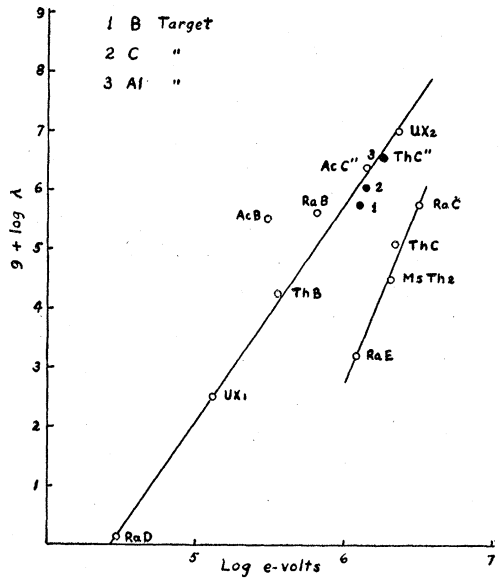

FIG. 4.

have reproduced his results in Fig. 4, where log $\lambda(\text{sec.}^{-1})$ is plotted against log energy in e.v. of the upper limit of the β-spectrum. It is seen that the elements fall into two main groups, each fitting rather closely a straight line. Ac B definitely does not fit but suggests the presence of a third group as Sargent states. Using the data of Crane and Lauritsen[3] for the half-lives of B (20 min.) and C (10.3 min.) activated by deutons, and of Henderson, Livingston and Lawrence[4] for the half-life of Al (3 min.) activated by deutons, and our own data on the energies (taking the intercepts, found as discussed above, to be very rough values for the upper limits of energy), we have found these three cases of positron disintegration to fit rather closely one of the curves on Sargent's diagram. It is a remarkable fact that C^{11}, N^{13}, and the as yet unidentified active product obtained from the Al target fall so close to the curve drawn for the natural radioactive bodies, considering the great difference in atomic number and in the type of disintegration (positron as compared with negatron) between these two classes of radioactive substances.

It is interesting to note that potassium, which is known to emit β-particles, does not lie on either of the above curves. Our measurements of the energies of the β-particles from potassium showed numerous cases in which the negatrons (no positrons were here observed) had energies exceeding 700,000 e.v., greater in order of magnitude than the energies to be expected on the above relation using 4.4×10^{16} minutes as the half-life of potassium. The radioactive potassium nucleus, therefore, in view of its disintegration energy, in comparison with other known negatron or positron emitters, is abnormally stable.

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April 15, 1934.

[2] Sargent, Proc. Roy. Soc. **A139**, 659 (1933).
[3] Crane and Lauritsen, Phys. Rev. **45**, 430 (1934).
[4] Henderson, Livingston and Lawrence, Phys. Rev. **45**, 428 (1934).

Infrared Absorption by Rochelle Salt Crystals

Optical tests were made of the theory that the change at 23°C in the very great dielectric constant of Rochelle salt crystals is due to a change in the polarizability of the molecules of the water of crystallization. Such a change in polarizability should result in a shift in the absorption bands due to the water of crystallization which appear in the near infrared.

Since the transmissibility of the crystal is very low in this region of the spectrum, it was necessary to prepare thin slabs of the substance for the tests. It was found feasible to prepare crystal plates ranging from one-quarter to one-half of a millimeter. These plates were made by first polishing a properly oriented cut and then scraping out a depression about one millimeter deep into the thick crystal plate. After the depression was polished, the crystal was cut parallel to the face so that the resulting plate was thick around the edges but contained a thin window in its central portion. Plates were made in this way for each of the principal crystallographic directions.

In making the tests a Hilger infrared spectrometer was used. The light source was a Nernst glower, and the crystal was so arranged that it could be inserted or withdrawn from the light beam at will. Since continuous passage of light through the crystal produced a gradual rise in temperature, a shutter was used to control the beam of light. The temperature of the crystal was indicated by a thermocouple pressed against its surface. Readings of light transmission were taken after a small definite rise in temperature had taken place.

Measurements were also taken using polarized light. With the light travelling along the *b* direction it was found that the absorption maxima are considerably more pronounced when the electric vector is in the *a* direction. However the wave-lengths at which they occur appear to be practically the same in all cases and their displacement with temperature remains unaltered. These absorption maxima were found at 1.55, 2.15 and 3.05 microns when the temperature of the crystal was 27°C. When the temperature was lowered to 18°C they were uniformly displaced by about 0.1 micron toward shorter wave-lengths. The former temperature is above and the latter is below the critical temperature of 23°C at which the substance loses its high dielectric and piezoelectric property. Any shift due to a change in polarizability of the molecules of

the water of crystallization of the magnitude suggested by the electrical properties should be much greater than the observed value.

These tests accordingly indicate that the unusually large dielectric constant of Rochelle salt crystals, especially in the *a* direction, is not due to the polarization of the water molecules. This makes it all the more probable that rotations of polarized water molecules or other parts of the tartrate molecule must account for the electrical effects. The corresponding changes in optical properties would then lie in the far infrared or Hertzian region of the spectrum.

The experimental work herein recorded was very efficiently performed by Mr. Alan Koerner.

JOSEPH VALASEK

University of Minnesota,
April 20, 1934.

H^3 in Heavy Hydrogen

A few months ago[1] Bleakney and Gould reported the results of a search for H^3 (hereafter designated by T) in heavy hydrogen. They found none although 1 in 10^5 could have been detected. Since then we have completed the construction of a much more sensitive apparatus with which we have subjected a sample of nearly pure deuterium to a careful test. In the meantime additional evidence for the existence of a third isotope of hydrogen has been offered by Oliphant, Harteck and Rutherford,[2] Tuve, Hafstad, and Dahl[3] and Allison.[4]

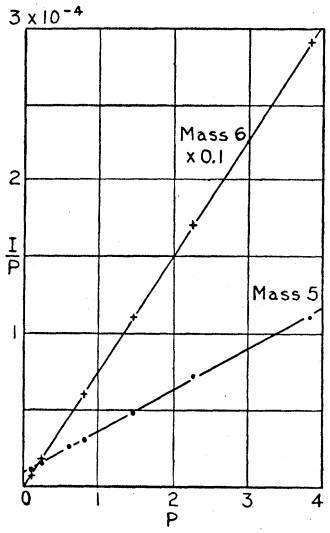

FIG. 1.

Our experimental data are represented by the curves in Fig. 1 where I as usual[1] is the intensity of a particular type of ion while the pressure p is measured by the number of D_2^+ ions. The curve for D_3^+ passes through the origin as expected since it is almost exclusively triatomic. The curve representing ions of mass 5 however has an appreciable intercept which we interpret as a measure of the ratio TD : DD. This gives for the abundance ratio T : D $= 5 : 10^6$ or one in two hundred thousand for this particular sample. This means that the ratio T : H in natural hydrogen is probably of the order of $1 : 10^9$ or smaller.

This result, we believe, confirms rather satisfactorily the existence of a third isotope of hydrogen from natural sources and gives a good measure of its abundance in this particular sample which was obtained by the electrolysis of heavy water and contained only about one percent light hydrogen.

We are indebted to Professor H. S. Taylor and his colleagues for the sample of deuterium.

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April 21, 1934.

[1] Bleakney and Gould, Phys. Rev. **45**, 281 (1934).
[2] Oliphant, Harteck and Rutherford, Nature **133**, 413 (1934).
[3] Tuve, Hafstad and Dahl, Washington Meeting, Am. Phys. Soc., April, 1934.
[4] Allison, Florida Meeting, Am. Chem. Soc., March, 1934.
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The Production of $_1H^3$ by a Canal-Ray Discharge in Deuterium

Judging from the experiments recently reported by Oliphant, Harteck and Rutherford,[1] and by Dee,[2] the production of hydrogen of mass three may occur quite frequently as the result of collisions between deutons of high energy. Furthermore, the exact mass which they deduce from their measurements of range indicates that the $_1H^3$ should be stable.* Prompted by these results we have been running a high voltage discharge in deuterium at low pressure and passing the canal rays from it into deuterium at a higher pressure, hoping in this way to accumulate an appreciable amount of $_1H^3$. We believe we have succeeded in doing so.

The apparatus consists of a discharge tube some 70 cm long and 6 cm in diameter with heavy water-cooled iron electrodes sealed in either end with de Khotinsky cement. The cathode is pierced by a canal 3 mm in diameter and 19 cm long. This leads into a glass tube 150 cm long and 3 cm in diameter. Gas is continually pumped out of the

[1] Oliphant, Harteck and Rutherford, Nature **133**, 413, March 17, 1934.
[2] Dee, Nature **133**, 564, April 14, 1934.
* Some evidence for the existence of this isotope has apparently been found also by Tuve, Hafstad and Dahl [Bull. Am. Phys. Soc. **9**, No. 2, p. 13, April (1934) (Washington Meeting)].