Raman Spectrum of the Hydroxyl Ion with High Dispersion

The Raman spectrum of a $10N$ aqueous solution of potassium hydroxide was photographed with a Hilger E1 large quartz spectrograph, using for excitation a hot-cathode helium arc of length 45 cm. The Pyrex tube which contained the solution was surrounded by a filter tube of nickel oxide glass, and the light was focused on it by an elliptical reflector. An exposure time of 100 hours was required.

The spectrum obtained consists of a single broad line having a fairly well defined intensity-maximum which corresponds to a frequency shift of 3603 ± 4 cm^{-1}. This is in good agreement with the value of 3615 ± 25 cm^{-1} recently reported by Woodward.[1] It is somewhat lower than the shift of 3630 cm^{-1} found by Krishnamurti[2] in crystalline sodium hydroxide. The line has a width of about 30 cm^{-1}. That it must be attributed to the hydroxyl ion is beyond doubt.

It was observed that the presence of dissolved sodium or potassium hydroxide greatly influences the structure and the intensity of the water band. We have studied this effect in solutions of various concentrations, using a spectrograph of smaller dispersion. The results will soon be reported in detail.

J. L. Thompson
J. Rud Nielsen
University of Oklahoma,
　May 27, 1931.

[1] L. A. Woodward, Phys. Zeits. **32**, 261 (1931).

[2] P. Krishnamurti, Indian J. Physics **5**, 651 (1930).

The Relative Abundance of the Oxygen Isotopes, and the Basis of the Atomic Weight System

Mecke and Childs,[1] as the result of a detailed quantitative investigation of the A and A' bands of oxygen, find the relative abundance of the oxygen isotopes O^{16} and O^{18} to be 630:1, in sharp contrast to the value 1250:1 found by Babcock[2] and 1075:1 found by Naudé.[3] We have made a careful study of Mecke and Childs' paper, and find several rather doubtful theoretical assumptions. We have accordingly recalculated a portion of their data, using a method that appears to us to be more reliable. Their final result is, however, not essentially changed, and it therefore seems unnecessary to publish the details.

. We have also examined Babcock's assumptions, and find two sources of possible error, one due to the fact that the rotational energy levels of the $O^{16}.O^{18}$ molecule differ from those of the $O^{16}.O^{16}$ molecule, and the other due to the fact that, in Babcock's work, the mean temperature of the $O^{16}.O^{18}$ molecule (in the atmosphere) differs from the temperature of the $O^{16} \cdot O^{16}$ molecule (in the laboratory). Both the energy and the temperature affect the Boltzmann factor, but fortunately the two errors thus introduced by Babcock's neglect of this factor tend to cancel. We find that for the lines used by Babcock,[4] the maximum resulting error is not more than about ten percent, and so is quite negligible.

Mecke and Childs suggest several possible sources of error in the work of Naudé, but we do not have the information necessary in order to discuss these suggestions. As far as the work of Babcock and of Mecke and Childs is concerned, it would appear that the discrepancy must be due mainly to experimental and not to theoretical errors. It would also appear that the Mecke and Childs result is entitled to much greater weight.

Assuming for the sake of argument that the abundance ratio is really 630 to 1, it follows, as noted by Mecke and Childs, that atomic masses based on $O^{16} = 16$ should be 2.2 parts in 10^4 greater than those based on the chemical system $O = 16$. It is accordingly of importance to test Aston's mass-spectrograph results[5] on this new basis. Aston,[6] Birge,[7] and Naudé[3] have previously considered this mat-

[1] R. Mecke and W. H. J. Childs, Zeits. f. Physik **68**, 362 (1931).

[2] H. D. Babcock, Proc. Nat. Acad. Sci. **15**, 471 (1929).

[3] S. M. Naudé, Phys. Rev. **36**, 333 (1930).

[4] According to a personal communication from Babcock, only the first few lines of the P branch were used.

[5] F. W. Aston, Proc. Roy. Soc. **A115**, 487 (1927).

[6] F. W. Aston, Nature **123**, 488 (1929).