

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 Pu²³⁹, half-life 2.4×10^4 yr., to Pu²⁴⁴, half-life 7.6×10^7 yr., and of Californium from days to Cf²⁶¹, 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 Zachariassen. This dissent is eliminated from the new volume, but, unfortunately, Zachariassen'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 Zachariassen'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 5*f*-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. Zachariassen'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 (actinide?) 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 MARV 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 H², C¹³, N¹⁵ and O¹⁸. 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.