

the exact setting of the mercury level in the pycnometers and, although the error involved thereby was minimized by repeating each setting five times and averaging the results of the five weighings, the probable error involved still amounted to 7.5 parts per million. This fact, together with the disappointingly small change (0.004 unit) in the average atomic weight of the electrolyzed mercury, discouraged us from proceeding further at the time. The results of the work were recorded by Dr. Haring in a Columbia University dissertation printed in 1924, but have not hitherto been given further publicity.

I have always been convinced, however, of the reality of the indicated fractionation and, in the expectation that more conclusive results would be obtained with a lighter element than mercury, Mr. James McLaren of Syracuse University began a systematic study of the electrolytic method of isotopic fractionation under the direction of myself and Dr. E. B. Ludlam at the University of Edinburgh in 1930. A considerable amount of work had been done on lithium, but no final results attained, when the discovery of the isotopic character of hydrogen turned our attention early in 1932 to that element, which obviously offered still greater chances of success. Spectrographic evidence suggesting that the proportion of the heavier hydrogen isotope in the first fraction of the electrolysis of water was less than in ordinary hydrogen was obtained, but while confirmatory experiments were in progress the more striking changes revealed in the last fractions, alluded to in the first paragraph of this letter, have been announced, and anything that we may now have to report regarding the other end of the process can only be of the nature of an anti-climax.

CHEMISTRY DEPARTMENT  
THE UNIVERSITY  
KING'S BUILDINGS  
EDINBURGH, SCOTLAND

JAMES KENDALL

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#### THE PARA-HYDROGEN CONVERSION AT PARAMAGNETIC SURFACES

*Sir:*

In extending the investigations of Taylor and Sherman [THIS JOURNAL, 53, 1614 (1931); *Trans. Faraday Soc.*, 28, 247 (1932)] on the function of van der Waals and activated adsorption of hydrogen on the para-hydrogen conversion, we have found that, modifying the earlier results, there is a whole series of surfaces on which, at liquid air temperatures, the van der Waals adsorption of hydrogen is accompanied by extremely rapid conversions of ortho to para hydrogen. Chromium oxide gel was the first of these which we discovered with the assistance of Mr. J. Howard, who has been investigating the adsorption of hydrogen on this substance. More recently we have added to the list a crude cerium oxide, probably containing

neodymium, samples of pure neodymium oxide and gadolinium oxide. These were chosen because of their known paramagnetic properties and give very rapid conversions of the hydrogen at high space velocities. Zinc oxide, lanthanum oxide and vanadium pentoxide possessing low or negligible paramagnetism show low or negligible conversion efficiencies even with marked van der Waals adsorption at liquid air temperatures. The paramagnetic lower oxide of vanadium shows rapid conversions. The magnetic characteristics of the surface appear, therefore, to be a controlling factor. The magnetic properties may possibly account for our earlier positive results with metallic nickel and for the recent results of Harkness and Emmett (Washington Meeting, A. C. S., March, 1933) with van der Waals adsorption on iron synthetic ammonia catalysts. We understand that L. Farkas and H. Sachsse have similarly found that paramagnetic substances such as oxygen, nitric oxide, nitrogen dioxide and paramagnetic salt solutions effect the para-ortho conversion in homogeneous systems. We are extending our heterogeneous studies to obtain quantitative data on the relation between magnetic moment and surface efficiency.

PRINCETON UNIVERSITY  
FRICK CHEMICAL LABORATORY  
PRINCETON, NEW JERSEY

HUGH S. TAYLOR  
H. DIAMOND

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### MAGNETO-OPTIC MINIMA OF ORGANIC COMPOUNDS

*Sir:*

We present below a table and graphs of readings of the minima obtained on the magneto-optic method of Allison with aqueous and ethereal solutions of four homologous series of organic compounds, namely, the normal, primary, aliphatic alcohols; the lower, normal, fatty acids; the alkyl acetates and the alkyl bromides. The concentrations in all cases were  $1 \times 10^{-3}$  by volume. Readings agreed to within one or two mm. and were the same within this limit irrespective of the solvent. Blanks were

#### MAGNETO-OPTIC MINIMA OF ORGANIC COMPOUNDS

|        | Alcohols | Acetates | Bromides | Acids |       |           |
|--------|----------|----------|----------|-------|-------|-----------|
|        |          |          |          | 12.08 | 12.26 | Formic    |
| Methyl | 5.56     | 12.00    | 13.89    | 11.80 | 11.88 | Acetic    |
| Ethyl  | 5.80     | 12.50    | 14.44    | 11.60 | 11.71 | Propionic |
| Propyl | 5.98     | 12.97    | 15.04    | 11.20 | 11.32 | Butyric   |
| Butyl  | 6.30     |          | 15.68    | 10.91 | 11.00 | Valeric   |
| Amyl   | 6.65     | 13.60    | 16.36    | 9.72  | 9.80  | Caproic   |
| Hexyl  | 7.02     |          | 17.16    | 7.72  | 7.88  | Heptylic  |
| Heptyl | 7.37     | 14.11    | 18.10    | 4.90  | 5.02  | Caprylic  |
| Octyl  | 7.65     |          | 19.00    | 2.68  | 2.80  | Nonylic   |
| Nonyl  | 8.03     |          |          | 0.25  | 0.38  | Capric    |