

cleavage of thiamin has suggested a modification of the yeast fermentation method which has wide applicability yet is simple and convenient to use.

Under appropriate conditions of *pH* and temperature thiamin is quantitatively (99%) cleaved by sulfite to yield 2-methyl-6-amino-pyrimidine-5-methyl-sulfonic acid and 4-methyl-5-(β -hydroxy)-ethylthiazole. We have found that neither of these substances is active in the yeast fermentation method for thiamin determination. 2-Methyl - 5 - ethoxymethyl - 6 - aminopyrimidine, which is a potential interfering substance in the original method, is unaffected by sulfite treatment. The corresponding 5-hydroxymethylpyrimidine or its esters which would also interfere are likewise unaffected by sulfite under mild conditions. The new method therefore consists of a determination of the fermentation response before and after sulfite treatment: the difference appears to represent the true thiamin content of the unknown.

To a solution or suspension of the unknown in a volume of 20 ml. add 0.2 g. of sodium sulfite

[$\text{Na}_2\text{SO}_3 \cdot 7\text{H}_2\text{O}$] and adjust the *pH* to 5.0. Place in flowing steam for thirty minutes, cool and destroy excess sulfite with 3% hydrogen peroxide using acidified starch-iodide solution as an outside indicator (spot plate). Adjust *pH* to 6.2 and make to volume. An aliquot of this mixture is then assayed for its effect on fermentation.

Solutions of pure thiamin or cocarboxylase have negligible effects on fermentation after such treatment. Preliminary studies in which this method has been applied to natural substances of widely different potencies indicate that equally satisfactory results may be obtained with them. Together with a study of the most suitable condition for the sulfite treatment of various materials, these results will form the subject of a later communication.

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A. S. SCHULTZ
LAWRENCE ATKIN
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NEW BOOKS

The Life of Ira Remsen. By FREDERICK H. GETMAN. Published by the Journal of Chemical Education, Easton, Penna., 1940. 172 pp. 16 × 24 cm. Price, regular edition \$2.50, de luxe edition, \$3.50.

In reviewing "The Life of Ira Remsen," it is extremely difficult to resist the temptation to add to the biography rather than merely to review the work of the biographer. The reviewer feels sure that every student of Remsen would have the same inclination, since each one of these students could recite some particular episode of interest not only to the student in question, but to all of Remsen's student family. The reviewer was for four years the laboratory and lecture room assistant to Remsen and can unhesitatingly deny that Remsen was ever difficult to approach.

Dr. Getman has accomplished a splendid work. He has been fortunate in having been able to consult original sources in securing all the data concerning Remsen's ancestry and his family life. He has divided his biography into seven parts, namely, Youth and Education, Teacher and Scientist, University President and Public Servant, Private Life, Public Addresses, A Chemist Again, and Closing Years. There is also included in an appendix a list of the investigations carried out by Remsen or under his direction. These number one hundred and sixty.

Most of those who read this biography will for the first time learn of the youth and education of Remsen as well

as of his private life and services as a university president and public servant. The readers of this biography will enjoy most the reminiscences brought to mind in connection with Remsen as a teacher and a scientist.

When Remsen returned to the United States from Germany, he was saturated with the German spirit of investigation acquired under Fittig, Liebig and Wöhler and he began his work at Johns Hopkins under the influence of that atmosphere. It must be remembered that Johns Hopkins was the first real university in the United States and it was eight years after its beginning that it became also a college by establishing an undergraduate course.

The methods which Remsen used in teaching were productive of splendid results in his students and this almost entirely on account of the inspiration with which he imbued them. He was simple, straightforward and honest. Money meant little to him. He sought the truth in a scientific way. Consider how lightly he passed off Fahlberg's capitalization on saccharin when von Bayer in Munich said that saccharin was a substance discovered by Remsen and stolen by Fahlberg.

The biographer has dealt in detail with the many phases of Remsen's life and the book should be read by every former student of Remsen who is alive, but unfortunately many have passed on. The book is inspirational and should therefore also appeal to the neophytes who are beginning their life work in Chemistry.

Lest he be accused of yielding to the temptation mentioned at the beginning of this review, the reviewer must stop.

It is eminently fitting that Remsen's ashes repose in Remsen Hall at Johns Hopkins where those, who wish, may meditate.

CHARLES E. CASPARI

Matrix and Tensor Algebra. By CLARENCE E. ROSE, E.E. M.E., LL.D., Member of American Institute of Electrical Engineers. Engineer, Navy Department, Washington, D. C. Chemical Publishing Company, Inc., 148 Lafayette Street, New York, N. Y., 1940. viii + 143 pp. 14.5 × 22 cm. Price, \$4.00.

In view of the rapidly expanding field of usefulness for the methods of Matrix and Tensor Algebra, a concise and readable presentation of these methods would certainly be welcomed by chemists with mathematical inclinations. Unfortunately the present book is disappointing. Probably in the effort to avoid the ponderous style of conventional presentations of higher mathematics, the author's treatment has become loose to the point of frequent obscurity, when not actually ungrammatical. For example, the vector product of two vectors is described in one place as a vector and in another as a tensor. Numerous errors mar the equations, making them unreliable for reference purposes. There appears to be small reason for recommending the book.

A. S. COOLIDGE

Phenomena at the Temperature of Liquid Helium. By E. F. BURTON, Head of the Department of Physics and Director of the McLennan Laboratory, University of Toronto, H. GRAYSON SMITH, Associate Professor of Physics, University of Toronto, and J. O. WILHELM, Assistant Professor of Physics, University of Toronto. American Chemical Society Monograph. Reinhold Publishing Corporation, 330 West 42d St., New York, N. Y., 1940. xi + 362 pp. 103 figs. 15.5 × 24 cm. Price, \$6.00.

The principal subjects discussed in this book are: The production of low temperatures by the liquefaction of gases and adiabatic demagnetization, the measurement of temperature, the properties of liquid helium, superconductivity, specific heats, magnetic phenomena, and electrical and thermal conductivities.

Although the title suggests that the discussion deals with phenomena at a few degrees absolute, the authors have found it desirable to discuss material "outside the limited range suggested by the title." The book is written in an interesting manner and gives one of the best discussions of the field covered. However, the book contains some rather obvious errors and some statements with which the reviewer cannot agree, *e. g.*, in considering a body at the absolute zero of temperature the book states, "We must conclude that it should be possible to reach a condition where the total kinetic energy is reduced to zero." This false idea from the older classical viewpoint is especially unfortunate in a book designed to acquaint non-specialists with low temperature phenomena where zero point energy is more important.

The book also helps continue another widespread false notion that low temperatures can be stated more accurately on the Centigrade than on the Absolute Scale, by remarking, "We are justified in saying that the boiling point of oxygen is $-182.983^{\circ}\text{C}.$ " (not International Scale) "although we would be justified only in giving the absolute temperature as $273.16 - 182.98 = 90.18^{\circ}\text{K}.$ " Although the authors state that the thousandths of degrees can be based only on reproducibility it is evident that reproducibility applies equally to both scales.

In the chapter on heat capacity we find an explanation based on the statement that a "body containing N atoms has $6N$ degrees of freedom," instead of $3N$. There is also the incorrect statement that $\text{Gd}_2\text{SO}_4 \cdot 8\text{H}_2\text{O}$ is "cubic." The book gives reference to "early specific heat measurements by Giauque and Johnston" on hydrogen. We have it on good authority that the above authors have never made any such measurements on hydrogen.

In Table 26, on the entropies of simple compounds, 4 cases are singled out and marked "neglecting nuclear spin," yet 10 other similar cases are unmarked.

We are at a loss to know where the authors got the impression, page 57, that "... has used ... graphite rods (lead pencils) ... for thermometers" and again on p. 128 "rod of amorphous carbon" when the actual thermometer was paper impregnated with lampblack.

The many anomalous effects which are observed in heat capacity determinations are very well treated.

The chapters on magnetic properties and adiabatic demagnetization contain 88 pages with suitable discussions of methods of measurement and theory frequently illustrated by experimental results.

A very good account is given of typical experimental facts of thermal and electrical conductivities with a discussion of the quantum statistical situation which qualitatively explains the phenomena of electrical conduction. As is the case throughout the book, many experimental results are included.

The discussions of the properties of liquid and solid helium are excellent, and the well-ordered presentation in the chapters on superconductivity make them the best the reviewer has read on this subject.

W. F. GIAUQUE

Electronic Structure and Chemical Binding with Special Reference to Inorganic Chemistry. By OSCAR KNEFLER RICE, Associate Professor of Chemistry, University of North Carolina. McGraw-Hill Book Co., Inc., 330 West 42d Street, New York, N. Y., 1940. xiv + 511 pp. 91 figs. 15.5 × 23 cm. Price, \$5.00.

This textbook is well-conceived and very nicely written. It is more than that. It is the book that many students and many teachers have been silently begging for. I say "silently," because many of us are loath to admit, even to ourselves, that the mathematical techniques, requisite for a working knowledge of quantum mechanics, are a little too much for us. Yet we would like to have a respectable understanding of what the quantum mechanics can do for chemistry; and find ourselves, as we scan the abundant journal literature, wishing over and over again that the fluent mathematical chemists would relax a bit, and *sell*

us in words what they want us to know. This is not easily done, of course. But Dr. Rice has succeeded in organizing a most appealing introduction to the subject. To quote from his Preface:

"The phenomena of inorganic chemistry are extremely complicated and involve such a variety of factors that any attempt at a complete wave mechanical analysis, without introduction of far-reaching simplifications, appears hopeless at the present time. Yet for the unraveling of the factors involved and the elucidation and classification of the phenomena in a more general manner, the semi-quantitative method outlined in the first part of the book often yields surprisingly adequate results. It is not to be denied, of course, that anyone desiring to become an investigator in this field will wish to make a more thorough study of wave mechanics. It is hoped, however, that such a student will find a helpful approach to this more detailed study in the first part of the book, and that he will gain from it a knowledge of some of the physical implications, which may well precede the mastery of the mathematical details. For many students of chemistry, who do not have a mathematical turn of mind and who intend to specialize in other branches, the treatment given in the first part of the present volume may well be all that is required."

A good notion of the scope and character of the book may be obtained from a list of the chapter headings: I. Development of the Atomic Theory in Chemistry, II. The Constitution of Matter, III. Wave and Corpuscular Properties of Radiation and Matter, IV. Elementary Quantum Theory, V. The Hydrogen Atom, VI. Electron Spin, Angular Momentum, and Magnetic Moment, VII. Many Electron Atoms and the Periodic System, VIII. Some Properties of the Elements and Their Connection with Electron Structure, IX. Molecular Potential-Energy Curves and Molecular Motion, X. The Hydrogen Molecule, XI. Theories of Valence, XII. Transition from Covalent to Ionic Binding in Simple Gaseous Compounds, XIII. The Nature of the Solid State, XIV. Ionic Crystals, XV. Further Properties of Covalent Bonds, XVI. Complex Compounds and Complex Crystals, Including Atomic Crystals, XVII. Molecular Crystals, XVIII. Metallic Crystals, XIX. The Structure of Water, Hydrates, and Aqueous Solutions. There are several helpful appendices and a list of general references.

The treatment is pitched for students of about the level of first year graduate work. The book is excellent.

EDWARD MACK, JR.

Collected Papers of Wallace Hume Carothers on High Polymeric Substances. Edited by H. MARK, Adjunct Professor of Organic Chemistry, Brooklyn Polytechnic Institute, and G. STAFFORD WHITBY, Director of Chemical Research, Chemical Research Laboratory, Teddington, Middx. Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y., 1940. xix + 459 pp. 16.5 × 23 cm. Price, \$8.50.

"No investigator has excelled Wallace Hume Carothers in advancing our knowledge of high polymeric chemistry and at the same time providing a basis for the develop-

ment of technically useful synthetic polymeric materials. He may rightly be called the outstanding personality in this new branch of organic chemistry. . . . His publications are deservedly to be considered as 'classical.'" This appreciation of Carothers and his achievements by the editors of the Collected Papers expresses the judgment of the many who were fortunate enough to know him personally and of organic chemists throughout the world who followed with keen interest his publications during the all-too-short period of his active life as an investigator.

It is fitting therefore that Volume I of the series of monographs on High Polymers should be the Collected Papers of W. H. Carothers on High Polymeric Substances. This volume serves to bring together in well-arranged form his papers in this field and serves also, particularly with the inclusion of the biography by Roger Adams, as a memorial to an outstanding American chemist.

Part I comprises Studies on Polymerization and Ring Formation. It includes 28 papers (270 pages) with a brief introduction by H. Mark. A handy abstract is given at the beginning of each paper. The papers are reprinted unchanged from the form in which they were originally published during the period of 1929 to 1936. The papers of Part I are given strictly in chronological order. They present clearly and logically the story of the growth of experimental data, laboratory technique and theory which had as the immediate practical outcome the development of the now widely-known Nylon super-polymer. These papers have had and will continue to have a far-reaching effect on our ways of thinking and methods of attack of problems in the field of condensation polymers.

Part II describes the investigation of Acetylene Polymers and their Derivatives. It includes 21 papers (128 pages) with an introduction by G. S. Whitby which is in fact an excellent and concise review of Carothers' contributions to the field of addition polymerization and related subjects. The papers of Part II describe the investigation that led to the practical development of the industrially important synthetic rubber substitute, poly-chloroprene. They contribute materially to our knowledge of (1) the effect of substituting groups on the readiness and degree of polymerization of the butadienoid system and (2) the chemical behavior (polymerization and addition reactions) of compounds containing double and triple bonds in conjugated relationship.

Part III comprises 4 miscellaneous papers relating to the subject matter of Part I. Two of these papers are properly placed in Part I in the bibliography mentioned below.

The volume includes also (1) a bibliography of Carothers' publications, including ten papers on subjects unrelated to high polymers, (2) a list of Carothers' patents (51 U. S. patents) that have issued through January, 1940, (3) an author index (6 pages) and (4) an adequate subject index (21 pages).

The book might have been improved by the elimination of several typographical errors among which are the reversal of figures 1a and 1b on page 133 and incorrectly printed formulas on pages 275 and 279. There is also the curious fact that in the bibliography the distribution of four of the papers among the three general groups differs from that used in the text. However, these items are of minor importance and do not detract from the value of the

book as an excellently arranged and edited record of brilliant achievement in the field of high polymers.

R. L. JENKINS

Fundamental Chemistry. By HORACE G. DEMING, Professor of Chemistry, University of Nebraska. John Wiley and Sons, Inc., New York, N. Y., 1940. xiii + 756 pp. 195 figs. 15.5 × 23.5 cm. Price, \$3.50.

This 1941 model of "an elementary textbook for college classes" differs as much from the older type of an elementary text as a 1941 Lincoln differs from a Model T Ford. The destination of a knowledge of the principles of chemistry is arrived at with power and smoothness, but at the expense of losing the unrelated detail of the roadside, with which the users of the older and slower vehicles formerly concerned themselves. The aids to driving in the form of italics, bold-faced type, lists of definitions, summaries, and exercises make it possible for the traveler to give more attention to the topography of the country through which he is passing. In other words, the book is the last word in the transition from elementary courses on "Inorganic Chemistry" to courses on the "Principles of Chemistry"; and it is very well done.

No better idea of the purpose and educational philosophy of the author can be given than to quote from the Preface, and from the notes "To the Instructor" which appear at intervals:

"Education discipline is not to be found in the hurried survey of a wide range of topics, perhaps comprehended imperfectly, but rather in the use of a limited number of items of moderate difficulty as training in logical thinking and in the art of expressing thought."

"The facts of chemistry are of no intellectual significance and have but limited practical uses unless correlated and interpreted in the light of general theories. Yet the theories themselves are never properly understood unless viewed against a background of familiar facts.

"So we have a contest of opinion. There are some who would unload a year's supply of chemical theory within the first few weeks of a course in chemistry, lest the chemical facts remain only facts and thus be nearly pointless; and others who would introduce a multitude of facts before attempting any theories, lest the theories remain nearly meaningless and of the substance of dreams. This book attempts a middle course...."

"Those who seek unusual approaches in this book may be interested in observing:

1. The absolute scale of temperatures is made to appear logically as a measure of the average exchangeable energy of molecules, instead of being disposed of in an arbitrary way, in terms of an imaginary ideal gas.

2. Energy is given a prominent part to play in all the transformations of matter.

3. A special effort has been made to develop precision in the use of scientific words.

4. Definitions have been made to conform to new points of view.

5. More than common attention is given to what might well be considered the chief concern of chemical science, namely, the question of why chemical substances react at all, and what forces hold atoms together in chemical union."

These ideas are rigidly adhered to through the volume. It is impossible to state the proportion of the book devoted to principles in distinction from descriptive factual material because the two are so cleverly made to supplement each other in every chapter. The general impression, however, is that the title "Fundamental Chemistry" expresses the emphasis.

One of the outstanding features of the book is the ability of the author to write clearly, to simplify explanations, and to use apt analogies. Only an excellent teacher with a thorough knowledge of modern chemistry could write a book so interesting to students and so stimulating to instructors.

KENNETH L. MARK

BOOKS RECEIVED

December 10, 1940-January 10, 1941

C. R. ADDINALL. "The Story of Vitamin B₁." Merck and Co., Inc., Rahway, New Jersey. 72 pp.

EUGEN BAMANN and KARL MYRBÄCK. "Die Methoden der Fermentforschung." Lieferungen 2, 3 and 4. Georg Thieme Verlag, Rossplatz 12, Leipzig C1, Germany. 302 + 392 + 407 pp. Rm. 22.80, 29.40 and 30.60, respectively.

DAVID E. GREEN. "Mechanisms of Biological Oxidations." (Cambridge: At the University Press), The Macmillan Co., 60 Fifth Avenue, New York, N. Y. 181 pp. \$2.75.

DUDLEY M. NEWITT. "The Design of High Pressure Plant and the Properties of Fluids at High Pressure." Oxford University Press, 114 Fifth Avenue, New York, N. Y. 491 pp. \$10.00.

WILLIAM THOMAS SALTER. "The Endocrine Function of Iodine." Harvard University Press, Cambridge, Massachusetts. 351 pp. \$3.50.

PERRY W. WILSON. "The Biochemistry of Symbiotic Nitrogen Fixation." The University of Wisconsin Press, Madison, Wisconsin. 302 pp. \$3.50.

"The Domestic Production of Essential Oils from Aromatic Plants." National Farm Chemurgic Council. 50 W. Broad St., Columbus, Ohio. 77 pp. \$0.50.

"Ingot Brass and Bronze." Non-Ferrous Ingot Metal Institute, 308 West Washington St., Chicago, Illinois. 74 pp. + supplements. \$5.00.

"Minerals Yearbook, 1940." Compiled by the Bureau of Mines, United States Department of the Interior. For sale by the Superintendent of Documents, Washington, D. C. 1514 pp. \$2.00.