

Letters to the Editor

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NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 128.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

Atomic Masses of Uranium and Thorium

WITH ions from a spark between a thorium or uranium electrode and a tin electrode, it was found that easily resolved doublets are given by the mass-spectrograph, formed by the doubly charged thorium ions with the tin isotope at 116 in one case, and in the case of uranium with the isotope at 119 (Fig. 1). The mass difference is found to be 0.120 ± 0.003 for thorium (the average of six doublets of nearly equal intensity), and 0.131 ± 0.003 in the case of uranium (average of the values for the five best doublets). The packing fraction for the tin isotopes has been determined by Dr. Aston¹ as 7.3 ± 1 . Using this value, the atomic mass of thorium (oxygen = 16.000) is 232.070 and that of uranium 238.088.

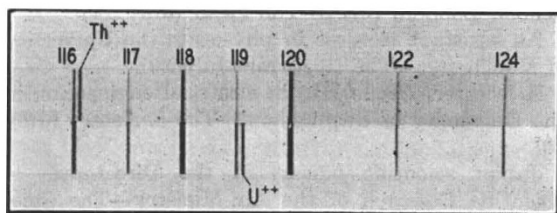


FIG. 1. Ions from electrons of tin and thorium (above) and tin and uranium (below).

Doubly charged ions of the faint isotope of uranium² at 235 appeared on four photographs, unsymmetrically spaced between the tin lines at 117 and 118. Its mass was found to be 235.084 ± 0.01 . The proportion of this isotope is 0.4 per cent, according to the actino-uranium theory. Reduced to the chemical scale, the atomic weights become 232.024 for thorium and 238.028 for the mean of the two uranium isotopes, as compared with the usually accepted values 232.12 and 238.14. The discrepancy of approximately one tenth of a unit is too large to be ascribed to an error in the masses of the tin isotopes.

From their analysis of the transformations induced by neutron bombardment of uranium, O. Hahn, L. Meitner and F. Strassmann³ have recently concluded that a uranium isotope of mass 235 exists with a half-life of only 24 minutes. It is transformed by β -ray emission into eka-rhenium ($N = 93$) of the same mass, which is probably a long-lived product. As the uranium and pitch-blende samples used in the present experiments were of unknown origin, analyses of the uranium ions from purified samples of uranium salts were made to make sure that the faint component is an isotope of uranium and not by any chance eka-rhenium. Pure uranyl nitrate crystals were heated and packed in a nickel tube. With this electrode the isotope at 235 was observed apparently in the same ratio as with the other electrodes. No precipitate was obtained by hydrogen

sulphide, showing the absence of an appreciable amount of eka-rhenium. The uranium was next freed from other elements by precipitating it as sodium uranyl acetate. This salt when heated and used as the electrode also gave the isotope at 235 just as before. Since this long-lived isotope at 235 thus belongs to uranium, the short-lived isotope formed by neutron bombardment must be isomeric with it, the two having the same mass and charge but differing in nuclear properties.

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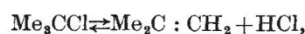
¹ F. W. Aston, *Proc. Roy. Soc., A*, **115**, 506 (1927).

² A. J. Dempster, *NATURE*, **136**, 180 (1935).

³ O. Hahn, L. Meitner, F. Strassmann, *Ber. deut. chem. Gesell.*, **69**, 913 (1936).

Unimolecular Elimination and the Significance of the Electrical Conduction, Racemization and Halogen Replacement of Organic Halides in Solution

THERE are a number of cases in which the development of electrical conductivity in sulphur dioxide solution has been held to indicate the electrolytic dissociation of an alkyl halide. One of the best known examples is that of *tert.*-butyl iodide¹. We find, however, that *tert.*-butyl chloride absorbs bromine quantitatively in sulphur dioxide, the products being *isobutylene* dibromide and hydrogen chloride. This suggests a rather rapidly established equilibrium,



in which, however, the left-hand components have the smaller free energy. α -Phenylethyl chloride also is said to give a conducting solution in sulphur dioxide: we find that the pure chloride in the pure solvent does not conduct, but that when there is conduction, styrene and hydrogen chloride are present:



Under conditions of purity in which the chloride does not conduct, hydrogen chloride itself has negligible conductivity in small concentration, but even in these circumstances the addition of bromine leads to a quantitative yield of styrene dibromide.

Observations of the unimolecular racemization of optically active alkyl halides have also been held to measure their rates of electrolytic dissociation or at least their ionization. α -Phenylethyl chloride has been shown to racemize in sulphur dioxide at a rate which is unaffected by added chloride ions². A similar but more rapid racemization has been observed with formic acid as solvent³. In formic acid also styrene and hydrogen chloride are formed; we find, moreover, that the rate of racemization is substantially accounted for by the rate of formation of