LETTERS TO THE EDITORS

The Editors do not hold themselves responsible for opinions expressed by their correspondents. No notice is taken of anonymous communications

Disintegration of Boron-10 by Protons

THE Atomic Energy Research Establishment, Harwell, has recently produced a number of separated stable isotopes in milligram quantities. The availability of such isotopes has already enabled new nuclear reactions to be discovered, and old ones to be confirmed. In this and a later communication we wish to report on some work of this nature with boron and magnesium.

In the work with boron we have observed the α -particles expected in the reaction¹

by using the magnetic analyser and photo-electric multiplier described in a previous communication². Short-range α -particles from the disintegration of boron-11 were eliminated by using a target of separated boron-10. The accompanying graph shows the number of particles counted as a function of current through the analyser coils, for a proton energy of 530 kV.; the α -particle group from reaction (1) is clearly resolved from the scattered protons. The yield of α -particles was found to increase smoothly as the proton energy was varied between 400 and 800 kV.

The energy of the α -particles was measured by putting an absorption cell with a 2-mm. mica window between the analyser and the fluorescent screen, and finding the pressure in the cell at which the particles were cut off. This was compared directly with the cut-off pressure for the α -particles from the reaction³

for which the Q -value was taken to be 2.074 MeV. The difference in extrapolated range of the α -particles from reaction (1) at 630 keV. proton energy, and

Disintegration of boron-10 by 530-kV. protons; magnetic analysis of particles from the target

from reaction (2) at 860 keV., was found to be 0.35 ± 0.01 cm. of air; if the difference in straggling of the two groups is neglected, this gives a mean range of 0.56 ± 0.01 cm. for the α -particles from reaction (1). The corresponding energy release is 1.04 ± 0.06 MeV., using the Cornell range velocity curve⁴. This is to be compared with the value of 1.15 MeV. predicted from the masses⁵.

As a check on this energy release the magnet current at which the α -particles from reaction (1) were observed was accurately determined. By comparing this with the current necessary for the observation of other known α -particle groups, including that from reaction (2), an energy release of 1.05 ± 0.07 MeV. in reaction (1) was obtained, in good agreement with the result from the range measurement.

It is possible that the beryllium-7 nucleus is formed in an excited state in reaction (1), but we have been unable to find any evidence of α -particles corresponding to transitions to the ground-state in numbers exceeding 10 per cent of the main group at the particular angle of observation (83° with the incident protons).

We wish to thank Sir John Cockcroft and Dr. W. D. Allen and members of his group at the Atomic Energy Research Establishment, Harwell, who supplied the boron-10 target used. One of us (J. M. F.) is indebted to the Australian Council for Scientific and Industrial Research for a studentship.

W. E. BURCHAM
JOAN M. FREEMAN

Cavendish Laboratory,
Cambridge. Nov. 19.

¹ Roberts, Heydenburg and Locher, *Phys. Rev.*, **53**, 1016 (1938).
Rumbaugh, Roberts and Hafstad, *Phys. Rev.*, **54**, 654 (1938).

² Freeman and Baxter, *Nature*, **162**, 696 (1948).

³ Rosario, *Phys. Rev.*, **74**, 304 (1948).

⁴ Holloway and Livingston, *Phys. Rev.*, **54**, 18 (1938).

⁵ Bethe, "Elementary Nuclear Theory", 124 (Wiley, New York).

Specific Ionization of Fast β -Particles in a Mixture of Air and Ethyl Alcohol-Water Vapour

Curran and Reid have given an account¹ of their investigations on the primary ionization of β -particles in mixtures of argon and ethyl alcohol vapour. I have carried out some experiments on the specific ionization of fast β -particles in a mixture of air and ethyl alcohol-water vapour².

A detailed study was made of the influence on the ionization in air of the mixture of ethyl alcohol and water generally used as a source of vapour in the Wilson cloud chamber. To this end both the probable and the primary ionization in air were determined at three pressures, namely, at 1, $\frac{1}{2}$ and $\frac{1}{4}$ atmosphere. Assuming the specific ionization in pure air in this region to increase linearly with the pressure, it is possible to deduce from the observed values the specific ionization in the vapour-mixture.

The experiments were made for β -particles of various energies, namely, with a ρH of 1,200, 1,600, 2,000 and 2,400 gauss/cm. The mean specific ionization in ethyl alcohol-water vapour (liquid 60/40 by volume) at 0°C . and 1 cm. mercury pressure, at the energies stated, was 3.86, 3.24, 2.71, 2.45 ion pairs/cm. for the probable ionization and 2.22, 1.68, 1.35, 1.18 ion pairs/cm. for the primary ionization respectively.

It follows from these figures that the mean specific primary ionization for a β -particle of energy 0.4 MeV.