AN EQUATION RELATING VISCOSITY AND SURFACE TENSION

Sir:

An equation relating viscosity and surface tension can be obtained by combining the following equations of Batchinski [*Z. physik. Chem.*, **84,** 643 (1913)] and McLeod [*Trans. Faraday Soc.*, **19,** 38 (1923)], respectively,

$$\eta = \frac{C'}{v - w} \qquad \frac{\gamma}{(D - d)^4} = C$$

where η is the viscosity, v the specific volume, w the limiting volume or approximately van der Waals b, γ the surface tension, D the density of the liquid, d the density of the vapor, and C' and C are constants for a given liquid. Below the boiling point the density of the vapor may be neglected in comparison with the density of the liquid. Neglecting d and equating v to $1/D$, we obtain

$$\gamma^{-1/4} = A\frac{1}{\eta} + B$$

where A and B are constants characteristic of the liquid.

If this equation is correct, a straight line will be obtained when $\gamma^{-1/4}$ is plotted against fluidity. When such plots were made for twenty-five liquids, water included, the deviations of the points from a straight line were within the experimental error except in the cases of ethyl ether and the alcohols, in which the surface tension at low fluidities was less than the straight-line requirements, the deviation increasing as fluidity decreases.

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THE PHOTOCHEMICAL FORMATION OF HYDROGEN PEROXIDE

Sir:

In previous communications [*J. Phys. Chem.*, **30,** 34 (1926); This Journal, **49,** 2763 (1927)] the author has reported the quantum yield for the formation of hydrogen peroxide from hydrogen and oxygen by light of wave length 2536 Å. when photosensitized by mercury vapor. In making these measurements, a quartz filter containing chlorine and bromine was used. The manufacturers gave the transmission of this filter for 2536 Å. as 80%. Since these papers were published Frankenburger and Klinkhardt [*Z. physik. Chem.*, **B15,** 421 (1932)] have also reported work on this reaction in which they obtain a yield of 1.2 molecules of H_2O_2 and 1.5–2.5 molecules of H_2O per quantum absorbed. The author originally reported 6.6 molecules of H_2O_2 formed per quantum absorbed. In attempting to account for this discrepancy the filter originally used was borrowed from Princeton University and its transmission measured by Mr. Frank Benford, in this Laboratory, using a Bausch and Lomb monochromator and receiving the transmitted energy on a thermopile. The transmissions measured are given in the accompanying table.

Wave length in Å.	Fraction of incident light transmitted	Wave length in Å.	Fraction of incident light transmitted
2475	0.24	3650	0.00
2536	.31	4047	.00
2650	.36	4350	.03
2804	.17	4916	.25
2967	.00	5461	.60
3024	.00	5770	.53

These results agree fairly well with measurements on a similar filter reported by Villars [THIS JOURNAL, **48,** 1874 (1926)]. As a result of these measurements the quantum yield reported by the author will have to be reduced from 6.6 to 2.5.

In previous experiments (Ref. 1) using a closed circulatory system the author was able to show that the product of the reaction was predominantly hydrogen peroxide. Due to an unfortunate accident, this was only an estimate, but a careful check on the volume of the system made from a photograph shows that the yield was at least 75% H_2O_2 and probably much greater. It is thus possible to say that in these experiments where the gas was saturated with water vapor at 20° the yield of water vapor in the reaction is not at all in agreement with the results of Frankenburger, who found more water formed than peroxide. His objection to the mechanism postulated

$$H + O_2 = HO_2 \tag{1}$$
$$HO_2 + H_2 = H_2O_2 + H \tag{2}$$

on account of the endothermic nature of reaction (2) is not necessarily valid since the original product HO_2 may react with oxygen before it loses the 69 k. cal. acquired in its formation.

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DERIVATIVES OF DIOXANE

Sir:

The recent article of C. L. Butler and L. H. Cretcher [THIS JOURNAL, **54,** 2987 (1932)] and the communication of R. K. Summerbell and R. Christ [*ibid.*, **54,** 3777 (1932)], both connecting with our first article [Böeseken, Tellegen and Henriquez, *Rec. trav. chim.*, **50,** 909 (1931) and *Proc. R. Acad.*, **34,** 631 (1931)] cause us to give a brief preliminary report of the continuation of our research. While chlorinating 2,3-dichlorodioxane, we obtained