The Half-Life of I^{131}

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An accurate determination of the half-life of I^{131} gives the value $8.07_5 \pm 0.02_2$ days.

VALUES have been reported for the I^{131} half-life, ranging from 8.0 days[1,2] to 8.14 days.[3] The low values can be explained in part as being due to the instability of I^{131} sources prepared by evaporation.[4] The high values can be explained on the basis of the 12-day metastable state of Xe^{131} to which I^{131} decays in approximately 1 percent of its disintegrations. If the source is such that the 12-day Xe^{131} isomeric state accumulates, and if the geometry is such that it is possible for the x- and γ-rays or conversion electrons of Xe^{131} to be detected, the measured half-life of the mixture will be greater than that of I^{131} alone.

Sreb[3] used a sandwiched, powdered I^{131} source directly below a 1.4-mg/cm^2 G-M counter window, and Kurie, to whom Sreb refers as having obtained 8.16 days in 1946, prior to the knowledge of the isomeric state of xenon, also used a sandwiched source; in this case directly below a 0.0002-in. aluminum ionization chamber window. In both cases, therefore, it is logical to assume that the decay of Xe^{131} was observed in addition to I^{131}.

TABLE I.

	Determination	Absorber cylinder thickness	Half-life (days)
1	March–April 1952	5-mm Al	$8.08_9 \pm 0.01_4$
2	June–July 1952	5-mm Al, 2.5-mm Pb	$8.06_3 \pm 0.01_0$
3	Aug.–Sept. 1952	5-mm Al, 5.9-mm Pb	$8.08_3 \pm 0.02_6$

With these factors in mind, the half-life of I^{131} has been redetermined with a Lauritsen electroscope by γ-ray comparison with radium and has been found to be $8.07_5 \pm 0.02_2$ days. The I^{131} was glass-sealed and the Xe^{131} radiation was completely attenuated by absorbing cylinders.

Independent determinations were made on three different samples of I^{131} received from the Oak Ridge National Laboratory from which the National Bureau of Standards I^{131} solution standards were also prepared and calibrated for semi-annual distribution.

The half-lives and standard deviations calculated by least squares are given in Table I.

The I^{131} sources were in the form of a solution of NaI in a wax-sealed, ground glass stoppered, 5-ml Pyrex volumetric flask and the Ra source was a 50-microgram solution standard in a 5-ml glass flame-sealed ampoule. The three determinations consisted of more than 1200 individual measurements which were made over periods of from 4 to 5 half-lives. The time-dependent variable was the ratio of the I^{131} drift rate to the Ra drift rate. It was found that the electroscope must remain fully charged at all times when not in use, to prevent insulator charging difficulties.

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