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THE NEW HYDROGEN[1]

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FOR more than a century scientific men believed with confidence that pure water was a well-defined chemical substance, H_2O, of molecular weight 18. This belief was shown by the fact that the unit of mass, the kilogram, consisting of a cylinder of platinum-iridium, was initially chosen to be of the same mass as 1,000 cubic centimeters of water at the temperature of maximum density. Subsequent measurements showed that this was slightly in error, so that the unit of mass was defined in terms of the metal standard. It was only about four years ago that this confidence was disturbed as a result of the study of the isotopic constitution of oxygen. Instead of being a simple element of mass 16, oxygen was found to contain in small quantity isotopes of masses 17 and 18. It was clear from this that pure water must contain some molecules of weight 19 and 20 as well as the normal 18. Since, however, it seemed very unlikely that the proportion of the isotopes could be sensibly changed in the processes of preparation of pure water, this result, while of much theoretical interest, did not appear to have any practical importance.

As a result of investigations during the last two years, there has been a revolutionary change in our ideas of the constancy of the constitution of water. This has resulted from the discovery that a hydrogen isotope of twice the normal mass is always present in preparations of ordinary hydrogen. While this isotope of mass 2 exists only in small proportion, about 1 in 6,000 of the main isotope of mass 1, yet, on ac-

[1] Lecture before the Royal Institution of Great Britain, March 23, 1934.