LETTERS TO THE EDITOR

Prompt publication of brief reports of important discoveries in physics may be secured by addressing them to this department. Closing dates for this department are, for the first issue of the month, the eighteenth of the preceding month, for the second issue, the third of the month. Because of the late closing dates for the section no proof can be shown to authors. The Board of Editors does not hold itself responsible for the opinions expressed by the correspondents.

Communications should not in general exceed 600 words in length.

Mass and Stability of C^{14}

The question of the radioactivity of C^{14} has not finally been settled. McMillan[1] observed a long period activity from targets in Berkeley which he suggested might be due to a common contaminant, probably carbon. Bonner and Brubaker[2] from cloud-chamber observations of the slow neutron reaction $N^{14}+n\rightarrow C^{14}+H^1$ concluded that the mass of C^{14} is 14.00767 which renders it unstable by 0.17 Mev. It should be possible to check this value by the reaction $C^{13}+D^2\rightarrow C^{14}+H^1$ and also the reaction $B^{11}+He^4\rightarrow C^{14}+H^1$. The former of these was studied by bombarding carbon targets with 3-Mev deuterons from a cyclotron and observing the range of the protons evolved. The protons from C^{13} should have a greater range than those from C^{12} and hence be easily distinguished. With an Aquadag target (supposedly pure Acheson graphite) a group of range 82.0 cm is found superposed on a longer range group which was traced to occluded nitrogen. A spectroscopically pure target gave no longer range group but a single group ending at 81.1 cm ($\pm$2.0 cm). The yield is small but definite and was found in each of eight separate runs which are consistent with one another. This group is ascribed to the reaction $C^{13}+D^2\rightarrow C^{14}+H^1$ and yields an energy change value of +8.21 Mev. The mass of C^{14} deduced is 14.00775 $\pm$0.00025. The number of protons was compared with that from $C^{12}+D^2\rightarrow C^{13}+H^1$ and found to correspond to a cross section one-half as great.

Some unpublished experiments made two years ago in which a boron target was bombarded by both polonium and ThC′ alpha-particles gave groups at 42.1 and 97.6 cm in the forward direction which can be ascribed to the $B^{11}+He^4\rightarrow C^{14}+H^1$ reaction. The energy change values are +0.62 and +0.70 Mev, respectively. If the mean value of 0.66 ($\pm$0.30) Mev is taken the value 14.00797 ($\pm$0.00035) is deduced for C^{14} which agrees reasonably with the previous value. It is likely that the ranges found with natural sources would be shorter than the true ranges so that the slightly higher value found here is reasonable. The suggested value for C^{14}, combining the two sets of data, is 14.00780$\pm$0.00020. This means that C^{14} should be unstable, emitting an electron with an energy of 300,000 ev. A thin-walled counter was used to look for activity from the targets but no such easily absorbable beta-rays could be found in numbers sufficiently great to warrant claiming their detection. It is likely that C^{14} has a half-life of several years in which case a total of twelve hours bombardment with 0.5 microampere of deuterons would not produce a detectable activity.

I wish to thank Mr. W. L. Davidson, Jr., for assistance in running the cyclotron and much invaluable activity.

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[1] Edwin McMillan, Phys. Rev. **49**, 875 (1936).
[2] T. W. Bonner and W. M. Brubaker, Phys. Rev. **49**, 778 (1936).

The Radioactivity of Mn^{56}

We have attempted to measure the γ-rays from Mn^{56} by counting the electrons ejected from a thin lamina in the Wilson cloud chamber. These electrons fit an energy group having an extrapolated end-point between 1.50 and 1.75 mc^2, indicating a γ-ray line of 600–700 kev. There is, however, marked straggling out to about 3.90 mc^2, which may indicate a γ-ray line at about 1.7 Mev. These findings agree with those of Dunworth,[1] except that the interpretation of the flat distribution between 1.75 and 3.90 mc^2 is not clear. It is possible that there are other lines between the two mentioned.

That such might be the case is suggested by the results obtained by other workers. If one examines the curves published by Seaborg and Livingood[2] and by Langer, Mitchell and McDaniel,[3] it is seen the γ-ray background is high compared to the measured β-ray intensity. There are three possible explanations of this: (a) the number of quanta per disintegration is large, (b) there are very many electrons (presumably of low energy) that are not being detected by the counting system, or (c) some combination of the above two possibilities.

Our measurements of the β-ray spectrum indicate that (c) is the most likely.

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[1] J. V. Dunworth, Nature **143**, 1065 (1939).
[2] G. T. Seaborg and J. J. Livingood, Phys. Rev. **54**, 397 (1938).
[3] Langer, Mitchell and McDaniel, Phys. Rev. **56**, 422 (1939).