number of α-particles of about 6 cm range when the deuton had an energy of at least 1,200,000 volts. B_2O_3 also yielded α-particles which may however have been produced by the protons rather than the deutons. CaF_2 and NaCl gave a small number of particles of 3.8 and 2.8 cm range, respectively, but these also require further investigation. The remaining targets SiO_2, $NaPO_3$, C, CuS, $Ca(ClO_3)_2$, Au, Pt, brass and mica gave no detectable α-particles.

We are indebted to Dr. M. C. Henderson, who constructed the linear amplifier used in these experiments and who has kindly helped us in many other ways. We are also indebted to the Research Corporation and the Chemical Foundation for their support.

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The Emission of Protons from Various Targets Bombarded by Deutons of High Speed

Deutons (nuclei of H^2) with energies ranging from 600,000 to 1,330,000 volts have been directed against the following targets: carbon, gold, platinum, lithium fluoride, silicon dioxide, sodium phosphate, calcium chlorate, copper sulphide and brass (the backing of the other targets). In addition to the emission of alpha-particles, which we have already reported in the preceding communication, we have observed the emission of protons in large numbers, with various ranges up to more than forty centimeters.

Every target, including gold and platinum which could hardly be expected to suffer nuclear disintegration, yielded protons of about 18 cm range in air. We have been unable to account for this group of protons common to all targets except on the hypothesis that the deuton itself is breaking up, presumably into a proton and a neutron. This assumption implies a lower value for the mass of the neutron than that of Chadwick[1] whose value, however, rests on the assumption that in the disintegration of B^{11} by α-particles, to form N^{14} and a neutron, there is no γ-radiation.

To examine this hypothesis of the instability of the deuton we have observed the relation between the range of the emitted protons and the energy of the bombarding deutons. In the case of gold we observed that when the deuton energy was increased from 1,000,000 to 1,330,000 volts the maximum range of the protons increased approximately from 16.7 cm to 17.9 cm, corresponding to an increased energy of 160,000 volts. This is in accord with the assumption that the proton and neutron fly apart with equal kinetic energies. Realizing that all of these assumptions may be modified by later work, we may nevertheless make a tentative calculation of the mass of the neutron. From the masses of H^1 and H^2 and from the measured energies of the deuton and the emitted proton, the mass of the neutron appears very close to unity. In the case of carbon the change in the energy of the proton was found to be approximately equal to the change in the energy of the deuton which suggests, if our hypothesis is at all correct, that in addition to the dissociation of the deuton there is a change in the carbon nucleus itself.

Aside from this group of protons common to all targets we have observed large numbers of protons from silica and sodium phosphate with ranges in the neighborhood of 12 cm and which were not obtained with the other targets. The investigations have not yet been carried below this range. On the other hand, sodium phosphate and lithium fluoride yielded protons of very high energy. In the former case two long range groups were observed, one of 26 cm and one of 35 cm. Lithium fluoride was not so carefully investigated but protons with ranges as great as 40 cm were observed.

A study of the relation between the number of emitted protons and the energy of the deuton shows that in all cases the emission of protons becomes unobservable when the deuton energy falls below 800,000, and at least in the case of the group common to all targets, there seems to be a very sharp threshold.

We are again indebted to Dr. M. C. Henderson who constructed the linear amplifier used in these experiments and who has kindly helped us in many other ways. We are also indebted to the Research Corporation and the Chemical Foundation for their support.

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[1] Chadwick, Proc. Roy. Soc. **A136**, 692 (1932).

The Masses of the Lithium Isotopes

The mass of Li^6 referred to O^{16} was measured as 6.0145 ± 0.0003 from five spectra by comparison with H_3^2 by the "doublet" method. The mass of Li^7 was measured from the same spectra as 7.0146 ± 0.0006. The lithium ions were obtained from a heated spiral of flat tungsten strip coated with spodumene. Simultaneously a discharge was run in hydrogen containing a high concentration of the heavy isotope. The hydrogen had been put at the disposal of the writer through the kindness of Professor G. N. Lewis.

Fig. 1 illustrates two $Li^{6+}-H_3^{2+}$ doublets.[1] The upper spectrum is one of the five used in the mass determinations. The mass of H^2 had previously been accurately determined