

	Symmetry class ⁷	Frequency	Intensity	Polarization
C—C stretching	A'	876	10	0.11
C=C stretching	A'	1072	7	0.37
	A'	1961	0.2	
Skeleton angle change in plane	A'	210	10 (broad)	
	A'	555	5	0.24
Skeleton angle change out of plane	A''	322	0.9	
=CH ₂ torsion	A''	523	0.5	
CH ₃ internal angle change	A'	1374	5	
	A'	1439	1	
	A''	1462	5	0.88
CH ₂ internal angle change	A'	1391 ⁶		
CH ₃ wagging (rocking)	A''	1003	0.2	
	A'	1132	10	0.40
CH ₂ wagging (rocking)	A'	858 ⁶		
	A''	1102	5	dp
CH bending	A''	842	3	
	A'	1327	2	0.26
CH stretching		2870 2910 2931 2954 2993 3061		

This assignment leads to the following improved agreement between the calculated and experimental entropies:

T, °K.	230	250	273.25	290
S ⁰ Calculated	65.26	66.65	68.21	69.45
S ⁰ Experimental ²	64.87 ± 0.30	66.58 ± 0.17	68.40 ± 0.14	69.39 ± 0.18

These calculated entropies were obtained using a value of 1900 cal./mole for the potential barrier hindering the rotation of the methyl group—in fair agreement with a value predicted from other considerations.²

We wish to thank Dr. N. Sheppard for helpful discussions.

(6) Lines observed in the infrared spectrum only. Infrared data obtained from American Petroleum Institute Research Project 44. Catalog of Infrared Spectrograms, Serial No. 41.

(7) Notation according to Herzberg, "Infrared and Raman Spectra," D. Van Nostrand Co., New York, N. Y., 1945, p. 105.

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RECEIVED SEPTEMBER 26, 1947

PAPER CHROMATOGRAPHY APPLIED TO THE ISOTOPIC DERIVATIVE METHOD OF ANALYSIS

Sir:

We have described a method of analysis of amino acids in the form of isotopic, *p*-I³¹-phenyl sulfonyl (pipsyl), derivatives.¹ The estimation of these derivatives using paper chromatography is reported here.

One mg. of amino acids in 0.6 ml. of 0.3 *M* sodium bicarbonate was shaken at 100° with 9 mg. of I³¹-pipsyl chloride. After acidification, derivatives were extracted with ether, the aqueous layer evaporated, sodium bicarbonate added, and the procedure repeated twice. Residual *p*-iodo-

(1) Keston, Udenfriend and Cabran, *THIS JOURNAL*, **68**, 1390 (1946).

phenylsulfonic acid was removed from the ether by appropriate extractions. The ether was evaporated, the residue dissolved in 0.5 ml. of ammoni-

acal alcohol, and an aliquot, equivalent to 1–7 micrograms of protein placed as a transverse line on Whatman No. 1 paper, 2 × 57 cm. The chromatogram was developed with *n*-pentanol saturated with 2 *N* ammonia.

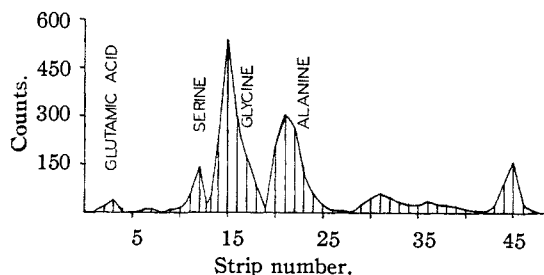


Fig. 1.

The diagram shows counts of successive 5-mm. strips of a chromatogram prepared from a mixture simulating silk hydrolysates. Total counts in a resolved band divided by *C_r*, counts per mole of isotopic reagent, gives equivalents of amino acid. Recoveries were: glutamic acid 104%, serine 91%, glycine 100%, alanine 100%. The ostensible pipsylglycine was eluted and identified by adding pipsylglycine carrier and demonstrating unchanged isotope concentration after purification. Analyses indicated 41% of silk nitrogen in glycine.

Estimations may be made independent of complete resolution of bands by adding indicators (either unlabelled derivative or derivative labelled with a second isotope) before chromatography.

Estimations then depend on isotope ratios in any pure sample. S^{35} -Pipsylalanine (B counts) was added, as indicator, to the derivatives obtained from silk hydrolysate and I^{131} -pipsyl chloride. Eluates of selected successive strips in the alanine band (identified by S^{35} counts) showed constant ratios, $R = I^{131}/S^{35}$. S^{35} counts are 99.7% removed by 0.003" Al which passes 56% of I^{131} counts. The alanine originally present equals RB/C_r . Analysis indicated 29% of silk nitrogen in alanine.

We acknowledge the interest of Prof. R. Keith Cannan, the assistance of Dr. Heinrich Rinderknecht, and a grant from the American Cancer Society recommended by the Committee on Growth, National Research Council.

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RECEIVED NOVEMBER 21, 1947

NEW BOOK

Mechanisms of Reactions at Carbon-Carbon Double Bonds. By CHARLES C. PRICE. Interscience Publishers Inc., New York, N. Y., 1946. 118 pp. Price, \$2.50.

The last three quarters of this small book, based on lectures given by the author at the Polytechnic Institute of Brooklyn, consists of an exceptionally effective discussion of the reactions of olefinic compounds. It is clear, and remarkably complete for so small a compass, and is based on the best available interpretations of the mechanisms involved, which have been largely clarified in recent years by physical chemical as well as by organic chemical evidence. The treatment of vinyl polymerizations, to whose understanding the author has made important contributions, is especially timely and interesting.

The first chapter, however, is concerned with a theory of the orienting effect of groups attached to the benzene ring which the present reviewer is quite unable to understand. While he is worried by the approximations made in the calculations and by the optimism with which a verification is claimed, he is bogged down completely by the bald assumption that an electrostatic force due to an orienting group which pushes the mobile ring electrons from the carbon atom to which the group is attached toward the ortho carbon atoms should produce a greater electron density on the para carbon than on the meta and that a force which pulls the electrons in the opposite direction should put greater density on the meta carbon than on the para.

The reviewer can therefore only recommend to readers of the book the alternatives of skipping this chapter entirely or of devoting to it a great deal of critical thought and much more imagination than is at his own disposal.

L. P. HAMMETT

BOOKS RECEIVED

October 10, 1947–November 10, 1947

E. F. ADOLPH and Associates. "Physiology of Man in the Desert." Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. 357 pp. \$6.50.

ROYAL T. BALCH. "Wax and Fatty Byproducts from Sugarcane." Technological Report Series, No. 3. Sugar Research Foundation, Inc., 52 Wall St., New York 5, N. Y. 62 pp.

IMO P. BAUGHMAN. "An Introduction to Chemistry. A Textbook and Laboratory Manual." (With "A Teachers' Guide.") W. B. Saunders Company, West Washington Square, Philadelphia 5, Pa. 315 pp. \$3.00.

WILLIAM C. BOYD. "Fundamentals of Immunology." Second Edition, Completely Revised and Rewritten. Interscience Publishers, Inc., 215 Fourth Ave., New York 3, N. Y. 503 pp. \$6.00.

VINCENT G. DETHIER. "Chemical Insect Attractants and Repellents." The Blakiston Company, 1012 Walnut St., Philadelphia 5, Pa. 289 pp. \$5.00.

OLAF A. HOUGEN and KENNETH M. WATSON. "Chemical Process Principles." Part II, "Thermodynamics." John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 804 pp. \$5.00.

GEORGE GLOCKLER and RUBY C. GLOCKLER. "Chemistry in our Time." F. S. Crofts and Co., 101 Fifth Ave., New York 3, N. Y. 667 pp. \$4.50.

E. JOSEPHY and F. RADT, Editors. "Elsevier's Encyclopaedia of Organic Chemistry." Volume 13, "Tricyclic Compounds." Series 111, "Carboisocyclic Condensed Compounds." Elsevier Publishing Company, Inc., 215 Fourth Ave., New York 3, N. Y. 1265 pp. Subscription price, \$78.00. Serial price, \$91.00. By single volume price, \$104.00.

FOREST RAY MOULTON. "Approaches to Tumor Chemotherapy. A Symposium." American Association for the Advancement of Science, 1515 Massachusetts Ave., N.W., Washington 5, D. C. 442 pp.

"Richter-Anschütz The Chemistry of the Carbon Compounds." Volume IV. "The Heterocyclic Compounds" by F. Reindel (translated by M. F. Darken) and "Organic Free Radicals" by Ludwig Anschütz (translated by A. J. Mee). Third English Edition, based on the Twelfth German Edition. Elsevier Publishing Co., Inc., 215 Fourth Ave., New York 3, N. Y. 498 pp. \$12.00.

N. C. SEN GUPTA and K. C. SEN. "A Textbook of Physical Chemistry." New Edition. Mondal Brothers and Co., Ltd., 54-8, College Street, Calcutta, India. 525 pp. Rs. 10/-.

HENRY C. SHERMAN. "Calcium and Phosphorus in Foods and Nutrition." Columbia University Press, Morning-side Heights, New York. 176 pp. \$2.75.

A. SKRABAL. "Homogenkinetik." Volume V. "Die Chemische Reaktion." Theodor Steinkopff, Verlagsbuchhandlung, Frankfurt A.M.-Griesheim, Einbaumstrasse 2, Germany (U. S. Zone). 232 pp.

L. A. WATERBURY. "Handbook of Engineering." Revised by H. W. Reddick, W. M. Lansford, C. O. Mackey, H. H. Higbie and H. S. Bull. Fourth edition. John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 386 pp. \$2.50.

FRANK J. WELCHER. "Organic Analytical Reagents." Vol. III. D. Van Nostrand Company, Inc., 250 Fourth Ave., New York, N. Y. 593 pp. Individual volume price, \$8.00. Series price, each, \$7.00.

ROLAND M. WHITTAKER and ALEXANDER P. MARION. "Laboratory Handbook for General Chemistry." Remsen Press Division, Chemical Publishing Company, Inc., 26 Court St., Brooklyn 2, N. Y. 363 pp. \$3.50.