exchange. All of our studies have been carried out in Pyrex glass systems so that there is undoubtedly some borate present in the alkaline solutions. If Dr. Bell's studies were carried out in soft glass then it is possible that the borate acts as a catalyst in the rapid establishment of exchange equilibrium while the soluble substances from soft glass do not act as efficiently.

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RECEIVED MARCH 23, 1935

CONCENTRATION OF TRITIUM (H^3)

Sir:

About a year ago detection of the hydrogen isotope of mass 3 in substantially protium-free deuterium was reported by Lozier, Smith and Bleakney [*Phys. Rev.*, **45**, 655 (1934)]. At that time the tritium concentration was estimated as 5 in 10^6 after the initial volume of ordinary water had been reduced by electrolysis to 1 part in 225,000. Electrolysis has been continued during the past year until the volume has now been reduced to 1 part in 150,000,000. That is, approximately 75 metric tons of ordinary water have been electrolyzed down to 0.5 cc. During this time the tritium concentration as determined by the mass spectrograph has increased to about 1 in 10^4. We are now in a position to obtain the ratio of specific discharge rates of deuterium and tritium, and to estimate the abundance of tritium in nature.

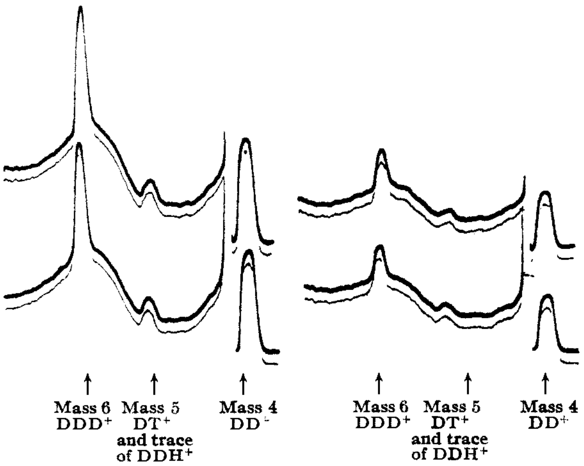

Fig. 1.

The discharge ratio (α_T^D) for deuterium and tritium may be obtained by graphical integration of the total tritium evolved during substantially complete electrolysis of a given sample of protium-free deuterium oxide. The value so obtained is 2.0, in good agreement with the theoretical prediction of Eyring [*Scientific Monthly*, **39**, 415 (1935)]. We have the relation $\alpha_T^H = \alpha_T^D \cdot \alpha_D^H$, and as α_D^H averages about 6 in the Princeton heavy water plant, α_T^H = about 12. In estimating the abundance of tritium in nature it must be borne in mind that during the earlier part of electrolysis, tritium is concentrated chiefly with respect to protium, but during the latter part entirely with respect to deuterium. For the purpose of making a rough computation we assume that α changes from 12 to 2 when the H:D ratio is 1–1. The abundance of tritium in ordinary water is then 7 in 10^{10}.

Figure 1 shows the intensities, recorded automatically, of the ions of masses 6, 5 and 4, the latter on a much reduced scale owing to its great abundance in the mixture. The intensities in the left half of the diagram are at a greater pressure than those on the right. From the pressure influence thus examined over a series of pressures we find that the intensity due to the ion of mass 6 varies as the square of the pressure. It is therefore triatomic and must be DDD^+. The ion of mass 5 varies in intensity nearly directly with the pressure and must therefore be mainly diatomic and hence DT^+. It is from the plot of the intensity–pressure ratio against pressure that, as has been previously described, the atomic content of tritium is deduced. Our results show that by further electrolysis of the deuterium oxide preparations now produced in commercial quantities both in this country and Europe, residues rich in tritium can readily be assembled without significant loss of deuterium since the electrolytic gas so produced can be recombined to yield deuterium oxide from which the tritium has been partially removed.

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RECEIVED MARCH 22, 1935

DEVELOPMENT OF AN AIR-DRIVEN ULTRACENTRIFUGE

Sir:

Up to last summer, Svedberg alone had produced convectionless centrifuges whose contents could be submitted to optical observation while in motion. In 1931, we undertook at Stanford