para-hydroxybenzenes are the reductants and some representatives of which have been investigated by Ball and Chen, *e. g.*, epinephrine, catechol, pyrogallol and gallic acid.

I should like, also, to suggest, from a consideration of the available facts, that luciferase serves the same oxidative function with regard to luciferin as oxidases such as catechol oxidase, laccase, and polyphenolase do, to their respective substrates.

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IRVIN M. KORR

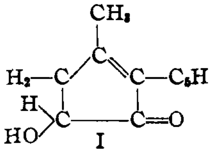
RECEIVED MAY 13, 1936

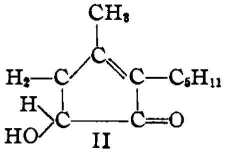
CONSTITUENTS OF PYRETHRUM FLOWERS. V. CONCERNING THE STRUCTURE OF PYRETHROLONE

Sir:

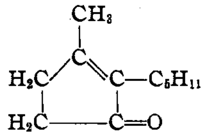
In article IV of this series [*J. Org. Chem.*, **1**, 38 (1936)] we have reported that the semicarbazones of pyrethrolone and tetrahydropyrethrolone contain two less hydrogen atoms than are required by their accepted formulas. Pyrethrolone semicarbazone corresponds to the formula $C_{12}H_{17}O_2N_3$ and tetrahydropyrethrolone semicarbazone to $C_{12}H_{21}O_2N_3$. The formulas for pyrethrolone and tetrahydropyrethrolone would therefore be represented by $C_{11}H_{14}O_2$ and $C_{11}H_{18}O_2$, respectively. These formulas have now been confirmed by analyses of the free ketones and some of their derivatives.

The establishment of the new empirical formulas for pyrethrolone and tetrahydropyrethrolone necessitates a revision of their structural formulas, and we suggest that formulas I and II be assigned to pyrethrolone and tetrahydropyrethrolone, respectively.


I


II

Tetrahydropyrethrolone, having a saturated side chain, is better suited for study of the nuclear reactions than is pyrethrolone. The hydroxyl group is readily replaced by chlorine, and the resulting chloro derivative yields on reduction an optically inactive ketone of probable structure III. This formula, on the basis of degradation and synthesis, has been assigned to dihydrojasmone, the semicarbazone of which melts at 175°. The semicarbazone of our reduced compound melts at 176°. While it has not been possible to make a mixed melting point, the two values are so close as to indicate identity [Treff and Werner, *Ber.*, **66**, 1521 (1933); Staudinger and Ruzicka, *Helv. Chim. Acta*, **7**, 257 (1924)].


III

With the assumption that tetrahydropyrethrolone corresponds to formula II, its recorded characteristic reactions also are readily explained.

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RECEIVED MAY 21, 1936

THE CONSTANCY OF NUCLEAR BOND ENERGIES

Sir:

Recent accurate determinations of the masses of the lighter elements [Oliphant, *Nature*, **137**, 396 (1936)] permit a further check on the assumption [Latimer and Libby, *J. Chem. Phys.*, **1**, 133 (1933)] that the energies of nuclear reactions can be calculated as the sum of changes in the energies of the nuclear bonds and the coulombic fields. As an approximation for the latter, Latimer and Libby used the classical expression $M_F = 2Z^2/3R$, where Z is the charge and R the radius. Experimental values for the nuclear radii agree very well with the equation [Dunning, *Phys. Rev.*, **45**, 587 (1934)] $R = 1.315 \times 10^{-13} \sqrt[3]{\text{at. wt.}}$ Using these values for the radii we may calculate M_F for each nucleus and the ΔM_F for nuclear reactions. The difference between the experimental change in mass, ΔM, and the ΔM_F then constitutes a measure of the change in the nuclear bond energies.

In Table I the data expressed in atomic weight units are summarized for reactions involving the emission of positrons and electrons. For the positron reactions the bond calculated is remarkably constant and appears to be simply the energy of the reaction: neutron plus positron to give a proton. For the five electron reactions, however, the energy for the conversion of a neutron to a proton is considerably smaller than the energies of the other four reactions, so that the bond energy must represent the expulsion of an electron from a H^4 group to form He^4.