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SOME NEW RADIOACTIVE ISOTOPES

Geoffrey Wilkinson and Harry G. Hicks

August 6, 1948

Special Review of Declassified Reports

Authorized by USDOE JK Bratton

Unclassified TWX P182206Z May 79

REPORT PROPERLY DECLASSIFIED

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Standard Distribution

Argonne National Laboratory	9
Armed Forces Special Weapons Project	10-11
Atomic Energy Commission, Washington	12
Battelle Memorial Institute	13-20
Brookhaven National Laboratories	21-24
Carbide & Carbon Chemicals Corp. (K-25 Area)	25-28
Carbide & Carbon Chemicals Corp. (Y-12 Area)	29
Columbia University (Dunning)	30-33
General Electric Company	34-38
Hanford Directed Operations	39
Iowa State College	40-42
Los Alamos	43-44
Monsanto Chemical Company, Dayton	45-46
National Bureau of Standards	47
Naval Radiological Defense Laboratory	48
NEPA	49-50
New York Directed Operations	51-58
Oak Ridge National Laboratory	59
Patent Advisor, Washington	60-74
Technical Information Division, ORDO	75
UCLA Medical Research Laboratory (Warren)	76-80
University of California Radiation Laboratory	81-82
University of Rochester	83
Chicago Directed Operations	84-87
Declassification Procedure	88
Declassification Officer	89-90
Publications Officer	91
Patent Department	92
E. O. Lawrence	93
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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

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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		Produced by
				Particles	γ -Rays	
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, \sim 1	L, K, x-rays 1.4	Eu- α -n Eu- α -3n
Tb ¹⁵⁵	D	K, e ⁻	\sim 1 y	0.1	L, K, x-rays	Eu- α -2n
Ho ¹⁶⁰	D	K?	\sim 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, \sim 1	L, K, x-rays \sim 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 ⁻	\sim 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, 0.13, 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