was determined. The results are as shown in the accompanying tables.

TABLE 1

Rate of entrance of heavy water into fish

	Time in hours	Decrease of the heavy water content of the surrounding water	Decrease expected in the case of equal distribution of the heavy water between fish and surrounding water
I	1	32 p.c.	30 p.c.
II	4	32 p.c.	29 p.c.
III	15	33 p.c.	30 p.c.

TABLE 2

Rate of loss of heavy water by the fish

	Time in hours	Initial heavy water content of the fish	Decrease of the heavy water content of the fish after the experiment	Decrease expected in the case of equal distribution of heavy water between fish and surrounding normal water
I	1	0·27 p.c.	68 p.c.	51 p.c.
II	4	0·27 p.c.	68 p.c.	67 p.c.
III	10	0·26 p.c.	86 p.c.	86 p.c.

It follows from the above that, at least in a small fish, within a few hours nearly all the water molecules leave the body of the fish, making way for water molecules derived from the surrounding water. It should be borne in mind that most fish contain about 80 per cent water.

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Band Spectrum of Aluminium Deutride

BEING in possession of heavy water obtained by the electrolysis of some hundreds of litres of water, kindly furnished us from Nordiska Syrgasverken in Örebro, we have started investigations on the isotope effects in the band spectra of hydrides. The following preliminary results are given for the spectra of AlH and AlD; the former spectrum is reanalysed in order to get more exact data for comparison.

Table 1 gives the origin of the bands in $^1\Pi \rightarrow {^1\Sigma}$ from measurements in the second order of a 21-ft. concave grating (dispersion 1A./mm.). The bands of the new AlD molecule are indicated by asterisks.

Table 1.

v'' \ v'	0	1	2
0	23470·91 23536·79*	24554·29 24379·89*	
1	21845·73 22354·75*	22929·11 23197·85*	— 23868·54*
2		21359·81 22045·29*	— 22715·98*
3		19844·94 20921·67*	

We have applied the theory on isotope effects in band spectra to the normal state $^1\Sigma$ as being most favourable on account of its regular structure. The harmonic frequencies ω_e of the nuclear vibrations and their anharmonic corrections are given below:

AlH	AlD
$\omega_e = 1682 \cdot 45$ cm.$^{-1}$	$\omega_e^i = 1212 \cdot 04$ cm.$^{-1}$
$x_e\omega_e = -29 \cdot 029$ „	$x_e^i\omega_e^i = -15 \cdot 145$ „
$y_e\omega_e = 0 \cdot 242$ „	$y_e^i\omega_e^i = 0 \cdot 090$ „

Our third order polynom, representing the vibrational levels in $^1\Sigma$, does not converge at high v numbers and must therefore be completed by terms of higher order to fit into the known value of dissociation ($D = 3 \cdot 1$ volts). The small corrections to be applied on the frequencies given above are, however, of minor importance in this connexion.

From analysis of the band structure we have calculated the coefficients of rotation in $^1\Sigma$ up to the sixth order in $(k+\frac{1}{2})$ as follows:

AlH	AlD
$B_e = 6 \cdot 3955 \pm 0 \cdot 0003$	$B_e^i = 3 \cdot 3190 \pm 0 \cdot 0003$
$\alpha_e = 0 \cdot 1850$	$\alpha_e^i = 0 \cdot 0689$
$D_0 = -3 \cdot 8 \times 10^{-4}$	$D_0^i = -0 \cdot 98 \times 10^{-4}$
$F_0 = 3 \times 10^{-7}$	$F_0^i = 0 \cdot 05 \times 10^{-7}$

These data applied to the general problems on isotopes are of interest as will be discussed below to some extent. Primarily, we assume that the mass-spectroscopic value based on the atomic weight of the heavy isotope of hydrogen 2·0136, obtained by Bainbridge[1] is correct. If this is true, $\rho^2 = 0 \cdot 51838$ corresponds to the ratio of the reduced masses of the isotopic molecules as deduced from the atomic weights 1·00778 and 26·97 of hydrogen and aluminium respectively. Errors in the latter value amounting to 3 parts in 1000 will be of no influence on the value of ρ^2 given above. Now generally,

$$\frac{\omega_e^i}{\omega_e} = \rho \left(\frac{\varkappa^i}{\varkappa}\right)^{\frac{1}{2}}$$

where $\varkappa^i$ and $\varkappa$ are the forces of direction in the case of harmonic vibrations. As these forces are to be derived from the interaction between the charged particles in the molecule, the isotope principle requires their ratio to approach unity to a very high degree of exactness. However, inserting our values for ω_e^i and ω^e ($\rho^2 = 0 \cdot 51898$), we find $\frac{\varkappa^i}{\varkappa} = 1 \cdot 00057$, corresponding to an increase in the binding forces of the nuclei at their position of equilibrum in AlD as compared to the ordinary AlH.

A similar effect appears in the values of the nuclear separations, as shown by finding the ratio of the moment of inertia ($B_e^i/B_e = \rho^2$) in both molecules. With the same assumptions as before, we get $\rho^2 = 0 \cdot 51896$, corresponding to an approach of the nuclei in AlD amounting to 0·056 per cent, which means a small displacement of 9×10^{-12} cm.

On the other hand, rejecting the mass-spectroscopic value of ρ^2, our results point at an atomic weight for deuterium of 2·0113, far less than that found by Bainbridge. At present, however, we postpone the discussion of the causes of these divergencies, awaiting the results of investigations of the band spectra of other deutrides (BiD, HgD, etc.) now in progress in this laboratory.

Details regarding the structure of the activated $^1\Pi$ state in AlD will be given later, after we have investigated the remarkable pressure effect which governs this rather unstable state. Incidentally, it may be mentioned that the measured Λ-doubling agrees with the formula: $T_d - T_c = q\,k(k+1)$, where $q_{\mathrm{AlH}} = 0 \cdot 009$ cm.$^{-1}$ and $q_{\mathrm{AlD}} = 0 \cdot 00225$ cm.$^{-1}$.

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[1] *Phys. Rev.*, **41**, 115; 1932.