

We wish to express our thanks to Prof. Niels Bohr for the kind interest he has taken in this work. For the preparation of the radioactive sources, and helpful assistance in making the measurements, we would also like to thank Mr. J. Ambrosen and Mr. S. Høffer-Jensen.

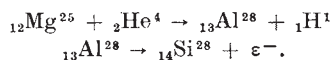
Finsen Hospital and
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Sept. 13.

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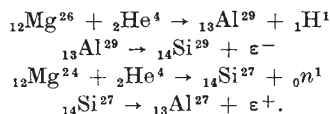
Induced Radioactivity by Bombarding Magnesium with α -Particles

THE publication of the full details of the following experiments will be somewhat delayed owing to the departure of one of us to Canada. We wish, therefore, to state briefly our main results.

We have examined in detail the induced radioactivity produced by bombarding magnesium with α -particles. The main effect is due to the well-known body Al²⁸, which emits β -rays and has a period of 137 sec.



In agreement, however, with Curie and Joliot¹, and with Eckardt², we have found the induced radioactivity to be complex, and by analysing the emission with a magnetic field, we have been able to identify two other bodies, present in only small quantities, one emitting β -rays with a period of about 11 minutes, and the other emitting positrons with a period of 5-7 minutes. We suggest these bodies are respectively Al²⁹ and Si²⁷, formed as follows:



By investigating the relative yield of these three bodies when produced by α -particles of different energies, we are led to believe that Mg²⁶ has a strong resonance level for α -particles of energy less than 5.4×10^6 volts, and that either Mg²⁴ or Mg²⁶, or both, have a resonance level for α -particles of energy between 5.4 and 6.1×10^6 volts.

Using α -particles of energies up to 6.6×10^6 volts to bombard a thick layer of magnesium, we find that the cross-section (integrated over all energies) for proton emission from Mg²⁵ is about thirty times that for proton emission from Mg²⁶, and about three hundred times the cross-section for neutron emission from Mg²⁴.

While Al²⁹ has a period of 11 minutes and Al²⁸ only 2.3 minutes, yet we find that the β -rays from Al²⁹ are more penetrating than those from Al²⁸. This suggests that Al²⁸ undergoes a 'permitted' transition (no change of spin) while for Al²⁹ the transition is 'non-permitted' (change of spin). The strong γ -ray emission from Al²⁸ shows that the Si²⁸ nucleus is usually formed in an excited state, whereas our experiments suggest that Si²⁹ is usually formed in the ground state.

The discussion of these results will be deferred until the publication of the full details of the experiments.

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¹ Curie and Joliot, *J. Phys.*, **5**, 153; 1931.
² Eckardt, *Naturwiss.*, **30**, 527; 1935.

¹⁹K⁴³ and the Radioactivity of Potassium

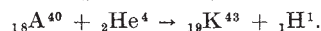
It has recently been suggested by Newman and Walke¹ and Klemperer² that the natural β -radioactivity of potassium is due to an isotope ¹⁹K⁴⁰ present in very small abundance. Sitte³, however, has come to the conclusion that another relatively rare isotope of potassium exists which is the source of the β -particles, and this, he states, can only be ¹⁹K⁴³.

It is to be noted in this connexion that β -ray emission occurs from isotopes in which too many neutrons are present, so that we should anticipate, in general, that when two or more β -radioactive isotopes of a single element exist, that those with the higher number of neutrons would have the shorter lives. This is clearly indicated by the unstable isotopes of thallium:

| | |
|---|-----------|
| ⁸¹ Tl ²¹⁰ (RaC'') | 1.32 min. |
| ⁸¹ Tl ²⁰⁸ (ThC'') | 3.20 min. |
| ⁸¹ Tl ²⁰⁷ (AcC'') | 4.76 min. |

Hence it appears probable that ¹⁹K⁴³ would have a shorter period than ¹⁹K⁴², since it has a higher number of nuclear neutrons. As the period of ¹⁹K⁴² is 16 hours, it is apparent that ¹⁹K⁴³ could not be the source of the natural radioactivity of potassium.

The period of this isotope could probably be tested by preparing it artificially. Rutherford and Chadwick have observed the emission of protons from argon when bombarded with α -particles. Since ¹⁸A⁴⁰ is 160 times as abundant as ¹⁸A³⁶, it is almost certain that the protons are produced by the reaction:



Thus by bombarding argon with strong sources of α -particles it should be possible to detect the β -radioactivity of ¹⁹K⁴³.

Finally, it is to be noted that Nier⁴, using a special type of mass-spectrograph, has detected ¹⁹K⁴⁰ present in normal potassium to the extent of about one part in 8,600, whereas he found no trace of either ¹⁹K⁴² or ¹⁹K⁴³ and concluded that these isotopes, if they exist at all, were present in abundance less than one part in 150,000.

It is apparent, therefore, that the hypothesis of Newman and Walke¹ and Klemperer² is confirmed by mass-spectrographic evidence, whereas that of Sitte³ is not.

Note added in proof. The existence of ¹⁹K⁴⁰ has been confirmed by Brewer (*Phys. Rev.*, **48**, 640; 1935), who estimates the ratio K³⁹/K⁴⁰ as $8,300 \pm 100$.

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¹ Newman and Walke, *NATURE*, **135**, 98; Jan. 19, 1935. *Phil. Mag.*, **19**, 787; 1935.

² Klemperer, *Proc. Roy. Soc. A*, **145**, 638; 1935.

³ Sitte, *NATURE*, **138**, 334, Aug. 31, 1935.

⁴ Nier, *Phys. Rev.*, **48**, 283; 1935.

A Molecular Map of Resorcinol

ALL those organic compounds which have until now yielded to quantitative X-ray analysis display some element of molecular symmetry in the crystal. The structure of the complete chemical molecule can then be built up from a fraction by symmetry operations, thus greatly simplifying the analysis. But some of the most interesting structures have a lower symmetry, and in these cases the molecule must be treated as a whole. This applies to resorcinol, space