assumes a strong background of statistical mechanics on the part of the reader. Some references to introductory material in this field, particularly on the use of Markoff chains, would have made this article of greater value to those not specialists in this area. The next two articles, "Ebulliometry Applied to Polymer Solutions" by R. S. Lehrle, and "Fractionation of High Polymers" by G. M. Guzmán, are excellent detailed surveys of the literature. The emphasis in both articles is on the experimental techniques and results, but more than adequate summaries of and references to the literature on the relevant theory are given.

G. J. Howard, in an article entitled "The Molecular Weight Distribution of Condensation Polymers," reviews the experimental evidence and the theoretical treatments of this subject. Much of the experimental work has been the study of the nylons, although other polymers are considered as well. The discussion of the so-called "step-addition" polymers such as polyethylene oxide is very brief. A large part of this article is devoted to examining the rival theories of Flory and of a Russian school headed by Korshak; the author leans heavily toward the Flory theory.

The article by L. B. Morgan, "The Fibre-Forming Properties of Polymers," is entitled rather misleadingly, at least in terms of United States usage. Basically this is a review of the current (1959) status of the picture of the structure of crystalline polymers and of crystallization mechanisms and kinetics. This field is currently very active and many contributions have been made since the article was written; nevertheless it may be recommended as a useful introduction to the subject.

In the final chapter W. Cooper reviews the mushrooming field of "Stereospecific Polymerization." In view of the vast amount of literature, particularly patents, it would have been impossible to cover in one chapter of a volume such as this all that has been published. The author has written therefore a critical rather than an exhaustive article that should be of particular interest to those entering this field. An appendix brings the literature survey up to date as of August, 1960.

An inevitable, often belabored, shortcoming of review volumes is the time lag between writing and publication. For the most part, except for the appendix to Cooper's article, the most recent references are to 1959 publications. However, when one balances this against the mass of literature published prior to this time that has been surveyed by the contributors to this volume it becomes easier to accept this shortcoming, as well as the minor errors and omissions which the specialists in each of the fields covered will undoubtedly detect. If the general level of the articles is maintained at that of this volume, future issues in this series should be welcome to every polymer chemist.

RESEARCH LABORATORIES
CELANESE CORPORATION OF AMERICA KURT F. WISSBRUN
SUMMIT, N. J.

An Introduction to Theoretical Physical Chemistry. By SIDNEY GOLDEN, Department of Chemistry, Brandeis University. Addison-Wesley Publishing Company, Inc., Reading, Mass. 1961. xi + 307 pp. 16 × 23.5 cm. Price, $9.75.

This textbook for physical chemists presents some basic material in classical thermodynamics, statistical thermodynamics and quantum mechanics. The level of presentation is somewhat higher than in a good undergraduate first course in physical chemistry, but it is not generally as high as in a graduate course devoted entirely to any one of the three topics.

The first 87 pages are concerned with classical thermodynamics. This is a concise and reasonable treatment. Much of the material should be familiar to the student who has already had a course in physical chemistry. The point of view is formal and axiomatic. For example, the second law is developed according to Caratheodory.

The next hundred pages deal with statistical thermodynamics. The ideal gas is treated in great detail, using the Maxwell–Boltzmann method of the most probable distribution. Then Gibbs' version of statistical mechanics is presented. (The canonical ensemble is described incorrectly as a collection of replicas of a system, all in weak mechanical interaction.) This is followed by some standard applications, the theory of almost ideal gases, the Debye–Hückel theory of electrolytes, Debye's theory of specific heats of solids, and the Bragg–Williams approximation in order–disorder problems. In treating the non-ideal gas, Prof. Golden falls into a classic trap: he asserts, wrongly, that the second virial coefficient $B(T)$ must obey the inequality $N^2B(T)/V < 1$, where N is the number of atoms contained in a volume V.

The book ends with a hundred page survey of quantum mechanics, containing a curious selection of highbrow and elementary topics. For example, one can read about the wave functions of a harmonic oscillator in the momentum representation, or Mathieu's equation, or the characters of irreducible representations of Abelian groups, or Heisenberg's form of the quantum mechanical equation of motion. But the hydrogen atom is not treated at all. Electron spin is mentioned only in a few casual remarks. Chemical binding is discussed by means of a one-dimensional model of adjacent rectangular potential wells. However, the *formalism* of quantum mechanics is essentially all there; only the useful applications are lacking.

The style throughout is elaborate—"The negligible interaction which has been supposed is nevertheless nonzero.", for example. Mathematical details are handled with great care. The book contains no pictures or diagrams, no numerical examples or problems. About one-fourth of the problems read "Verify Eq. (--)". The lack of reference to the real world is often distressing. As an example, Debye's T^3 law of specific heats is derived, but no indication is given as to typical orders of magnitude for the Debye characteristic temperature.

This text can be recommended for use in an introductory course in theoretical chemistry only if the teacher is prepared to fill in many of the missing applications and illustrations. The serious student of theoretical chemistry is urged to learn his statistical thermodynamics and quantum mechanics from standard texts where the subjects are treated in greater depth.

DIVISION OF PHYSICAL CHEMISTRY
NATIONAL BUREAU OF STANDARDS ROBERT W. ZWANZIG
WASHINGTON 25, D. C.

Statistical Mechanics. By NORMAN DAVIDSON, Professor of Chemistry, California Institute of Technology. McGraw–Hill Book Company, Inc., 330 West 42nd Street, New York 36, N. Y. 1962. ix + 540 pp. 16 × 23.5 cm. Price, $14.50.

This is a textbook. It is devoted mainly to those parts of statistical mechanics that are interesting and useful to physical chemists. The book should be suitable for a one-year graduate course in a chemistry department; it was actually developed from such a course at Cal Tech.

The general tone is set in Davidson's dedication to the late William Moffitt: "In his own way, Bill Moffitt was a theorist with a passion for elegance and generality; but he insisted that the function of the theorist was to be useful. I hope that, were he still alive, he would think this book useful."

Because of this tone, it is not a book for the student who wants to work specifically in statistical mechanics, to develop new methods, and solve new problems, although he is advised to read it anyhow just to see what has been accomplished in this field. It is recommended for the student who wants to apply known results of statistical mechanics to problems in physical chemistry. For this purpose it is well organized and written.

The book covers all the standard topics that one has come to expect in an introductory course in chemical statistical mechanics, and many special topics also. As a random sample, we mention (1) the most comprehensive treatment we have seen in a textbook of black body radiation, including a discussion of radiative recombination; (2) a long chapter on fluctuations and noise, including the statistical part of the theory of light scattering from multicomponent solutions (but not the beautiful derivation by Einstein of the basic formula), and also a simple derivation of the Wiener–Khintchine formula; (3) the theory of the helix–coil transition; and (4) a discussion of electrical birefringence. This illustrates the remarkable variety of topics covered.

The style is clear and direct, with an occasional flash of humor. (I suspect that this will encourage the student to

read the text more carefully—if he doesn't, he might miss something comical!) An especially attractive feature is the number of humane warnings about pitfalls and tough points. (On page 317, "The result . . . is correct and important. The derivation given is a fraud and a hoax." On page 379, "Although we shall review some of the mathematical operations, it is doubtful that readers who are unfamiliar with the elementary aspects of matrix algebra can profit from this section.")

On the negative side, there are a few places where one might wish for more clarity or detail, or a change in emphasis. On page 24 a rule is given for constructing quantum mechanical operators; on the following page it is qualified, and in fact only the qualified rule, called "safe" by the author, is correct. The name "Boltzon" is coined on page 36. This seems at first to be a useful addition to Fermion and Boson, until one realizes that all particles in nature are either of the latter, and that no Boltzons exist. The statement on page 91 that a single particle function q is not an intensive quantity, while q/N is intensive, is confusing. The principles of detailed balancing and microscopic reversibility are lumped together in a single statement (page 233) and are not carefully distinguished; this is a common source of semantic confusion in statistical arguments. The discussion of lattice specific heats, and in particular the graph on page 368 of a typical frequency spectrum, is somewhat out of date. It should include reference to the work of Van Hove, who showed that there are important discontinuities in such graphs.

In summary, this is an excellent textbook of practical statistical mechanics. Graduate students in physical chemistry are urged to become acquainted with its contents.

DIVISION OF PHYSICAL CHEMISTRY
NATIONAL BUREAU OF STANDARDS ROBERT W. ZWANZIG
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Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Calcium. Teil B–Lieferung 3. Schluss der Verbindungen Chemisches Verhalten des Calcium-Ions Nachweis und Bestimmung von Calcium, Strontium und Barium. System-Nummer 28. Edited by Gmelin-Institut. Begonnen von R. J. MEYER. Fortgeführt von E. H. ERICH PIETSCH. Verlag Chemie, G.m.b.H., Pappelallee 3, Weinheim Bergstr., Germany. 1961. lxii + 912 pp. 18.5 × 25.5 cm. Price, DM. 568.— ($142.00).

Part B, Section 3, of the volumes dealing with calcium, completes the summary of calcium compounds, discusses the reactions of the calcium ion, and summarizes the detection and determination of calcium, strontium, and barium. Treatment of the compounds begins with the calcium–sulfur–oxygen system and continues according to the well-established Gmelin pattern through the binary and ternary compounds of calcium with the non-metallic elements of Groups VI, V, IV, and III. Reactions of the calcium ion include those with both inorganic and organic species. Both qualitative and quantitative analytical approaches are described, and many procedures applicable to specific substances or products are outlined. Throughout, all items have been particularly carefully and critically documented. The inclusion of a Table of Contents and marginal indexing in English—now standard practice in the Gmelin series—makes the contents of the volume even more accessible than they would normally be.

The general treatment presents a wealth of detailed chemical and physico-chemical information. Usual data of the latter type are supplemented by an extensive treatment of phase diagrams involving a variety of calcium-containing systems. It is most unlikely that any aspect of the areas covered has been slighted.

This volume is a worthy addition to the Gmelin series. As a source of useful and correct information, it has no competitor. The printing, binding, appearance and general presentation are attractive and practical. It is recommended without reservation to anyone seeking information in these areas.

NOYES CHEMICAL LABORATORY
UNIVERSITY OF ILLINOIS THERALD MOELLER
URBANA, ILLINOIS

Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Kobalt. Teil A. Ergänzungsband. System-Nummer 58. Edited by Gmelin-Institut. Begonnen von R. J. MEYER. Fortgeführt von E. H. ERICH PIETSCH. Verlag Chemie, G.m.b.H., Pappelallee 3, Weinheim/Bergstr., Germany. 1961. lxxii + 886 pp. 18.5 × 25.5 cm. Price, DM. 556— ($139.00).

Part A of the volumes on cobalt presents a broad summary of the history, occurrence, technology, properties and alloys of the element, the chemical reactions of its ions, and the compounds it forms with both non-metallic and metallic elements. Included in the last category are many of the coördination compounds, but no attempt is made to treat these separately as a particular class of compounds. Each area is handled with the characteristic and highly commendable Gmelin thoroughness and comprehensive documentation. The volume is a definitive source of an almost unbelievably large amount of chemical and physico-chemical information pertaining to cobalt and its compounds. Access to this information is of course improved by the inclusion of a supplementary Table of Contents and marginal indexes in English.

Particular attention has been given both to recently published information and to physical data. The volume contains many tabulations, a large number of pertinent graphs and diagrams, and a substantial number of pictorial representations of crystal structures. All of these are included logically where they can best describe the substances in question.

It is difficult to discuss any volume in the new Gmelin series in other than superlatives. This is no exception. It is recommended as undeniably the best and most comprehensive compilation available on cobalt chemistry. No person or concern interested in any of the areas covered can afford to be without access to it.

NOYES CHEMICAL LABORATORY
UNIVERSITY OF ILLINOIS THERALD MOELLER
URBANA, ILLINOIS

Gmelins Handbuch der Anorganischen Chemie. Achte Völlig Neu Bearbeitete Auflage. Kupfer. Teil B–Lieferung 2. Verbindungen bis Kupfer und Wismut. System-Nummer 60. Edited by Gmelin-Institut. Begonnen von R. J. MEYER. Fortgeführt von E. H. ERICH PIETSCH. Verlag Chemie, G.m.b.H., Pappelallee 3, Weinheim/Bergstr., Germany. 1961. xli + 352 pp. 18.5 × 25.5 cm. Price, DM. 231.— ($58.00).

This volume in the series on copper describes, according to the well-established Gmelin sequence, the binary and more complex compounds of the element based upon boron, carbon, silicon, phosphorus, arsenic, antimony and bismuth. Understandably, the major amount of space is allotted to the copper(II) salts of the organic acids. The treatment throughout is comprehensive and definitive, with emphasis being divided between descriptive information and physical data. Coördination compounds and complex ions are discussed as the ligands from which they are derived are treated, but not in separate sections. Graphic representations of structure and phase diagrams are included where data are available.

All of the virtues of meticulous attention to detail, comprehensiveness, direct and up-to-date literature citation, and clarity of presentation that characterize the Gmelin series are apparent for this volume. These are complemented by the inclusion of a Table of Contents and marginal indexing in English. Although the area encompassed is somewhat limited, the volume is a "must" for any technical library and a highly recommended source for any person who is pursuing copper chemistry.

NOYES CHEMICAL LABORATORY
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The Metal Plutonium. EDITED BY A. S. COFFINBERRY and W. N. MINER. The University of Chicago Press, 5750 Ellis Avenue, Chicago 37, Illinois. 1961. xi + 446 pp. 16.5 × 24.5 cm. Price, $9.50.

The chapters of this book were originally presented as papers at the 1957 World Metallurgical Congress in Chicago