

The Dipole Moments of Cyclohexanol and Cyclohexanone in Dioxane

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In the course of an investigation on the structure of the bile acids it was desirable to know the dipole moments of cyclohexanol and cyclohexanone in dioxane. These compounds have been measured in benzene by Williams,² the moments being cyclohexanol, 1.9, and cyclohexanone 2.9.³

$$P_{E_2} = p_{20}M_2$$

$$\mu = 0.0127 \sqrt{(P_{20} - P_{E_2})T}$$

P_{E_2} values were calculated from the molar refractivities of the electron groups present in the molecules.

The $\epsilon_{12}-\omega_2$ curves were linear for both compounds and the extrapolated value of ϵ_1 was approximately equal to the observed value, indicating that the compounds are not associated in these solutions.

TABLE I
MEASUREMENTS IN DIOXANE AT 25°

Cyclohexanol			Cyclohexanone							
ω_2	ϵ_{12}	ϵ_{11}	ω_2	ϵ_{12}	ϵ_{11}	α	β	P_{20}	P_{E_2}	μ
0.002696	0.97424	2.2237	0.002580	0.97422	2.2395					
.005279	.97447	2.2337	.004785	.97448	2.2631					
.007566	.97476	2.2432	.008013	.97472	2.2972					
.010630	.97508	2.2554	.009462	.97491	2.3128					
.012633	.97524	2.2639	.011496	.97512	2.3342					
.014741	.97549	2.2723	.014441	.97546	2.3657					
	ϵ_1 measured	ϵ_1 extrapolated	ϵ_1 extrapolated							
Cyclohexanol	2.2123	2.2126	0.97395	4.05	0.104	97.8	29.2	1.82		
Cyclohexanone	2.2128	2.2121	0.97395	10.63	0.102	202.2	27.7	2.90		

The symbols in the equations and tables are the same as those given previously.⁴ The equations used in calculating the moments are⁴

$$p_{20} = \frac{3\alpha\epsilon_1}{(\epsilon_1 + 2)^2} + (\epsilon_1 + \beta) \frac{(\epsilon_1 - 1)}{(\epsilon_1 + 2)}$$

(1) Abraham Rosenberg Fellow in Pharmaceutical Chemistry 1941-1942.

(2) Williams, *THIS JOURNAL*, **52**, 1831 (1930).

(3) Through a typographical error, the moment of cyclohexanone is listed in William's article as 2.8.

(4) Halverstadt and Kumler, "A Critical Study of Dielectric Polarization Concentration Curves," in publication.

Eastman Kodak Co. practical cyclohexanol was dried over "Drierite" and twice fractionally distilled through a Widmer column, b. p. 160.9-161.3° cor. at 759 mm.

Eastman Kodak Co. practical cyclohexanone was twice fractionally distilled through a Widmer column, b. p. 157.0-157.5° cor. at 759 mm.

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NEW BOOKS

The Tools of the Chemist. Their Ancestry and American Evolution. By ERNEST CHILD. Reinhold Publishing Corporation, New York, N. Y., 1940. 220 pp. Price, \$3.50.

"Tools of the Chemist," by Ernest Child is an historical account of the development of laboratory apparatus and ware with special emphasis on American enterprise. The book is divided into three parts. Part I, "People and Events in American Chemistry," is entirely historical and biographical and reviews the accomplishments of the pioneers of our science in this country. This part of the book is particularly valuable to the student of the history of chemistry and makes interesting and fascinating reading.

The major portion of the book, Part II, describes the "Ancestry and Development of American Chemical Laboratory Apparatus." In turn, the following appliances, ware and other materials are taken up: balances, glass, porcelain and silica ware, filter paper, heating apparatus, metal laboratory ware, platinum, alundum, rubber ware and optical apparatus. The section on balances is by far the best presented and is given in greatest detail, the illustrations being particularly well chosen to show the earlier forms. One is forcibly reminded throughout the reading of this section of the important and vital role the American chemist has had in developing and perfecting our modern chemical tools. More illustrations of present types of apparatus would have added interest to the book.

The book closes with a short historical account of the leading supply houses and distributors of laboratory apparatus.

The book is profusely and attractively illustrated with over one hundred illustrations. It is an admirable and valuable addition to our growing libraries on historical chemistry. Every chemist will delight and profit in perusing it.

CARL J. ENGELDER

Fluorescent Chemicals and their Applications. By JACK DE MENT, Research Chemist, The Mineralogist Laboratories; Associate Editor, the Mineralogist Magazine. With a Special Chapter on Ultraviolet Radiation Sources by H. C. Dake, Editor, the Mineralogist Magazine. Chemical Publishing Company, Inc., 232 King Street, Brooklyn, N. Y., 1942. xiii + 240 pp. Illustrated. 14 × 22 cm. Price, \$4.25.

During the last few years, fluorescence phenomena have been arousing scientific scrutiny because of the remarkable results obtained from them in fluorescent lighting and in cathode ray tubes. Such successful application has stimulated attempts to develop still other commercial uses. The author of the present book has evidently been diligent in conversing with many who are engaged in these developments, and he records some novel applications, though not all, which are quite up to the minute. Furthermore, he has examined a large number of chemical compounds and listed the color of their fluorescence.

It is in these two respects that interest in the book lies. Its discussion of the theory is inadequate to the needs of the scientist, and there is not to be found the critical viewpoint that characterizes some older books on the subject.

The information given on the fluorescence of chemical compounds is no doubt helpful in chemical analysis as a guide, but the real value of fluorescence in this field can best be determined by the individual chemist for those specific cases with which he is confronted. The colors involved are generally subtle and, particularly at low intensities, are influenced by the low visible transmission of the ultraviolet lamp filter employed. Consequently, the chemist must ultimately depend on judgments formed from his own observations.

While it is true that the book contains some information that may be interesting or helpful to the chemist, yet it is necessary to point out some serious deficiencies. Its style gives evidence of haste and carelessness in composition. The treatment is superficial and too often pseudo-scientific. Its discussions, which are sometimes poorly balanced, indicate a lack of comprehension and understanding of present scientific viewpoints. The price for such a small book seems inexcusably high.

G. R. FONDA

The Polarographic Method of Analysis. By OTTO H. MÜLLER, Department of Anatomy, Cornell University Medical College, New York City. Journal of Chemical Education, Easton, Pennsylvania, 1941. vi + 114 pp. 30 figs. 13 × 20.5 cm. Price, \$1.00.

Dr. Müller's stated intention in writing this little monograph on polarographic analysis has been "to present a

simple account of polarography in a form which can be used by teachers and students in courses of physical chemistry as well as in advanced courses of analytical chemistry." The tone of the book is thus that of an elementary text, and the discussion is limited mainly to fundamental principles with only cursory mention of practical applications.

The book comprises five chapters, the first of which is well described by its title, "Review of Electro-Analytical Methods." The second chapter, entitled "Apparatus," is devoted practically entirely to the description of simple home-made equipment that should be very useful for instructional purposes. The third chapter, "Fundamentals of Quantitative Analysis," contains a discussion of the factors that govern the limiting current. The analysis of polarographic waves and the significance of the half-wave potential are treated in the fourth chapter under the title, "Fundamentals of Qualitative Analysis." The last chapter contains a good résumé of the types of analyses to which the polarographic method can be applied, and a discussion of various points that must be considered in practical work.

The following misstatements and errors have been noticed. Opposite sign conventions are given on p. 21 and p. 39 for cathodic and anodic currents. The discussion on p. 52 of the relation between diffusion current and diffusion coefficient, and the comparison of observed and theoretical diffusion current ratios, lacks conviction because no mention is made of the source of the diffusion coefficient data. It is unfortunate in this connection that the author did not make use of recent data in the literature that demonstrate conclusively the validity of the Ilkovic equation. In the statement at the top of p. 55 the author implies that the use of a "capillary constant" P/m is less laborious than the use of m itself for characterizing and checking the behavior of a capillary, which is misleading. On p. 74, and again on p. 81, it is stated incorrectly that the cathodic and anodic half-wave potentials of a reversible oxidation-reduction system will only be identical if the diffusion coefficients of the reduced and oxidized forms are identical. Actually the cathodic and anodic half-wave potentials will be identical regardless of any difference in the diffusion coefficients. In stating on p. 79 that the theory regarding the shift of the half-wave potential of a metal ion by complex formation "has not yet been subjected to critical tests" the author has apparently overlooked recent work in this field.

On p. 84 the author discusses anodic waves that involve the oxidation of the mercury itself under the general heading "Irreversible Reactions," and he states that "The curves are not the usual S-shape and the half-wave potentials are not independent of concentration." It is thus implied that such reactions are always irreversible, whereas certain waves of this type have actually been shown to correspond to reversible reactions. On p. 98 it is stated incorrectly that a polarogram of a mixture of thallos and cadmium salts in a potassium cyanide supporting electrolyte would only show the cadmium wave. Actually such a polarogram does show a wave and diffusion current for the thallium preceding the cadmium wave, but the position of the thallium wave corresponds to the potential at which cyanide ion depolarizes the dropping electrode rather than the true reduction potential of the thallos ion. In the discussion on p. 111 of amperometric titrations in which the current changes sign, it is stated incorrectly that the end-

point is indicated by zero current. Actually the end-point is reached when the current has become equal to the residual current of the medium.

The author's style is clear and easy to follow and the arrangement of topics is good. An outstanding feature of the book is the inclusion at numerous points throughout the text of directions for well-chosen experiments that illustrate important theoretical points. This feature, combined with a laudable emphasis on simplicity of apparatus, should make this little monograph quite useful as an elementary text of the subject.

JAMES J. LINGANE

Organic Reagents in Inorganic Analysis. By PAUL VON STEIN, Director of Analytical Developments, Cadmium Residue and Pigment Department, Harshaw Chemical Company, Elyria, Ohio. Chemical Publishing Co., Inc., Brooklyn, N. Y., 1942. viii+242 pp. 22 × 14.5 cm. Price, \$4.50.

In this book forty-seven elements and radicals are arranged in alphabetical order, and brief abstracts of the more pertinent methods of detection, using organic reagents, are given. Each abstract is accompanied by an average of only one or two references to the literature.

Although a majority of the more useful of the methods given can be found in brief form in the larger reference books of qualitative analysis and in Lange's "Handbook of Chemistry," such a compilation as the one under consideration should be useful to the analytical chemist. Unfortunately, the book is so replete with errors of omission and commission that its value is considerably lowered. Certainly in a book that the author states is intended to be "a complete reference work of organic compounds which yield indicative reactions with inorganic materials," the omission of dimethylglyoxime as a precipitant for nickel is surprising, to say the least. The scantiness of the bibliography is also disappointing.

Typographical errors begin at the second line of the text and continue with alarming frequency throughout the book, including the appendix and index. On page 56, where the author sees fit to take time out to show us how to oxidize chromic ions to chromate, he makes two glaring grammatical errors in as many sentences.

The reviewer questions the implication that dimethylglyoxime precipitates so many metals from acid solution that its use as a precipitant for palladium is of little importance. But he is completely baffled to learn that the test for gold with dimethylaminobenzylidene rhodamine is specific only in the absence of *gold*, mercury and palladium. A great many other errors could be listed if space permitted. The above merely serve as examples.

Most of the material in the appendix is either repetitious or could well be incorporated in the text. The index is incomplete.

Altogether, the impression the book gives is that it was too hastily compiled and even more hastily printed.

STEPHEN G. SIMPSON

BOOKS RECEIVED

June 10, 1942–July 10, 1942

- F. E. BROWN. "A Short Course in Qualitative Analysis." Revised Edition. D. Appleton-Century Company, Inc., 35 West 32nd Street, New York, N. Y. 367 pp. \$2.60.
- WILLIAM S. DUTTON. "Du Pont—One Hundred and Forty Years." Charles Scribner's Sons, New York, N. Y. 396 pp. \$3.00.
- L. A. GOLDBLATT, Editor. "Collateral Readings in Inorganic Chemistry." Second Series. D. Appleton-Century Company, Inc., 35 West 32nd Street, New York, N. Y. 198 pp. \$1.40.
- FRANK THOMSON GUCKER, JR., AND WILLIAM BUELL MELDRUM. "Physical Chemistry." American Book Company, 88 Lexington Avenue, New York, N. Y. 683 pp. \$4.00.
- MORRIS B. JACOBS. "War Gases." Interscience Publishers, Inc., 215 Fourth Avenue, New York, N. Y. 180 pp. \$3.00.
- VLADIMIR A. KALICHEVSKY AND BERT ALLEN STAGNER. "Chemical Refining of Petroleum." Revised edition. (American Chemical Society Monograph Series.) Reinhold Publishing Corporation, 330 West 42nd Street, New York, N. Y. 550 pp. \$7.50.
- JAMES MURRAY LUCK, Editor. "Annual Review of Biochemistry." Vol. XI. Annual Reviews, Inc., Stanford University P. O., California. 736 pp. \$5.00.
- JOSEPH J. MATTIELLO, Editor. "The Microscopic Identification of Azo Dyes and Organic Pigments" (Reprint of Chapter 3 of Protective and Decorative Coatings, Vol. II, published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York, N. Y.). Harmon Color and Chemical Co., Inc., Haledon, New Jersey. 163 pp.
- H. J. S. SAND. "Electrochemistry and Electrochemical Analysis." Vol. III. "Electrical Methods Applied to Titration, Moisture Determination and pH Measurement." Chemical Publishing Company, 234 King Street, Brooklyn, New York. 118 pp. \$2.25.
- RUDOLF SCHOENHEIMER. "The Dynamic State of Body Constituents." Harvard University Monograph in Medicine and Public Health, No. 3. Harvard University Press, Cambridge, Mass. 78 pp. \$1.75.
- H. B. WATSON. "Modern Theories of Organic Chemistry." Second Edition. Oxford University Press, 114 Fifth Avenue, New York, N. Y. 267 pp. \$5.00.