Walling goes on to discuss Free Radical Polymerizations in the next three chapters which are called, respectively, Free Radical Polymerizations; The Kinetics of Radical Chain Processes (Chapter 3); Copolymerization, Chain Transfer, and Inhibition in Polymerization (Chapter 4); Some Further Characteristics of Radical Polymerizations (Chapter 5). These are superb accounts of the whole field of free radical polymerizations. The treatment is very detailed, but most lucid. All the important work in this vast field is summarized succinctly and the reference coverage is remarkable for its inclusiveness. There are excellent compilations of data in tabular form. Here great care has obviously been taken in selecting reliable information and in assembling it in a manner as to make it easily accessible. Here again I felt compelled to compare Professor Walling's account with that given in a standard work, namely, "The Mechanism of Polymer Reactions" by G. M. Burnett, and this certainly indicates just how thorough and up-to-date is the account of this field which Professor Walling has given.

After this very excellent and complete account of free radical polymerizations, Professor Walling proceeds to discuss in turn Radical Addition Reactions Yielding Small Molecules (Chapter 6); Radical Addition Reactions Involving Atoms Other than Carbon (Chapter 7); and Halogen Substitution Reactions (Chapter 8). In these the same high standard is maintained and important stereochemical aspects of free radical reactions are stressed throughout. Kinetic details of the various reactions are also carefully and critically discussed.

The book then continues with a really outstandingly well-written and complete account of Autoxidations (Chapter 9). In the reviewer's opinion, this is by far the best review of the chemistry of autoxidation which has appeared in the literature. The literature coverage is excellent and the subject matter most judiciously selected. There then follow two very good chapters on Radical Formation by Thermal Cleavage of Covalent Bonds (Chapter 10) and Radical Production by Photochemical, High-Energy Radiation, and Oxidation–Reduction Processes.

Throughout the book the literature seems to be very completely covered right up to about the middle of 1956. It is also pleasing to note that Professor Walling has included a large number of references to important relevant Russian work. The book has two good indexes, and it is interesting to note that the Author Index is twice as large as the Subject Index; this is an indication of how extensively the literature has been covered.

This then is a major work of scholarship and it will obviously be the standard monograph on the Chemistry of Free Radicals in Solution for some considerable time. It will appeal to all chemists, and no physical or physical-organic chemist who wishes to keep informed of the advances in free radical chemistry can afford to be without a copy.

In closing, one might note that the book is dedicated to Morris S. Kharasch and Frank R. Mayo, pioneers of free radical chemistry, who first aroused and then maintained Professor Walling's interest in the subject. Regrettably, Professor Kharasch died recently. This book would be a fitting memorial to this great chemist who laid the foundations of much of the work described in its pages.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF BRITISH COLUMBIA C. A. MCDOWELL
VANCOUVER 8, B. C., CANADA

Ion-Exchange Resins. By J. A. KITCHENER, University Reader in Physical Chemistry, Imperial College of Science and Technology, University of London. John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N. Y. vii + 109 pp. 11 × 17 cm. Price, $2.00.

Although the ion-exchange process was discovered more than a hundred years ago, synthetic organic ion-exchange materials were not invented until 1935. As a matter of fact, the currently popular sulfonated styrene–divinylbenzene cation-exchange copolymers did not make an appearance until 1944 and the strongly basic quaternary ammonium type anion-exchange resins were unknown until 1948. With the advent of stable, high capacity ion-exchangers which possessed a single functional group, it became possible to understand the behavior and properties of ion-exchange media. Many thorough investigations of ion-exchange equilibria have cast light on the mechanisms involved and have expedited the exploitation of sorption and elution processes by industry. Uses of ion-exchange resins are becoming so numerous and in some instances are so elegant that it behooves the chemist and chemical engineer to acquaint himself with the fundamental principles involved in ion-exchange processes.

Kitchener has not tried to justify all the theories concerning ion exchange, but instead has attempted to sift out the main, well established principles from those which are controversial in a formidable amount of original literature. Considering the versatility and complexity of the process, he has done an excellent job of organizing and condensing the pertinent details into a minimum number of pages.

The book is interesting and written in such a manner that anyone with a rudimentary knowledge of physical chemistry can understand its contents. It appears that the information contained would be valuable supplementary material for a standard course in physical chemistry and should by all means be included in the course on unit processes offered to chemical engineers.

Only one discrepancy is apparent in the entire book. It occurs in the elution sequence for divalent ions on page 29. The appearance of Ba^{++} as the first and last member of the sequence will cause some consternation among those who read the book.

The author has covered the important applications of ion exchange rather well, in general, except that he has apparently not kept up with the most recent developments in the separation of rare earths by this method. The most recent reference cited on this subject is more than ten years old and citric acid is not the complexing agent used for the commercial production of pure rare earths. Citric acid has been replaced by the more efficient chelating agents such as ethylenediaminetetraacetic acid and N-hydroxyethylethylenediaminetriacetic acid.

AMES LABORATORY
BOX 14-A, STATION A JACK E. POWELL
AMES, IOWA

The Physical Chemistry of Electrolytic Solutions. Third Edition. ACS Monograph No. 137. By HERBERT S. HARNED, Professor of Chemistry, Yale University Emeritus, and BENTON B. OWEN, Professor of Chemistry, Yale University. Reinhold Publishing Corporation, 430 Park Avenue, New York 22, New York, 1958. xxxiii + 803 pp. 16.5 × 23.5 cm. Price, $20.00.

Although not truly "a drastic revision," the Third Edition of Harned and Owen's "The Physical Chemistry of Electrolytic Solutions" is much bigger and better than the earlier editions. This book has grown from 643 pages in 1943 and 681 in 1950 to 836 pages in 1958.

The numerical values in Chapter V and in the equations throughout the book are now up-to-date except that 1.858 instead of 1.860 persists for the freezing point constant of water. Of course the authors have not revised all the experimental results which depend upon these values because they are mortal and have only two lives to give to their science. Otherwise the first edition is reprinted almost unchanged except that the material in the 37 pages of Appendix B of the second edition and much new material is incorporated at the ends of the appropriate sections or as new sections at the ends of the appropriate chapters. The first five theoretical chapters have been increased by 60 pages, and the experimental chapters and appendix by 120 pages.

The important additions are discussions of "Irreversible Thermodynamics" (25 pages), of the Fuoss–Onsager treatment of the conductance of moderately concentrated solutions (25 pages), of the Onsager–Kim treatment of the Wien effect, the effect of high field strengths on conductance (10 pages), of the Mayer treatment of chemical potentials (3 pages), of the Glueckauf–McKay cross-differentiation methods (10 pages), and the presentation of new experimental material (about 100 pages). The authors have made a noble effort to give clear discussions, but the nature of the material necessarily makes the reading of the first four chapters even more difficult than before, and pushes the first presentation of an experimental result back to page 197.

It is very logical to discuss first all of the theoretical development, second irreversible properties such as conductance and diffusion, third the heat and volume functions and finally the free energies and activities, and this method makes a fine reference book, but it makes reading or study very difficult.

The errors in the treatment of the thermodynamics of the galvanic cell and in the first derivation of the Debye–Hückel potential which were noted in my review of the First Edition[1] still persist. The Brønsted theory of specific ion interaction includes the relation which most of us, but not Harned and Owen, call the Harned rule. Since this latter rule is discussed at great length one would expect a clear presentation of the Brønsted theory, but there was no part of the former editions which needed more drastic revision. Unfortunately the changes are trivial and no improvement at all.

The collection and correlation of experimental results is the most valuable contribution. The focus is quite properly on the work at Yale and similar work elsewhere, but there is remarkable freedom from pushing pet theories of the authors. Emphasis is placed upon precision work with simple electrolytes. Except for very brief excursions into hydration and into micelle formation with the aliphatic carboxylate ions, the only chemical reaction discussed is the association of weak electrolytes.

I repeat with even more conviction the summarizing sentence of my former review, "Every worker in the field will be grateful to the authors for the labor they have spent collecting and coordinating this material, and will need to have a copy easily accessible."

(1) THIS JOURNAL, **66**, 1043 (1944).

DEPARTMENT OF CHEMISTRY
MASSACHUSETTS INSTITUTE OF TECHNOLOGY
CAMBRIDGE 39, MASSACHUSETTS GEORGE SCATCHARD

Surface Active Agents and Detergents. Volume II. ANTHONY M. SCHWARTZ, Harris Research Laboratories, Washington, D. C., JAMES W. PERRY, Center for Documentation and Communication Research, Western Reserve University, Cleveland, Ohio, and JULIAN BERCH, Harris Research Laboratories, Washington, D. C. Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 1958. xv + 839 pp. 16 × 23.5 cm. Price, $17.50.

The tremendous growth of the literature on surface active agents led the authors to restrict Volume II to developments during the 1947–56 period. Their original intention was to revise Volume I which was compiled by the first two of the present three authors. The vast number of carefully documented references attest to the activity in the field and the attempts at completeness. As a source book, therefore, this book deserves a place on the chemists' bookshelf.

Numerous advances recorded in the literature since 1956 make it apparent that Volume II already lacks freshness. This reaction is heightened by the curious arrangement which parallels Volume I. After an introduction covering economics and general technological considerations, processes for manufacturing surfactants are given in Part I. There follows in Part II a miscellaneous group of subjects including surfactants for special functions such as germicides, fungicides and anticorrosive action, both inorganic and organic builders, both qualitative and quantitative analysis and then biological effects. Part III attempts to survey recent advances in the physical and colloidal chemistry of surfactants and ends with a non-critical survey of the complex field of detergency. Finally, Part IV comes back again to practical applications such as cleaning in its various aspects, medical and cosmetic uses, uses in the mineral, building, agricultural, leather, paper, foil, plastics, paints, petroleum and chemical industries. The arrangement seems involved and space-consuming to this reviewer.

The presentation of theoretical developments in Part III is largely disjointed and incomplete, possesses a number of minor errors and, all in all, is not very useful. While this book is meant to be mostly technological, a more coherent theoretical treatment would be helpful to all readers. Such a presentation is not easy to achieve in a brief space because of rapid developments.

Furthermore, it is difficult if not impossible for the authors to be critical and authoritative in so many areas. For example, in the discussion of hemolysis (p. 372), the relation between penetration of cholesterol model membranes on water by surfactants and their hemolytic activity (Pethica and Schulman) was not brought out. Again, in the discussion of detergency and cleansing, solubilization is brought up in several places; it is not pointed out, however, that most washing (except the hands) is done below the critical micelle concentration where solubilization is scarcely a factor. The coating chemist can hardly be helped by the vague accounting of the Applications in Paints and Coatings (pp. 689). Separation into groupings on uses as dispersing agents, as wetting agents, as medicinal agents, etc., may have helped to avoid such a burden. It should be emphasized, however, that the survey of types and processes for manufacture in Part I will be quite valuable to many readers.

Typography is excellent and few typographical errors such as those evident in the first letters of the lines in the middle of p. 448 mar the context.

DEPARTMENT OF CHEMISTRY
LEHIGH UNIVERSITY A. C. ZETTLEMOYER
BETHLEHEM, PENNSYLVANIA

Naturally Occurring Quinones. R. H. THOMSON, D.Sc., Ph.D., F.R.I.C., Lecturer in Organic Chemistry, University of Aberdeen. Academic Press, Inc., 111 Fifth Avenue, New York 3, N. Y. 1957. vii + 302 pp. 14.5 × 22.5 cm. Price, $9.00.

Among the oldest of known organic compounds, quinones have been of interest to many organic chemists since the beginning of the science. Their chemistry is complex and the multitude of reactions which they undergo forms a fascinating chapter of organic chemistry. They occur widespread in nature and come from the most varied sources; many have had important uses which antedate the elaboration of any systematic chemistry. Some are dyes, others are fungicides and disinfectants. Some have been used as medicines, others are toxic. Some are antibiotics, some have been isolated from bacilli, some are vitamins.

Professor Thomson's book is a valuable addition to chemical literature, for in it he has gathered together all of the naturally occurring quinones. For each quinone the sources are given, the isolation is described, the physical properties are listed, and finally the proof of structure is given in quite some detail. The book is not—and is not intended to be—a complete discussion of the chemistry of quinones. It is rather a detailed catalog of quinones, with enough of the chemistry, and a complete outline of the proof of structure, so that there is presented a comprehensive picture of the quinones occurring naturally. The discussions are adequate, well written, and extremely well documented. There are three indexes: zoological, botanical and general and these indexes contribute greatly to the usefulness of the book as a reference.

There is a brief introduction, and this is followed by five chapters: benzoquinones (30 compounds, 159 references); naphthaquinones (40 compounds, 309 references); anthraquinones (70 compounds, 331 references); phenanthraquinones and miscellaneous quinones (8 compounds, 35 references); extended quinones (aphins, hypericin, pseudohypericin, fagopyrin, 51 references).

The paper and printing are excellent and the book-making is good. Altogether a first-rate contribution to the literature.

SCHOOL OF CHEMISTRY
UNIVERSITY OF MINNESOTA LEE IRVIN SMITH
MINNEAPOLIS, MINNESOTA