

found. Oxygen, in the few cases in which it was found, was accompanied by nitrogen and was assumed to have been the result of air leaking into the apparatus. Ethane might have been formed by the decomposition of two molecules of the acid, yielding ethylene glycol as the other product. No attempt was made to find this trace of ethylene glycol as the author's previous experience with this compound did not lead to the belief that it could be detected.

Summary

1. Lactic acid in water solution is decomposed by radiations of wave lengths shorter than 2500 Å. The chief products of decomposition by radiations from a quartz mercury arc are alcohol and carbon dioxide. Carbon monoxide, saturated hydrocarbons and unsaturated hydrocarbons form about 9% of the gaseous products.

2. Aldehyde, if produced, is present in quantities less than 1% of the total decomposition products.

3. The ratio between the energy absorbed and the carbon dioxide produced corresponds to a quantum yield of approximately 0.65.

4. More ethyl alcohol is produced than is required by the assumption that lactic acid decomposes into equal amounts of alcohol and carbon dioxide.

NEW HAVEN, CONNECTICUT

NEW BOOKS

Das Buch der grossen Chemiker. (The Book of the Great Chemists.) Edited by Dr. GÜNTHER BUGGE with the coöperation of special scholars. Vol. I. From Zosimos to Schönbein. Verlag Chemie G. m. b. H., Corneliusstrasse 3, Berlin W 10, Germany, 1929. xii + 496 pp. Illustrated. 16 × 24 cm. Price, unbound, M. 21; bound, M. 24.

This is a book for the chemist's leisure. The publisher's advertisement says that biographical essays in the history of chemistry have not before been published in the German language. The various chapters have been written by scholars who are well known for their researches in the history of chemistry and generally include the latest knowledge on the subjects with which they deal. The first volume brings the account nearly up to the middle of the nineteenth century, and contains chapters on Zosimos (Ruska), Jabir (Ruska), Albertus Magnus (Strunz), Roger Bacon (Strunz), Raymund Lull (Strunz), pseudo-Geber (Ruska), Biringuccio (Johannsen), Paracelsus (Strunz), Agricola (Darmstaedter), Libavius (Darmstaedter), pseudo-Basil Valentine (Fritz), Van Helmont (Strunz), Glauber (Walden), Boyle (Färber), Stahl (Koch), Boerhaave (Speter), Goeffroy the Elder (Speter), Marggraf (Speter), Black (Speter), Cavendish (Lockemann), Priestley (Lockemann), Scheele (Lockemann), Leblanc (Bloch), Lavoisier

(Speter), Klaproth (Bugge), Berthollet (Färber), Proust (Färber), Fourcroy and Vauquelin (Bloch), Davy (Ostwald), Faraday (Ostwald), Berzelius (Söderbaum), Mitscherlich (Bugge) and Schönbein (Färber).

It is apparent that we cannot charge Dr. Bugge, as Colson charged Ladenburg, with overemphasizing the part which Germans have played in the development of chemistry. Indeed we think that another German ought to have been included—Kunckel, who discovered fulminate and phosphorus, and manufactured ruby glass, whose writings first turned Scheele toward chemistry, a man who early developed the applications of chemistry, not alchemy, to the production of *thalers*. His school is numerous in the twentieth century. And there ought certainly to have been a chapter on Lomonosov.

The illustrations are excellent, old prints, pictures of apparatus and portraits which have been chosen with care. A reproduction of an autograph recipe of Paracelsus is very convincing. The book is well bound, well indexed, and well printed in a modernistic manner with paragraphs commencing at the margin. The book can be recommended to chemists in general and to students who wish to improve their chemistry or their knowledge of literary German. Each chapter is an adventure. The book will surely have a wide circulation.

TENNEY L. DAVIS

The Corrosion of Metals. Part I. General Theory. BY PROFESSOR WILH. PALMAER, D.Sc. *Ingeniörsvetenskapsakademiens Handlingar* Nr 93. Svenska Bokhandelscentralen A.-B., Stockholm, Sweden, 1929. 347 pp. 101 figs. 5 plates. 16.5 × 24 cm.

This Memoir (in English) of the Royal Swedish Institute for Scientific-Industrial Research of Stockholm gives an extended account of the investigations that Professor Wilh. Palmaer and his associates have been conducting since 1920 on the corrosion of metals. Two brief preliminary summaries of these investigations have already been published, one in Sweden and one in Germany.

The author first gives a thorough discussion of earlier theories of the solution of metals in aqueous solution. The *Theory of Local Galvanic Elements* is discussed with particular thoroughness. Several experimental investigations are then presented in detail, as follows: (a) the Velocity of Solution of Aluminum in Acids; (b) the Voltage Required to Deposit Hydrogen on Graphite; (c) the Velocity of Solution of Iron in Acids; and finally (d) the Velocity of Solution of Calcium Carbonate in Acids.

The bearing of these results and of those obtained by others in similar researches on the three main theories of this phenomenon are then discussed at length, the conclusion being that the primary factor in the solution of metals in acids is the activity of local galvanic elements. Various

consequences of this conclusion are then examined and certain catalytic phenomena are explained.

Part II is to deal with special researches on the solution of metals; Part III with the special theory of the corrosion of iron.

This comprehensive and exhaustive study of a scientific and practical problem of the first importance will be of great interest to the many chemists and engineers who are concerned with it.

ARTHUR B. LAMB

The Theory and Technique of Quantitative Analysis. BY MARIE FARNSWORTH, Ph.D., Instructor in Chemistry, Washington Square College, New York University. John Wiley and Sons, Inc., New York, 1928. vii + 154 pp. 34 figs. 15 × 23.5 cm. Price, \$2.50.

This little book differs from other books on this subject in that its purpose is not to describe definite procedures but to classify and generalize the operations and to apply the theory of quantitative analysis. Most courses in this subject lay too much stress on the ability of the student to obtain results merely by following a definite set of directions and too little on a thorough discussion of the theory involved. In the laboratory the student is too often left to acquire the technique as best he can, and although it can best be taught by demonstration, this book will at least acquaint him with the tools of the analyst and his manner of working.

It is obvious that this book is mainly the work of Dr. Wendt although his name does not appear as co-author.

Chapters are devoted to the balance and its use, to reagents, laboratory ware, preparation of samples, precipitation and filtration, as well as to the various types of volumetric reactions. The nephelometer is briefly described but unfortunately nothing is said about colorimetric methods, which are more commonly used than nephelometric. Chapters on electrolytic processes and electrometric titrations complete the book.

Inasmuch as many students in quantitative analysis have not yet studied physical chemistry, a book of this type will be of great assistance. In presenting the theory as simply as possible, the author has not made much mention of the many cases to which the simple theory will not apply. For example, the solubility product principle is not as generally applicable as might seem from the chapter in which this subject is discussed, owing to the disturbing effects of hydrolysis, complex formation and presence of other salts.

Attention might be called to a few errors and omissions which can readily be corrected in a future edition. The reviewer cannot agree with the optimistic statement on page 32 that sillimanite ware "rarely breaks when dropped from the laboratory table to the floor." On page 140 it is recommended to remove platinum black from a hydrogen electrode previous

to replatinizing by means of sandpaper; it is difficult to imagine anyone doing it that way. The chapter on filtration should include descriptions of sintered glass and porous porcelain filtering crucibles. On page 97 in the list of primary acidimetric standards, potassium acid phthalate is not included, although it answers every requirement and is issued by the Bureau of Standards. The use of the ball mill in grinding samples and the electric muffle for ignitions should be mentioned.

This book can be heartily recommended to all students in quantitative analysis.

H. H. WILLARD

Die anisotropen Flüssigkeiten. (Anisotropic Liquids (Liquid Crystals).) By C. W. OSEEN, Professor at the University of Upsala. Gebrüder Borntraeger, W 35 Schöneberger Ufer 12 a, Berlin, Germany, 1929. iii + 87 pp. 5 figs. 16.5 × 25.5 cm. Price, unbound, RM. 6.80.

Here at last is the long desired monograph, the only balanced and unbiased account of the highly important yet little known field of liquid crystals. Lehmann's discovery and exploration of this truly remarkable subject earned for him much obloquy and sharp recrimination from many sides, continued throughout his lifetime. The subject is still regarded in most quarters as a somewhat doubtful scientific curiosity. It will be news to most men of science of the present time that Vorländer has prepared 2000 different substances in one or more of the liquid crystalline or anisotropic liquid states. It will be news to almost every chemist that perfectly stable material in this condition is being manufactured and sold in the form of soap solutions on the scale of thousands of tons. Every soap is capable of forming two kinds of liquid crystal, existing over a wide range of temperature and concentration.

The subject of liquid crystals has suffered from the fact that most exemplars of this state are complicated organic compounds easily decomposed by excessive heating and yet exhibiting these states only over comparatively narrow ranges of elevated temperature, usually observed only in microscopes provided with heating stages and water-cooled objectives. These liquids are doubly refracting, like crystals, and often spontaneously assume highly characteristic and hitherto totally unexplained shapes, as, for example, the double cone of an ammonium oleate droplet. The adequate elucidation of this group of states of matter, which cannot be called gaseous, liquid or crystalline, is obviously a problem of first class importance.

Oseen, who in his own papers has developed a highly mathematical treatment, has avoided this almost completely in his admirable review of the subject. He has brought together a most interesting account of the quantitative studies of various phenomena such as the dependence

of electrical and other physical properties on direction in a liquid crystalline phase. It is very interesting to note that none of the English speaking countries have contributed anything worthy of mention to this subject. It has been developed exclusively by Germans, French, Dutch and Swedes. Oseen's monograph is held together by constantly referring the phenomena and measurements described to the touchstone of a comparison between the general theory of Oseen and its somewhat primitive rival, the dipole theory of Riecke (1905) adopted by Vorländer (1910) and given quantitative form by M. Born and F. Grandjean in 1916 and 1917.

JAMES W. MCBAIN

Elements of Physical Chemistry. BY JAMES M. BELL, Head of the Department of Chemistry, University of North Carolina, and PAUL M. GROSS, Head of the Department of Chemistry, Duke University. Longmans, Green and Co., 55 Fifth Avenue, New York, 1929. xiii + 466 pp. 88 figs. 13.5 × 21 cm. Price, \$3.75.

The authors describe this volume as prepared with the college student in mind who has had a course in "General Chemistry, Analytical Chemistry and Organic Chemistry, and who has had a course in General Physics and preferably in the Calculus." In the text the kinetic theory, behavior of solutions, crystal structure, equilibrium and phase rule are among those topics which are particularly emphasized. An interesting chapter on Polar Properties of Solutions is included. The derivation of equations throughout the text is very clear cut. Descriptive matter is not included in large measure, the topics of atomic structure and colloid chemistry being described rather briefly and radioactivity being omitted entirely. Each chapter is followed by ten or a dozen problems with answers at the end of the book.

The volume is also a laboratory manual, giving at the conclusion of fourteen of the chapters a laboratory experiment illustrative of the foregoing principles. No special apparatus is required for most of these experiments.

The text is well illustrated with diagrams which are particularly legible and the experiments by large clear drawings.

HENRY E. BENT

Colloid Chemistry. BY THE SVEDBERG, Professor of Physical Chemistry, University of Upsala. Second edition, revised and enlarged in collaboration with ARNE TISELIUS, Research Assistant in Physical Chemistry, University of Upsala. American Chemical Society Monograph Series. The Chemical Catalog Company, Inc., 419 Fourth Ave., New York, 1928. 302 pp. 167 figs. 15.5 × 23.5 cm. Price, \$5.50.

The special lectures on Colloids given by Professor Svedberg and the research which he organized on his visit to the University of Wisconsin during the spring and summer of 1923 not only gave an immense impetus

to the study of Colloids in this country but culminated in the brilliant development of the author's experimental methods on the grand scale, providing a new and invaluable method for the investigation of some of the most obstinate problems of chemical and biological science. The prompt publication of Svedberg's lectures as an outstanding volume of the American Chemical Society's series of monographs did much to fructify the study of some of the more quantitative aspects of colloid science.

Now after five years, during which the author has become a Nobel Prizeman, we have a new and enlarged edition in which the remarkable invention of the ultracentrifuge is described and some of its many varied fields of application in general science are illustrated by actual results. The quantitative information that will come from the use of this unfortunately very costly apparatus is bound to become as distinctive and important as, for example, the study of everyday materials by X-rays. The exposition of these two methods constitutes the most important addition in the present edition, although the whole book has been thoroughly revised.

This is one of the few indispensable works of colloid science. Nevertheless, one is bound to point out that the title is somewhat of a misnomer, since there is comparatively little chemistry in the book. The strength of the treatment lies in its one-sidedness, in the full presentation of the study of colloids in relation to kinetic theory, a field in which the author has played so prominent a part.

JAMES W. McBAIN