boiling was condensed and returned to the flask. The transmission increases slightly for a few days after the alcohol is boiled. The alcohol condensed from the vapor produced by boiling gave the same transmission as the un-boiled alcohol.

It is quite possible that the change in transmission here described is not due to any real change in absorption but to a scattering produced by colloidal particles of the material of the flask or to oxidation of the alcohol.

It is hoped that in the near future experiments can be performed to determine whether scattering or oxidation is the cause of the change in transmission. Similar changes, although somewhat less marked, were found for boiled water and boiled glacial acetic acid.

Cornell University,
    December, 1921.

The Absorption by Water Vapor of Radiation of Wave-lengths near 6 μ.

By W. W. Sleator and E. R. Phelps.

The study of the absorption spectrum of water vapor undertaken a few years ago has been continued, and the analysis of the region of 6 μ has been completed. The new map shows a more complicated structure than was presented before, and proves the existence of many individual lines hitherto only suspected or quite unknown. It is plain however that the number of known lines would be still further increased by higher dispersion. The interest of the work lies in its bearing on the theory of band spectra, the information it supplies about possible series in the water vapor spectrum and the help it may give in problems of molecular structure.

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The Infra-red Absorption Spectra of Diatomic Gases and their Ionization Potentials.

By Edwin C. Kemble.

The Lenz[1] theory of the infra-red band spectra of gases is simply the straightforward application to molecular rotational and vibrational motion of the Wilson-Sommerfeld quantum conditions, the Bohr frequency principle, and the Bohr principle of selection. Kratzer[2] has recently derived a formula for the frequencies of the lines in the infra-red absorption spectra of diatomic gases in conformity with the Lenz theory, but his method of evaluating the quantum integral for the vibrational motion is open to objection.[3]

Using a method of integration in series described in a previous paper[3] the writer obtains the following new formula for the frequencies in the infra-red

[1] W. Lenz, Verh. d. D. Phys. Ges., 31, p. 632, 1919.

[2] A. Kratzer, Zeit. f. Phys., III., 5, p. 289, 1921.

[3] E. C. Kemble, Proc. Nat. Acad. Sci., 7, p. 283, Oct., 1921.

absorption spectrum of a diatomic gas:

$$\nu_s{}^n = k_0{}^{(n)} + k_1 s + k_2{}^{(n)} s^2 + k_3 s^3 + k_4{}^{(n)} s^4 + \cdots.$$

Here n, $|s|$ are the vibrational and rotational quantum numbers for the final stationary state, respectively, and 0, $|s \pm 1|$ are the corresponding initial quantum numbers. n is unity for the "fundamental" band, two for the first "harmonic," etc. s is the term number of the line in question reckoned from the component next the center on the red side as zero. The coefficients k_1 and k_3 are independent of n. All the constants are determined in terms of the coefficients in a power series expansion for the potential energy.

The new formula agrees with that of Kratzer for small values of s and n. It may be checked in three ways. There is, in the first place, a definite relation between k_3, k_1, and k_0 which may be verified by an experimental study of these constants. The recent observations of Colby and Meyer[1] on the HCl band at $3.5\ \mu$ form a rough, but as yet insensitive check on this requirement of the theory. In the second place, the coefficients k_1 and k_3 should be the same for the harmonic band as for the fundamental. In testing this point the data obtained by Imes[2] for the HCl band at $1.7\ \mu$ were used. The agreement is not perfect, but seems to be within the limits of experimental error.

From a sufficiently complete experimental knowledge of the infra-red absorption spectrum of a diatomic gas it is possible by means of this theory to calculate its ionization potential and thus to obtain a third check. The ionization potential of HCl calculated from the available spectroscopic data is 14 volts in close agreement with the experimental vaule obtained by Foote and Mohler[3] and the theoretical value calculated by Born[4]. The spectroscopic data for HBr are neither so complete nor so accurate as for HCl, but a rough preliminary calculation yields an ionization potential of 12 + volts in satisfactory agreement with the value 13.5 volts, computed by Born.

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THE EFFECT OF CERTAIN DISSOLVED SUBSTANCES ON THE INFRA-RED ABSORPTION OF WATER.

BY J. R. COLLINS.

THE absorption spectrum of aqueous solutions of inorganic compounds were studied quantitatively to determine the effect of the solute on the absorption of the water. The spectrum was studied from $0.8\ \mu$ to $2.3\ \mu$, which range includes four absorption bands of water. The procedure consisted of determining the per cent. transmission of a measured thickness of the solution and of a thickness of pure water equivalent to the amount of water in the solution.

[1] W. Colby and C. F. Meyer, Astrophys. Journ., 53, p. 300, May, 1921.

[2] E. S. Imes, Astrophys. Journ., 50, p. 251, 1919.

[3] Foote and Mohler, J. Am. Chem. Soc., 42, p. 1832, Sept., 1920.

[4] M. Born, Verh. d. D. Phys. Ges., 21, p. 679, 1919.