Letters to the Editor.

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The Bombardment of Elements by α-Particles.

IN previous papers we have shown that hydrogen nuclei are ejected from the elements boron, nitrogen, fluorine, sodium, aluminium, and phosphorus by bombardment with α-particles. In these experiments the material subjected to the bombardment was placed immediately in front of the source of α-particles and observations of the ejected particles were made on a zinc sulphide screen placed in a direct line a few centimetres away. The ranges of the H particles were in all the above cases greater than the range (30 cm. in air) of free H nuclei set in motion by α-particles, so that, by inserting absorbing screens of 30 cm. air equivalent in front of the zinc sulphide screen, the results were made independent of the presence of hydrogen as an impurity in the bombarded material.

Some of the other light elements were examined at absorptions less than this, but in general the number of particles due to hydrogen contamination of the materials was so large that no confidence could be placed in the results. The difficulty of making trustworthy observations under these conditions is illustrated by the case of chlorine, where we were unable to observe the liberation of H particles although our present experiments show that such particles must have been present.

A further complication arises at absorptions less than 13 cm. of air. Bates and Rogers (NATURE, September 22, 1923, and Proc. Roy. Soc., A, 105, 1924) have recently shown that radium C emits, in addition to the α-particles of 7 cm. range, also particles of ranges 9·3, 11·2, and 13·3 cm., and the number of these particles is large compared with the disintegration effect we usually observe.

The difficulties of observation by the above direct method are also shown by the experiments of Kirsch and Pettersson (NATURE, September 15 and November 10, 1923, *Phil. Mag.*, March, 1924), who took special precautions to avoid hydrogen contamination both in the source and in the bombarded materials.

To overcome these difficulties we have devised a simple method by which we can observe with certainty the disintegration of an element when the ejected particles have a range of only 7 cm. in air. This method is based on the assumption that the particles of disintegration are emitted in all directions relative to the incident α-rays. A powerful beam of α-rays falls on the material to be examined and the liberated particles are observed at an average angle of 90° to the direction of the incident α-particles. By means of screens it is arranged that no α-particles can fall directly on the zinc sulphide screen.

This method has many advantages. We can now detect particles of range more than 7 cm. with the same certainty as particles of range above 30 cm. in our previous experiments, for the presence of hydrogen in the bombarded material has no effect. This can be shown at once by bombarding a screen of paraffin wax, when no particles are observed on the zinc sulphide screen. On account of the very great reduction in number of H nuclei or α-particles by scattering through 90°, the results are quite independent of H nuclei from the source or of the long-range particles found by Bates and Rogers. The latter are just detectable under our experimental conditions when a heavy element like gold is used as scattering material, but are inappreciable for the lighter elements.

A slight modification of the arrangement enables us to examine gases as well as solids.

Working in this way we have found that in addition to the elements boron, nitrogen, fluorine, sodium, aluminium, and phosphorus, which give H particles of maximum range in the forward direction between 40 and 90 cm., the following give particles of range above 7 cm.: neon, magnesium, silicon, sulphur, chlorine, argon, and potassium. The numbers of the particles emitted from these elements are small compared with the number from aluminium under the same conditions, varying between 1/3 and 1/20. The ranges of the particles have not been determined with accuracy. Neon appears to give the shortest range, about 16 cm. under our conditions, the ranges of the others lying between 18 cm. and 30 cm. By the kindness of Dr. Rosenhain we were able to make experiments with a sheet of metallic beryllium. This gave a small effect, about 1/30 of that of aluminium, but we are not yet certain that it may not be due to the presence of a small quantity of fluorine as impurity. The other light elements, hydrogen, helium, lithium, carbon, and oxygen, give no detectable effect beyond 7 cm. It is of interest to note that while carbon and oxygen give no effect, sulphur, also probably a "pure" element of mass $4n$, gives an effect of nearly 1/3 that of aluminium. This shows clearly that the sulphur nucleus is not built up solely of helium nuclei, a conclusion also suggested by its atomic weight of 32·07.

We have made a preliminary examination of the elements from calcium to iron, but with no definite results, owing to the difficulty of obtaining these elements free from any of the "active" elements, in particular nitrogen. For example, while a piece of electrolytic iron gave no particles beyond 7 cm., a piece of Swedish iron gave a distinct effect which was undoubtedly due to the presence of nitrogen, for after prolonged heating *in vacuo* the greater part disappeared. Similar results were experienced with the other elements in this region.

We have observed no effects from the following elements: nickel, copper, zinc, selenium, krypton, molybdenum, palladium, silver, tin, xenon, gold, and uranium. The krypton and xenon were kindly lent to us by Dr. Aston.

We hope later to make a systematic examination of the elements with an improved counting microscope in order to settle definitely whether any evidence of disintegration can be obtained. In the case of the lighter elements it should be possible to carry the examination for particles of disintegration down to an absorption of about 3 cm.

E. RUTHERFORD.
J. CHADWICK.

Cavendish Laboratory,
Cambridge.

The Gorilla's Foot.

IN NATURE of January 5, I showed conclusively that the figure of the gorilla's foot published by the well-known taxidermist, Mr. Carl Akeley, in the *World's Work*, October 1922, is (as I had stated in my book, "Great and Small Things") entirely erroneous. The figure was a reproduction of a photograph of a cast deceptively illuminated and made to present a false resemblance to the foot of man. It was adduced by Mr. Akeley as evidence in support of his erroneous statements as to the existence of a closer resemblance between the gorilla and man than has been recognised, hitherto, by men of science.

At the same time I demonstrated by means of