In the aggregate of a considerable number of experiments, however, these errors would tend to compensate each other, and, in fact, the total observed heat production for the 57 trials differs from that computed by only +0.4%. This difference is of about the same order of magnitude as those observed by previous investigators, being slightly greater than Rubner's and slightly less than Laulanié's and Benedict's, although the range of error in the individual experiments is somewhat greater. Only the earlier averages of Atwater and Benedict show a materially closer agreement.

The conclusion seems warranted, therefore, that the same equivalencies between chemical energy, heat energy and mechanical energy obtain in the bodies of herbivorous animals as in those of carnivora or of man, and, as a rule, elsewhere in nature.

STATE COLLEGE, PA.

NEW BOOKS.

Elementary Chemistry with Special Reference to the Chemistry of Medicinal Substances.
By H. M. GORDIN, Professor of Chemistry in the Schools of Pharmacy and Dentistry of the Northwestern University. Vol. I. Inorganic Chemistry. Medico-Dental Publishing Co., Chicago. Price, $3.00.

This book was written to fulfil the two-fold purpose of supplying an elementary text for medical students, and a fairly complete compendium of inorganic medicinal preparations. It gives a very complete discussion of the preparation and properties of the elements and their compounds, with many references to substances of greater pharmaceutical than chemical importance, and closes each chapter with a very satisfactory set of questions. The spirit in which one would have to teach from the book may be well summed up in a few words from the introduction to the chapter on the Periodic Table (p. 178); "It is of much greater importance to know the physical and chemical properties of an element than to decide to what family it belongs." The book would encourage learning by rote rather than acquiring any powers of reasoning. Chapters on Matter and Energy, Physical and Chemical Changes, Gas Laws, Molecular Hypothesis, Atomic Hypothesis, Chemical Formulas and Chemical Equations and Calculations serve as an introduction and are, probably by reason of their location, presented in a rather simplified form. On p. 21 one notes that "Avogadro proposed a hypothesis according to which all molecules of all gases, no matter of what elements they consist, are of the same size;" on p. 67 gypsum is given as $2CaSO_4.H_2O$; on p. 116, "The largest amount of a solute which will give a clear solution with a definit amount of the solvent is called the solubility of that solute;" on p. 119, "If the solution contains more than 20.2 per cent. of the gas, hydrogen chloride alone escapes when the solution is heated; when the solution con-

tains less than 20.2 per cent. of the gas, water alone distills over, until in both cases the concentration reaches 20.2 per cent." Satisfactory chapters on Solution, Electrolysis, Hydrolysis, and Chemical Equilibrium are scattered through the book, but there is a marked lack of application of this theoretical matter to specific examples, while a complete lack of presentation of the kinetic hypothesis makes the presentation of such subjects as vapor pressure, osmotic pressure and solution pressure unsatisfactory.   HELEN ISHAM MATTILL.

General Chemistry, Theoretical and Applied. By J. C. BLAKE, Ph.D., Professor of Chemistry and Chemical Engineering in the Agricultural and Mechanical College of Texas. New York: The Macmillan Co., 1913. xiv + 417 pp. Price, $1.90, net.

Avowedly this book was written for college students and was designed as a text for those who pursue the subject for but a single year and also to serve as a foundation for more advanced chemical study. With these objects the amount of material is reduced to a minimum, leaving much information to be gained in the laboratory and through collateral reading. There is a noticeable absence of descriptions of the numerous compounds generally found in college texts. Thus, the alkali metals and their compounds, including ammonium, are discussed in eight pages; only the hydroxides and carbonates are described and these but briefly. Condensation is accomplished also by giving the physical properties of all the common metals in tabulated form after the description of the metallic compounds.

The author presents first the non-metals, beginning with oxygen and hydrogen, but tries to show the relationship of the elements by following back through the groups of the extended periodic series, so that compounds of antimony and bismuth are the first of the metals to be considered and the alkali metals the last. The relationships of compounds are shown by giving so-called oxidation tables for each element, wherein formulas of some of the chief compounds are arranged in accordance with the degree of reduction or oxidation; thus, for sulphur,

$$H_2S \ (H_2S_2) \ (H_2S_5) \ S_2 \ SO_2 \ SO_3.$$

While the atomic theory is mentioned early, extended discussion is deferred until after the study of the non-metals, where also the gas laws are considered. Similarly, the explanation of the periodic law is delayed until after study of the metals.

The last thirty pages of the book, under the title of Applied Chemistry, are devoted to the Atmosphere, Natural Waters, Rocks, the Soil, the Ferrous Metals, Fuels and Oils. Thirty pages are given to organic chemistry.

If criticisms were to be made, it might be said that all chemists would not agree to what is here stated as a fact, that in oxidation by hypochlorous

acid the nascent oxygen exists temporarily in the monatomic state; fur-
thermore, in view of the author's definition of chemistry as the science
which deals with the transformations of various substances into others,
the name "Elements without Chemistry" applied to the zero group of
elements does not appear entirely satisfactory and their description is
hardly full enough to make it clear to a beginner.   The rules for valence
seem rather cumbersome, although usually the statements throughout
the book are very clear.   These are, however, not serious faults.

Perhaps to some college instructors where an extended course is given,
the degree of condensation would be the most objectionable feature,
since other reference books would be a necessity; on the other hand,
the tendency noticeable in many texts, to make an encyclopedia instead
of a guide, is here avoided.   Doubtless many colleges will approve of
the amount of material presented and the work appears well suited for
their use.   F. W. ROCKWOOD.

The Mathematical Theory of Heat Conduction.   With Engineering and Geological
    Applications.   By L. R. INGERSOLL AND O. J. ZOBEL.   Boston: Ginn & Company.
    Price, $1.60.

As stated in the preface, "The aim of the authors has been two-fold:
they have attempted, in the first place, to develop the subject with spe-
cial reference to the needs of the student who has neither time nor mathe-
matical preparation to pursue the study at greater length.* * * * The
second aim has been to point out more clearly and specifically than ap-
parently has been done before, the many applications of which the results
are susceptible: for in its practical bearing this field is second to no
other in mathematical physics."

In their attempt to fulfil these aims the authors have produced a very
readable and interesting volume, which, while not claiming to be at all
a comprehensive treatise on Fourier's series, gives the student a clear
grasp of the significance and utility of this branch of mathematics.

The first two chapters are devoted to a discussion of various fundamen-
tal concepts, such as thermal conductivity, temperature gradient, the
distinction between particular and general solutions of differential equa-
tions and the significance of initial and boundary conditions.   The
last section develops the generalized Fourier equation of conduction.

In Chapters III and IV this equation is integrated for the case of the
steady state (in one and more than one dimensions, respectively), while
Chapter V deals with the case of the periodic flow of heat in one dimension,
with special application to the periodic variation of temperature at any
point below the earth's surface.

It is not until the sixth chapter is reached that the authors discuss
the development of functions in trigonometric series, the necessity for
this having been made apparent in the previous two chapters.   The

method of developing functions as sine and co-sine series, respectively, is fully explained. Numerous graphs illustrate the effects of successive terms in a series on the form of the corresponding curve, and a section is added on the use of harmonic analyzers.

In Chapters VII and VIII numerous cases are discussed of the flow of heat in one and more than one dimensions, respectively.

What adds exceedingly to the value of the volume are the numerous sections entitled "Applications," that are given in connection with each chapter. In these sections the authors show how the methods deduced in the theoretical portion can be applied to the solution of many problems in engineering and geology.

As examples of some of the problems discussed may be mentioned the following: The distance of overheating in thermite welding, the rate of thawing of frozen soil, the rate of cooling of lava, the rate of cooling of steel in the hardening process, the effect of radioactivity on the cooling of the earth, and the rate of fall of temperature in decomposing granite. It is interesting to note that, owing to the effect of radioactivity, "the time required for the earth to cool from initial conditions of surface at $995°$ and temperature gradient of $5°$ per kilometer to the present surface gradient of $1°$ in 35 meters comes out to be 45.85×10^6 years. Without radioactivity the same initial conditions give 22.0×10^6 years, so we see that in this case the continuous generation of heat under these conditions increases the computed age of the earth by over 100 per cent."

The theory of the fire-proof wall is developed very fully and the conclusions checked by comparing with experimental results. The last chapter (IX) deals with the problem of ice formation.

Numerous references to various investigations and original papers are given, and throughout the different sections are distributed a number of interesting practical problems to serve as a useful exercise for the student.

Tables of thermal conductivity constants, emissivity factors, and of the "probability integral" are given in the appendix.

When it is considered that the conclusions derived for the flow of heat are also applicable, with but slight modification, to the flow of electricity and to the diffusion of salts in solution, this volume ought to prove useful not only to the engineer and geophysicist but to a much wider circle of scientific workers. SAUL DUSHMAN.

Einführung in die Spektrochemie. VON G. URBAIN. Uebersetzt von Ulfilas Meyer. Pp. viii + 213. 67 figures and 9 plates. 1913. Dresden and Leipzig: Theodor Steinkopf. Price, unbound, 9 marks.

In the words of the author—"This book contains some new methods of observation, especially in the field of phosphorescence; I have laid chief stress upon the paragraphs that deal with new questions. At the same time,

I have discussed in detail the variations in the spect. · · · · · · due to the
different sources of light, in order to protect the inc · · · · 1 observer
from many illusions and errors. The little book make · · · · to com-
pleteness; it is chiefly for the use of those young chemist · · · the de-
sire to work in a promising field, wish rapidly to obtain t · · · · ental
information that is essential to the understanding of theo· · · · ex-
perimental chemistry."

Following an introduction in which the history, application· · · ·
tations of spectrum analysis are briefly discussed, the successiv· · ·
of the book deal with Light and the Spectrum, Emission Spec· · · •
Luminosity of Gases at Low Pressure, Arc and Spark Spectra, L· · ·
cence, Absorption, The Constitution of Spectra.

The book contains interesting although fragmentary information con-
cerning certain applications of spectroscopy to the solution of chemical
problems, and some of the recent advances in this field: for this reason
it will be of value to those who already possess some knowledge of chem-
ical spectroscopy. The work is, however, entirely unsuited for use as an
introduction to spectro-chemistry for students beginning the study of
the subject. Descriptions of the technic of the work are brief and incom-
plete, the accessory apparatus is frequently of antiquated type, and the
treatment of the various topics is historical rather than didactic.

<div style="text-align:right">L. M. DENNIS.</div>

Geologische Diffusionen. By VON RAPHAEL ED. LIESEGANG. With 44 figures. Dresden
und Leipzig: Theodor Steinkopff, 1913. 180 pp. Price, unbound, 5 marks,
bound, 6 marks.

This is an interesting example of the application of a single idea to the
explanation of many kinds of phenomena which, though apparently essen-
tially distinct in origin, have one feature in common. The author studies
experimentally the diffusion of salts, acids and alkalies in gelatin. When
a salt, such as silver nitrate, diffuses into gelatin containing potassium
chromate, precipitation takes place not through the mass, but in concen-
tric rings (on a plate) or parallel sheets (in a tube), with clear gelatin
between. One is reminded of Spencer's famous chapter on the Rhythm
of Motion. The explanation given of this phenomenon is sound and
fairly obvious.

The author then applies the idea of rhythmic precipitation through
diffusion to diverse geological phenomena, such as the formation of agates,
zones of weathering, lateral secretion, gold Banket deposits, banded
flints, eozoonal limestones, clay concretions, orbicular gabbros, and some
schists, though he omits rhyolitic lithophysae. The explanation is rational
and apparently correct for most banded agates, but seems somewhat
forced and inadequate for other structures, since other factors, as capil-
larity, diurnal heat changes and various chemical actions, are minimized

or disregarded. As a mimetic study of some natural phenomena the work is well carried out, and, if not too strongly and exclusively insisted on, the general ideas may be found applicable to some minor geological phenomena. HENRY S. WASHINGTON.

Cours de Chimie Organique. PAR FRED. SWARTS, professeur à l'Université de Gaud. 2ᵉ edition. 740 pages. Paris. Price, 15 francs.

The second edition of a theoretical treatise of organic chemistry, which apparently has been successfully received in France. It contains many data of value and the subject matter is taken up in a logical order. In the opinion of the reviewer, however, the work is not didactically arranged. For instance, the cycloparaffins and the terpenes are discussed before the student becomes familiar with the chemistry of benzene. It cannot be recommended as a practical text-book. It attempts more than the student of chemistry should be expected to master. Any one who has had any experience in teaching organic chemistry recognizes the growing difficulty in making a proper presentation of this subject in the limited time available. Fundamental reactions and theories of organic chemistry deserve as full treatment as possible, and an effort should be made to give the student such ground-work as will give connection to the whole subject. Fundamental principles are omitted in the text, which should be incorporated. Altogether too much attention is devoted in the text to physical chemistry. This is a scientific branch of chemistry which is of sufficient importance to be treated independently. While the work cannot be recommended as a text-book, on the other hand, it should be of value as a book of reference for advanced students in organic chemistry. T. B. JOHNSON.

The Chemistry of Plant and Animal Life. By HARRY SNYDER, B.S. Third edition. 388 pp., illustrated. New York: The MacMillan Company, 1913. Price, $1.50.

This book is an elementary description of the composition of plant and animal bodies, the chemistry of the plant and of its food and growth, the chemistry of human foods and animal nutrition, the digestibility and value of foods and the laws governing their economic use.

This book is intended, primarily, for students who have had very little, if any, training in chemistry. In order, therefore, to prepare the way for a more intelligent study of the subject, and to show the relation between chemistry and plant and animal life, the author has divided the subject into two parts, devoting part one, nearly a third of the whole text, to the consideration of the elements and the simpler compounds present in plants and animals, and the laws governing their combinations. This part may be omitted, however, by all who have had a fairly extensive training in General Chemistry. Numerous experiments illustrate the

descriptive matter, and in part two, there are many tables containing valuable data on fodders and foods.

The types of operations peculiar to Agricultural Chemistry and Food Analysis are described and illustrated, and whenever possible suitable problems have been introduced, which greatly enhance the usefulness of the text. In striving for brevity, the author has, at times, sacrificed clearness. This is especially true in the chapters on Organic Compounds of Plants. A brief introduction to the subject of Organic Chemistry in general would have been of great aid in showing the genetic relations of the individual compounds discussed later. On the other hand, some passages might advantageously be omitted, for example, on page 84 where the reader might be led to conclude that one of the chief commercial uses of nitric acid was for the dyeing of cloth.

In the preface, the author states he has included "a few topics of an industrial nature but closely related to plant and animal life" and yet in this revised edition one looks in vain under Nitrogen for any mention of the recent successes in utilizing the nitrogen of the air by the Birkeland-Eyde Process.

The author might also be criticized as not being quite up to date when, in discussing the cost and value of foods, he takes as an example the comparison of rump steak at 15 cents per pound, with milk at 5 cents per qt.

The book on the whole will serve as an excellent elementary text in Agricultural Chemistry and Household Economics.

W. L. JENNINGS.