may be readily calculated and are found to agree well with the physical properties of the solvates.

It is clear that the potential of the chloranil electrode may be assumed independent of the solvent only if the electrode materials remain unsolvated under the conditions of the experiment.

DEPARTMENT OF CHEMISTRY
THE UNIVERSITY OF WISCONSIN
MADISON, WISCONSIN
BERNARD O. HESTON
NORRIS F. HALL

RECEIVED OCTOBER 18, 1933 PUBLISHED NOVEMBER 7, 1933

THE VISCOSITY OF H^2H^2O

Sir:

The great difference between the conductivity of potassium chloride in H^2H^2O and in H^1H^1O which was found by Lewis and Doody [THIS JOURNAL, **55,** 3504 (1933)], made it desirable to ascertain the viscosity of heavy water. The time required to fill a pipet through a fine capillary, with a known head of pressure, was measured with a stop watch, the apparatus being enclosed in a constant temperature bath. At each temperature the heavy water was compared directly with ordinary pure water. The very close approximation to linearity between viscosity and isotopic composition is shown by the results obtained with water containing 70 and 90% of H^2. If η_1 and η_2 represent the viscosities of H^1H^1O and H^2H^2O, η_2/η_1 at 20° was found to be 1.249 by extrapolation from 90% and 1.244 by extrapolation from 70%.

The 90% sample was next compared with ordinary water between 5 and 35°. The results extrapolated to pure H^2H^2O show η_2/η_1 to be nearly linear with the temperature. The values interpolated at even temperatures are given in Table I, in which the first row gives the values of η_2/η_1 the second reproduces the values of η_1 given in "International Critical Tables," and the third the viscosity (in millipoises) of pure H^2H^2O obtained by multiplying the numbers in the first row by those in the second. We believe the results to be accurate within 0.5%.

VISCOSITY OF PURE H^2H^2O

t, °C.	5	10	15	20	25	30	35
η_2/η_1	1.309	1.286	1.267	1.249	1.232	1.215	1.198
η_1	15.19	13.10	11.45	10.09	8.95	8.00	7.21
η_2	19.88	16.85	14.51	12.60	11.03	9.72	8.64

These measurements of the viscosity, together with the measurement of the dielectric constant of H^2H^2O (accompanying communication), will permit the application of the Onsager equation to the conductivity measurements of Lewis and Doody. Since our experimental measurements of the viscosity were made, values of the viscosity of heavy water, at 20°, have been given by Selwood and Frost [THIS JOURNAL, **55**, 4335 (1933)], but for some reason that we cannot understand, their results do not agree at all with our own.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA
GILBERT N. LEWIS
RONALD T. MACDONALD

RECEIVED OCTOBER 23, 1933 PUBLISHED NOVEMBER 7, 1933

THE DIELECTRIC CONSTANT OF H^2H^2O

Sir:

By balancing capacities in an oscillating radio circuit, we have made a preliminary study of the dielectric constant of water in which the isotope H^2 constituted over 99% of the total hydrogen. A small cell (0.4 cc.) with parallel platinum plates was tested with various liquids and the capacity was found to be very nearly linear with the dielectric constant. The heavy water was then compared with ordinary conductivity water, at frequencies corresponding to 25, 34 and 40 meters. In the first experiments, the heavy water which had been distilled from sodium hydroxide in a vacuum was found to have a high conductivity ($\kappa = 3 \times 10^{-4}$) which certainly invalidated the results at the longer wave lengths. A somewhat improved cell was then made and the water was again distilled to obtain a conductivity of $\kappa = 1 \times 10^{-5}$ at the beginning and $\kappa = 3 \times 10^{-5}$ after several manipulations, including the filling of the cell. With such small samples it is difficult to obtain a higher purity than this. The conductivity still proved to be too high to give satisfactory results at 40 meters, but at 25° we found D_2/D_1, the ratio of the dielectric constant of H^2H^2O to that of H^1H^1O, to be 0.987 at 25 meters and 0.991 at 34 meters, while the value obtained with the more impure water at 25 meters was 0.993. The average of these three values, $D_2/D_1 = 0.990$ at 25°, may also be taken as the ratio at infinite wave length. The only attempt to obtain the temperature coefficient was made with the more impure water. At 10° (25 meters) we found $D_2/D_1 = 0.982$. Here as in all other cases we find the divergence between the two kinds of water increasing with diminishing temperature.

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA
GILBERT N. LEWIS
AXEL R. OLSON
WILLIAM MARONEY

RECEIVED OCTOBER 23, 1933 PUBLISHED NOVEMBER 7, 1933