10^{13} molecules per cc. per sec. [Hinshelwood and Burk, *Proc. Roy. Soc.* (London), **A106,** 284 (1924)]. On the other hand, the number of collisions between N_2O molecules and oxygen atoms at the equilibrium concentration under these conditions proves to be of the order of 10^{24} collisions per cc. per sec., and thus the thermal decomposition is very small compared to this. We are thus forced to the conclusion that either the probability of reaction between N_2O and O is very small, or that the rate of thermal dissociation into N_2 and O is very small, never even approximately establishing equilibrium even for low rates of the thermal decomposition. Both statements may, of course, be true. The first is not at all surprising, rather, indeed, probable. However, the second statement, also, may very possibly be true. In this case, in contrast to the case of ozone (see first reference cited above), we are dealing with a molecule made up of the dissociation products O (normal state ^3P) and N_2 (normal state $^1\Sigma$) and this, in addition to all chemical knowledge of the inertness of nitrogen, suggests that the two reactions represented by the equilibrium $N_2O \rightleftarrows N_2 + O$, even at 838°K., are very slow. In the case of the molecule O_3 the situation is different, the constituents being O (normal state ^3P) and O_2 (normal state $^3\Sigma$). It should be noted that, with respect to the dissociation products, the energy content of the two molecules N_2O and O_3 is of the same order of magnitude, namely, about 41,500 calories and 24,000 calories, respectively. The author plans to discuss the above more fully in a later paper.

BUREAU OF CHEMISTRY AND SOILS
U. S. DEPARTMENT OF AGRICULTURE
WASHINGTON, D. C.
OLIVER R. WULF

RECEIVED JANUARY 26, 1932
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THE STRUCTURE OF METAL KETYLS

Sir:

The metal ketyl derived from benzophenone has been found to conduct the electric current in liquid ammonia solution [observations of Mr. Paul B. Bien in this Laboratory] and the results also suggest that this substance is ionized in accordance with the equation

$$(C_6H_5)_2CONa \longrightarrow [(C_6H_5)_2CO]^- + Na^+$$

The anion represents an interesting and unusual type of stable complex for it contains both an *odd* and an *extra* electron. Consequently, a careful study of such substances might be expected to throw some new light on fundamental valence problems.

It has already been shown [Wooster, THIS JOURNAL, **51,** 1856 (1929)] that the Schmidlin formula for the metal ketyls is incorrect and that the question of their constitution is still open. Several alternative hypotheses

including those of Schlenk and his co-workers [Schlenk and Weickel, *Ber.*, **44**, 1182 (1911); Schlenk and Thal, *ibid.*, **46**, 2840 (1913)] are now being critically studied.

CHEMICAL LABORATORY OF BROWN UNIVERSITY CHARLES BUSHNELL WOOSTER
PROVIDENCE, RHODE ISLAND

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NEW BOOKS

An Introduction to Chemistry. A Pandemic Text. By JOHN ARREND TIMM, Assistant Professor of Chemistry, Yale University. With a Foreword by John Johnston. McGraw-Hill Book Company, 370 Seventh Avenue, New York, 1930. xviii + 561 pp. 161 figs. 14.5 × 21 cm. Price, $3.50.

Those who are seeking something different in the way of presenting first-year chemistry will be interested in this book. It is an outgrowth of a course given at Yale for those students who desire to broaden their educational horizon by the acquisition not only of some of the pertinent facts of science but an understanding of some of the modern theories of chemistry and physics. It is not intended for those students who plan to take further training in the subject. The author has well stated in his Introduction that "A well-balanced life results from the cultivation of all of its moods. The risks of living too exclusively in any one of them are too great for any but the genius to take. In education none of these moods should be neglected. The student who studies literature and the humanities exclusively, is as ill-cultured as he who cares for science alone." And, further (from the Foreword by John Johnston), "This course endeavors, not to give the student a contemporary command of assorted facts relating to restricted classes of substances, but to correlate, and to explain in simpler terms, some of the chemical and physical phenomena which he encounters every day."

To those orthodox teachers who have always regarded chemistry essentially as a laboratory science, the idea of giving a year's course in introductory chemistry without laboratory work, without the practice of writing equations ("a cruel waste of time"), and without the working of problems, will come somewhat as a jolt. The author is certainly to be commended for his boldness in breaking away from all tradition. In choice of material, its arrangement and method of presentation, the author has thrown aside all that is conventional and, it must be admitted, has produced a book that is both informative and interesting.

The reviewer believes that if the lower seventy-five per cent. of the class of students who will desire to take a "pandemic" course in chemistry could be eliminated this would be a most excellent text. It is difficult for