

oxygen atoms, the reaction goes almost quantitatively with the formation of ozone. A comparison with equivalent mixtures of oxygen and nitrogen shows that of the two possible reactions of initially formed oxygen atoms, $O + O_2 + X = O_3 + X$ and $O + CO + X = CO_2 + X$, the first goes at least 100 times faster. As both reactions are exothermic and probably do not require activation energy the above result should be attributed to the necessity for the oxygen atom and the carbon monoxide molecule to be properly oriented at the moment of collision, while the oxygen atom and the oxygen molecule can react more independently of their relative orientation in a similar triple collision.

Some years ago Coehn and Tramm [*Ber.*, **54**, 1148 (1920)] reported that at room temperature water vapor has no influence on the rate of the photochemical oxygen-carbon monoxide reaction. We have repeated their experiments at 575° with the result that at this temperature water vapor has a very pronounced accelerating effect on the rate. This action is probably due to setting up of semi-thermal chains and may be linked with the well-known action of water in the thermal explosions of the carbon monoxide-oxygen mixtures. Further experiments on this subject are in progress and will be reported later in THIS JOURNAL.

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THE OXIDATION OF LACTAL

Sir:

M. Bergmann¹ states that when lactal is oxidized with perbenzoic acid 4-galactosido-mannose is produced in good yield. His experimental results indicate that solely this sugar is formed in the reaction. For the pure sugar he finds the value $[\alpha]_D^{23} + 23.04$ in water five minutes after solution, the rotation becoming constant at $+30.0$ after about eighty minutes. In the autumn of 1929 we undertook the preparation of a considerable quantity of 4-galactosido-mannose for the purpose of studying the rotations of the sugar and some of its derivatives. The beautifully crystalline lactal which was prepared showed $[\alpha]_D^{20} + 27.69$ in water, in full agreement with Bergmann's measurement ($+27.70$). The substance did not reduce Fehling's solution and was therefore free of sugar. Its oxidation by a solution of perbenzoic acid in ethyl acetate, following Bergmann's directions, gave a good yield of a crystalline sugar the initial and final rotations of which corresponded well with his data, previously quoted. When the product, which absorbed no bromine and therefore contained no residual

¹ M. Bergmann, *Ann.*, **434**, 79 (1923).

lactal, was fractionally recrystallized it proved to be a mixture of at least two sugars, one having a final $[\alpha]_D$ less than 30° and the other a greater value. Many repetitions of the work gave the same result. The mixture of sugars was dissolved in the minimum amount of water and allowed to crystallize slowly after the addition of methyl alcohol, thus separating the product into two fractions. After five such fractionations the extreme values for the high and low fractions were $[\alpha]_D$ 34.6 and 26.9 (stable aqueous solutions). It is evident therefore that a review of Bergmann's data for 4-galactosido-mannose is required. We suppose that this sugar predominates in the lower-rotating fraction. What then is the identity of the higher-rotating sugar? It is apparently not lactose because it shows upward mutarotation and is very soluble in cold water. The separation of the sugars by fractional crystallization is tedious and considerable time will probably be required for the completion of the work. We are accordingly publishing this record of our year's studies on the subject. The experiments will be resumed in the fall of 1930, and it is also planned to make a similar study of the oxidation of cellobial and similar substances.

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NEW BOOKS

The Analytical Expression of the Results of the Theory of Space Groups. By RALPH W. G. WYCKOFF. Second edition. Carnegie Institution of Washington, Washington, D. C., 1930. 239 pp. 222 figs. 17.5×25.5 cm.

The tabulation of the special positions of the space groups has been useful in facilitating the determinations of atomic arrangements in crystals. The second edition of this work has been modified to include a graphical presentation of the symmetry elements of the space groups together with statements of the symmetry properties of the special positions. C. Hermann's recently proposed nomenclature is included in the outline of the derivation of the space groups. The majority of the errors in the tables of the first edition have been corrected.

STERLING B. HENDRICKS

Trattato di Chimica Organica. (Treatise on Organic Chemistry.) By GIUSEPPE ODDO, Professor of Chemistry at the University of Palermo. Casa Editrice Remo Sandron, Palermo, Italy, 1930. xv + 949 pp. 101 figs. 17.5×25 cm. Price, L. 90.

It is doubtful whether or not an elementary textbook of organic chemistry can be expected to serve at the same time as a reference work for the advanced student. Most American textbook writers have contented themselves with a brief survey of the subject and have placed much