Physics. — *Second preliminary note on some experiments concerning the isotope of hydrogen.* By P. ZEEMAN and J. DE GIER.

(Communicated at the meeting of September 30, 1933).

FURTHER ¹) photos were made with a mixture of 3 cc hydrogen, containing, according to estimation, 10 % H^1H^2, which was kindly given us for the analysis by Prof. KEESOM at Leiden.

Fig. 1 on the left shows us a photo made with the 3 % mixture, on the right a photo made with the 10 % mixture.

In consequence of variations of tension some parabolas on the left are somewhat less sharp.

The lefthand photo was exposed considerably longer than the righthand one, where the time of exposition was ¾ hour. Besides in a relative greater intensity of the parabolas 3, 4, and 5, the improvement of concentration manifests itself in the appearance of a new parabola with $\frac{m}{e} = 6$, which is to be ascribed to an $(H_3{}^2)^+$ion. So that now the hydrogen "spectrum" is complete.

Besides, a parabola with $\frac{m}{e} = 20$ was found. The explanation of this becomes clear when we bear in mind that the water vapour in the discharge tube, which is never entirely to be avoided, readily gives rise to $OH_3{}^+$ions, which appears from the presence of a parabola $\frac{m}{e} = 19$ in photos with natural hydrogen. As in such pictures $\frac{m}{e} = 20$ was always absent, it must be ascribed to an $(OH_2{}^1H^2)^+$ion.

FURTHER is noteworthy the greater intensity of the parabolas 14, 28, 29, and 30 on the right, compared with those on the left. This shows the presence of nitrogen as contamination. This is the more plausible, as it has not been tried to purify the mixture.

The parabolas 5 and 6 are of importance for the comparison of the mass of the hydrogen isotopes with that of the "light" atoms ²).

Moreover the parabolas 5 and 6 enable us to determine the concentration of the mixture in first approximation in a very simple way from a single photo.

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¹) See P. ZEEMAN and J. DE GIER, These Proc. Amsterdam XXXVI 1933, footnote on page 610.

²) In the meantime determinations with this are already being made: K. T. BAINBRIDGE: Phys. Rev. July 1st 1933, p. 56, 57.

P. ZEEMAN and J. DE GIER: SECOND PRELIMINARY NOTE ON SOME EXPERIMENTS CONCERNING THE ISOTOPE OF HYDROGEN.

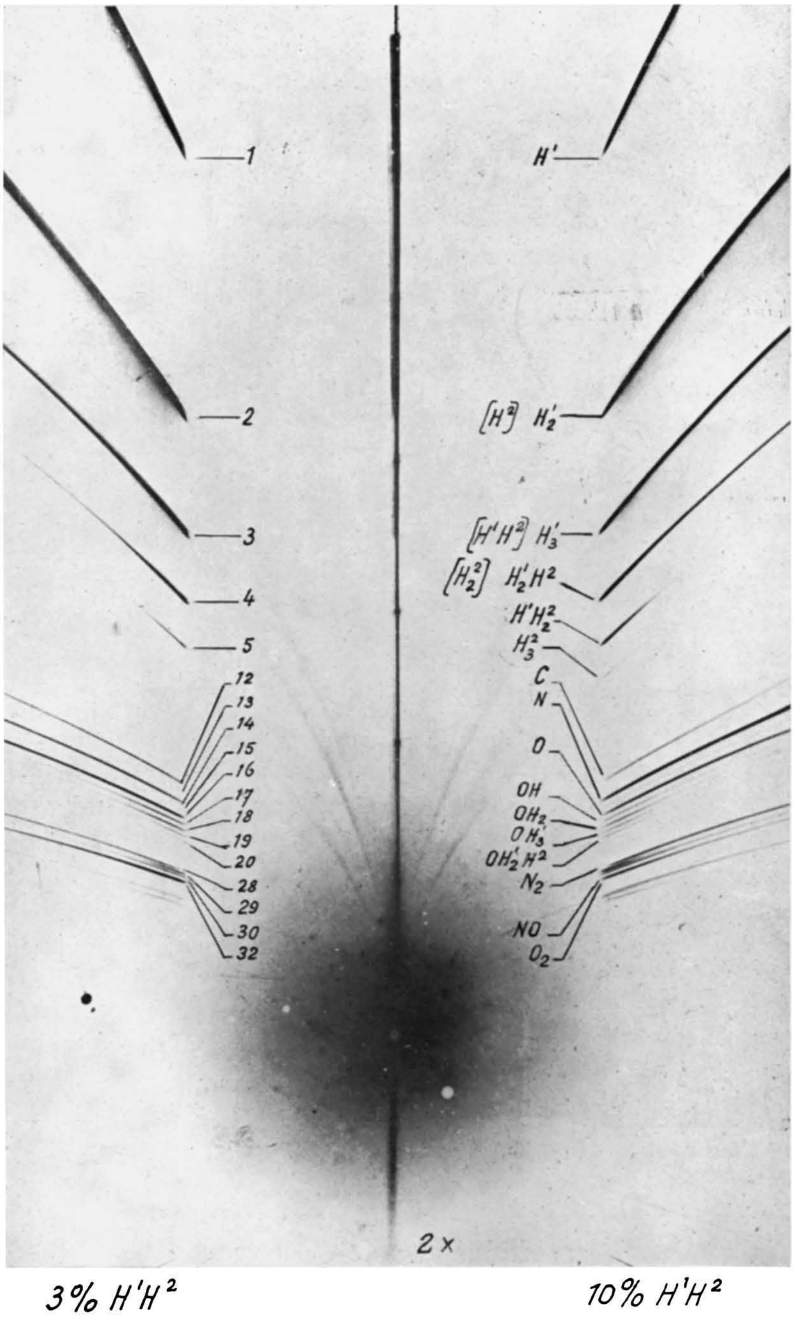

Fig. 1.

Proceedings Royal Acad. Amsterdam, Vol. XXXVI, 1933.

This is not possible from the mutual densities of the parabolas 2, 3, or 4. because these are owing to two different kinds if ions[1]).

A serious objection to a determination of the mixing proportion of the isotopes lies, however, in the fact that this cannot be considered as constant during the exposition. Probably in consequence of cleaning up by the aluminium electrodes, at first relatively more H^2 than H^1 atoms are withdrawn from the gasfilling. Possibly a state of equilibrium is only gradually established.

When once a density curve shall have been obtained, the variation of the concentration with the time can be quantitatively found by taking a series of short timed photos, and the different circumstances which are of influence here can be examined.

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[1]) On the Plate the ions between square brackets always are the combinations with the smaller probability. The parabolas of both kinds of ions always coincide, because their mass difference is too small for obtaining separation. We have succeeded however by taking photographs of a mixture of *He* and concentrated hydrogen, to separate the hydrogen ions with masses 4,5 and 6 from He^+, HeH^{1+}, HeH^{2+}. In a following communication we intend to give details of this method of exhibiting the mass defect.

Chemistry. — *Stationary, checked and other states of osmotic systems.* II.

By F. A. H. SCHREINEMAKERS.

(Communicated at the meeting of September 30, 1933).

Stationary states in osmotic systems in which several substances can diffuse.

In the preceding communication we have discussed a few stational states of osmotic systems with membranes permeable for one substance only, viz. water; now we shall consider the case that more substances may diffuse. For this purpose we take the osmotic system

$$inv\ i_1 \mid L \mid inv\ i_2 \quad \ldots \ldots \ldots \quad (1)$$

in which we take the substances and concentrations of the three liquids and the permeability of the two membranes quite arbitrarily. If we leave this system alone, the variable liquid L will go on changing its composition until at a certain moment of the osmosis, as we shall see further on, a stational state

$$inv\ i_1 \mid stat\ L \mid inv\ i_2 \quad \ldots \ldots \ldots \quad (2)$$

will occur, in which liquid L does not change its composition any longer.

Of course all the diffusing substances of the liquids i_1 and i_2 will be present in the stationary liquid of (2), no matter whether these substances were or were not present already in the variable liquid of (1). Diffusing substances of liquid L in (1), which are not present in i_1 and i_2, will be taken in and removed from the system by the invariant liquids during the osmosis, so that they are no longer present in (2).