Further experiments to elucidate the nature of the first stage of the decomposition, and to investigate reactions induced by ethylene oxide, are in progress.

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EXCHANGE REACTIONS OF IODINE BY THE METHOD OF RADIOACTIVE INDICATORS*

Sir:

Using the radioactive isotope of iodine [25 min. half-life, Fermi *et al.*, *Proc. Roy. Soc.* (London), **A146,** 483 (1934)] as an indicator, we have investigated several types of reaction involving exchange between the iodine atoms in different compounds. The radio-iodine is prepared by irradiating a saturated solution of sodium iodate containing a little iodide with the neutrons from beryllium and radon [Amaldi *et al.*, *ibid.*, **A149,** 522 (1935)]. Upon acidifying the solution, iodine is set free and is then separated from the bulk of the solution by extraction with ether. The concentrated sample of radio-iodine thus obtained is mixed with an inactive sample (containing approximately the same number of iodine atoms) of the compound which it is desired to study. After a minute or two the free iodine is separated from the compound, the two samples are prepared in a convenient form, usually as silver iodide, and the activity of each is measured by means of a tube counter.

The results obtained thus far are briefly stated as follows: (1) I_2 and I^-, mixed in aqueous solution to form the I_3^- complex, exchange freely. After separation, the activity is found equally distributed between the two forms of the element. (2) I_2 and IO_3^-, shaken together in 1 *N* H_2SO_4, do not exchange with appreciable speed. After separation, the IO_3^- (measured as $AgIO_3$) is still inactive. However, when I_2 is mixed with IO_3^- in hot 20 *N* H_2SO_4 and immediately cooled and separated, 10–15% of the activity is found in the IO_3^-. (3) Active I_2 dissolved in C_2H_5I undergoes no exchange, and AgI precipitated from the C_2H_5I is quite inactive. No exchange was found between these substances even when they were heated together for fifteen minutes at 90°. However, when active NaI and inactive C_2H_5I are dissolved together in alcohol and heated to 100° for five minutes, exchange takes place. (4) I_2 mixed with CHI_3 in ether solution undergoes no exchange. The CHI_3 (measured as such) remains inactive after separation from the active I_2. Also, a negative result was obtained when CHI_3 and NaI were dissolved together in alcohol solution.

The partial exchange found in the case of the iodine–iodate mixture suggests an oxidation–reduction reaction proceeding at a measurable rate. Although no net chemical reaction between these substances is possible, the present experiments show that a kinetic equilibrium actually exists in concentrated acid, and it may be possible to measure the rate of the reaction by means of the radioactive indicator method. It is planned to carry out further experiments along this line, and to investigate the analogous reactions with bromine and chlorine. The experimental details will be reported in a later publication.

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