experiment obtained by Huntington and Seitz[2] who calculated the activation energy for self-diffusion in copper on basis of a vacancy mechanism. The following experimental measurements provide preliminary data on the disorder produced at elevated temperature, presumably vacancies, in pure gold.

Gold wires, 99.999 percent pure, of 16-mil diameter were quenched in a blast of gaseous helium to room temperature. The wires were then immediately immersed in liquid nitrogen. The time required for the quench from the high temperature was 7 ± 3 milliseconds. About a third of a second was required to get the wire from room temperature to liquid nitrogen temperature.

After quenching, an increase in the residual electrical resistivity at liquid nitrogen temperature was detected. Measurements were made on the annealing of the quenched-in resistance. About one-third of the resistance increase can be annealed at temperatures in the vicinity of room temperature. The resistance at liquid nitrogen temperature was measured as a function of the annealing time at -21.7°C and also at -2.7°C. From these data the energy required to move a vacancy is 0.4 ev$\pm$0.14 ev.

The remaining two-thirds of the resistance anneals out at some temperature between 100°C and 500°C.

Quenches were made from five different high temperatures, from 920°C to 690°C and the increment in resistance quenched in from these temperatures varied, respectively, from 0.82 percent to 0.065 percent. The large change in the amount of resistance quenched-in with the temperature from which the quench was made indicates that stresses arising from thermal gradients are not the source of the resistance increase. Further, these data may be used to determine the energy required for the production of a vacancy. However, errors in measuring the temperature from which the quenches are made give rise to large errors for the energy to form a vacancy, and with this difficulty we can at present only estimate this energy as lying between 1 ev and 2 ev. More accurate measurements are in progress.

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Some Experiments on Ge^{75} and Ge^{75m}†

ALAN B. SMITH, R. S. CAIRD, AND ALLAN C. G. MITCHELL
Indiana University, Bloomington, Indiana
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Ge^{75} has not been investigated by spectroscopic means. The half-life is known[1–3] to be 80 min and the beta-ray end point has been measured by aluminum absorption and found to be[1,2] 1.3 Mev.

In the present investigation germanium enriched in Ge^{74} was bombarded by neutrons, and measurements were made with the help of a magnetic lens spectrometer, scintillation spectrometer, and coincidence counting techniques. In all of the work the activity was quite weak.

The beta-ray spectrum was measured in the lens spectrometer and two beta-ray groups were found having end-point energies, relative abundances, and logft values of 1.137 Mev, 85 percent, logft=5.2; 0.614, 15 percent, logft=4.5. In addition, two internal conversion lines were seen. There was a well-resolved line at 0.408 Mev and an unresolved group at about 0.520 Mev.

The gamma-rays were measured from observations of photoelectrons from a uranium radiator. A line at 0.265 Mev was found and also a Compton distribution for a line around 0.600 Mev. The line at 0.265 Mev was confirmed with the help of a scintillation spectrometer. In addition, weak lines at 0.418 and 0.572 Mev were seen on the scintillation spectrometer.

Beta-gamma coincidence experiments were performed using ordinary counters. No coincidences were found between the high energy group of beta-rays and gamma-rays showing that the high energy group leads to the ground state.

Some of the gamma-rays seen in Ge^{75} are also seen in the transition[4–7] $Se^{75}\rightarrow As^{75}$. Those which appear in both are the ones at 0.265 and 0.408 Mev. Although a careful search for internal conversion lines of low energy was made, none was seen.

Since the ground state of As^{75} has a configuration $p_{3/2}$, and the transition from the ground state of Ge^{75} to the ground state of As^{75} is allowed, the configuration of the ground state of Ge^{75} is probably $p_{1/2}$. The fact that the higher states of As^{75} are excited by the K-capture transitions from Se^{75} infers that the ground state of Se^{75} has the configuration $g_{9/2}$. It is interesting to note that both beta-ray groups of Ge^{75} have logft values corresponding to allowed transitions.

We have produced a metastable state of Ge^{75}. This state was produced both by a Ge^{74} (separated) (n, γ) reaction and $As^{75}(n, p)$ reaction. The energy of the gamma-ray was measured photographically on a scintillation spectrometer and was found to be 0.175 Mev. The half-life of the state was found by setting on the line with a scintillation spectrometer connected to a differential pulse-height selector. The half-life is 48 ± 2 sec. While this experiment was in progress a similar experiment was reported by Flammersfeld.[8]

Assuming the radiation to be $E3$, using the empirical lifetime formula of Goldhaber and Sunyar,[9] and the expected conversion coefficient and K/L ratio, the half-life comes out 88 sec compared with the measured half-life of 48. If, on the other hand, this radiation has been assumed to be $M4$, the half-life would have been of the order of 10^6 sec.

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K^{40} Radioactive Decay: Its Branching Ratio and Its Use in Geological Age Determinations*

A. K. MOUSUF
Geophysics Laboratory, Department of Physics, University of Toronto, Toronto, Canada
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THE ratio of K-capture to beta-emission for the naturally occurring radioactive isotope K^{40} has been determined. For this purpose argon was extracted from four different samples of microcline and purified. The volume of the extracted argon was measured by means of a McLeod gauge built into the apparatus, and the amount of radiogenic A^{40} was ascertained by mass spectrometric analysis of the isotopic abundances in the extracted argon. The potassium contents of the samples of microcline were determined by chemical analysis and the amount of K^{40} has been estimated using the recent value[1] of Nier, 0.0119 ± 0.0001 percent, as the isotopic abundance of K^{40} in potassium.

Previous determinations of the branching ratio by direct measurements have used counting techniques,[2–9] whereas those based on indirect measurements have used age data couplied with either Ca^{40} or A^{40} extraction data to get the branching ratio,[10–12] except Inghram *et al.*,[13] who measured both A^{40} and Ca^{40} to get the branching ratio.

The argon was extracted by heating a sample of known weight of powdered microcline (75 g in each case) with metallic sodium in vacuum to about 600°C, and it was purified by treating the gas in a calcium furnace to constant volume. The results of the isotopic analysis of argon thus obtained are shown in Table I. All