$HNO_3 \cdot CH_3OH$: C, 62.42; H, 5.91; N, 10.96)], and tetradehydrodeserpidine [perchlorate, m.p. 190–192° (found: C, 56.66; H, 5.67; N, 4.27)], respectively. However, *d,l*-$\Delta^{15(20)}$-yohimbene (III),[10] m.p. 196–197° (found: C, 81.57; H, 7.72; N, 9.93), obtained by sodium borohydride reduction of sempervirine, is converted into a ring D dehydro product (IV) [nitrate, m.p. 305–306° (dec.), λ_{max}^{EtOH} 223,320 mμ (log ε 4.58, 4.33), λ_{min} 276 mμ (log ε 3.85) (found: C, 68.06; H, 5.60; N, 12.27)].[11] Mercuric acetate accomplishes the same transformation. Sodium borohydride reduction reverts IV into III, while hydrogenation of IV, at *p*H 10, leads to *d,l*-alloyohimbane.[12]

(10) For the chemistry of the N_a-methyl derivative, see B. Witkop, THIS JOURNAL, **75**, 3361 (1953).

(11) Professor Elderfield has kindly informed the authors that tetrahydroalstoniline,[7] in essence also a $\Delta^{15(20)}$-dehydro compound, likewise undergoes ring D dehydrogenation, yielding alstoniline.[7]

(12) The authors are most grateful to Sir Robert Robinson, and Drs. Aghoramurthy, Diassi, Huebner, Lucas and MacPhillamy for a generous supply of alkaloids and their derivatives.

DEPARTMENT OF CHEMISTRY
IOWA STATE COLLEGE ERNEST WENKERT
AMES, IOWA DILIP K. ROYCHAUDHURI

RECEIVED JANUARY 21, 1957

BOOK REVIEWS

Hydrogen Ions. Their Determination and Importance in Pure and Industrial Chemistry. Volume II. Fourth Edition, Revised and Enlarged. By HUBERT T. S. BRITTON, D. Sc., London and Bristol, D.I.C., F.R.I.C., Professor of Chemistry and Director of the Washington Singer Laboratories, University of Exeter. D. Van Nostrand Company, Inc., 126 Alexander Street, Princeton, New Jersey. 1956. xix + 489 pp. 15 × 22 cm. Price, $12.50.

This second volume of the revised fourth edition is devoted for the most part to applications of *p*H measurements. The author is to be praised for his courage in assembling under one cover selections from a literature that has become enormous.

The general nature of the coverage is indicated as follows. Four chapters are devoted to precipitations of hydroxides, basic chromates, borates, carbonates, silicates, sulfides and phosphates. One chapter, each, deals with reactions between weak organic acids and inorganic bases, complex ions, analytical processes, detection of metals with organic reagents, electro-deposition of metals, sugar manufacture, pulp and paper manufacture, brewing, milk, eggs, baking, water purification and sewage disposal (including corrosion by waters), soils, ceramics, the dye and textile industries, ore flotation, and miscellaneous applications. Four chapters deal with the manufacture and tanning of leather. Notably lacking are reviews of applications in broad fields of biology such as biochemistry, physiology and bacteriology (except here and there). Relatively few applications in the broad field of organic chemistry are reviewed.

Several of the chapters may be characterized as annotated bibliographies and as such the necessarily limited bibliographies and the perspective provided by the notes will be useful to those who set about collecting all the information available in the literature.

The first chapter on oxidation-reduction potentials could be considered to be somewhat out of place in that the theory can be economically developed in direct connection with that of the special oxidation-reduction system H_2, H^+. However, it is used in connection with some important analytical methods. There are a few slips in this chapter but none of great importance except the lack of a comprehensive, systematic way of deriving the complex equations and failure to emphasize strongly enough the fact that two processes, which in the course of history were sometimes regarded to be distinct and separable, are often inseparably coupled. The reviewer, who was guilty of introducing the term rH for a strictly limited purpose, may be permitted to express regret that the author has used this term. It has become an unmitigated nuisance.

So far as a correlation between *p*H numbers and a given phenomenon is concerned it makes little difference how *p*H is interpreted theoretically. But one never knows when further theoretical treatment of the phenomenon may become confused by failure to recognize what an experimental method cannot reveal as well as what it can reveal. Many of the applications reviewed in this book have been formulated in terms of the activity of hydrogen ions (whatever these may be). Because it is impossible to determine precisely the activity of ions of a single kind, a concession has been made to those who follow the current trend of theory by defining *p*H in terms of activity while a trend toward formulations in terms of operations, with elimination of artificial definitions, is revealed in the arbitrary standardization of the *p*H scale. Accordingly the reader of volume II will have to refer to volume I to find the author's justification for his use of hydrogen ion *concentration*, for some clarification of the chapter on non-aqueous solutions and the "*p*H" numbers thereof and for interpretations of measurements made in odd ways of which several are mentioned. From this point of view it is a pity that theory and practice have been separated by the covers of two books. Some compensation is found in the fact that the index lists subjects in both volumes so that one finds juxaposition of *Activated sludge* and *Activity*, *Defecation of sugar juice* and *Degree of ionization*, *Eggs* and E_h, *Potatoes* and *Potentials*, etc.

The diagrams serve well particular purposes. However, one ordinate may be potentials referred to the normal calomel electrode, another potentials referred to the saturated calomel electrode, another potentials referred to the standardized, standard hydrogen electrode. The author may be excused because he takes over what he finds in the literature. There failure to reduce e.m.f. data to one standard is causing confusion in addition to that caused by the use of two opposing conventions regarding signs. It is to be hoped that in future editions Dr. Britton will help to unify the presentation of electromotive force data.

On the whole this book will serve well those interested in applications if only in providing annotated bibliographies.

DEPARTMENT OF CHEMISTRY
THE JOHNS HOPKINS UNIVERSITY W. MANSFIELD CLARK
BALTIMORE, MD.

Light-Scattering in Physical Chemistry. By K. A. STACEY, Ph.D., Chester Beatty Cancer Research Institute. Academic Press, Inc., Publishers, 111 Fifth Avenue, New York 3, N. Y. 1956. viii + 230 pp. 14 × 25.5 cm. Price, $6.75.

"In the past decade the technique of light-scattering has seen a rapid development and its use extended to many branches of physical chemistry. Although the time is not yet ripe for an exhaustive or authoritative monograph on all its aspects the author felt that an attempt to review the

main outlines of the theory, practice and use of this technique would be helpful. The very range of its usefulness has already made it impossible to give an adequate treatment of all its uses and emphasis has therefore been concentrated on macromolecular chemistry where the development has been most spectacular. Since the appearance of new work is so continuous no attempt has been made to be encyclopaedic but it is hoped that a general view will help to show, particularly to the new-comer to this technique, its potentialities and limitations in physical chemistry."

We have just quoted the author's words in the preface to this useful little book. They tell the author's purposes; in this reviewer's opinion they are well carried out.

After a short introduction the serious part of the book begins with a chapter on basic theory. In some respects this is disappointing. The reader searching for an accurate and critical discussion of the theory will not find it here; however, he will find an introduction to the ideas and the formulas used to interpret experimental data. The author is hardly to be blamed for the limitations of this chapter, in that these limitations really reflect the confused state of the literature. In this reviewer's opinion ninety per cent. of the published papers on the theory of light scattering of the past forty years will have to be disregarded when the definitive survey is written.

The following chapter, on experimental methods, is much better. In forty-three pages it describes nearly every important apparatus design that has been published; it also discusses calibration and the results of the determination of the scattering powers of pure liquids, which have led to considerable controversy. The section on corrections for refraction effects is perhaps too condensed for easy intelligibility, but it serves as a useful guide to the literature.

The next three chapters on the application of light scattering to high polymers, proteins and polyelectrolytes are to be highly recommended. They describe practically everything that has been done, and for the most part, clearly and accurately. This is a commendable achievement, and probably will remain a unique one, since progress is so fast that a complete review of all these fields will soon be impracticable. The following is a sampling of topics treated: polymer–solvent interaction, size of polymer coils, molecular weights of miscellaneous proteins, antigen–antibody reactions, effect of charge, shape and size of polyelectrolytes, nucleic acids, micelle formation.

This book is a necessity for any one engaged in light scattering work and in addition should be of interest to any worker in the fields of macromolecular and colloidal chemistry.

GENERAL ELECTRIC RESEARCH LABORATORY
SCHENECTADY, NEW YORK BRUNO H. ZIMM

Trocknungstechnik. Volume I. By O. KRISCHER AND K. KRÖLL. **Die wissenschaftlichen Grundlagen der Trocknungstechnik.** By O. KRISCHER, a.o. Professor an der Technischen Hochschule, Darmstadt. Springer-Verlag, Reichpietschufer, West Berlin W 35, Germany. 1956. xix + 400 pp. 16.5 × 23.5 cm. Ganzleinen DM 46.50.

This book is the first of two volumes, under the general heading Trocknungstechnik. It deals with the scientific principles of the drying of solids. The author of the first volume, O. Krischer, has presented the fundamentals of the drying of solids in eleven chapters. A certain amount of the material presented is derived from journal articles published by Krischer over the past twenty years, as well as other literature data on heat and mass transfer.

The subject matter of the book deals with phenomena peculiar to the drying of wet solids. General aspects of heat and mass transfer familiar to chemical engineers are also summarized.

Chapter I treats material and energy balances in drying; the properties of gas–vapor mixtures and their graphical representation on enthalpy–concentration charts; the nature of the binding forces between liquids and solids and the resulting equilibrium moisture content relationships with numerous curves of equilibrium moisture for a large number of materials.

Chapter II deals with well-known heat transfer concepts, and is essentially a review of radiation, conduction and convection with a summary of recent data on these methods of heat transfer. Special attention is given to heat transfer within porous solids, in particular, a rather complete summary of available data on the thermal conductivity of porous solids and the effects of absolute pressure, temperature, percentage voids and solids composition on this property is presented.

Chapter III is devoted to the transport of mass by flow and by diffusion. In addition to the usual problems of mass transfer from external surfaces of various shapes, the problem of flow of liquids and gases within non-hygroscopic porous solids is treated. Diffusional flow of vapors and capillary flow of liquids in porous solids is treated by conventional methods which have appeared in the literature. Useful data on the resistance to flow of vapors in various types of porous solids are presented in tables of porosity, effective path of vapor flow, termed *wegfaktor*, and a diffusion resistance factor. Methods of measuring capillarity and suction potentials of porous solids are described and a useful tabulation of liquid viscosities and surface tensions for application to capillary flow problems is provided.

Chapter IV, a short section of only ten pages, deals with the important problem of the thermal conductivity of wet materials. This subject has received only slight attention in the theory of drying solids, and this material is a valuable contribution.

Chapter V discusses air drying from the well-known standpoint of the constant-rate and the two falling-rate periods. The usual factors affecting these periods of drying and the critical moisture content are presented in conjunction with numerous plots of drying rate curves for various materials. Selected experimental methods for determining drying rates are described. Data on moisture gradients in various solids are also presented. The latter part of the chapter treats, in less detail, vacuum, contact and high frequency drying.

Chapter VI deals with the effect of external conditions of air velocity, temperature and humidity and radiation on the drying rate from plane surfaces. Both the constant-rate and falling-rate periods are treated, with numerous empirical rate equations proposed. The important problem of material shape and configuration is given cursory treatment in Chapter VII.

Chapter VIII provides examples of making typical calculations of the drying process. A mathematical treatment of heat and mass transfer in the drying of hygroscopic materials is presented in Chapter IX, which involves, essentially, the solution of the partial differential equations for diffusion.

Limited aspects of commercial drying conditions are described in Chapter X, while the final chapter treats briefly the problem of determining moisture in solids and the measurement of humidity.

This book is a valuable reference book for fundamental concepts in the drying of solids. It does not treat freeze drying, superheated vapor and very high temperature drying, nor radiant drying in any detail, and there are serious gaps in literature coverage. It is *not* useful for dryer design calculations, nor for application to process design, nor can it be used to obtain information on dryer selection and performance. It is understood, however, that Volume II is expected to meet these needs. Volume I can be recommended for those scientists and engineers engaged in research and development on drying processes, and as a reference for studies related to the movement of liquids and vapors inside solids.

ENGINEERING EXPERIMENT STATION
UNIVERSITY OF WISCONSIN W. R. MARSHALL, JR.
MADISON 6, WIS.

Synthetic Ion Exchangers. Recent Developments in Theory and Application. By G. H. OSBORNE, F.R.I.C., Consulting Chemist, Chief Chemist, International Alloys Ltd., and Chief Analyst, The British Drug House, Laboratory Chemicals Group. The Macmillan Co., 60 Fifth Avenue, New York 11, N. Y., 1956. ix + 194 pp. 14.5 × 22 cm. Price, $6.00.

This volume represents an excellent concise introduction to the subject of ion exchange. It contains a comprehensive bibliography of the rapidly growing literature of this field in its varied aspects. The most noteworthy feature of this book is its lucid introductory chapters on such various phases of ion exchange as resin structure, performance data, ion exclusion, membranes and both analytical and therapeutic