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.

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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 Al^{28}, which emits β-rays and has a period of 137 sec.

$$_{12}Mg^{25} + {}_2He^4 \rightarrow {}_{13}Al^{28} + {}_1H^1$$
$$_{13}Al^{28} \rightarrow {}_{14}Si^{28} + \varepsilon^-.$$

In agreement, however, with Curie and Joliot[1], and with Eckardt[2], 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 Al^{29} and Si^{27}, formed as follows:

$$_{12}Mg^{26} + {}_2He^4 \rightarrow {}_{13}Al^{29} + {}_1H^1$$
$$_{13}Al^{29} \rightarrow {}_{14}Si^{29} + \varepsilon^-$$
$$_{12}Mg^{24} + {}_2He^4 \rightarrow {}_{14}Si^{27} + {}_0n^1$$
$$_{14}Si^{27} \rightarrow {}_{13}Al^{27} + \varepsilon^+.$$

By investigating the relative yield of these three bodies when produced by α-particles of different energies, we are led to believe that Mg^{25} has a strong resonance level for α-particles of energy less than $5 \cdot 4 \times 10^6$ volts, and that either Mg^{24} or Mg^{26}, or both, have a resonance level for α-particles of energy between $5 \cdot 4$ and $6 \cdot 1 \times 10^6$ volts.

Using α-particles of energies up to $6 \cdot 6 \times 10^6$ volts to bombard a thick layer of magnesium, we find that the cross-section (integrated over all energies) for proton emission from Mg^{25} is about thirty times that for proton emission from Mg^{26}, and about three hundred times the cross-section for neutron emission from Mg^{24}.

While Al^{29} has a period of 11 minutes and Al^{28} only 2·3 minutes, yet we find that the β-rays from Al^{29} are more penetrating than those from Al^{28}. This suggests that Al^{28} undergoes a 'permitted' transition (no change of spin) while for Al^{29} the transition is 'non-permitted' (change of spin). The strong γ-ray emission from Al^{28} shows that the Si^{28} nucleus is usually formed in an excited state, whereas our experiments suggest that Si^{29} 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.

$_{19}K^{43}$ and the Radioactivity of Potassium

IT has recently been suggested by Newman and Walke[1] and Klemperer[2] that the natural β-radioactivity of potassium is due to an isotope $_{19}K^{40}$ present in very small abundance. Sitte[3], 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 $_{19}K^{43}$.

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 $_{19}K^{43}$ would have a shorter period than $_{19}K^{42}$, since it has a higher number of nuclear neutrons. As the period of $_{19}K^{42}$ is 16 hours, it is apparent that $_{19}K^{43}$ 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 $_{18}A^{40}$ is 160 times as abundant as $_{18}A^{36}$, it is almost certain that the protons are produced by the reaction:

$$_{18}A^{40} + {}_2He^4 \rightarrow {}_{19}K^{43} + {}_1H^1.$$

Thus by bombarding argon with strong sources of α-particles it should be possible to detect the β-radioactivity of $_{19}K^{43}$.

Finally, it is to be noted that Nier[4], using a special type of mass-spectrograph, has detected $_{19}K^{40}$ present in normal potassium to the extent of about one part in 8,600, whereas he found no trace of either $_{19}K^{42}$ or $_{19}K^{43}$ 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 Walke[1] and Klemperer[2] is confirmed by mass-spectrographic evidence, whereas that of Sitte[3] is not.

Note added in proof. The existence of $_{19}K^{40}$ has been confirmed by Brewer (*Phys. Rev.*, **48**, 640; 1935), who estimates the ratio K^{39}/K^{40} as 8,300 ± 100.

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Sept. 12.

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[1] Newman and Walke, NATURE, **135**, 98; Jan. 19, 1935. *Phil. Mag.*, **19**, 767; 1935.

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

[3] Sitte, NATURE, **136**, 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