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Some New Radioactive Isotopes

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SOME NEW RADIOACTIVE ISOTOPES

Geoffrey Wilkinson and Harry G. Hicks

August 6, 1948

Berkeley, California

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Some New Radioactive Isotopes

Geoffrey Wilkinson and Harry G. Hicks

Radiation Laboratory and Department of Chemistry
University of California
Berkeley, California

August 6, 1948

In order to allow quantitative interpretation of the reactions of high energy particles from the 184-inch cyclotron with tantalum and heavier elements, a systematic survey is being made of radioactive isotopes of the rare earth elements; hafnium, tantalum, tungsten and rhenium. Bombardments of various elements are being made using 38 Mev and 20 Mev helium ions, 19 Mev deuterons and 10 Mev protons from the 60-inch Crocker Laboratory cyclotron. Chemical separation of the rare earth elements is made by ion-exchange resin columns. The accompanying table summarizes present data; energies of radiations are determined from absorption measurements; positrons are observed using a "magnetic counter"; mass allocations are made on the basis of measured cross-sections.

Detailed accounts of experimental techniques and of the isotopes will be published.

The allocation of the previously reported β active isotopes of lutecium with half-lives of 3.75 h and 6.8 d, to masses 176 and 177 respectively, has been confirmed by measurement of the d,p cross sections for 19 Mev deuterons on lutecium.

This paper is based on work carried out at the University of California under the auspices of the Atomic Energy Commission.

Table I

Isotope	Class	Type of Radiation	Half-Life	Energy of Radiation in Mev Particles	γ-Rays	Produced by
Tb^{152}	D	K	4.5 h		K, x-rays	Eu-α-3n
Tb^{153}	D	K, e^-	5.1 d	0.15, 0.4	L, K, x-rays	Eu-α-2n
Tb^{154}	D	β^+, K, e^-, γ	17.2 h	β^+ 2.6 e^- 0.22, ~1	L, K, x-rays 1.4	Eu-α-n Eu-α-3n
Tb^{155}	D	K, e^-	~1 y	0.1	L, K, x-rays	Eu-α-2n
Ho^{160}	D	K?	~20 m		x-rays	Tb-α-3n
Ho^{161}	B	K, e^-, γ	4.5 h	0.3	L, K, x-rays 1.1	Tb-α-2n Dy-p-n
Ho^{162}	B	K, e^-, γ	65 d	0.16, 0.6	L, K, x-rays	Tb-α-n Dy-d-n, 2n, 3n Dy-p-n
Ho^{164}	D	β^-	35 m	0.7		Dy-p-n
Tm^{166}	B	β^+, K, e^-, γ	7.7 h	β^+, 2.1 e^- 0.24, ~1	L, K, x-rays ~1.5	Ho-α-3n
Tm^{167}	B	K, e^-, γ	9 d	0.21	L, K, x-rays 0.22, 0.95	Ho-α-2n Ta-d-5z-16a
Tm^{168}	B	K? e^-	~150 d			Ho-α-3n

Table I (continued)

Isotope	Class	Type of Radiation	Half-Life	Energy of Radiation in Mev Particles	γ-Rays	Produced by
Lu^{170}	B	β^+, K, e^-, γ	2.15 d	β^+ 1.7 e^- 0.1	L, K, x-rays 1.5	Tm-α-3n Yb-d-2n, 3n Ta-d-3z-13a
Lu^{171}	B	K, e^-, γ	9 d	0.17, 0.7	L, K, x-rays	Tm-α-2n Ta-d-3z-12a Yb-d-n, 2n, 3n
Lu^{172}	B	K, e^-, γ	>100 d			Tm-α-n Yb-d-n, 2n, 3n
Ta^{176}	B	K, e^-, γ	8.0 h	0.12, 0.18, 1.2	L, K, x-rays 1.7	Lu-α-3n Ta-d-z-7a
Ta^{177}	B	K, e^-	2.66 d	0.1	L, K, x-rays	Lu-α-2n Ta-d-z-6a Hf-d-n, 2n, 3n
Ta^{179}	B	K, e^- or β^-	16 d	1.1		Lu-α-n Hf-d-n, 2n, 3n
Re^{182}	B	K, e^-, γ	64 h	0.11, 0.27 0.6	L, K, x-rays 0.22, 1.5	Ta-α-3n W-p-n
Re^{183} or 4	C	K, e^-, γ	~80 d	0.1	L, K, x-rays 1.0	Ta-α-2n W-p-n
Re^{184} or 3	C	K, γ	13 h		K, x-rays 1.6	Ta-α-n W-p-n