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Contract No. W-7405-eng-48

A COMPILATION OF THE NON-RADIOACTIVE NUCLEAR PROPERTIES OF THE NATURALLY OCCURRING ISOTOPES

Elwin H. Covey

February 15,1949

Berkeley, California

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RADIATION LABORATORY
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Introduction

The following tabular list of values has been compiled mainly from the sources given below, and has been brought more nearly up to date by abstracting appropriate periodicals for the period January 1, 1947, to October 1, 1948. No claim is made for complete inclusiveness of this information, but it is felt that with very few exceptions this compilation presents most of the published data on the nuclear spins, magnetic moments, and exact masses of all naturally occurring isotopes known up to October, 1948. It is believed that this is one of the first attempts to bring all this data together in one place so that the concurrence (or lack of it) of previous authors and compilers on given values for each isotope can be noted conveniently, and different values compared.

The purpose of compiling the data which follows was to collect this information preparatory to entering the most authoritative values for the masses, spins and moments onto the wall type "Chart of the Isotopes" (Rm. 113, Bldg. 5, Dr. G. T. Seaborg's office), photographic copies of which are soon to be made available.

Until substantial future changes and revisions occur, all values now in the chart mentioned above can be supported by literature references by referring to: (1) The "Table of Isotopes" which appeared in the October, 1948, issue of Reviews of Modern Physics, and (2) this compilation.

For the sake of completeness, the percent abundance of the isotopes in nature has been included in this list under column three. This data was taken from the "Table of Isotopes", compiled by G. T. Seaborg and I. Perlman in Reviews of Modern Physics 20, 585-667 (1948). For further completeness, elemental cross section values have been included in column one of this list, and isotopic cross section values have been listed in column two. The latter values represent thermal neutron ($v = 2200$ m/sec) absorption cross sections, (σ) in units of barns (10^{-24} cm^2). This data was taken, for the most part, from "Thermal Neutron Cross Sections for Elements and Isotopes, H to Bi" by K. Way and G. Haines published as AECD-2138 (declassified July 23, 1948).

An asterisk (*) following the letter symbol (or parentheses around the value given) denotes that uncertainty of the value given has been indicated in the reference or in subsequent work. Where a naturally occuring isotope emits radiation, the nature of such radiation has been given in parentheses immediately following the isotope listed in column one. Where several measurements have been made of the same isotopic property, generally the order of listing values in this report is such that the first values presented are either (1) the most recent ones published or (2) the ones which most previous compilers have accepted.

The letter symbols and corresponding references which have been used are:

A - This denotes concurrence of all references given below on a given value, omitting B. (This reference (B) is omitted from "A" since it takes up only the exact masses.)

* A very few artificially produced isotopes have been included in this compilation for the sake of completeness, and because some of their non-radioactive nuclear properties and their respective values are significant and/or commonly used.

B - Bainbridge, K. T., Isotopic Weights of the Fundamental Isotopes, Nuclear Science Series, Preliminary Report No. 1; National Research Council, Division of Mathematical and Physical Sciences, November, 1947.

F - Feld, B. T., Nuclear Electric Quadruple Moments and Quadruple Couplings in Molecules, Nuclear Science Series, Preliminary Report No. 2; National Research Council, Division of Mathematical and Physical Sciences, September 1948.

G - Goldsmith, H. H., and M. Hamermesh, "Table of Nuclear Spins and Moments", in Conference on Nuclear Spins and Magnetic Moments, Brookhaven National Laboratory, August 19, 1947 (notes by Prof. M. Hamermesh), Information and Publications Division, Brookhaven National Laboratory. (Atomic Energy Commission Report BNL-C2).

G_8 - Goldsmith, H. H., and D. R. Inglis, The Properties of Atomic Nuclei I. Spins, Magnetic Moments, and Electrical Quadruple Moments, Information and Publications Division, Brookhaven National Laboratory. (AEC Report BNL-15) October 1, 1948.

K - Kellogg, J. B., and S. Millman, Reviews of Modern Physics, 18, 323 (1946). (See the Table on page 348).

Ma - Mattauch, J., and S. Fluegge, Nuclear Physics Tables and an Introduction to Nuclear Physics, Interscience Publishers, Inc., New York, 1946. 173 pp. and 8 plates. (Copyright 1942, Springer-Verlag, Berlin - OHG; Reproduced through the U. S. Alien Property Custodian.)

Me - Meggers, W. F., Journal of the Optical Society of America, 36, 431 (1946). (These data tables are used in the Welch Periodic Chart and accompanying key. No value for the experimental error is given.)

Mi - Massachusetts Institute of Technology staff, Notes for Seminar in Nuclear Science and Engineering, Appendix A (8.44), 1946. (Dr. E. Segrè appears to use these and "Project Handbook" mass values for his Isotope Chart.)

P - "Project Handbook, Metallurgical Laboratory Project Report CL-697, Vol. 2, Chapter IIIA, Revised Edition, November 1944 (Masses in Section 2.1, pp. 5-9; Spins and Moments in Section 4, pp. 24-26.)

S - "Original Seaborg Wall Chart", (1939) Gilman Hall, Department of Chemistry, University of California, Berkeley, California. (For most of the values taken from this wall chart, the supporting references unfortunately cannot be located. Thus it is impossible to recheck and verify values given for several of the isotopes for which no other source reports confirmatory data.)

Names and superscripts - For recent work and appropriate references (taken from the periodical literature) see the numerical list of references at the end of this tabulation, arranged in the order in which authors appear in the table.

Elwin H. Covey
February 15, 1949

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I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
0) n^1 (β^-)		--	1.008983	±.0057	B	1/2	G, G_8, Ma, Me, Mi, P&S	-1.91307	±.0006	Bloch(1)
			1.008937	.0075	Hughes (3)			-1.9103	.0012	G, G_8 & Arnold & Roberts(2)
			1.008945	.025	Ma			-1.935	.02 (Ma)	Ma, Me&P
			1.00893	.03	Mi&P			-1.93	--	S
1) H^1 σ_H=.32	.32	99.9844	1.0081283	.0028	B	1/2	G, G_8, K, Ma, Me, Mi, P&S	(K+)2.7896	.008(G)	G, G_8, K, Me, P&S
			1.008123	.006	Mi&P			2.7928	.0008	Bloch(1)
			1.008131	.0032	Ma			+2.785	.02	Ma
H^2	.00065^x	.0156	2.0147186	.0056	B	1	A	.85742	.0003	Bloch(1)
			2.014708	.011	Mi&P			.85742	.00001	G_8
			2.014725	.0064	Ma			+ .85647	.003	Arnold& Roberts(2)
								(K+) .8565	--	K, P&S
								.855	.006(Ma)	Ma&Me
								.85641	.0003	G
H^3 (β^-)		--	3.017032^x			1/2	G&G_8	2.9756	.003	G_8
			3.017029	.032	B			2.9791	--	Anderson& Novick(4)
2) He^3 σ_{He}=.008	6,000(np)	1.3×10^{-4}	3.017013^x			1/2	G&G_8	-2.129	.020	G_8
			3.017016	.032	B			-2.131	.020	Anderson& Novick(4)
			3.01700	.04	Mi&P					
			3.016988	.020	Ma					

x = Recalculated by G. T. Seaborg to correspond with more accurate decay energy values.

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
He^4		99.9999	4.003880 4.00390 4.003860	±.030 .03 .031	B Mi&P Ma	0	G, G_8, Ma, Me, Mi, P&S	0	--	P
5) Li^6 σ_{Li}=65	970(nα)	7.39	6.01690 6.016917 6.01697	-- .051 (Ma) .05	B Ma&Mi P	1	G, G_8, K, Ma, Me, Mi, P&S	.8214 +.820 (K+).8213	±.0005 .005 (Ma) --	G&G_8 Ma&Me K, P&S
Li^7	.033	92.61	7.01820 7.01822 7.018163	.10 .06 .057	B Mi&P Ma	3/2	A(F*)	3.2527 (K+)3.2532 +3.250 3.2535	.0003 -- .016 .0015	G_8 K, Me, P&S Ma G
4) Be^9 σ_{Be}=.01	.01	100	9.01506 9.01503 9.014958	.20 .06 .062	B Mi&P Ma	3/2	G, G_8, K*, Me, P*&S	-1.176 {g=μ/i= -.783; μ= -1.1745} .003	.005 (G) Ma	G, G_8, K, Me, P&S
5) B^{10} σ_B=715	3800 (nα)	18.83	10.01616 10.01618 10.016169	.13 .09 .070	B Mi&P Ma	3 1	G_8 G, K*, Me, P&S	1.7987 +.597 (K+).598	.0009 .003 (Ma) .003 (G)	G_8 Ma&Me G, K, P&S
B^{11}	<.05	81.17	11.01287 11.01284 11.012901	.10 .08 .050 .10	B Mi&P Ma B	3/2	G, G_8, K*, Me, P*&S	2.6857 2.682 (K+)2.686 2.687 {g=μ/i= +1.788; μ=2.682}	.0005 -- -- .008 .005	G_8 Me K, P&S G Ma
6) C^{12} σ_C=.0045	.0035	98.9	12.003856 12.00382 12.003880	.019 .04 .025	B Mi&P Ma	0	G, G_8, Ma, Me, Mi, P&S	0	--	P

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
C^{13}	.1	1.1	13.00751 13.007561	±.010 .043	Mi&P Ma	1/2 3/2	F*,G,G_8,K*, Me,P*&S Ma*	.70156 (K+).701 ($g=\mu/i=$ 1.401)	±.0001 .002(G) .004	G_8 G,K,Me,P&S Ma
C^{14} (β^-)	<200					0	Jenkins(5) &G_8			
7) N^{14} σ_N=1.7	1.7(np)	99.62	14.007536 14.00751 14.007530	.022 .04 .016	B Mi&P Ma	1	A	+.402 (K+).403	.002(Ma) .002(G)	Ma&Me G,G_8,K,P&S
N^{15}	.00002	.38	15.00489 15.004870	.21 .072	Mi&P Ma	1/2	G,G_8,K,Ma, Me,Mi,P*&S	(G±?)-.280	.003(Ma)	G_8,K,Ma,Me, Mi,P&S
8) O^{16} σ_O=<.001		99.757	16.000000	Stan- dard	A	0	G,Ma,Me,Mi, P&S	0	--	P
O^{17}		.039	17.00450	.06	Ma,Mi&P	--	--	--	--	--
O^{18}	.00022	.204	18.0049 18.00485	.40 .18	Mi&P Ma	0	F*&G_8	--	--	--
9) F^{19} σ_F=.01	.01	100.	19.00450 19.00454	.26 .12	Mi&P Ma	1/2	G,G_8,K,Ma, Me,Mi,P&S	2.6255 2.627 (K+)2.625 +2.622	.0003 .003(G) -- .014	G_8 G K,Me,P&S Ma
10) Ne^{20} σ_{Ne} Unknown		90.51	19.99872 19.99877 19.998895	.13 .10 .061	B Mi&P Ma	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Ne^{21}		.28	20.99963 21.00002	±.22 .2	Mi&P Ma	--	--	--	--	--
Ne^{22}		9.21	21.99844 21.99858	.36 .30	Mi&P Ma	--	--	--	--	--
11) Na^{22} σ_{Na}=.45						3	G_8	1.746	±.003	G_8
Na^{23}	.45	100.	22.99618 22.99644	.31 .18	Mi&P Ma	3/2	A(F*)	2.2149 2.217 (K+)2.215 +2.216	.0002 .002(G) -- .011	G_8 G K,Me,P&S Ma
12) Mg^{24} σ_{Mg}=.3		78.60	23.9924 23.99300	.60 .38	Mi&P Ma	--	--	--	--	--
Mg^{25}		10.11	24.9938 24.99462	.90 .46	Mi&P Ma	--	--	--	--	--
Mg^{26}	.08	11.29	25.9898 25.99012	.50 .3	Mi&P Ma	--	--	--	--	--
13) Al^{27} σ_{Al}=.21	.21	100.	26.9899 26.99069	.80 .43	Mi&P Ma	5/2	G,G_8,K,Ma, Me,Mi,P&S	3.634 3.6364 +3.628 (K+)3.630	.010(G) .0004 .010(Ma) --	 G_8 Ma&Me K,P&S
14) Si^{28} σ_{Si}=.24		92.28	27.9866 27.98723	.60 .45	Mi&P Ma	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Si^{29}		4.67	28.9866 28.98651	±.60 .62	Mi&P Ma	--	--	--	--	--
Si^{30}	.12	3.05	29.9832 29.98399	.90 .50	Mi&P Ma	--	--	--	--	--
15) P^{31} σ_P=.23	.23	100.	30.9843 30.98441	.50 .27	Mi&P Ma	1/2	G, G_8, Ma, Me, Mi, P&S	1.1304 +1.1314	±.0001 .0013	G_8 Pound(6)
16) S^{32} σ_S=.4		95.06	31.98089 31.98252	.07 .26	Mi&P Ma	0	G, G_8, Ma, Me, Mi, P&S	0	--	P
S^{33}		.74	32.9800 32.9819	.60 .3	Mi&P Ma	1/2 3/2	F* Townes (7) &G_8	--	--	--
S^{34}	.26	4.18	33.97710 33.97981	.35 .37	Mi&P Ma	0	F*&G_8	--	--	--
S^{36}	.14	.016	35.978	1.0	Mi&P	--	--	--	--	--
17) Cl^{35} σ_{Cl}=40	53	75.4	34.97867 34.97884	.21 .19	Mi&P Ma	5/2 3/2	K*, Ma, Me, Mi, P&S F, G&G_8	.8210 .821 1.365 (K+)1.368	.003 .003(G) .005(Ma) --	G_8 G Ma&Me K, P&S
Cl^{37}	.56	24.6	36.97750 36.97770	.14 .09	Mi&P Ma	5/2 3/2	K*, Ma, Me, Mi, P&S F, G, G_8	1.135 (K+)1.136 .681	.005(Ma) -- .003(G)	Ma&Me K, P&S G&G_8
18) A^{36} σ_A=.62 to 1.2		.307	35.97728 35.9780	.37 1.0(P)	Ma Mi&P	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
A^{36}		.060	37.97463 37.974	±.33 2.50	Ma Mi&P	--	--	--	--	--
A^{40}	.62 to 1.2	99.633	39.97549 39.9756	.12 .60	Ma Mi&P	--	--	--	--	--
19) K^{39} σ_K=2.5		93.3	38.9747 38.976 38.97544	-- 1.6 --	Mi&P* Ma S	3/2	A(F*,K*)	.392 .391	±.002(G) .002(Ma)	G&G$_8$ K,Ma,Me,Mi,P&S
K^{40}(K,β,γ)		.011	39.9760	1.0	Mi&P	4	G,G$_8$,K,Mi,P&S	-1.292 -1.290	.005(G) --	G&G$_8$ K,Me,P&S
K^{41}	1.0	6.7	40.9739	--	S*	3/2	G,G$_8$,Ma,Me,Mi,P&S	(K+).215 + .217	.002(G) .001(Ma)	G,G$_8$,K,P&S Ma&Me
20) Ca^{40} σ_{Ca}=.5	.0002	96.96	39.9753 (39.9745)	1.50 --	Mi&P S*	--	--	--	--	--
Ca^{42}		.64	41.9711	--	Mi,P&S	--	--	--	--	--
Ca^{43}		.15	42.9723	--	Mi,P&S	--	--	--	--	--
Ca^{44}	.63	2.06	--	--	--	--	--	--	--	--
Ca^{46}		.0033	--	--	--	--	--	--	--	--
Ca^{48}	.55 (→ 30m Ca^{49}) .21 (→ 2.5h Ca^{49})	.19	--	--	--	--	--	--	--	--
21) Sc^{45} σ_{Sc}=22	22	100.	44.9669 44.96977	-- .63	Mi&P Ma	7/2	G,G$_8$,Ma,Me,Mi,P&S	4.8 4.6 (4.4 to 4.8)	-- -- --	G,G$_8$,Ma&Me P S

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
22) Ti^{46} σ_{Ti}=5.2		7.95	45.9661 (45.9678)	±1.0 --	Mi&P S*	--	--	--	--	--
Ti^{47}		7.95	46.9647	1.0	Mi&P	--	--	--	--	--
Ti^{48}		73.45	47.9631 47.96570	.50 .38	Mi&P Ma	--	--	--	--	--
Ti^{49}		5.51	48.9646 48.964	.60 2.0	Mi&P Ma&S	--	--	--	--	--
Ti^{50}	.14(→ 6m Ti^{51}) .039(→72d Ti^{51})	5.34	49.9621 49.963	.40 2.0	Mi&P Ma&S	--	--	--	--	--
23) V^{51} σ_V= 4.5	4.5	100.	50.9577 50.96035	.50 .63	Mi&P Ma	7/2(?) (G&G_8)	Ma*,Mi,S &G	--	--	--
24) Cr^{50} σ_{Cr}=2.5	11	4.49	--			--	--	--	--	--
Cr^{52}		83.78	51.956 51.959	-- .9(Ma)	Mi&P Ma&S	--	--	--	--	--
Cr^{53}		9.43	52.956 (52.9572)	-- --	Mi&P S*	--	--	--	--	--
Cr^{54}	.0061	2.30	--	--	--	--	--	--	--	--
25) Mn^{55} σ_{Mn}=13	13	100.	54.957 (54.9653)	-- --	Mi&P S*	5/2	G,G_8,Ma,Me, Mi,P&S	3.0	--	G,G_8,Ma,Me,Mi, P&S
26) Fe^{54} σ_{Fe}=2.5	2.5	5.81	53.957 53.961	-- 2.4(Ma)	Mi&P Ma&S	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Fe^{56}	2.9	91.64	55.9568 55.9571	$\pm$1.7 1.8(Ma)	Mi&P Ma&S	--	--	--	--	--
Fe^{57}	.5	2.21	56.957 (56.9609)	--	Mi&P S*	--	--	--	--	--
Fe^{58}	.36	.34	--	--	--	--	--	--	--	--
27) Co^{59} σ_{Co}=36	22(→ 5.3y Co^{60}) .66(→ 10.7 m Co^{60})	100.	--	--	--	7/2	G,G_8,Ma,Me, Mi,P&S	2.7 2.63 (3.5)	-- -- --	G,Me&G_8 Ma&P S
28) Ni^{58} σ_{Ni}=4.5	4.3	67.76	57.95971	.41	Ma	--	--	--	--	--
Ni^{60}	2.7	26.16	59.94981	.33	Ma	--	--	--	--	--
Ni^{61}		1.25	60.9540	1.5	Ma	--	--	--	--	--
Ni^{62}	14.8	3.66	61.94959	.39	Ma					
Ni^{64}	2.6	1.16	63.94744	.56	Ma	--	--	--	--	--
29) Cu^{63} σ_{Cu}=3.5	2.8	69.09	62.957	1.3	Ma	3/2	F,G,G_8,Ma, Me,Mi,P&S	2.2233 +2.2265 2.5 2.43 (μ_{65}/μ_{63}= 1.04(per Ma))	$\pm$.0007 .0025 -- --	G_8 Pound(8) G,Ma&Me P&S

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Cu^{65}	1.8	30.91	64.955	±1.3	Ma	3/2	F,G,G_8,Ma, Me,Mi,P&S	2.3817 +2.3847 2.6 2.54	±.0007 .0030 -- --	G_8 Pound(8) G,Ma&Me P&S
30) Zn^{64} σ_{Zn}=.9	.5	48.89	63.957	2.7	Ma	(0)	S	---	--	--
Zn^{66}		27.81	65.953	2.8	Ma	(0)	S	--	--	--
Zn^{67}		4.07	--	--	--	5/2	G,G_8,Ma, P&S	+ .9	--	G,G_8,Ma,Me, Mi,P&S
Zn^{68}	1.0(→57m Zn^{69}) .09(→13.8h Zn^{69})	18.61	67.955	3.5	Ma	(0)	S	--	--	--
Zn^{70}	.09	.620	69.954	3.7	Ma	--	--	--	--	--
31) Ga^{69} σ_{Ga}=22	1.4	60.2	68.956	3.5	Ma	3/2	F,G,G_8,Me, Mi,P&S,Ma	2.016 2.0165 +2.11 μ^{71}/μ^{69}= 1.270 (per Ma)	.003 .0035 --	G_8 Pound(6) G,Ma,Me,Mi, P&S
Ga^{71}	3.4	39.8	70.954	3.6	Ma	3/2	F,G,G_8,Ma, Me,Mi,P&S	2.561 2.5611 +2.69	.003 .0030 --	G_8 Pound(6) G,Ma,Me,Mi, P&S
32) Ge^{70} σ_{Ge}=2.8	.45(→11d Ge^{71}) <.073(→39.7h Ge^{71})	20.55	--	--	--	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Ge^{72}		27.37	--	--	--	--	--	--	--	--
Ge^{73}		7.61	--	--	--	--	--	--	--	--
Ge^{74}	.38	36.74	--	--	--	--	--	--	--	--
Ge^{76}	.085 (→12h Ge^{77}) .095 (→59s Ge^{77})	7.67	--	--	--	--	--	--	--	--
33) As^{75} σ_{As}=4.3	4.3	100.	(74.934)	--	S*	3/2	F,G,G_8,Ma, Me,Mi,P&S	+1.5	--	G,Ma,Me,Mi P&S
34) Se^{74} σ_{Se}=15	22	.87	--	--	--	0	G_8	--	--	--
Se^{76}		9.02	--	--	--	0	G_8	--	--	--
Se^{77}		7.58	--	--	--	1/2	G_8	--	--	--
Se^{78}		23.52	(77.938)	--	S*	0	G_8	--	--	--
Se^{80}	.034 (→39m Se^{81}) .46 (→17m Se^{81})	49.82	(79.942)	--	S*	0	G,G_8,Ma,Me &S	--	--	--
Se^{82}	.05 (→67s Se^{83}) .004 (→25m Se^{83})	9.19	--	--	--	--	--	--	--	--
35) Br^{79} σ_{Br}=6.5	2.8 (→4.4h Br^{80}) 8.1 (→18m Br^{80})	50.5	(78.942)	--	S*	3/2	F,G,G_8,Ma, Me,Mi,P&S	2.108 2.1066 (2.110) 2.6 2.61 μ^{79}/μ^{81}= 1.0 (per Ma)	±.003 .003 (.021) -- --	G_8 Pound (9) G Ma,Me&S P

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10-3	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Br^{81}	2.25	49.5	(80.940)	--	S*	3/2	F,G,G_8,Ma, Me,Mi,P&S	2.2668 2.2706 2.6 2.61 (2.273)	±.0009 .003 -- -- (.023)	G_8 Pound(9) Ma,Me&S P G
36) Kr^{78} σ_{Kr}=.045	.26	.342	77.945	±1.6	Ma	--	--	--	--	--
Kr^{80}		2.223	--	--	--	--	--	--	--	--
Kr^{82}		11.50	81.938	1.3	Ma	(0)	S	--	--	--
Kr^{83}		11.48	--	--	--	9/2	F,G,G_8,K*, Ma,Me&P*	- .971 - .967 -1.0	 -- --	G&G_8 K Ma,Me&P
Kr^{84}	.063(→ 9.4y Kr^{85}) .096(→ 4.5h Kr^{85})	57.02	83.939	1.3	Ma	(0)	S	--	--	--
Kr^{86}	.064	17.43	85.939	1.4	Ma	(0)	S	--	--	--
37) Rb^{85} σ_{Rb}=.56	.72	72.8	--	--	--	5/2	G,G_8,K,Ma, Me,Mi,P&S	1.3515 +1.345 +1.345 (K+)1.340	.0007 .008(G) .005(Ma) --	G_8 G,Ma&Me P&S
Rb^{87}(β^-, γ)	.12	27.2	--	--	--	3/2	G,G_8,K,Ma, Me,Mi,P&S	2.7471 +2.733 +2.741 2.723 2.744	.0008 .009(Ma) -- .009(G)	G_8 K Ma&Me P&S G
38) Sr^{84} σ_{Sr}=1.8		.56	--	--	--	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Sr^{86}	1.3	9.86	--	--	--	(0)	S	--	--	--
Sr^{87}		7.02	--	--	--	9/2	G, G_8, Ma, Me&P	-1.1	--	G, G_8, Ma, Me&P
Sr^{88}	.005	82.56	--	--	--	(0)	S, G&G_8	--	--	--
39) Y^{89} σ_Y=1.2	1.2	100.	--	--	--	1/2(?) (G&G_8)	G, Me*&S	<0.1	--	G, G_8&Me
40) Zr^{90} σ_{Zr}=.4		51.46	--	--	--	--	--	--	--	--
Zr^{91}		11.23	--	--	--	--	--	--	--	--
Zr^{92}		17.11	--	--	--	--	--	--	--	--
Zr^{94}	.43	17.40	--	--	--	--	--	--	--	--
Zr^{96}	.60	2.80	--	--	--	--	--	--	--	--
41) Cb^{93} σ_{Cb}=1.2	1.2	100.	--	--	--	9/2	G, G_8, Ma, Me&P	3.7 5.3	--	Ma*, Me&P G, G_8&Meeks (10)
42) Mo^{92} σ_{Mo}=2.6	.006	15.86	--	--	--	--	--	--	--	--
Mo^{94}		9.12	93.945	$\pm$4.2	Ma	--	--	--	--	--
Mo^{95}	13.4	15.7	94.946	4.3	Ma	1/2(?) (G&G_8)	Me*, G	--	--	--
Mo^{96}	1.	16.5	95.946	4.3	Ma	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Mo^{97}	2.3	9.45	96.945	±2.9	Ma	1/2(?) (G&G$_8$)	G, Me*	--	--	--
Mo^{98}	.4	23.75	97.944	3.0	Ma	--	--	--	--	--
Mo^{100}	.5	9.62	99.939	3.0	Ma	--	--	--	--	--
43) Tc σ_{Tc} Unknown		--	--	--	--	--	--	--	--	--
44) Ru^{96} σ_{Ru}=2.5	.01	5.68	95.945	2.9	Ma	--	--	--	--	--
Ru^{98}		2.22	--	--	--	--	--	--	--	--
Ru^{99}		12.81	98.944	2.9	Ma	--	--	--	--	--
Ru^{100}		12.70	--	--	--	--	--	--	--	--
Ru^{101}		16.98	--	--	--	--	--	--	--	--
Ru^{102}	1.2	31.34	--	--	--	--	--	--	--	--
Ru^{104}	.67	18.27	--	--	--	--	--	--	--	--
45) Rh^{103} σ_{Rh}=149	137 (→44s Rh^{104}) 11.6 (→4.2m Rh^{104})	100.	102.949	5.2	Ma	--	--	--	--	--
46) Pd^{102} σ_{Pd}=7		.8	--	--	--	--	--	--	--	--
Pd^{104}		9.3	(103.946)	--	S	--	--	--	--	--
Pd^{105}		22.6	(104.945)	--	S	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment $= \mu$	VIb Est. Error	VIc Ref.
Pd^{106}		27.2	105.946	± 4.3	Ma	--	--	--	--	--
Pd^{108}	11	26.8	(107.943)	--	S	--	--	--	--	--
Pd^{110}	.39	13.5	109.944	4.4	Ma	--	--	--	--	--
47) Ag^{107} $\sigma_{Ag}=60$	30	51.35	106.950	3.2	Ma	1/2	G, G_8, Ma, Me&P	- .10 $\{\mu^{109}/\mu^{107} = 1.93$ (per Ma)$\}$	--	G, G_8, Ma, Me&P
Ag^{109}	97($\rightarrow$24.2s Ag^{110}) 2.3($\rightarrow$225d Ag^{110})	48.65	108.949	3.3	Ma	1/2	G, G_8, Ma, Me&P	- .19	--	G, G_8, Ma, Me&P
48) Cd^{106} $\sigma_{Cd}=2900$	~1	1.215	--	--	--	--	--	--	--	--
Cd^{108}		.875	--	--	--	--	--	--	--	--
Cd^{110}	.2	12.39	--	--	--	(0)	S	--	--	--
Cd^{111}		12.75	--	--	--	1/2	G, G_8, Ma, Me, Mi, P&S	- .63 - .65	-- --	Me G, G_8, Ma, Mi, P&S
Cd^{112}		24.07	--	--	--	(0)	S	$\{\mu^{113}/\mu^{115} = 1.0$ (per Ma)$\}$	--	--
Cd^{113}	24,000	12.26	--	--	--	1/2	G, G_8, Ma, P&S	- .63 - .65	-- --	Me G, G_8, Ma, Mi, P&S
Cd^{114}	1.1($\rightarrow$2.33d Cd^{115}) .14($\rightarrow$43d Cd^{115})	28.86	--	--	--	(0)	S	--	--	--
Cd^{116}	1.4	7.58	--	--	--	(0)	S	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
49) In^{113}	56(→48d In^{114})	4.23	--	--	--	9/2	G,G_8,K,Ma	+5.49		K
σ_{In} = 194	2(→72s In^{114})						Me&P	5.52	±.040(G)	G&G_8
								5.48	--	Me
								6.4	--	Ma
								5.43	--	P
In^{115}	52(→13s In^{116})	95.77	--	--	--	9/2	F,G,G_8,K,	5.49	--	Me&P
	145(→543m In^{116})						Ma,Me&P	5.43	.03	Ma
								5.52	.040(G)	G&G_8
								+5.50		K
50) Sn^{112}	1.1	.90	--	--	--	--	--	--	--	--
σ_{Sn} = .55										
Sn^{114}		.61	--	--	--	--	--	--	--	--
Sn^{115}		.35	--	--	--	1/2	G,G_8&P	- .9	--	G,G_8&P
Sn^{116}		14.07	115.943	±4.8	Ma	--	--	--	--	--
Sn^{117}		7.54	--	--	--	1/2	G,G_8,Ma,Me, Mi,P&S	- .89 (μ^{117}/μ^{119} = 1.0(per Ma))	--	G,G_8,Ma,Me, Mi,P&S
Sn^{118}		23.98	117.940	3.8	Ma	--	--	--	--	--
Sn^{119}		8.62	118.938	3.8	Ma	1/2	G,G_8,Ma,Me, Mi,P&S	- .89	--	G,G_8,Ma,Me, Mi,P&S
Sn^{120}		33.03	(119.930)	--	S	--	--	--	--	--
Sn^{122}	.16	4.78	121.946	5.0	Ma	--	--	--	--	--
Sn^{124}	.57	6.11	123.945	5.1	M	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin $\pm i$	Vb Ref.	VIa Magnetic Moment $= \mu$	VIb Est. Error	VIc Ref.
51) Sb^{121} $\sigma_{Sb}=5$	6.8	57.25	--	--	--	5/2	F,G,G_8,Ma, Me,Mi,P&S	3.7 4.0 μ^{121}/μ^{123} =1.316 (per Ma)	-- --	G,G_8,Ma,P&S Me
Sb^{123}	2.5	42.75	--	--	--	7/2	F,G,G_8,Ma, Me,Mi,P&S	2.8 3.2	-- --	G,G_8,Ma,P&S Me
52) Te^{120} $\sigma_{Te}=4$		.091	--	--	--	--	--	--	--	--
Te^{122}		2.49	--	--	--	--	--	--	--	--
Te^{123}		.89	--	--	--	--	--	--	--	--
Te^{124}		4.63	--	--	--	--	--	--	--	--
Te^{125}		7.01	--	--	--	--	--	--	--	--
Te^{126}	.073($\rightarrow$90d Te^{127}) .78($\rightarrow$9.3h Te^{127})	18.72	(125.937)	--	S*	--	--	--	--	--
Te^{128}	.015($\rightarrow$32d Te^{129}) .13($\rightarrow$72m Te^{129})	31.72	(127.936)	--	S*	--	--	--	--	--
Te^{130}	<.008($\rightarrow$30h Te^{131}) .22($\rightarrow$25m Te^{131})	34.46	--	--	--	--	--	--	--	--
53) I^{127} $\sigma_{I}=7$	7	100.	(126.932)	--	S	5/2	F,G,G_8,Ma, Me,Mi,P&S	2.812 2.8122 2.8	±.003 .0030 --	G_8 Pound(6) G,Ma,Me,Mi,P&S

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
54) Xe^{124} σ_{Xe} Unknown		.094	--	--	--	--	--	--	--	--
Xe^{126}		.088	--	--	--	--	--	--	--	--
Xe^{128}		1.90	--	--	--	--	--	--	--	--
Xe^{129}		26.23	128.946	$\pm$1.4	Mn	1/2	G, G_8, Ma, Me, Mi, P&S	- .9 - .8 (μ^{129}/μ^{131} =-1.11 (per Ma))	-- --	G, G_8, Ma, P&S Me
Xe^{130}		4.07	--	--	--	--	--	--	--	--
Xe^{131}		21.17	--	--	--	3/2	F, G, G_8, Ma, Me, Mi, P&S	- .8 + .8 . .7	-- -- --	G_8 G, Ma&P Me&S
Xe^{132}	.2	26.96	131.946	~5.	Ma	--	--	--	--	--
Xe^{134}	.2[x]	10.54	--	--	--	--	--	--	--	--
Xe^{136}	.15	8.95	--	--	--	--	--	--	--	--
55) Cs^{133} σ_{Cs}=26	3(→ 3.15h Cs^{134}) 26(→ 2.3y Cs^{134})	100.	(132.933)	--	S	7/2	A	2.5753 2.575 2.586 (K+)2.588 +2.572	$\pm$.0013 .007(G) -- -- .013	G_8 G Me K, P&S Ma
Cs^{137}		--	--	--	--	7/2	G_8	2.86	--	G_8

x = To form 15.6m Xe^{135} and/or (or both) 9.2h Xe^{135}

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
56) Ba^{130} σ_{Ba}=1.3		.101	--	--	--	--	--	--	--	--
Ba^{132}	6	.097	--	--	--	--	--	--	--	--
Ba^{134}		2.42	--	--	--	--	--	--	--	--
Ba^{135}		6.59	--	--	--	3/2	G, G_8, K, Ma, Me, Mi, P&S	+ .831 + .837 .8363	±.003 --	K G, G_8, Ma, P&S Me
Ba^{136}		7.81	--	--	--	--	--	--	--	--
Ba^{137}		11.32	--	--	--	3/2	G, G_8, K, Ma*, Me, Mi, P&S	+ .929 .935 + .9354 + .936	.003 (G) -- .003	K G&G_8 Me Ma, P&S
Ba^{138}	.51	71.66	(137.916)	--	S*	--	--	--	--	--
57) La^{138} σ_{La}=8		.089	--	--	--	--	--	--	--	--
La^{139}	8	99.911	(138.955)	--	S	7/2	G, G_8, Ma, Me, Mi, P&S	2.76 2.8	-- --	G, G_8&Me Ma, P&S
58) Ce^{136} σ_{Ce}=1 to 6		.193	--	--	--	--	--	--	--	--
Ce^{138}		.250	--	--	--	--	--	--	--	--
Ce^{140}	>.4	88.48	--	--	--	--	--	--	--	--
Ce^{142}	1.1	11.07	--	--	--	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
59) Pr^{141} σ_{Pr}=10	10	100.	--	---	--	5/2	G, Ma, Me, Mi, P&S	--	--	--
60) Nd^{142} σ_{Nd}=46		27.13	xxx	--	--	--	--	--	--	--
Nd^{143}		12.20	xxx	--	--	--	--	--	--	--
Nd^{144}		23.87	xxx	--	--	--	--	--	--	--
Nd^{145}		8.30	xxx	--	--	--	--	--	--	--
Nd^{146}	1.5	17.18	145.964	±3	Ma	--	--	--	--	--
Nd^{148}	2.5	5.72	147.964	3	Ma	--	--	--	--	--
Nd^{150} (β^-)		5.60	149.970	3	Ma	--	--	--	--	--
61) Pm σ_{Pm} Unknown		--	--	--	--	--	--	--	--	--
62) Sm^{144} σ_{Sm} Unknown		3.16	--	--	--	--	--	--	--	--
Sm^{147}		15.07	--	--	--	--	--	--	--	--
Sm^{148}		11.27	--	--	--	--	--	--	--	--
Sm^{149}	46,000	13.84	--	--	--	--	--	--	--	--
Sm^{150}		7.47	--	--	--	--	--	--	--	--
Sm^{152} (α)	200	26.63	--	--	--	--	--	--	--	--
Sm^{154}	6	22.53	--	--	--	--	--	--	--	--

xxx= See page 31

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
63) Eu^{151} σ_{Eu} Unknown	1,380	47.77	--	--	--	5/2	F,G,G_8,Ma, Me,Mi,P&S	3.4 (μ^{151}/μ^{153} =2.24 (per Ma))	--	G,G_8,Ma,Me, Mi,P&S
Eu^{153}	x	52.23	--	--	--	5/2	F,G,G_8,Ma, Me,Mi,P&S	1.5	--	G,G_8,Ma,Me, Mi,P&S
64) Gd^{152} σ_{Gd} Unknown	<125	.20	--	--	--	--	--	--	--	--
Gd^{154}		2.15	--	--	--	--	--	--	--	--
Gd^{155}	57,000	14.78	154.977	±3.2	Ma	--	--	--	--	--
Gd^{156}		20.59	155.977	3.0	Ma	--	--	--	--	--
Gd^{157}	200,000	15.71	156.976	3.2	Ma	--	--	--	--	--
Gd^{158}		24.78	157.976	3.3	Ma	--	--	--	--	--
Gd^{160}		21.79	159.976	3.4	Ma	--	--	--	--	--
65) Tb^{159} σ_{Tb}=<33	11(→3.9h Tb^{160}) >22(→73.5d Tb^{160})	100.	--	--	--	3/2	G,G_8,Ma,Me &S	--	--	--
66) Dy^{156} σ_{Dy}=1000		.0524	--	--	--	--	--	--	--	--
Dy^{158}		.0902	--		--	--	--	--	--	--

x = for Eu^{151} and Eu^{153} = 2500b, to form long lived Eu^{152} and >20y Eu^{154}

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10^{-3}	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Dy^{160}		2.294	--	--	--	--	--	--	--	--
Dy^{161}		18.88	--	--	--	--	--	--	--	--
Dy^{162}		25.53	--	--	--	--	--	--	--	--
Dy^{163}		24.97	--	--	--	--	--	--	--	--
Dy^{164}	2620 (→145m Dy^{165}) 2860 (→1.25m Dy^{165})	28.18	--	--	--	--	--	--	--	--
67) Ho^{165} σ_{Ho}=60	60	100.	--	--	--	7/2	G, G_8, Ma, Me &S	--	--	--
68) Er^{162} σ_{Er} Unknown		.1	--	--	--	--	--	--	--	--
Er^{164}		1.5	--	--	--	--	--	--	--	--
Er^{166}		32.9	--	--	--	--	--	--	--	--
Er^{167}		24.4	--	--	--	--	--	--	--	--
Er^{168}		26.9	--	--	--	--	--	--	--	--
Er^{170}	>7	14.2	--	--	--	--	--	--	--	--
69) Tm^{169} σ_{Tm}=100	100	100.	--	--	--	1/2	G, Ma, Me&S	--	--	--
70) Yb^{168} σ_{Yb}=36		.06	--	--	--	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Yb^{170}		4.21	--	--	--	--	--	--	--	--
Yb^{171}		14.26	--	--	--	1/2	G, G_8, Ma, Me, Mi, P&S	+ .45 (μ^{173}/μ^{171} =1.4 (per Ma))	--	G, G_8, Ma, Me, Mi, P&S
Yb^{172}		21.49	--	--	--	--	--	--	--	--
Yb^{173}		17.02	--	--	--	5/2	F, G, G_8, Ma, Me, Mi, P&S	- .65	--	G, G_8, Ma, Me, Mi, P&S
Yb^{174}	~50	29.58	--	--	--	--	--	--	--	--
Yb^{176}	~6	13.38	--	--	--	--	--	--	--	--
71) Lu^{175} σ_{Lu}=>110	~20	97.5	--	--	--	7/2	F, G, G_8, Ma, Me&S	+2.6	±.5	G, G_8, Ma, Me&S
Lu^{176} (K,β^-,γ)	3640	2.5	--	--	--	≥7 7/2	F, G, G_8, Ma &Me P	+3.8	.7	G, G_8, Ma, Me&P
72) Hf^{174} σ_{Hf}=100		.18	--	--	--	--	--	--	--	--
Hf^{176}		5.30	--	--	--	--	--	--	--	--
Hf^{177}		18.47	--	--	--	≤ 3/2	G, G_8, Ma* &Me*	--	--	--
Hf^{178}		27.10	--	--	--	--	--	--	--	--
Hf^{179}		13.84	--	--	--	≤ 3/2	G, G_8, Ma* &Me*	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va. Spin =i	Vb Ref.	VIa Magnetic Moment $=\mu$	VIb Est. Error	VIc Ref.
Hf^{180}	10	35.11	--	--	--	--	--	--	--	--
73) Ta^{181} $\sigma_{Ta}=20$	21 ($\rightarrow$ 117d Ta^{182}) .034 ($\rightarrow$ 16.2m Ta^{182})	100.	(180.928)	--	S*	7/2	F, G, G_8, Ma, Me, Mi, P&S	2.1	--	G, G_8 & Me
74) W^{180} $\sigma_W=18$		.122	--	--	--	--	--	--	--	--
W^{182}		25.77	--	--	--	--	--	--	--	--
W^{183}		14.24	--	--	--	1/2(?)	G & G_8	--	--	--
W^{184}	2.1	30.68	--	--	--	--	--	--	--	--
W^{186}	34	29.17	--	--	--	--	--	--	--	--
75) Re^{185} $\sigma_{Re}=85$	101	37.07	--	--	--	5/2	F, G, G_8, Ma, Me, Mi, P&S	+3.3 (μ^{187}/μ^{185} =1.011 (per Ma))	--	G, G_8, Ma, Me, Mi, P&S
Re^{187} (β^-)	75	62.93	--	--	--	5/2	F, G, G_8, Ma, Me, Mi, P&S	+3.3	--	G, G_8, Ma, Me, Mi, P&S
76) Os^{184} $\sigma_{Os}=15$		.018	--	--	--	--	--	--	--	--
Os^{186}		1.59	--	--	--	--	--	--	--	--
Os^{187}		1.64	--	--	--	--	--	--	--	--
Os^{188}		13.3	--	--	--	--	--	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $\times 10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment $=\mu$	VIb Est. Error	VIc Ref.
Os^{189}		16.1	--	--	--	1/2	G	--	--	--
Os^{190}	2.5	26.4	190.038	±16.3	Ma	--	--	--	--	--
Os^{192}	5.3	41.0	192.038	6.3	Ma	1/2	Me	--	--	--
77) Ir^{191} $\sigma_{Ir}=470$	260 ($\rightarrow$ 1.5m Ir^{192}) 1000^{x}	38.5	191.038	10.2	Ma	1/2	G, G_8, Ma, Me*, S	μ^{191}/μ^{193} =1.0 (per Ma)	--	--
Ir^{193}		61.5	193.039	10.3	Ma	3/2	G, G_8, Ma, Me*, S			
78) Pt^{192} $\sigma_{Pt}=15$		.78	(192.05)	--	S*	--	--	--	--	--
Pt^{194}		32.8	194.039	6.4	Ma	--	--	--	--	--
Pt^{195}		33.7	195.039	4.3	Ma	1/2	A	+.6	--	G, Ma, Me, Mi, P&S
Pt^{196}	1.1 ($\rightarrow$ 18h Pt^{197}) 4.5 ($\rightarrow$ 3.3d Pt^{197})	25.4	196.039	8.1	Ma	--	--	--	--	--
Pt^{198}	3.9	7.23	198.044	6.3	Ma	--	--	--	--	--
79) Au^{197} $\sigma_{Au}=95$	96	100.	197.039	5.9	Ma	3/2	G, G_8, Ma, Me, Mi, P&S	.195 +.3	-- --	G, G_8, Me&S Ma&P
80) Hg^{196} $\sigma_{Hg}=430$	3100	.15	--	--	--	--	--	--	--	--
Hg^{198}	20	10.1	--	--	--	(0)	S	--	--	--

x = To form 70d Ir^{192} and/or (or both) 1.5m Ir^{192}

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error $x10^{-3}$	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
Hg^{199}	2500	17.0	--	--	--	1/2	G, G_8, Ma, Me&P μ^{199}/μ^{201} = -.9018 (per Ma)	+.547	±.002	G, G_8, Ma&Me
Hg^{200}	<60	23.3	(200.028)	--	S*	(0)	S	--	--	--
Hg^{201}	<60	13.2	--	--	--	3/2	F, G, Ma, Me, Mi, G_8, P&S	-.607	.003	G, G_8, Ma&Me
Hg^{202}	2.4	29.6	--	--	--	(0)	S	--	--	--
Hg^{204}	.34	6.7	--	--	--	(0)	S	--	--	--
81) Tl^{203} σ_{Tl}=3	7.6	29.1	203.059	±9.2	Ma	1/2	G, G_8, Ma, Me Mi, P&S	1.5541 +1.45 1.44 μ^{205}/μ^{203} =1.0097 (per Ma)	.0005 -- --	G_8 G, Ma, Me&S P
Tl^{205}	.11	70.9	205.059	9.2	Ma	1/2	G, G_8, Ma, Me, Mi, P&S	1.6254 +1.45 1.628	.0005 -- --	G_8 G, Ma, Me, Mi, P&S Poss (11)
82) Pb^{204} σ_{Pb}=.2		1.5	(204.058)	--	S	(0)	S	--	--	--
Pb^{206}		23.6	206.061	9.2	Ma	--	--	--	--	--
Pb^{207}		22.6	--	--	--	1/2	G, G_8, Ma, Me, Mi, P&S	+ .6	--	G, G_8, Ma, Me, Mi, P&S
Pb^{208}	.00045	52.3	208.060	9.0	Ma	(0)	S	--	--	--

I Isotope & Elemental Cross Section (σ in barns)	II Isotopic Cross Section (σ in barns)	III Abundance (in %)	IVa Exact Mass	IVb Est. Error x10-3	IVc Ref.	Va Spin =i	Vb Ref.	VIa Magnetic Moment = μ	VIb Est. Error	VIc Ref.
83) Bi^{209} σ_{Bi}=.015	.015	100.	209.056	±8.6	Ma	9/2	F, G, G_8, Ma, Me, Mi, P&S	3.45 +3.6 3.8 (4.0)	-- -- -- --	G, G_8&Me Ma P S
90) Th^{232}(α)		100.	--	--	--	--	--	--	--	--
91) Pa^{231} (α,γ)		--	--	--	--	3/2	G, G_8, Ma&Me	--	--	--
92) U^{234}(α)		.0051	--	--	--	--	--	--	--	--
U^{235} (α,γ)		.71	--	--	--	5/2 (7/2)	G&G_8	--	--	--
U^{238}(α)		99.28	--	--	--	--	--	--	--	--
93) Np^{237}(α)		--	--	--	--	5/2	Tompkins (12)&G_8	--	--	--

xxx = Intensity Ratios of Mass Numbers of Neodymium

142/144 = 1.15 ± .01
142/146 = 1.57 ± .03
146/143 = 1.25 ± .03
143/145 = 1.42 ± .02
145/148 = 1.34 ± .03
148/150 = 1.15 ± .01

(1) Bloch, Phys. Rev. 74, p. 1044, November, 1948.

(2) Arnold & Roberts, Phys. Rev. 71, 878-12, June, 1947; 70, 766, 1946.

(3) Hughes, Phys. Rev. 70, 219, 1946.

(4) Anderson & Novick, Phys. Rev. 73, 919-8, April, 1948.

(5) Jenkins, Phys. Rev. 73, 639, March, 1948; 74, 355-4, August, 1948.

(6) Pound, Phys. Rev. 73, 1112-9, May, 1948.

(7) Townes, Phys. Rev. 74, 626, September, 1948.

(8) Pound, Phys. Rev. 73, 523-5, March, 1948.

(9) Pound, Phys. Rev. 72, 1273-12, December, 1947.

(10) Meeks, Phys. Rev. 72, 169-2, July, 1947.

(11) Poss, Phys. Rev. 72, 637, October, 1947.

(12) Tompkins, Phys. Rev. 73, 1214, May, 1948.