several chapters reveals the vast amount of literature covering the past and present art and theory from which the author critically selected the material for this book. In Appendix B are listed approximately a thousand commercially available emulsifying agents—yet an admittedly incomplete list. Contrast this with the two papers in "Industrial and Engineering Chemistry" in 1931 describing two emulsifying agents, ammonium linoleate and triethanol amine stearate, that first made possible the commercial production of stable paraffin wax emulsions. The earlier emulsifying agents were primarily limited to a few soaps and the naturally occurring products of animal and plant origin used in pharmaceutical preparations and cosmetics. Coincidental with the modern industrial development in emulsions came the host of fundamental researches on surface chemistry by Adam, Bartell, Hardy, Harkins, Langmuir, McBain, and many others that form the basis for present day theories of emulsion chemistry, ably discussed by the author.

The monograph is divided into nine chapters and two appendices: (1) Introduction; (2) Surface Activity; (3) Physical Properties of Emulsions; (4) Theory of Emulsions: Stability; (5) Theory of Emulsions: Creaming, Inversion, and Demulsification; (6) The Chemistry of Emulsifying Agents; (7) Techniques of Emulsification; (8) Emulsion Applications; (9) Demulsification; Appendix A, Testing of Emulsion Properties; and Appendix B, Commercially Available Emulsifying Agents. After each chapter is an adequate list of cited references that should enable students and newcomers in the field to get off to a good start in the exploration of the different areas of the subject of emulsions, theory and practice. While this book is a monograph and not a compendium, the various chapters, nevertheless, deal with a considerable number of subjects and it would have been helpful to the reader and researcher if, in the table of contents, subheadings had been included so that more direct approach to topics of especial interest would be afforded.

The format of the book is excellent and in keeping with the standards for the American Chemical Society Monograph Series. The book will appeal to the teacher, student and industrial worker alike.

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The Chemistry of the Actinide Elements. By JOSEPH J. KATZ, Argonne National Laboratory, and GLENN T. SEABORG, University of California, Berkeley. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. 1957. xv + 508 pp. 16 × 24 cm. Price, $14.00.

This book follows by only four years, "The Actinide Elements" edited by the same authors, and reviewed in THIS JOURNAL, **76**, 5262 (1954). The commendations of the former review would apply equally to the present volume. It is pertinent to ask what requires a new work now.

Some advances have been notable and well advertised. Three new elements have been reported, though some reports are that the real discovery of element 102 will have to be credited to the California monopoly. It would be reassuring to have more diverse confirmation of discoveries since, to quote pp. 433–434 on the discovery of element 101, "it was possible to make the first chemical identification with amounts of the element as small as one atom, on the average, per experiment." This one atom had to behave correctly in elution from a column. These are heroic experiments and require heroic faith.

Perhaps equally propitious are the long-lived isotopes of previously reported transuranic elements. For example, in only four years the most stable known isotope of plutonium has increased from Pu^{239}, half-life 2.4×10^4 yr., to Pu^{244}, half-life 7.6×10^7 yr., and of Californium from days to Cf^{251}, half-life 660 years.

Still fragmentary is the information from outside the U.S.A., and no really unusual developments have been recorded in chemical or other properties. The authors have redigested the known information in the field, and have presented it in an up-to-date, more concise, better organized package. The authors, of course, write with authority on the chemistry, isolation, detection and proof of identity of new elements. No two authors could be authorities in all the chemical and physical fields covered; the review of magnetic, spectral and crystallographic properties and their bearing on atomic structure, and *f*-orbital bonding is useful but not always critical and definitive. In these respects, in spite of being older, the edited volume has some special merits.

After treating chemical and physical aspects of each element in turn, Chapter XI presents a summary in which the thesis is defended that the elements, thorium through 103, are actinides in the same sense that cerium through lutetium are lanthanides. Here seems to be the purpose behind the new volume. "The Actinide Elements" contained a clear, well-documented challenge to this thesis in a chapter by Zachariasen. This dissent is eliminated from the new volume, but, unfortunately, Zachariasen's arguments are essentially left unanswered. Since the authors seem to have chosen a lawyers brief to defend their thesis one can only recommend the reading of Zachariasen's chapter in the older work.

Since makers of periodic tables are accepting the actinide thesis, chemists should study the evidence *now* and decide for themselves or find acceptance an accomplished fact. After reviewing the matter I have a tentative opinion which I set forth in the hope that it may at least cause some further discussion before the actinide terminology is either accepted or rejected:

The elements after thorium without doubt form a transition series within which the 5f-subshell is filled. The start is not abrupt as in the lanthanide series; though at the end of the group the +3 oxidation state is dominant there is no reason for calling thorium an actinide, and probably no advantage for elements at least through plutonium. Zachariasen's suggestion that in oxidation state +3 the elements are actinides, in +4 thorides, in +5 protactinides, in +6 uranides, has some merit.

The end of the series will probably not be abrupt. Elements 104, 105 and 106 will probably resemble Hf, Ta and W, but this also means they will probably resemble Th, Pa and U within the series.

There are advantages in keeping thorium in group IV, protactinium in V, uranium in VI. The elements 93 through 106 (not 103) could then be listed as a series (actiuranide?) since, in truth, the majority of the group have oxidation states and chemistry not like actinium, but like members of this *range* of elements. This would allow one and only one position in the periodic table per element and would not over-emphasize the 3-valent state.

If one book in the field is to be bought "The Chemistry of the Actinide Elements" will no doubt be the choice. "The Actinide Elements" still has its points.

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Isotopic Tracers in Biology. An Introduction to Tracer Methodology. Third Edition, Revised, Enlarged and Reset. By MARTIN D. KAMEN, Associate Professor of Radiochemistry, Edward Mallinckrodt Institute of Radiology, Washington University Medical School, St. Louis, Missouri. **Organic and Biological Chemistry. A Series of Monographs.** Edited by LOUIS F. FIESER and MARY FIESER, Harvard University, Cambridge, Massachusetts. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xii + 474 pp. 16 × 23.5 cm. Price, $9.50.

This book is a revision of "Radioactive Tracers in Biology" with the more inclusive new title justified perhaps by the addition of relatively brief sections on the stable isotopes H^2, C^{13}, N^{15} and O^{18}. The Table of Contents is extensively reorganized; however, much of the book is literally unchanged, excepting for the rearrangement of various sections.

The discussions of the assay methods for and the applications of the stable isotopes to problems in biochemistry suffice to demonstrate the principles involved. A chapter designated "Practical Interlude" consists chiefly of generalities which are of little practical value to the beginner.

It is in the chapters on biochemical aspects where the most extensive additions have been made, particularly in the detailed presentation of the biosynthesis of cholesterol and the porphyrins. Yet very few new specific references to the original literature have been added to those of the second edition (1951). References through 1955 are chiefly limited to a number of general and review articles; these are appended at the close of each chapter.

In spite of its shortcomings it remains a useful introductory textbook in tracer chemistry, particularly for students of biochemistry.

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Thermodynamics of One-Component Systems. By WILLIAM N. LACEY and BRUCE H. SAGE, Chemical Engineering Laboratory, California Institute of Technology, Pasadena, California. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. xi + 376 pp. 16 × 23.5 cm. Price, $8.00.

This book is designed to help students of engineering make the transition "from idealized thermodynamics to the combination of thermodynamics with mechanics needed for the every day problems of the engineer." The subject matter is limited to one-component systems for the authors believe that "a clear understanding of a limited field is more valuable than a superficial acquaintance over a broader front." The units used are the usual engineering units.

The first part (144 pp.) deals with thermodynamic principles. Its special feature is some use of the concept of friction in the development of relations between heat, work and the thermodynamic functions. This concept allows the engineer to differentiate between the applied work and the actual work done on the system. In this section equations are developed and applied to homogeneous systems of gases and liquids of unit weight, heterogeneous systems of unit weight, and systems of variable weight. A chapter on irreversible processes and reactions between systems of constant weight is also included.

The second part deals with flow processes under conditions of steady flow. About 70 pages are devoted to principles and to the development of equations and 70 pages to engines, compression of gases, refrigeration, and liquefaction of gases at low temperature. An appendix of 60 pages includes a 14 page section on the experimental determination of thermodynamic properties.

In view of the experience of the authors, non-engineers should not be surprised to find in this book a detailed treatment of the thermodynamics of one or two-phase one-component systems from the point of view of one who is to make measurements on them or to interpret thermodynamic diagrams of them. The book will also be useful to those who wish to consider the application of thermodynamics to practical situations.

SEVERANCE CHEMICAL LABORATORY
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Biophysical Chemistry. Volume I. Thermodynamics, Electrostatics, and the Biological Significance of the Properties of Matter. By JOHN T. EDSALL, Biological Laboratories, Harvard University, Cambridge, Massachuetts, and JEFFRIES WYMAN, Middle East Science Cooperation Office, UNESCO, Cairo, Egypt. Academic Press Inc., 111 Fifth Avenue, New York 3, N. Y. 1958. xv + 699 pp. 16 × 23.5 cm. Price, $14.00.

The rapidly growing and important field of biology which lies at the juncture of chemistry and physics as well as of biochemistry and biophysics has been given various names such as physical biochemistry and biophysical chemistry. The timely appearance of the first of a projected two volume series by Edsall and Wyman will aid materially in the growing need for suitable texts in the area of physical chemistry of biological systems. The following chapters are included: Biochemistry and Geochemistry (4% of content), Water and its Biological Significance (3), Problems of Protein Structure (14), Thermodynamics (15), Electrostatics: its Application to Polar Molecules and Ionic Solutions (12), Dielectric Constants and their Significance (9), Conductivity of Electrolytes (3), Acid–Base Equilibria (11), Polybasic Acids, Bases, and Ampholytes, Including Proteins (11), Carbon Dioxide and Carbonic Acid (6), and some General Aspects of Molecular Interaction (12).

The authors have placed the major emphasis on the fundamentals of bio-physical-chemical systems and only a minor attention to techniques. This reflects the strength of this growing field, for as soon as a major discipline concerns itself less with techniques and more with the fundamentals of the subject under study, the contributions from this field become substantial. It has been necessary for the authors to restrict the coverage of material and in doing so they have elected to discuss those topics more "intimately" known. For this reason the authors speak with considerable authority. They will be criticized for the omission of any discussion of polynucleotides and we may hope that in the next volume some consideration can be given to this rapidly growing field of biology.

Throughout the text the "biological significance" of the principles of physical chemistry is stressed. This includes the chapter on thermodynamics which is frequently included in texts of this nature as a matter of routine. In the present instance, however, the approach to this fundamental topic has been oriented to the specific problems of the biochemist. Of considerable value are the contributions made by the authors in their discussions of such systems as the malate–fumarate equilibrium, peptide bond synthesis, and the standard free energy of hydrolysis of adenosine triphosphate. Copious examples of biological systems are used to illustrate their points, but the authors do not err in a tendency of including too much detail. Indeed, it is probably their excellent choice of illustrative material which contributes most successfully to the teaching value of this volume.

The subject matter is presented in a concise and straightforward manner, beginning in many instances with first principles. A knowledge of calculus, organic and physical chemistry is assumed. As a guide for the student a list of problems is included at the end of several chapters. The final chapter provides an excellent review of the phenomena associated with molecular interactions and of the experimental problems they present. The style of the authors provides a readable text which should give the student little difficulty. It should become a standard in classrooms, despite the over-emphasis of certain subjects and omission of others. In addition it will find a useful place in any reference library. A generous bibliography is included with each topic. As with any first edition a few typographical errors have made their way to the final copy, but these are readily recognized. A twenty page subject index is included.

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Modern Electroanalytical Methods. Proceedings of the International Symposium on Modern Electrochemical Methods of Analysis, Paris, 1957. Sponsored by the I.U.P.A.C.'s Sections of Analytical and Physical Chemistry (C.I.T.C.E.). Edited by G. CHARLOT, Professeur à l'Ecole de Physique et de Chimie industrielles de Paris. D. Van Nostrand Company, Inc., 126 Alexander Street, Princeton, N. J. 1958. 186 pp. 17 × 24.5 cm. Price, $4.95.

This volume contains in a convenient form the papers published in "Analytica Chimica Acta" (Nos. 1 and 2, Vol. 18, 1958). These 22 papers in English, German or French were presented at the symposium organized by Professor Charlot in Paris in July, 1957. The meeting was well attended by delegates from Western Europe, the United States, the U.S.S.R., Yugoslavia, Poland, Czechoslovakia, Japan, India, Australia, etc.

The general purposes of C.I.T.C.E. are set forth in the inaugural address of T. P. Hoar. Kolthoff, in his introductory remarks, points out the significance of electroanalytical methods in the teaching of analytical chemistry.

Papers cover a great variety of electroanalytical methods. Two trends, however, can be distinguished: methods for