TABLE I

VARIABLE DIFFUSION OF *p*-SULFOBENZENE-AZO-BENZENE-AZO-6-BENZOYLAMINO-1-NAPHTHOL-3-SULFONIC ACID (SODIUM SALT)

Solution (g./l.) of Dye	+ NaCl	Age of dye solution	Diffusing into NaCl solution, g./l.	T, °C.	$D \times 10^{-6}$ sq. cm./sec.
1.0	1.0	90 hours	...	27	2.39
1.0	1.0	90 hours	0.5	27	2.47
1.0	1.0	90 hours	.75	27	Not measurable
1.0	1.0	4 weeks	...	29	2.14
1.0	1.0	4 weeks	.5	30	3.03
0.5	1.0	48 hours	...	29	3.13
.5	1.0	48 hours	.5	30	3.22
.5	1.0	3.5 weeks	...	25	2.12
.5	1.0	3.5 weeks	.5	26	3.18
.5	1.0	3.5 weeks	.125	25	2.58
After addition of 1.0 g./l. NaCl to preceding dye solution					
0.5	2.0		...	26	2.20
.5	2.0		1.0	26	2.08

erated diffusion which produced a marked distortion of the color boundary within two to three minutes. The distortion is best described as the formation of small spearheads of color projecting for a distance of 0.5–1.0 mm. into the salt solution. This breaking of the color boundary may result in diffusion of dye throughout the entire cell chamber within a few minutes.

Possibility that the accelerated diffusion is produced by density differences in the two solutions is ruled out by the fact that the more dense solution is in the lower part of the cell. It was shown in a number of tests that, when the solution in the upper half of the cell is of the greater density, a turbulent mixing occurs in which the dye is partially displaced from its original compartment within a few seconds. On reversing the positions of the solutions the diffusion occurs as originally described.

Measured increases of 20–50% in the diffusion constant of aged dye solutions into dilute sodium chloride solutions, as compared with diffusion into water, are given in Table I. The diffusion rate into more concentrated salt solutions is increased several fold. The motion of the color ions in the aged dye solution is markedly affected by the presence of sodium chloride in the solution into which diffusion occurs at a concentration as low as 0.125 g./l. With a fresh dye solution no effect on the motion of the color ions is observed until this concentration of sodium chloride is approximately 0.75 g./l. This difference in the sensitivity of the color ions toward salt indicates that, in the aged solution, the dye has adsorbed a large portion of the electrolyte originally added. This marked affinity for electrolytes may account for the accelerated diffusion observed in these experiments.

These observations were made in the course of another investigation, and since further study of the phenomena reported cannot be made by the authors, this brief report is given to draw attention to additional instances of accelerated diffusion.

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SAMUEL LENHER
J. EDWARD SMITH

RECEIVED MARCH 22, 1934

THE VAPOR PRESSURE OF MIXTURES OF LIGHT AND HEAVY HYDROGEN

Sir:

Although our apparatus was not designed for the purpose, and the amount of gas available was insufficient for accurate work, we have made some preliminary study of the vapor pressures of various mixtures of H^2_2 and H^1_2. These mixtures approximate closely to Raoult's law, as shown in Fig. 1, where the total vapor pressure is plotted against the mole fraction of H^2_2 at 18.65°K.

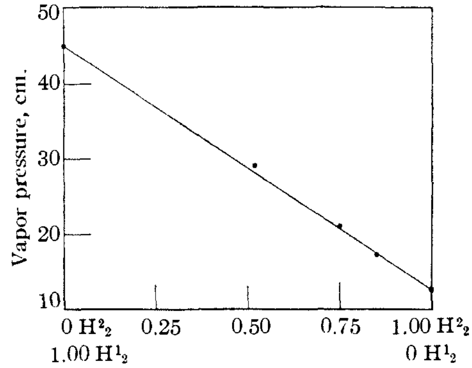

Fig. 1.

The temperature at which freezing begins also proved to be nearly linear with the mole fraction, as shown in Fig. 2, where the ordinate represents the temperature at which the first discontinuity in the vapor pressure curve occurs. In some cases a second discontinuity appeared, showing the final disappearance of the liquid phase. These observations indicate that while the solid phase contains a larger fraction of H^2_2 than the liquid phase, the difference is not great. We estimate that when the mole fraction of H^2_2 is 0.50 for the liquid, it is about 0.55 for the solid.

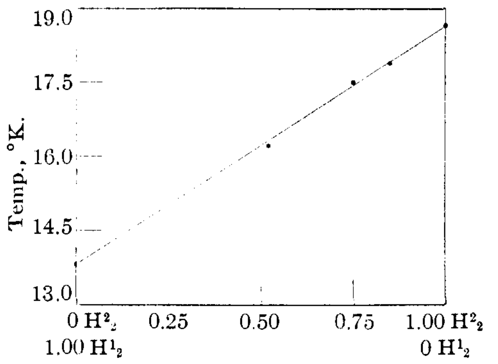

Fig. 2.

All these mixtures contained only the molecules H^1_2 and H^2_2. One mixture containing equal amounts of these two species was later kept for thirty hours in a bulb containing a hot platinum filament in order to produce the equilibrium amount of H^1H^2. The vapor pressure of this mixture was then studied. Unfortunately the amount of the mixture was too small for accurate measurements, but there appeared to be no great difference in vapor pressure before and after treatment with the hot wire.

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GILBERT N. LEWIS
W. T. HANSON, JR.

RECEIVED MARCH 22, 1934

THE VAPOR PRESSURE OF SOLID AND LIQUID HEAVY HYDROGEN

Sir:

In a series of investigations in which we have been aided by Dr. R. T. Macdonald and Dr. P. W. Schutz, to whom we wish to express our great obligation, we have studied the vapor pressure of pure H^2_2, and of mixtures of H^2_2 and H^1_2 (accompanying communication). The vapor pressures have been compared at each temperature with that of ordinary hydrogen in the para form, which has served as our thermometer. Our final measurements with pure H^2_2 are shown in the table and the figure. The ratio of p_2, the vapor pressure of H^2_2, to p_1, that of H^1_2(para), is plotted and tabulated as a function of p_1. The two large circles in the figure show for comparison provisional values which have just been announced by Brickwedde, Scott, Urey and Wahl [*Bulletin of the American Physical Society*, **9**, 16 (1934)].

The centigrade temperature corresponding to each value of p_1 may be obtained from the equation of Keeson, Bilj and van de Horst (Leiden Comm. 217a).

$$t = -260.937 + 1.0270 \log p + 1.7303 \log^2 p$$

Thence we find for $p_1 = 45.40$, corresponding to the triple point of H^2_2, 18.66°K.

TABLE I

p_1	p_2/p_1	p_1	p_2/p_1	p_1	p_2/p_1
77.00	0.3328	44.94	0.2824	41.01	0.2694
61.17	.3119	44.38	.2810	38.06	.2588
51.21	.2954	44.05	.2795	29.22	.2262
47.27	.2883	43.71	.2782	21.56	.1915
46.27	.2861	42.89	.2761	11.85	.1426
45.26	.2844	42.14	.2731		

The choice of an equation of state for heavy hydrogen, and its use in an exact calculation of the heats of vaporization and the heat of fusion from our data, will be discussed in a later publication, together with our apparatus and method.

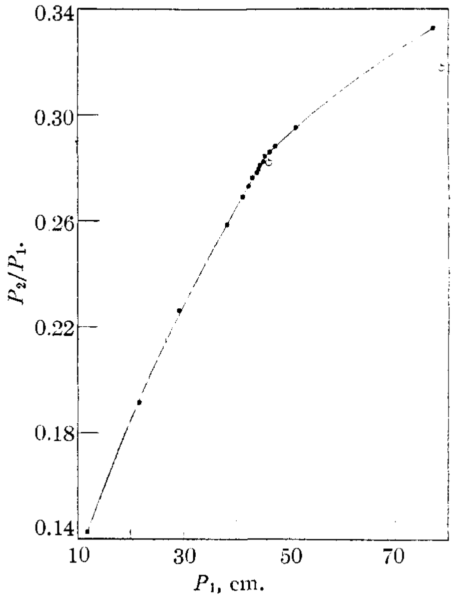

Fig. 1.

The measurements are extremely sensitive to an impurity of light hydrogen. In our first experiment, in which the hydrogen had been produced by the action of heavy water on a fresh sample of sodium, a considerable amount of H^1_2 was found to be present, which undoubtedly came from the sodium. The same sodium was treated again with H^2_2O and the gas still contained 1.5% of H^1. Finally the same sodium was treated with water in which every effort was made to exclude H^1. The impurity of 0.1–0.2% remaining in the gas thus produced was finally eliminated by