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The radioactive isotope Cr^{49} was first described by O'Connor, Pool and Kurbatov,[1] who determined its half-life as 41.9±0.3 minutes and measured positrons of 1.45 Mev and gamma-rays of 1.55 and 0.18 Mev by absorption techniques. Huber, Lienhard, and Wäffler[2] measured the half-life of Cr^{49} as 45±5 minutes.

In the present work, titanium foils were bombarded for one hour with 40 Mev alpha-particles which produced Cr^{49} by the reactions Ti^{48} (α, 3n) and Ti^{47} (α, 2n).

The activated titanium foils were dissolved in hot concentrated nitric acid containing a few drops of hydrofluoric acid and 1 mg chromium carrier. Boric acid was added to complex the hydrofluoric acid. The solution was boiled with potassium bromate to oxidize the chromium to chromate. It was then neutralized with ammonium hydroxide and the precipitate redissolved by addition of a few drops of nitric acid. After chilling to -5°C, more potassium bromate was added to hold the chromium in the 6-state. Addition of a few drops of hydrogen peroxide formed peroxychromic acid, which was then extracted into pre-chilled diisopropyl ketone. After washing with pre-chilled 1/2 N nitric acid containing some potassium bromate, the peroxychromic acid was back-extracted into a dilute ammonium hydroxide solution. This was boiled down to near dryness and transferred to the thin tygon film that served as source backing. The remaining moisture was then evaporated.

The half-life of Cr^{49}, followed on a trochoidal analyzer, was found to be 41.7±0.5 minutes.

The positron spectrum was determined using a thick lens β-spectrograph of two percent transmission and four percent resolution. Fermi plots were constructed that could be resolved into three components, as shown in Table I.

Table I

Positron Spectrum of Cr^{49}

Energy Mev	Abundance percent	log *ft*
1.54±0.01	50	4.9
1.39±0.02	35	4.9
0.73±0.05	15	4.1

Photo-electrons ejected from a gold radiator were observed and yielded one set of energy values for the gamma-rays present. Conversion electrons belonging to the 153 Kev line were also measured whereas no conversion electrons could be detected for the 609 Kev line. Table II shows measured gamma energies and conversion coefficients.

Table II

Gamma-rays of Cr^{49}

Energy from photo-electrons Kev	Energy from conversion electrons Kev	Conversion coefficient α_K	Type of transition
609		$< 4 \times 10^{-4}$	M1
153	153	$(2.2 \pm 0.8) \times 10^{-2}$	M1

No evidence of the 762 Kev crossover transition could be found.

Figure 1 shows a suggested decay scheme, based on the present data. Cr^{49} is expected to have a 5/2- ground state. Since in the low Z region proton and neutron shells fill in the same order as given by the shell model,[3] Cr^{49} with 25 neutrons will have the same spin and parity as Mn^{55} with 25 protons. Mn^{55} has a measured spin of 5/2 resulting from the configuration $(f_{7/2})^5{}_{5/2}$.

V^{49} should have the same ground state spin and parity as V^{51}, which is $f_{7/2}$. Since all three beta-components are allowed, the first two excited states of V^{49} must have odd parity like its ground state. The conversion coefficient of the 153 Kev gamma-ray identifies it as a magnetic dipole transition. The measured upper limit on the conversion coefficient of the 609 Kev gamma-ray indicates that it is of multipole order one. Since its initial and its final state have the same parity, this transition must also be magnetic dipole. The first two excited states of V^{49} are assigned spins of 5/2 and 3/2, respectively, to account for the allowed nature of the three beta-components as well as for the two magnetic dipole gamma-rays. The lack of an observable crossover transition to the ground state agrees with this scheme. This assignment of spins and parities may well result from different coupling of the $(f_{7/2})^3$ proton configuration.

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[1] J. J. O'Connor, M. L. Pool, and J. D. Kurbatov, Phys. Rev. 62, 413 (1942).

[2] O. Huber, O. Lienhard, and H. Wäffler, Helv. Phys. Acta 17, 195 (1944).

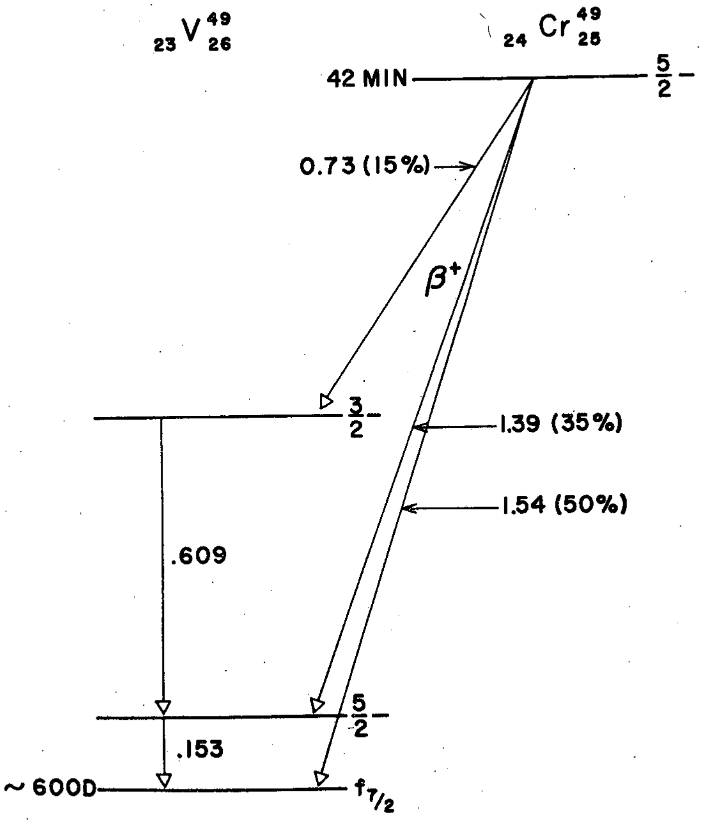

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Fig. 1 Decay scheme for Cr^{49}. Energies in Mev.