is to be devoted to physical and chemical processes. Vols. IV and V will treat of descriptive inorganic chemistry. Volume III, of which this is the first half, is devoted to physico-chemical measurements. The topics treated in this part with their authors are as follows: Vapor Density, Osmotic Pressure, Viscosity, Diffusion, Conduction of Heat and Specific Heat (Eucken); Weight, Volume and Density (Fellgentraeger); Surface Tension (Freundlich); Density of Gases (Guye); Metallurgy (Gerens and Ruer); Compressibility and Thermal Expansion (Heuse); Solubility of Gases (Just); Critical Constants (Klemensiewicz); Boiling and Subliming Points (Krafft); Compressibility and Thermostats (Richards); Molecular Weights in Solution (Sieverts); Calorimetry and Heat of Reaction (Steinwehr); Solubility and Adsorption (Thiel); Melting Points (v. Wartenberg).

As this list indicates the plan of the entire work involves the coöperation of a brilliant corps of co-editors, including in addition to those whose names occur above, many well-known chemists, each writing on one or more subjects in which, as a rule, he himself has been an active investiga-

tor. In some chapters, as for example, that on weighing, matters of real interest to the specialist are preceded by a detailed discussion of the most elementary topics. In other chapters, notably that dealing with the determination of molecular weights by the boiling point method, long descriptions of primitive forms of apparatus are given, the inclusion of which might be the subject of criticism were it not for the fact that the latest improved forms are also described, thus giving the reader the history of the evolution of the subject.

The result is the production of an exhaustive as well as an authoritative treatise that must become indispensable to all advanced workers in the field of general and physical chemistry. .

HERBERT N. MCCOY.

The Elements of Physical Chemistry. By J. LIVINGSTON R. MORGAN, PH.D., Professor of Physical Chemistry in Columbia University. Fifth edition. New York: John Wiley and Sons. Small octavo, pp. xiv + 506. Cloth, \$3.00 net.

This book now appears in a fifth edition, and its general arrangement and Ostwaldian heredity are doubtless already familiar to those interested. The author remarks that, in this edition, the discussions of the phase rule and of the subject of colloidal solutions have been restricted, because special works on these subjects are now available. The system of notation employed has been changed throughout in order to conform to that adopted by the International Commission for the Unification of Physico-Chemical Symbols. The 238 problems comprised under Chapter X will still be found useful, in spite of the works of Prideaux and of Knox. The commendable effort to keep the book modern is perhaps more successful in individual detail than in general viewpoint. It is with regret that one finds that such errata have escaped notice as appear on p. 389: "The unit of electrical resistance is the *ohm*. . . This is equal to 10^9 ergs. The unit of current strength. . . is called the *ampere*—equal to 10^{-1} ergs. The unit of electromotive force is the *volt*, or 10^8 ergs." Truly, as Bret Harte would say, it were better for the student to know fewer facts clearly than more facts in a confused way.

ALAN W. C. MENZIES.

Handbuch der Mineralchemie. DOELTER, *et al.* Vol. II, No. 6 (Bogen 1-10) and Vol. III, No. 5 (Bogen 41-50). Theodor Steinkopff: Dresden and Leipzig. Price, M. 6.50 each.

The editors of this work are to be congratulated that the European war has not lessened their output up to the present time, though the name of one of them, Dittrich, who has heretofore contributed the analytical methods, is conspicuously absent from this latest issue.

The contents of Vol. III, No. 5, is devoted chiefly to the mineral arsenates. They are mostly rare and have been the subject of little chemical work. There are only about a dozen references to work done in the last decade and a comparison of what there is about them with the matter

of a first-class mineralogy (Dana's) shows only slight additions. The subject of antimony is begun in this left.

Vol. II, No. 6, deals with the important aluminum silicates. The anhydrous natural silicates are satisfactorily treated and the matter on porcelain is definite and adequate. The clay minerals, especially kaolin, possess great interest to the geologist and have been the subject of literally hundreds of investigations. Much of this work appears to be mere rubbish and its treatment in *Mineralchemie* seems to the abstractor open to serious criticism; page after page of futile experimentation is recorded in detail where a paragraph or two with references would have been all the matter is worth. This situation has occurred rather frequently in *Mineralchemie*, and while the effort of the editors to deal with all data in an unprejudiced manner is to be commended, definiteness and unity have often been inexcusably sacrificed.

E. T. ALLEN.

A Laboratory Manual of Qualitative Analysis for Students of Medicine, Dentistry and Pharmacy. By A. R. BLISS, JR., Professor of Chemistry and Pharmacy in the Birmingham Medical College. W. B. Saunders Company: Philadelphia, 1914. Octavo of 244 pages with 8 tables. Cloth, \$2.00 net.

This small book is even smaller than it appears, about one-third of the pages being blank to receive the notes of the student. Nevertheless the ground covered seems to the writer to be adequate to the needs of students of Dentistry and Pharmacy and of prospective students of Medicine. For medical students the book should be used during one of the preliminary college years, for there is certainly no time for this work in the better medical schools. In order to meet the increasing demands for preliminary training in chemistry before entering the medical school, Qualitative Analysis should, in the writer's opinion, encroach upon the laboratory time of the first course in college chemistry and be given in the second half of the freshman year. Only in this way can sufficient training in Organic Chemistry and Quantitative Analysis be obtained in the two years of college work now required for entrance to most of the good medical schools. In such a scheme this manual would be very serviceable, for it contains under each element, in addition to the usual qualitative reactions and plan of separation, a list of common compounds and especially of the "official" pharmacopoeial preparations.

An extensive knowledge of many of the latter preparations is perhaps of doubtful value to the physician, who has so many more important and more useful chemical facts and principles to learn, but the names and composition of the "official" compounds should at least be brought to the student's attention, and the inclusion of the list for consideration during the work in Qualitative Analysis seems to the reviewer desirable.

For students of pharmacy and dentistry and for students in those medical schools which still find it necessary to give Qualitative Analysis

as a part of the medical course, this book should also prove acceptable.

P. A. SHAFFER.

Traité Complet d'Analyse Chimique appliquée aux essais industriels par J. Post et B. Neumann, avec la collaboration de nombreux chimistes et spécialistes. Deuxième édition française entièrement refondue, traduite d'après la troisième édition allemande et augmentée de nombreuses additions par G. Chenu et M. Pellet. Tome troisième, second fascicule. Paris: Librairie Scientifique, A. Hermann et Fils. 1913. 465-902 pp. Price, 15 francs.

In this fascicle, itself a book of 438 pages, two related subjects are discussed: Coal Tar, and Coloring Materials. The general treatment is the same as in other fascicles, already reviewed in *THIS JOURNAL*,¹ and the same standard of excellence is maintained. Here again, however, as in the first instalment of this volume, the space does not seem to be equitably divided between the topics. It cannot be reasonably objected that 403 pages is too much to devote to pigments and to coal-tar dyes and their raw materials, vegetable dyes, dyeing and chemical tests. Coal tar is disposed of in 35 pages, but perhaps the excuse for this lies in the fact that both sections were written by G. Schultz, of Munich, so that any deficiency in one place can be remedied in another. C. E. W.

Der Nachweis organischer Verbindungen. Ausgewählte Reaktionen und Verfahren. VON L. ROSENTHALER, Professor an der Universität Bern. Die chemische Analyse. Sammlung von Einzeldarstellungen auf dem Gebiete der chemischen Analyse. Band XIX/XX. Stuttgart: Ferdinand Enke, 1914. Large 8, 1070 pp. Price, 34 Marks, unbound; 32.30 Marks, cloth.

The author explains in the preface that his aim has been to assemble upon a sufficient theoretical foundation the material facts of organic qualitative analysis which seemed to be of the most importance to the practicing analyst, after having verified and supplemented them, so far as possible, by his own observations. The result is probably the most comprehensive collection of analytical characterizations of organic compounds of all classes that has been brought within the compass of a single volume.

No rigid general scheme of procedure is laid down; but after a few sensible words of advice on the principles which will usually guide the analyst in planning his examination of unknown compounds or mixtures, and a section on the qualitative determination of the elements in organic compounds, the main portion of the book is given up to a series of descriptions of the analytically important reactions and properties of approximately three thousand compounds. The value of these characterizations is enhanced by the occasional discussion of methods for particular separations and extractions, and abundant bibliographical references. At the beginning of each chapter the analytical reactions of greatest importance for the class of compounds contained in it, and particularly such as are useful for

¹ *THIS JOURNAL*, 31, 120 (1909); 34, 752 (1912).

establishing the membership of individuals in the special groups, are clearly presented, and their uses indicated.

The grouping of the subject matter may be best indicated by naming the chapter titles. These are: Hydrocarbons; Alcohols; Aldehydes; Ketones; Carbohydrates; Phenols; Acids; Oxyacids; Ethers; Quinones; Esters; Halogen-derivatives; Nitro-derivatives; Nitroso-derivatives; Nitriles; Acid-amides; Amines; Acid-derivatives of Bases; Heterocyclic Bases; Amino-acids; Sulfur Compounds; Arsenic Compounds; Alkaloids; Resin Acids; Tannins; Glucosides; Bitter Compounds; Dyestuffs; Proteins; Enzymes; Toxalbumins.

A table of the compounds described, placed at the end of the book and arranged according to the elements present and the melting and boiling points, tends to lessen the difficulties arising from the lack of closer analytical coordination between the class reactions.

The author has done his work with care and discrimination, and the resulting volume, which is attractive in appearance, will prove a valuable book of reference.

S. P. MULLIKEN.

Applied and Economic Botany. By HENRY KRAEMER. Especially adapted for the use of students in technical schools, agricultural, pharmaceutical and medical colleges, and also as a book of reference for chemists, food analysts and students engaged in the morphological and physiological study of plants. 8°. Pp. vi + 806, with 424 plates comprising about 2,000 figures. Philadelphia, published by the author (145 N. Tenth St.), 1914. Price, \$5.00.

Two addresses, respectively by the President of the Botanical Society of America and the Chairman of the botanical section of the American Association for the Advancement of Science, at the recent Convocation Week meetings in Philadelphia, present the very different viewpoints from which botany, like the other sciences, must be seen by those to whom the privileges and duties of teaching fall. The practical utilization of every one of the fundamental sciences has become so great that the teacher can hardly make peace with his conscience if he lets his one opportunity, with students who take an introductory course only, go by with little or no reference to its applications, while those to whom the arts based upon it and other sciences are of more direct interest than the science itself are impatient of the use of their time and effort for more of the latter than they see or believe to be of practical use. This is true of the sciences directly fundamental to engineering, agriculture, and the like, for instance, to such an extent that in the former, to which physics is indispensable, its teaching has become so specialized that in a great university with a strong college of engineering, the general student who has escaped physics in the secondary school may have difficulty in finding opportunity in college to learn the salient facts and relations in physics that every intelligent person needs; while a civil engineer who is to know the distinguishing

marks of structural timber, or the sanitary engineer who is to recognize the danger line in the bacterial contents of drinking water, must acquire the desired knowledge with little or no understanding of the structure and life of plants which forms the essence of an intelligent comprehension of our every-day dependence upon these humble relatives of mankind.

Professor Kraemer is a seasoned teacher in the field of pharmacognosy, in which, almost to our day, a general knowledge of botany has been considered indispensable, and which, even now, he and those of his training and practice are unwilling to reduce to an art divorced from the underlying science. The present book is doubly interesting as a concrete exposition of this viewpoint and a compendium of reference for the botanical facts most frequently desired by pharmacists and organic chemists, to whom the source and origin of their materials are important. It is the outgrowth of long experience in the laboratory, and may be regarded as the most mature expression of the author's views, since it replaces earlier books from his pen in the same field. Dealing primarily with the structure and products of plants, it is necessarily lacking in the full analysis of their activities that the agriculturist is coming more and more to recognize as fundamental to agronomy—though physiology is by no means excluded from its pages; but a student who had really mastered its contents in the laboratory would form excellent material for the development of a specialist in any field of botany, if he had absorbed at the same time the spirit of investigation that its intelligent use ought to foster.

Little need be said in detail of the contents of the book, further than that it is modern and accurate as these attributes may be applied to a compendious work of its kind. An outline of the vegetable kingdom occupies about one-fifth of its space, with a chapter on organic evolution. Somewhat more concerns the contents and forms of cells, and a like part is given to the external and internal structure of plants. Chapters on botanical nomenclature and terminology and on the cultivation of medicinal plants give a reference character as valuable as it is unusual in books usually accessible to those who are neither botanists nor pharmacists; a far too short chapter presents the essentials of technique as practiced by the student of drugs; and over one-third of its bulk consists in a synopsis, at once readable and instructive, of the vegetable kingdom and its products. Not the least of its merits is that the book is fully indexed.

WILLIAM TRELEASE.

Chemistry of Common Things. By RAYMOND P. BROWNLEE, ROBERT W. FULLER, WILLIAM J. HANCOCK AND JESSE E. WHITSITT. Allyn and Bacon: Boston, New York and Chicago. 1914. viii + 616 pages. Price, \$1.50.

The authors of this book are teachers in high schools of New York City, and their work is an attempt to satisfy a practical requirement in public school teaching by furnishing a manual which "is designed to meet the

growing demand that high school courses should prepare the pupil for citizenship;" it therefore deals with the chemistry of everyday affairs.

The authors have shown great industry in bringing together a large number of facts relating to applied chemistry. The compilation might almost be described as an elementary chemical technology and if a student is interested at all in the things which go on around him he should find much in this book that is entertaining and probably helpful.

There is no attempt at a presentation of the principles of chemistry in a systematic way and not much is given in the nature of general chemical theory. The course is not intended for "discipline," but to impart information to that large class of young people who never expect to go to college. Such information must be of necessity somewhat superficial, but, all things considered, it is perhaps the wisest plan. Teachers are divided on this point. The reviewer believes that the greatest mistakes are made in trying to follow a rigorously scientific method with beginning students; it sometimes happens that at the end of the freshman year the boy has neither facts nor discipline, and after a high school course the situation may be, if possible, even worse.

The present book contains, however, too much material for high school purposes and the authors admit that only portions of it can be used. It shows frequent evidences of hasty preparation, calling for not a few corrections in future editions. For example, the equations on pages 9 and 10 illustrating the action of iodine on mercury and of oxygen on phosphorus should be changed. In one of the early chapters boric acid is described among the important acids. The erroneous statement is made that it and its salts are largely employed as food preservatives. In the attempt to give some information on an unusually wide range of topics this information is frequently incorrect as well as superficial. An example of this is shown in the discussion of alcoholic beverages on pages 218 and 219. The water analysis quoted on page 169 would doubtless prove somewhat confusing to a beginner. But these and other faults may be easily corrected in future editions.

J. H. LONG.

Lehrbuch der physikalischen Chemie. By JELLINEK. Ferdinand Enke, Stuttgart, 1914. Vol. I, 732 pp. Unbound, 24 marks; bound, 34 marks.

This is the first volume of a treatise on physical chemistry, which the author intends to carry out in the characteristic Teutonic spirit of exhaustive research. We may hope that the present war will not prevent its ultimate accomplishment.

The completeness of the author's scope is indicated by the fact that the 732 pages in the present volume suffice merely for the consideration of the fundamental laws of chemistry and thermodynamics and for the consideration of matter in the gaseous and liquid states.

The author's treatment is largely conventional, as it should be in a work which is to serve as a compendium of existing knowledge. The general method of treating any particular field of investigation is to discuss in turn the experimental methods, the experimental results and their theoretical interpretation. Without being offensively elementary the presentation is pedagogical in the best sense, thus permitting the use of the book by chemists not previously familiar with the particular field treated. The complete references to the literature will prove of special value.

The author's presentation of the principles of thermodynamics seems very clear and satisfactory. He defines free energy in the familiar Helmholtz form which makes the decrease in free energy equal to the maximum obtainable external work instead of the maximum work minus the imposed work, which is the definition more often used in chemical calculations. Let us hope that he will stick to his own definition more consistently than is the custom of German chemists.

The author has very wisely postponed the presentation of the Nernst heat theorem until a later portion of his work. In spite of the fact that valuable principles are certainly connected with the Nernst theorem and that considerable progress in the way of systematic presentation has been made by Planck in the third edition of his *Thermodynamics*, it seems to the reviewer that the exact definition and significance of the principle is still a problem for the future. The reviewer hardly believes that it will be possible, as Jellinek apparently intends, in his later treatment, to identify the Nernst heat theorem with the principle stating the impossibility of attaining the absolute zero of temperature, since this principle is one which has long been familiar to thermodynamic thought.

The specific heat of gases is treated from the standpoint of the simple Einstein quantum theory, which to the reviewer certainly seems less unsatisfactory than any of the more complicated quantum theories, all of which are in a rather unsatisfactory stage of development.

The book, if brought to completion, will certainly rank as a standard treatise on physical chemistry, and will perform a valuable service for which Ostwald's *Allgemeine Chemie* becomes less adequate as the science of physical chemistry advances. Even with only one volume published it is a valuable contribution to systematic knowledge and might well find a place in every library of physical chemical books.

RICHARD C. TOLMAN.

Die Wasserstoffionenkonzentration. By PROFESSOR DR. LEONOR MICHAELIS, Privatdozent an der Universität Berlin. Julius Springer, Berlin, 1914. xiii + 210 pp. Price, M. 8.

This book is the first volume of a series of "Monographien aus dem Gesamtgebiet der Physiologie der Pflanzen und der Tiere," and its purpose

is primarily to show the absolute necessity of considering the hydrogen ion concentration in biological processes, and to explain clearly how it can be measured.

The author considers, first, the theoretical meaning of the "hydrogen number," *i. e.*, the logarithm, with the minus sign omitted, of the hydrogen ion concentration. This division includes discussions of the dissociation of water, acids, bases and amphoteric electrolytes, the hydrolysis of salts, the influence of the hydrogen ion concentration on the coagulation of colloids, and its influence upon the action of the most important ferments.

The second division gives experimental results on the hydrogen ion concentration in various fluids of the living organism.

The third main division of the book describes the theory and technique of the measurement of the "hydrogen number" by means of the hydrogen electrode and by means of indicators. There is included also a discussion of the preparation of solutions of definite hydrogen number.

There has been a great need for just such a book as this, and the author has succeeded in filling it admirably. In books which seek to place the methods or results of one branch of science at the disposal of another, one often finds a superficial knowledge of one field or the other, but the author of the present work writes neither as a physical chemist assuming the role of prophet to the biologists, nor yet like a biologist who has acquired a smattering of physical chemistry. The book should, therefore, prove of great value not only to biologists but also to many of the chemists who need the information that it gives.

JOEL H. HILDEBRAND.