NEUTRON SCATTERING AND ABSORPTION PROPERTIES*

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This Table presents an evaluated set of values for the experimental quantities, which characterize the properties for scattering and absorption of neutrons. The neutron cross section is given for room temperature neutrons, 20.43° C, corresponds to a thermal neutron energy of 0.0253 electron volts (eV) or a neutron velocity of 2200 meters/second. The neutron resonance integral is defined over the energy range from 0.5 eV to 0.1 x 10^6 eV, or 0.1 MeV. Bound neutron scattering lengths and neutron cross sections averaged over a maxwellian spectrum at 30 keV for astrophysical applications are also presented. A list of the major references used is given below. The literature cutoff date is December 1996. Uncertainties are given in parentheses. Parentheses with two or more numbers indicate values to the excited state(s) and to the ground state of the product nucleus. Discussions with Frank Feiner and Harold Knox of KAPL on thermal cross sections and resonance integrals and the assistance of Felicia Kramer in assembling this file are gratefully acknowledged.

TABLE LAYOUT

Column No.	Column Title	Description
1	Isotope or Element	For elements, the atomic number and chemical symbol are listed. For nuclides, the mass number and chemical symbol are listed. Isomers are indicated by the addition of m, m1, or m2.
2	Isotopic Abundance	in atom percent.
3	Half-life	Half-life in decimal notation. μs = microseconds; ms = milliseconds; s = seconds; m = minute; h = hours; d = days; and y = years.
4	Thermal Neutron Cross Section	Cross sections for neutron capture reactions in barns (10^{-24} cm^2) or in millibarns (mb). Proton, alpha production and fission reactions are designated by σ_p, σ_a, σ_f, respectively. Separate values are listed for isomeric production.
5	Neutron Resonance Integral	Resonance integrals for neutron capture reactions in barns (10^{-24} cm^2) or millibarns (mb). Proton, alpha production and fission reactions are designated by RI_p, RI_a, RI_f, respectively. Separate values are listed for isomeric production.
6	Neutron Scattering Length	Bound Coherent scattering length for neutron scattering reactions in units of femtometer (fm), which is equal to fermis (10^{-13} cm).
7	Maxwellian Averaged Cross Section	Astrophysical Cross Sections, averaged over a stellar neutron maxwellian spectrum characterized by a thermal energy of 30 keV, expressed in barns (10^{-24} cm^2), millibarns (mb) or microbarns (μb).

GENERAL NUCLEAR DATA REFERENCES

The following references represent the major sources of the neutron data presented:

1. Mughabghab, S.F.; Divadeenam, M.; Holden, N.E.; Neutron Cross Sections, Vol. I *Neutron Resonance Parameters and Thermal Cross Sections* Part A Z=1-60. Academic Press Inc., New York, New York (1981); Mughabghab, S.F.; Part B, Z-61-100. Academic Press Inc., Orlando, Florida (1984).

2. Parrington, J.R.; Knox, H.D.; Breneman, S.L.; Baum, E.M.; Feiner, F.: *Chart of the Nuclides, 15th Edition*, Knolls Atomic Power Laboratory (Oct. 1996).

3. Holden, N.E.; *Fifty Years with Nuclear Fission* Conference, Wash., D.C., Gaithersburg, Md. April 26-29, 1989, p. 946. American Nuclear Society, LaGrange Park, Illinois (1989).

4. Holden, N.E.; *Review of Thermal Neutron Cross Sections and Isotopic Composition of the Elements*, BNL-NCS-42224 (March 1989) and Holden, N.E.; *Thermal Neutron Cross Sections for the 1991 Table of the Isotopes*, BNL-45255 (Feb. 1991).

5. Tuli, J.K.; *Nuclear Wallet Cards*, Brookhaven National Laboratory (July 1995).

6. Holden, N.E.; *Half-lives of Selected Nuclides*, Pure & Applied Chemistry 62, 941 (1990).

7. Koester, L; Rauch, H.; Seymann, E.; *Neutron Scattering Lengths: A Survey of Experimental Data and Methods*, Atomic Data Nuclear Data Tables 49, 65 (1991).

8. Sears, V.F.; *Neutron Scattering Lengths and Cross Sections*, Neutron News 3, (3), 26 (1992).

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Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
$_{1}$H			0.332(2)	0.149(1)	- 3.739(1)	
^{1}H	99.985(1)		0.332(2)	0.149(1)	- 3.741(1)	0.25(2) mb*
^{2}H	0.015(1)		0.51(1)mb	0.23(2) mb	6.671(4)	
^{3}H		12.32 y	< 6. μb		4.79(3)	
$_{2}$He			< 0.05		3.26(3)	
^{3}He	1.37x10^{-6}		σ_p=5.33(1)x10^{3}	RI$_p$=2.39(1)x10^{3}	5.74(7)	
			0.05(1) mb			8.(1) μb*
^{4}He	≈ 100.				3.26(3)	
$_{3}$Li			71.(2)	32.(1)	- 1.90(2)	
^{6}Li	7.5(2)		σ_α=9.4(1)x10^{2}	RI$_\alpha$=422.(4)	2.0(1)	
			39.(5) mb	17.(2) mb		
^{7}Li	92.5(2)		45.(5) mb	20.(2) mb	- 2.22(2)	39(6) μb
$_{4}$Be			8.8(4) mb	3.9(2) mb	7.79(1)	
^{7}Be*		53.28 d	σ_p=3.9(1)x10^{4}	RI$_p$=1.75(5)x10^{4}	σ_p 16(4)	
			$\sigma_\alpha \approx$ 0.1			
^{9}Be	100.		8.8(4) mb	3.9(2) mb	7.79(1)	
^{10}Be		1.52x10^{6} y	<1. mb			
$_{5}$B			7.6(1)x10^{2}	343.(5)	5.30(4)	
^{10}B	19.9(2)		σ_α=38.4(1)x10^{2}	RI$_\alpha$=17.3(1)x10^{2}	- 0.1(3)	
			0.3(1)	0.13(4)		
			σ_p=7.(1) mb			
			σ_t=8.(2) mb			
^{11}B	80.1(2)		5.(3) mb	2(1) mb	6.65(4)	
$_{6}$C			3.5(1) mb	1.6(1) mb	6.646(1)	
^{12}C	98.89(1)		3.5(1) mb	1.6(1) mb	6.651(2)	16(1) μb*
^{13}C	1.11(1)		1.4(1) mb	1.7(2) mb	6.19(9)	0.2(1) mb
^{14}C		5715. y	<1. μb			1.5(4) μb*
$_{7}$N			1.9(1)	0.85(5)	9.36(2)	
^{14}N	99.634(9)		σ_p=1.83(7)	RI$_p$=0.82(3)	9.37(2)	σ_p 1.8(2) mb*
			0.080(1)	0.034(1)		0.04(7) mb
^{15}N	0.366(9)		0.04(1) mb	0.11(3) mb	6.44(3)	4.9(5) μb*
$_{8}$O			0.29(1) mb	0.40(4) mb	5.805(4)	
^{16}O	99.76(1)		0.19(1) mb	0.36(4) mb	5.805(5)	34(4) μb
^{17}O	0.04		σ_α=0.24(1)	0.11(1)	5.8(2)	σ_α 3.9(5) mb*
			0.54(7) mb	0.39(5) mb		
^{18}O	0.20(1)		0.16(1) mb	0.81(4) mb	5.84(7)	7.2(6) μb*

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
$_{9}$F			9.5(7) mb	21.(3) mb	5.65(1)	
^{19}F	100.		9.5(7) mb	21.(3) mb	5.65(1)	6.(1) mb
$_{10}$Ne			42(5) mb	19(3) mb	4.566(6)	
^{20}Ne	90.48(3)		39(5) mb	18(3) mb	4.631(6)	0.12(1) mb
^{21}Ne	0.27(1)		0.7(1),σ_α<1.5	0.31(5)	6.7(2)	≈ 1.6 mb
^{22}Ne	9.25(3)		51(5) mb	23(3) mb	3.87(1)	60.(5) μb*
$_{11}$Na			0.53(2)	0.32(2)	3.63(2)	2.3(2) mb
^{22}Na		2.605 y	σ_p=2.8(3)x10^4 σ_α=2.6(4)x10^2	< 2x10^5 1.2(2) x 10^2		
^{23}Na	100.		σ_m=0.43(3)	RI_m=0.30(6)	3.63(2)	
$_{12}$Mg			66(6) mb	38.(5) mb	5.375(4)	
^{24}Mg	78.99(3)		0.053(6)	32.(4) mb	5.7(2)	4.2(2) mb
^{25}Mg	10.00(1)		.20(1)	98.(15) mb	3.6(2)	6.5(3) mb
^{26}Mg	11.01(2)		.038(1)	25.(2) mb	4.9(2)	66.(3) μb
^{27}Mg		9.45 m	0.07(2)	0.03(1)		
$_{13}$Al			0.230(2)	0.17(1)	3.45(1)	
^{26}Al			σ_p ≈ 2.1			0.14(2)
^{27}Al	100.		0.230(2)	0.17(1)	3.45(1)	3.8(3) mb
$_{14}$Si			0.166(9)	0.12(2)	4.15(1)	
^{28}Si	92.21(2)		0.17(1)	0.11(2)	4.11(1)	1.8(2) mb
^{29}Si	4.69(2)		0.12(1)	0.08(2)	4.7(1)	7.9(9) mb
^{30}Si	3.10(1)		0.107(4)	0.62(6)	4.61(1)	6.4(6) mb
^{31}Si		2.62 h	73.(6) mb	33.(3) mb		
$_{15}$P			0.17(1)	0.08(1)	5.13(1)	
^{31}P	100.		0.17(1)	0.08(1)	5.13(1)	1.7(1) mb
$_{16}$S			0.54(2)	0.24(2)	2.847(1)	
^{32}S	95.02(9)		0.55(5) σ_α < 0.5 mb	0.25(2)	2.804(2)	4.7(2) mb
^{33}S	0.75(4)		0.46(3) σ_α = 0.12(1) σ_p = 2 mb	0.21(2) RI_α = 0.05(1)	4.7(2)	7.4(15) mb σ_α = 0.18(1)
^{34}S	4.21(8)		0.30(2)	0.13	3.48(3)	2.9(9) mb
^{36}S	0.02(1)		0.23(2)	0.26(3)		0.17(1) mb
$_{17}$Cl			33.6(3)	15.(2)	9.58(1)	
^{35}Cl	75.77(7)		43.7(4);σ_p=0.44(1) σ_α ≈ 0.08 mb	20.(2);RI_p=0.2	11.7(1)	10.(3) mb σ_p 1.7(2) mb

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{36}Cl		3.01x10^5 y	σ_p=46.(2) mb <10. σ_α = 0.59(7) mb	RI$_p$=0.02		σ_p 91.(8) mb σ_α 0.9(2) mb
^{37}Cl	24.23(7)		(0.05 + 0.38)	(0.04+0.26)	3.1(1)	2.15(8) mb
$_{18}$Ar			0.66(3)	0.42(5)	1.91(1)	
^{36}Ar	0.337(3)		5(1);σ_p<1.5 mb σ_α 6(1) mb	2.(1)	24.9(1)	
^{37}Ar		35.0 d	σ_α=2.0(3)x10^3 σ_p = 69(14)	RI$_\alpha$=900. RI$_p$=31.		
^{38}Ar	0.063(1)		0.8(2)	0.4(1)	3.5(35)	
^{39}Ar		268. y	6.(2)x10^2			
^{40}Ar	99.600(3)		0.64(3)	0.41(5)	1.83(1)	2.3(2)mb
^{41}Ar		1.82 h	0.5(1)	0.2(1)		
$_{19}$K			2.1(1)	1.0(1)	3.67(2)	
^{39}K	93.2581(44)		2.1(2) σ_α = 4.3(5) mb σ_p < 0.05 mb	0.9(1)	3.74(2)	11.8(4)mb
^{40}K	0.0117(1)	1.26x10^9 y	30.(8) σ_p=4.4(4) σ_α = 0.42(8)	13.(4) 2.0(2)		σ_p .7(1)mb σ_α 40(6)mb
^{41}K	6.7302(44)		1.46(3)	1.4(2)	2.69(8)	22.0(7)mb
$_{20}$Ca			0.43(2)	0.23(2)	4.70(2)	
^{40}Ca	96.941(18)		0.41(3) σ_α 0.13(4) mb	0.22(4)	4.80(2)	6.7(7)mb
^{41}Ca		1.02x10^5 y	≈ 4. σ_α = 0.19			
^{42}Ca	0.647(9)		0.65(10)	0.39(4)	3.4(1)	16.(2)mb
^{43}Ca	0.135(6)		6.(1)	3.9(2)	- 1.56(9)	51.(6)mb
^{44}Ca	2.086(12)		0.8(2)	0.56(1)	1.42(6)	9.(1)mb
^{45}Ca		162.7 d	≈ 15.			
^{46}Ca	0.004(3)		0.70(3)	0.9(1)	3.6(2)	5.7(5)mb
^{48}Ca	0.187(4)		1.1(1)	0.5(1)	0.39(9)	1.0(2)mb
$_{21}$Sc			27.2(2)	12.(1)	12.3(1)	
^{45}Sc	100.		(10.+17.)	(5.6+6.4)	12.3(1)	90.(6)mb
^{46}Sc		83.81 d	8.(1)	3.6(5)		
$_{22}$Ti			6.1(1)	2.8(2)	- 3.438(2)	
^{46}Ti	8.25(3)		0.6(2)	0.4(1)	4.93(6)	27.(3)mb
^{47}Ti	7.44(2)		1.6(2)	1.6(2)	3.63(1)	64.(8)mb
^{48}Ti	73.72(3)		7.9(9)	3.6(2)	- 6.09(2)	31.(5)mb
^{49}Ti	5.41(2)		1.9(5)	1.2(2)	1.04(5)	22.(2)mb
^{50}Ti	5.18(2)		0.179(3)	0.12(2)	6.18(8)	4.0(5)mb

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
$_{23}$V			5.0(2)	2.8(1)	- 0.382(1)	
^{50}V	0.250(4)	>1.4x10^{17} y	21(4)	50.(20)	7.6(6)	
			σ_p = 0.7(4) mb			
^{51}V	99.750(4)		4.9(1)	2.7(2)	- 0.402(2)	42.(3)mb
$_{24}$Cr			3.0(2)	1.7(1)	3.635(7)	
^{50}Cr	4.345(13)		15.(1)	8.(1)	- 4.5(1)	52.(1)mb
^{51}Cr		27.70 d	< 10.			
^{52}Cr	83.79(2)		0.8(1)	0.6(2)	4.91(2)	8.8(4)mb
^{53}Cr	9.50(2)		18.(2)	9(1)	- 4.2(1)	0.06(1)
^{54}Cr	2.365(7)		0.36(4)	0.25(5)	4.6(1)	7.(2)mb
$_{25}$Mn			13.3(1)	14.0(3)	- 3.75(2)	
^{53}Mn		3.7x10^{6} y	70.(10)	32.(5)		
^{54}Mn		312.2 d	< 10.			
^{55}Mn	100.		13.3(1)	14.0(3)	- 3.75(2)	40.(2)mb
$_{26}$Fe			2.6(1)	1.4(2)	9.45(2)	
^{54}Fe	5.85(4)		2.7(5)	1.3(2)	4.2(1)	29.(2)mb
			σ_α = 10 μb	RI$_\alpha$ = 1.1(1) mb		
^{55}Fe		2.73 y	13.(2)	6.(1)		
			σ_α = 0.03			
^{56}Fe	91.75(4)		2.6(2)	1.4(2)	9.93(3)	13.5(5)mb
^{57}Fe	2.12(1)		2.5(5)	1.6(2)	2.3(1)	35.(4)mb
^{58}Fe	0.28(1)		1.3(1)	1.3(2)	15.(7)	13.(2)mb
^{59}Fe		44.51 d	13.(3)	6.(1)		
$_{27}$Co			37.19(8)	74.(2)	2.49(2)	
^{58m}Co		9.1 h	1.4(1)x10^{5}	2.5(10)x10^{5}		
^{58}Co		70.88 d	1.9(2)x10^{3}	7.(1)x10^{3}		
^{59}Co	100.		(20.7+16.5)	(39.+35.)	2.49(2)	38.(4)mb
^{60m}Co		10.47 m	58.(3)	230.(50)		
^{60}Co		5.271 y	2.0(2)	4.3(10)		
$_{28}$Ni			4.5(2)	2.3(2)	10.3(1)	
^{58}Ni	68.077(9)		4.6(4)	2.3(2)	14.4(1)	42.(3)mb
			σ_α < 0.03 mb			
^{59}Ni		≈7.6x10^{4} y	σabs=92.(4)	RIabs=1.4(1)x10^{2}		
			σ_α = 14(2)			
			σ_p = 2(1)			
^{60}Ni	26.223(8)		2.9(3)	1.5(2)	2.8(1)	27.(2)mb
^{61}Ni	1.140(1)		2.5(5)	1.5(4)	7.60(6)	82.(1)mb
			σ_α = 0.03 mb			
^{62}Ni	3.634(2)		15.(1)	6.8(3)	- 8.7(2)	36.(4)mb
^{63}Ni		100. y	20(5)	9.(2)	26.(8)mb	
^{64}Ni	0.926(1)		1.6(1)	1.(2)	- 0.37(7)	10.(1)mb
^{65}Ni		2.517 h	22.(2)	10.(1)		
$_{29}$Cu			3.8(1)	4.1(4)	7.718(4)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{63}Cu	69.17(3)		4.5(2)	5.(1)	6.43(15)	0.09(1)
^{64}Cu		12.701 h	$\approx$ 270.			
^{65}Cu	30.83(3)		2.17(3)	2.2(1)	10.61(19)	53(5)mb
^{66}Cu		5.09 m	1.4(1)x10^2	60.(20)		
$_{30}$Zn			1.1(2)	2.8(4)	5.680(5)	
^{64}Zn	48.6(6)		0.74(5) σ_p < 12 μb σ_α = 11(3) μb	1.4(3)	5.23(4)	59(5)mb
^{65}Zn		243.8 d	66.(8) σ_α = 2.0(2)	30.(4)		
^{66}Zn	27.9(3)		0.9(3) σ_α < 0.02 mb	1.8(2)	5.98(5)	35(3)mb
^{67}Zn	4.1(1)		6.9(1.4) σ_α = 0.4 mb	25.(5)	7.58(8)	0.15(2)
^{68}Zn	18.8(5)		(0.072 + 0.8) σ_α <0.02 mb	(0.2 + 2.9)	6.04(3)	19(2)mb
^{70}Zn	0.6(3)		(8.1+83.) mb	0.9(2)		
$_{31}$Ga			2.9(1)	22.(3)	7.288(2)	
^{69}Ga	60.11(3)		1.68(7)	16.(2)	7.88(4)	0.15(1)
^{71}Ga	39.89(3)		4.7(2);σ_m=0.15(5)	31.(3)	6.40(3)	0.12(1)
$_{32}$Ge			2.2(1)	6.(2)	8.19(2)	
^{70}Ge	21.23(4)		(0.3 + 2.7)	2.3(1)	10.0(1)	86(5)mb
^{72}Ge	27.66(3)		0.9(2)	0.8(3)	8.5(1)	0.06(2)
^{73}Ge	7.73(1)		15.(1)	66.(20)	5.02(4)	0.28(8)
^{74}Ge	35.94(2)		(0.14 + 0.28)	(0.4+0.5)	7.6(1)	54(6)mb
^{76}Ge	7.44(2)		(0.09 + 0.06)	(1.3+0.6)	8.2(15)	16(1)mb
$_{33}$As			4.0(4)	61.(5)	6.58(1)	
^{75}As	100.		4.0(4)	61.(5)	6.58(1)	0.46(2)
$_{34}$Se			12.(1)	14.(3)	7.970(9)	
^{74}Se	0.89(4)		50.(2)	520(50)	0.8(3)	
^{75}Se		119.78 d	3.3(10)x10^2			
^{76}Se	9.37(29)		(22. + 63.)	(9.+31.)	12.2(1)	164(8)mb
^{77}Se	7.63(16)		42.(4),σ_α=0.97(3)μb	30.(5)	8.25(8)	
^{78}Se	23.77(28)		σ_m=0.38(2)	RI$_m$=4.3(4)	8.24(9)	0.08
^{80}Se	49.61(41)		(0.06+0.35)	(0.36+1.0)	7.48(3)	44.(3)mb
^{82}Se	8.73(22)		(39.+ 5.2) mb	39.(4)mb	6.34(8)	
$_{35}$Br			6.8(2)	92.(8)	6.79(2)	
^{76}Br		16.0 h	224.(42)			
^{79}Br	50.69(7)		(2.5+8.3)	(36.+96)	6.79(7)	0.74(3)
^{81}Br	49.31(7)		(2.4+0.24)	51.(5)	6.78(7)	0.24(1)
$_{36}$Kr			24.(1)	39.(6)	7.81(2)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{78}Kr	0.35(1)		(0.17+6.)	20.(1)		0.34(4)
^{80}Kr	2.28(6)		(4.6+7.)	57.(6)		0.24(1)
^{82}Kr	11.58(14)		(14.+7.)	130.(13)		79(6)mb
^{83}Kr	11.50(6)		183.(30)	183.(20)	0.24(2)	
^{84}Kr	56.99(4)		σ_m=0.09;σ_m+g=0.11	2.4(3)	(17+17)mb	
^{85}Kr		10.73 y	1.7(2)	1.8(10)		0.07(2)
^{86}Kr	17.30(22)		3.(2)mb	≈1. mb	8.1(3)	3.5(3)mb
$_{37}$Rb			0.39(4)	6.(3)	7.08(2)	
^{84}Rb		32.9 d	σ_p=12.(2)			
^{85}Rb	72.17(2)		(0.06+0.38)	(0.7+7.)	7.0(1)	240(9)mb
^{86}Rb		18.65 d	<20.			
^{87}Rb	27.83(2)	4.88x10^{10} y	0.10(1)	2.3(4)	7.3(1)	18.0(5)mb
^{88}Rb		17.7 m	1.2(3)	0.5(1)		
$_{38}$Sr			1.2(1)	10.(1)	7.02(2)	
^{84}Sr	0.56(1)		(0.6+0.2)	(9.+1.)		
^{86}Sr	9.86(1)		σ_m=0.81(4)	RI$_m$=4.(1)	5.68(5)	(48+22)mb
^{87}Sr	7.00(1)		16.(3)	118.(30)	7.41(7)	97.(5)mb
^{88}Sr	82.58(1)		5.8(4)mb	0.07(3)	7.16(6)	6.1(2)mb
^{89}Sr		50.52 d	0.42(4)	0.2		
^{90}Sr		29.1 y	9.7(7)mb	4. mb		
$_{39}$Y			1.25(5)	1.0(1)	7.75(2)	
^{89}Y	100.		(0.001+1.25)	(0.006+1.0)	7.75(2)	19.(1)mb
^{90}Y		2.67 d	<6.5			
^{91}Y		58.5 d	1.4(3)	0.6(1)		
$_{40}$Zr			0.19(1);σ_α<0.1mb	0.95(9)	7.16(3)	
^{90}Zr	51.45(40)		≈0.014	0.2(1)	6.4(1)	21.(2)mb
^{91}Zr	11.22(5)		1.2(3)	5.(2)	8.8(1)	60.(8)mb
^{92}Zr	17.15(8)		0.2(1)	0.6(2)	7.5(2)	33.(4)mb
^{93}Zr		1.5x10^6 y	<4.	16.(5)		0.10(1)
^{94}Zr	17.38(28)		0.049(6)	0.25(3)	8.3(2)	26.(1)mb
^{96}Zr	2.80(9)		0.020(3)	5.0(5)	5.5(1)	10.0(3)mb
$_{41}$Nb			1.11(1);σ_α<0.1mb	8.5(6)	7.14(3)	
^{93}Nb	100.		1.1;σ_m=0.86	(6.3+2.2)	7.14(3)	266.(5)mb
^{94}Nb		2.4x10^4 y	σ_m+g=15.(1) σ_m=0.6(1)	126.(13)		
^{95}Nb		34.97 d	<7.	<200.		
$_{42}$Mo			2.5(1),σ_α<0.1mb	26.(5)	6.72(2)	
^{92}Mo	14.84(35)		0.06,σ_m=0.2μb	≈0.8	6.93(8)	
^{94}Mo	9.25(12)		0.02	≈0.8	6.82(7)	
^{95}Mo	15.92(13)		13.4(3),σ_α=30.(4)μb	109.(5)	6.93(6)	0.29(1)
^{96}Mo	16.68(2)		0.5	17.(3)	6.22(6)	112.(5)mb

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{97}Mo	9.55(8)		2.5(2),σ_α=0.4(2)μb	14.(3)	7.26(8)	0.34(1)
^{98}Mo	24.13(31)		0.14(1)	7.2(7)	6.60(7)	99.(5)mb
^{100}Mo	9.63(23)		0.19(1)	3.6(3)	6.75(7)	
$_{43}$Tc						
^{98}Tc		4.2x10^6 y	σ_m = 0.9(2)			
^{99}Tc		2.13x10^5 y	23.(2)	4.0(4)x10^2	6.8(3)	0.78(4)
$_{44}$Ru			2.6 (1)	48.(5)	7.03(3)	
^{96}Ru	5.52(20)		0.23(4)	7.(2)		
^{98}Ru	1.86(9)		< 8.			
^{99}Ru	12.74(26)		4.(1)	195.(20)		
^{100}Ru	12.60(19)		5.8(6)	11.(2)		0.21(1)
^{101}Ru	17.05(7)		5.(1),σ_α<0.15μb	1.1(3)x10^2		1.00(4)
^{102}Ru	31.57(31)		1.2(1)	4.3(5)		0.19(1)
^{103}Ru		39.27 d	<20.	≈30.		
^{104}Ru	18.66(44)		0.49(2)	6.(2)		0.16(1)
^{105}Ru		4.44 h	0.29(3)	0.13(1)		
^{106}Ru		1.020 y	0.15(4)	2.0(6)		
$_{45}$Rh			145.(2)	1.2(1)x10^3	5.88(4)	
^{103}Rh	100.		(11.+ 134.)	(0.08+1.1)x10^3	5.88(4)	0.81(1)
^{104m}Rh		4.36 m	800.(100)			
^{104}Rh		42.3 s	40.(30)			
^{105}Rh		35.4 h	1.1(3)x10^4	1.7(4)x10^4		
$_{46}$Pd			7.(1)	82.(8)	5.91(6)	
^{102}Pd	1.02(1)		3.2(10)	10.(2)		
^{104}Pd	11.14(11)			16.(2)		
^{105}Pd	22.33(13)		22.(2),σ_α=0.5(2)μb	60.(20)	5.5(3)	1.20(6)
^{106}Pd	27.33(6)		(0.013+0.28)	(0.2+5.5)	6.4(4)	0.25(3)
^{107}Pd		6.5x10^6 y	1.8(2)	108.(4)		1.34(6)
^{108}Pd	26.46(15)		(0.19+8.5)	(2.+240.)	4.1(3)	0.20(2)
^{110}Pd	11.72(16)		(0.033+0.7)	(0.7+8.)		0.15(2)
$_{47}$Ag			62.(1)	767.(60)	5.922(7)	
^{107}Ag	51.839(8)		(0.37+35.)	(1.2+105.)	7.56(1)	0.80(2)
^{109}Ag	48.161(8)		(4.2 + 87.)	(0.7+14.1)x10^2	4.17(1)	0.78(2)
^{110m}Ag		249.8 d	82.(11)	20.(4))		
^{111}Ag		7.47 d	3.(2)	105.(20)		
$_{48}$Cd			2.52(5)x10^3	73.(8)	4.87(5)	
^{106}Cd	1.25(6)		0.20(3)	4.(1)		0.56(6)
^{108}Cd	0.89(3)		1.	14.(3)	5.4(1)	0.41(7)
^{109}Cd		462.0 d	≈180.,σ_α<0.05	6.7(12)x10^3		
^{110}Cd	12.49(18)		(0.06+11.)	(6.+34.)	5.9(1)	0.25(3)
^{111}Cd	12.80(12)		3.5(20)	51.(6)	6.5(1)	1.06(13)
^{112}Cd	24.13(21)		(0.012+2.2)	15.	6.4(1)	0.23(3)
^{113}Cd	12.22(12)	9x10^{15} y	2.06(4)x10^4,σ_α<1.μb	390.(40)	- 8.0(2)	0.73(8)

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{114}Cd	28.73(42)		(0.04+0.29)	16.(7)	7.5(1)	0.16(3)
^{116}Cd	7.49(18)		(26.+52.)mb	1.2	6.3(1)	0.09(1)
$_{49}$In			197.(4)	3.3(2)x10^{3}	4.07(2)	
^{113}In	4.29(5)		(3.1+5.0+3.9)	(220.+90)	5.39(6)	0.79(7)
^{115}In	95.71(5)	4.4x10^{14} y	(88.+73.+44.)	(1.5+1.2+0.7)x10^{3}	4.01(2)	0.74(7)
$_{50}$Sn			0.61(3)	8.(2)	6.225(2)	
^{112}Sn	0.97(1)		(0.15+0.40)	(8.+19.)		0.20(5)
^{113}Sn		115.1 d	≈ 9.	210.(50)		
^{114}Sn	0.66(1)		≈ 0.12	5.(1)	6.2(3)	134.(3) mb
^{115}Sn	0.34(1)		σ_α=0.06 mb	29.(6)		0.34(1)
^{116}Sn	14.54(9)		(0.006+0.14)	(0.5+11.)	5.93(5)	91.(2)mb
^{117}Sn	7.68(7)		1.1(1)	16.(5)	6.48(5)	319.(7)mb
^{118}Sn	24.22(9)		σ_m=4. mb	4.7(5)	6.07(5)	62.(1)mb
^{119}Sn	8.58(4)		2.(1)	2.9(5)	6.12(5)	0.25(5)
^{120}Sn	32.59(9)		(0.001+0.13)	1.2(3)	6.49(5)	(0.5+36)mb
^{122}Sn	4.63(3)		(0.15+0.001)	0.81(4)	5.74(5)	
^{124}Sn	5.79(5)		(0.13+0.005)	RI_m=8.0(2)	5.97(5)	
$_{51}$Sb			5.2(2)	169.(20)	5.57(3)	
^{121}Sb	57.21(5)		(0.4+5.6)	(13.+192.)	5.71(6)	0.53(2)
^{123}Sb	42.79(5)		(0.02+0.04+4.0)	(1.+119.)	5.38(7)	0.30(1)
^{124}Sb		60.20 d	17.(3)	≈8.		
$_{52}$Te			4.2(1)	47.(3)	5.80(3)	
^{120}Te	0.096(2)		(0.25+2.0)	≈1.	5.3(5)	
^{122}Te	2.603(4)		2.4(5)	80.(20)	3.8(2)	295.(3)mb
^{123}Te	0.908(2)	1.3x10^{13} y	370.(40),σ_α=0.05mb	4.5(3)x10^{3}	- 0.05	0.83(1)
^{124}Te	4.816(6)		(0.05+7.)	5.2(7)	8.0(1)	155.(2)mb
^{125}Te	7.139(6)		1.6(2)	21.(4)	5.02(8)	431.(4)mb
^{126}Te	18.952(11)		(0.12+0.8)	8.2(6)	5.56(7)	81.(1)mb
^{128}Te	31.687(11)		(0.016+0.20)	(0.08+1.5)	5.89(7)	
^{130}Te	33.799(10)	2.5x10^{21} y	(0.03+0.20)	(0.08+0.34)	6.02(7)	
$_{53}$I			6.15(10)	148.(7)	5.28(2)	
^{125}I		59.4 d	900.(100)	1.4(2)x10^{4}		
^{127}I	100.		6.15(10)	148.(7)	5.28(2)	0.64(3)
^{128}I		25.00 m	22.(4)	≈10.		
^{129}I		1.7x10^{7} y	(20.7+10.3)	36.(4)		0.44(2)
^{130}I		12.36 h	18.(3)	≈8.		
^{131}I		8.040 d	≈ 0.7	8.(4)		
$_{54}$Xe			25.(1)	263.(50)	4.92(3)	
^{124}Xe	0.09(1)		(28.+137.)	(0.6+3.0)x10^{3}		
^{125}Xe		17.1 h	σ_α≤<0.03			
^{126}Xe	0.09(1)		(0.45+3.)	(8.+52.)		
^{127}Xe		36.4 d	σ_α≤0.01			

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{128}Xe	1.92(3)		σ_m=0.48	RI_m=38.(10)		0.35(11)
^{129}Xe	26.44(24)		22.(5)	250.(50)		0.76(7)
^{130}Xe	4.08(2)		σ_m=0.45	RI_m=16.(4)		0.18(5)
^{131}Xe	21.18(3)		90.(10)	9.(1)x10^2		0.45(8)
^{132}Xe	26.89(6)		(0.05+0.4)	(0.9+3.7)		65.(5)mb
^{133}Xe		5.243 d	190.(90)			
^{134}Xe	10.44(10)		(0.003 + 0.26)	0.40(4)		20.(2)mb
^{135}Xe		9.10 h	2.65(11)x10^6	7.6(5)x10^3		
^{136}Xe	8.87(16)		0.26(2)	0.7(2)		0.9(1)mb
$_{55}$Cs			30.4(8)	422.(50)	5.42(2)	
^{132}Cs		6.48 d	σ_α< 0.15			
^{133}Cs	100.		(2.7+27.7)	(32.+390.)	5.42(2)	0.51(2)
^{134}Cs		2.065 y	140.(10)	54.(9)		
^{135}Cs		2.3x10^6 y	8.9(5)	90.(20)		
^{137}Cs		30.2 y	0.25(1)	0.36(7)		
$_{56}$Ba			1.3(2)	10.(2)	5.07(3)	
^{130}Ba	0.106(1)		(1.+8.)	(25.+200.)	- 3.6(6)	
^{132}Ba	0.101(1)		(0.84+9.7)	(4.7+24.)	7.8(3)	
^{133}Ba		10.53 y	4.(1)	85.(30)		
^{134}Ba	2.417(18)		(0.1+1.3)	(5.6+18.)	5.7(1)	0.18(6)
^{135}Ba	6.592(12)		(0.014+5.8)	(0.47+131.)	4.7(1)	0.30(6)
^{136}Ba	7.854(24)		(0.010+0.44)	(0.1+1.5)	4.91(8)	62.(2)mb
^{137}Ba	11.232(24)		5.(1)	4.(1)	6.8(1)	0.05(1)
^{138}Ba	71.698(42)		0.41(2)	0.4(1)	4.84(8)	4.1(2)mb
^{139}Ba		1.396 h	5.(1)	2.2(5)		
^{140}Ba		12.75 d	1.6(3)	14.(1)		
$_{57}$La			9.2(2)	12.(1)	8.24(4)	
^{138}La	0.090(1)	1.06x10^{11} y	57.(6)	4.1(9)x10^2		
^{139}La	99.910(1)		9.2(2)	12.(1)	8.24(4)	38.(3)mb
^{140}La		1.678 d	2.7(3)	69.(4)		
$_{58}$Ce			0.64(4)	0.71(6)	4.84(2)	
^{136}Ce	0.185(2)		(1.0+6.5)	58.(12)	5.80(9)	(28+272)mb
^{138}Ce	0.251(2)		(0.018+1.)	(1.5+5.2)	6.70(9)	179.(5)mb
^{140}Ce	88.450(18)		0.58(4)	0.50(5)	4.84(9)	11.0(4)mb
^{141}Ce		32.50 d	29.(3)	13.(2)		
^{142}Ce	11.114(17)		0.97(3)	1.3(3)	4.75(9)	28.(1)mb
^{143}Ce		1.38 d	6.1(7)	2.7(3)		
^{144}Ce		284.6 d	1.0(1)	2.6(3)		
$_{59}$Pr			11.5(4)	14.(3)	4.58(5)	
^{141}Pr	100.		(4.+7.5)	14.(3)	4.58(5)	0.12(2)
^{142}Pr		19.12 h	20.(3)	9.(1)		
^{143}Pr		13.57 d	90.(10)	190.(25)		
$_{60}$Nd			51.(2)	49.(5)	7.69(5)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{142}Nd	27.2(5)		19.(1)	34.(11)	7.7(3)	46.(4)mb
^{143}Nd	12.2(2)		330.(10),σ_α=17.mb	128.(30)		0.24(1)
^{144}Nd	23.8(3)	2.1x10^{15} y	3.6(3)	3.9(5)	2.8(3)	0.11(1)
^{145}Nd	8.30(1)		47.(6),σ_α=12.μb	260.(40)		0.49(10)
^{146}Nd	17.2(3)		1.5(2)	3.0(4)	8.7(2)	0.16(4)
^{147}Nd		10.98 d	440.(150)	200.		
^{148}Nd	5.7(1)		2.4(1)	13.(2)	5.7(3)	0.19(4)
^{150}Nd	5.6(2)		1.0(1)	14.(2)	5.3(2)	
$_{61}$Pm						
^{146}Pm		5.53 y	8.4(1.7)x10^3			
^{147}Pm		2.6234 y	(84.+96.)	(1000.+1280.)	12.6(4)	
^{148m}Pm		41.3 d	10600.(800)			
^{148}Pm		5.37 d	≈ 10^3	2.6(2.4)x10^3		
^{149}Pm		2.212 d	1400.(200)			
^{151}Pm		1.183 d	≈ 150.			
$_{62}$Sm			5.6(1)x10^3	1.4(2)x10^3		
^{144}Sm	3.08(7)		1.6(1)	2.4(3)		
^{145}Sm		340. d	280.(20)	600.(90)		
^{147}Sm	14.99(17)	1.06x10^{11} y	56.(4),σ_α=0.6mb	710.(50)	14.(3)	0.97(1)
^{148}Sm	11.24(10)	7x10^{15} y	2.4(6)	27.(14)		241.(2)mb
^{149}Sm	13.82(7)	10^{16} y	40100.(600),σ_α=31.mb	3100.(500)		1.82(2)
^{150}Sm	7.38(1)		102.(5)	290.(30)	14.(3)	422.(4)mb
^{151}Sm		90. y	15200.(300)	3520.(60)		
^{152}Sm	26.74(14)		206.(15)	3000.(300)	- 5.0(6)	473.(4)mb
^{153}Sm		1.929 d	420.(180)			
^{154}Sm	22.75(27)		7.5(3)	32.(6)	9.(1)	
$_{63}$Eu			4570.(100)	3.8(5)x10^3	5.3(3)	
^{151}Eu	47.81(6)		(4.+3150.+6000.) σ_α=8.7(3)μb	(2000.+4000.)		4.4(2)
^{152m1}Eu		9.30 h	68000.(15000)	< 100000.		
^{152}Eu		13.5 y	11000.(2000)	1600.(200)		
^{153}Eu	52.19(6)		300.(20),σ_α<1.μb	1800.(400)	8.2(1)	3.2(3)
^{154}Eu		8.59 y	1500.(300)	1600.(200)		4.4(7)
^{155}Eu		4.76 y	3900.(200)	16000.(2000)		
$_{64}$Gd			48.8(6)x10^3	400.(10)	9.5(2)	
^{152}Gd	0.20(1)		700.(200),σ_α<7.mb	700.(200)		1.05(7)
^{153}Gd		241.6 d	20000.(10000),σ_α=0.03			
^{154}Gd	2.18(3)		(0.06+60.)	230.(50)		0.88(3)
^{155}Gd	14.80(12)		61.(1)x10^3,σ_α=.08mb	1540.(100)		2.72(9)
^{156}Gd	20.47(9)		≈2.0	104.(15)	6.3(4)	0.64(6)
^{157}Gd	15.65(2)		2.54(3)x10^5,σ_α<0.05	800.(100)		1.36(4)
^{158}Gd	24.84(7)		2.3(3)	73.(7)	9.(2)	0.22(2)
^{160}Gd	21.86(19)		1.5(7)	6.(1)	9.15(5)	
^{161}Gd		3.66 m	2.0(6)x10^4			
$_{65}$Tb			23.2(5)	420.(50)	7.38(3)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{159}Tb	100.		23.2(5)	420.(50)	7.38(3)	1.75(10)
^{160}Tb		72.3 d	570.(110)			
$_{66}$Dy			$9.5(2)\times10^{2}$	$1.5(2)\times10^{3}$	16.9(3)	
^{156}Dy	0.06(1)		33.(3),σ_α<9mb	1000.(100)		
^{158}Dy	0.10(1)		43.(6),σ_α<6mb	120.(10)	6.1(5)	
^{159}Dy		144. d	$8.(2)\times10^{3}$			
^{160}Dy	2.34(8)		60.(10),σ_α<0.3mb	1100.(200)	6.7(4)	0.77(4)
^{161}Dy	18.91(24)		600.(50),σ_α<1μb	1100.(100)	10.3(4)	2.01(6)
^{162}Dy	25.51(26)		170.(20)	2755.(300)	- 1.4(5)	0.47(5)
^{163}Dy	24.90(16)		120.(10),σ_α<20μb	1600.(400)	5.0(4)	1.14(4)
^{164}Dy	28.18(36)		$(1.7+1.0)\times10^{3}$	(420.+100.)	49.4(2)	0.27(3)
^{165m}Dy		1.26 m	$2.0(6)\times10^{3}$			
^{165}Dy		2.33 h	$3.5(3)\times10^{3}$	$2.2(3)\times10^{4}$		
$_{67}$Ho			61.(2)	670.(40)	8.01(8)	
^{165}Ho	100.		(3.1+58.),σ_α<20μb	(?+670.)	8.01(8)	1.32(7)
^{166}Ho		1.2×10^{3} y	9140.(650)	1140.(90)		
$_{68}$Er			169.(20)	730.(10)	7.79(2)	
^{162}Er	0.14(1)		19.(3),σ_α<11mb	480.(50)	8.8(2)	
^{164}Er	1.61(3)		13.(3),σ_α<1.2mb	105.(10)	8.2(2)	0.71(6)
^{166}Er	33.61(35)		(15.+5.),σ_α<70μb	96.(12)	10.6(2)	0.61(6)
^{167}Er	22.93(17)		700.(200),σ_α=3μb	2970.(70)	3.0(3)	1.5(2)
^{168}Er	26.78(26)		2.0(6),σ_α=0.09mb	37.(5)	7.4(4)	0.37(4)
^{170}Er	14.93(27)		6.(1)	26.(4)	9.6(5)	0.22(3)
^{171}Er		7.52 h	370.(40)	170.(20)		
$_{69}$Tm			106.(5)	$1.5(2)\times10^{3}$	7.07(3)	
^{169}Tm	100		(8.+98.)	$1.5(2)\times10^{3}$	7.07(3)	1.13(6)
^{170}Tm		128.6 d	100.(20)	460.(50)		
^{171}Tm		1.92 y	≈ 160.	118.(6)		
$_{70}$Yb				52.(10)	$1.7(2)\times10^{2}$	12.43(3)
^{168}Yb	0.13(1)		2.4(2)x103,σ_α<0.1mb	$2.0(5)\times10^{4}$	-4.07(2)	
^{169}Yb		32.03 d	$3.6(3)\times10^{3}$	5200.(500)		
^{170}Yb	3.04(15)		12.(2),σ_α<10μb	320.(30)	6.8(1)	0.74(3)
^{171}Yb	14.3(6)		53.(5),σ_α<1.5μb	315.(30)	9.7(1)	1.41(5)
^{172}Yb	21.8(7)		≈ 1.3,σ_α<1μb	25.(3)	9.4(1)	0.41(3)
^{173}Yb	16.13(3)		16.(2),σ_α<1μb	380.(30)	9.56(7)	0.87(7)
^{174}Yb	31.8(9)		(46.+74.),σ_α<0.02mb	(13.+47.)	19.3(1)	0.18(2)
^{176}Yb	12.8(4)		3.1(2),σ_α<1μb	8.(2)	8.7(1)	
$_{71}$Lu			78.(7)	$8.3(7)\times10^{2}$	7.21(3)	
^{175}Lu	97.41(2)		(16.+8.)	(550.+270.)	7.24(3)	1.18(4)
^{176}Lu	2.59(2)	3.8×10^{10} y	(2.+2100.)	(3.+1100.)	6.1(2)	1.54(6)
^{177m}Lu		160.7 d	3.2(3)	1.4(2)		
^{177}Lu		6.75 d	1000.(300)			

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
$_{72}$Hf			106.(3)	19.7(5)x10^{2}	7.8(1)	
^{174}Hf	0.162(3)	2.0x10^{15} y	600.(50)	400.(50)	11.(1)	
^{176}Hf	5.206(5)		23.(4)	700.(100)	6.6(2)	0.46(2)
^{177}Hf	18.606(13)		(1.+375.),σ_α<20μb	7170.(200)		1.37(6)
^{178}Hf	27.297(4)		(53.+32.)	(340.+1500.)	5.9(2)	0.31(1)
^{179}Hf	13.629(6)		(0.43+46.)	(6.8+620.)	7.5(2)	0.99(3)
^{180}Hf	35.100(7)		13.(1),σ_α<13μb	32.(2)	13.2(3)	175.(5)mb
^{181}Hf		42.4 d	30.(25)			
$_{73}$Ta			20.(1)	650(20.)	6.91(7)	
^{180m}Ta	0.012(2)	> 1.2x10^{15} y	≈ 560.	1350.(100)		
^{181}Ta	99.998(2)		(0.012 + 20),σ_α<1μb	(0.4+650.)	6.91(7)	0.77(2)
^{182}Ta		114.43 d	8200.(600)	900.(90)		
$_{74}$W			18.(1)	3.6(3)x10^{2}	4.86(2)	
^{180}W	0.12(1)		≈ 4.	210.(30)		
^{182}W	26.50(16)		20.(1)	600.(90)	6.97(4)	274.(8)mb
^{183}W	14.31(4)		10.5(3)	340.(50)	6.53(4)	0.52(2)
^{184}W	30.64(2)		(0.002 + 2.0)	15.(2)	7.48(6)	0.23(1)
^{185}W		74.8 d	≈ 3.3	300.(50)		
^{186}W	28.43(19)		37.(2)	510.(50)	- 0.72(4)	176.(5)mb
^{187}W		23.9 h	70.(10)	2760.(550)		
$_{75}$Re			90.(4)	8.4(2)x10^{2}	9.2(3)	
^{185}Re	37.40(2)		(0.33+110.)	1700.(50)	9.0(3)	1.54(6)
^{187}Re	62.60(2)	4.4x10^{10} y	(2.+72.)	(9.+310.)	9.3(3)	1.16(6)
$_{76}$Os			17.(1)	1.5(1)x10^{2}	10.7(2)	
^{184}Os	0.020(3)		3.3(3)x10^{3},σ_α<10mb	1.4(1)x10^{3}		
^{186}Os	1.58(2)	2.x10^{15} y	≈ 80.,σ_α<0.1mb	280.(40)	12(2)	0.42(2)
^{187}Os	1.6(4)		2.(1)x10^{2},σ_α<0.1mb	500.(70)		0.87(3)
^{188}Os	13.3(1)		≈ 5.,σ_α<30μb	150.(20)	7.6(3)	0.40(2)
^{189}Os	16.1(1)		(0.00026+40),σ_α<10μb	(0.013+670.)	10.7(3)	1.17(5)
^{190}Os	26.4(2)		(9.+4.),σ_α<20μb	(22.+8.)	11.0(3)	0.30(5)
^{191}Os		15.4 d	3.8(6)x10^{2}			
^{192}Os	41.0(3)		3.(1),σ_α<10μb	6.(1)	11.5(4)	0.31(5)
^{193}Os		30.5 h	40.(10)			
$_{77}$Ir			4.2(1)x10^{2}	2.8(4)x10^{3}	10.6(3)	
^{191}Ir	37.3(2)		(660.+260.)	(1000.+4200.)		1.35(7)
^{192}Ir		73.83 d	1450.(250)	4800.(700)		
^{193}Ir	62.7(2)		(6.+110.)	1400.(200)		0.86(4)
^{194}Ir		19.3 h	1.5(3)x10^{3}			
$_{78}$Pt			10.(1)	1.3(1)x10^{2}	9.60(1)	
^{190}Pt	0.014(1)	6.5x10^{11} y	1.5(1)x10^{2},σ_α<8mb	70.(10)	9(1)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{192}Pt	0.782(7)		(2.0+6.),σ_α<0.2mb	115.(20)	9.9(5)	0.20(6)
^{194}Pt	32.97(10)		(0.1+1.1),σ_α< 5μb	(4.+?)	10.55(8)	0.37(8)
^{195}Pt	33.832(10)		28.(1),σ_α< 5μb	365.(50)	8.8(1)	0.9(2)
^{196}Pt	25.242(41)		(0.045+0.55)	7.(2)	9.89(8)	0.20(2)
^{198}Pt	7.16(6)		(0.027+3.6)	(0.5+56.)	7.8(1)	
^{199}Pt		30.8 m	≈ 16.			
$_{79}$Au			98.7(1)	1.55(3)x10^3	7.63(6)	
^{197}Au	100.		98.7(1)	1.55(3)x10^3	7.63(6)	582.(9)mb
^{198}Au		2.694 d	26.5(15)x10^3	≈ 4.x10^4		
^{199}Au		3.14 d	≈ 30.			
$_{80}$Hg			3.7(1)x10^2	87.(5)	12.69(2)	
^{196}Hg	0.15(1)		(105.+3000.)	(53.+410.)	30.(1)	
^{198}Hg	9.97(20)		(0.017+2.)	(1.7+70.)		0.17(2)
^{199}Hg	16.87(22)		2.1(2)x10^3	435(20)	16.9(4)	0.37(2)
^{200}Hg	23.10(19)		< 60.	2.1(5)		0.12(1)
^{201}Hg	13.18(9)		< 60.	30.(3)		0.26(1)
^{202}Hg	29.86(26)		4.9(5)	4.5(2)		74.(6)mb
^{204}Hg	6.87(15)		0.4(1)	0.8(2)		42.(4)mb
$_{81}$Tl			3.3(1)	12.5(8)	8.776(5)	
^{203}Tl	29.52(1)		11.(1),σ_α<0.3mb	41.(2)	7.0(2)	124.(8)mb
^{204}Tl		3.78 y	22.(2)	90.(20)		
^{205}Tl	70.48(1)		0.11(2)	0.6(2)	9.52(7)	54.(4)mb
$_{82}$Pb			0.172(2)	0.14(4)	9.402(2)	
^{204}Pb	1.4(1)		0.68(7)	2.0(2)	10.6(20)	90.(6)mb
^{205}Pb		1.51x10^7 y	≈ 5.			
^{206}Pb	24.1(1)		0.030(1)	0.10(1)	9.23(5)	14.(1)mb
^{207}Pb	22.1(1)		0.70(1)	0.38(1)	9.28(4)	8.4(4)mb
^{208}Pb	52.4(1)		0.49(3)mb,σ_α<8μb	2.0(2) mb	9.50(6)	0.36(2)mb
^{210}Pb		22.6 y	< 0.5			
$_{83}$Bi			0.034(1)	0.19(2)	8.532(2)	
^{209}Bi	100.		(11+23)mb,σ_α<0.3μb	0.19(2)	8.532(2)	3.1(3)mb
^{210m}Bi		3.0x10^6 y	54(4)mb	0.20(3)		
$_{84}$Po						
^{210}Po		138.38 d	σ_m<0.5mb,σ_α< 2.mb σ_g<30.mb,σ_f< 0.1			
$_{85}$At						
$_{86}$Rn						
^{220}Rn		55.6 s	<0.2			
^{222}Rn		3.8235 d	0.74(5)			

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
$_{88}$Ra						
^{223}Ra		11.435d	$1.3(2)\times10^{2}$,$\sigma_f<0.7$			
^{224}Ra		3.66 d	12.0(5)			
^{226}Ra		1599. y	$\approx 13.$,$\sigma_f< 7.\mu b$	280.(50)	10.(1)	
^{228}Ra		5.76 y	36.(5),$\sigma_f<2.$			
$_{89}$Ac						
^{227}Ac		21.77 y	$8.8(7)\times10^{2}$,$\sigma_f<.35$ mb	$1.5(4)\times10^{3}$		
$_{90}$Th			7.4	85.(3)	10.31(3)	
^{227}Th		18.72 d	$\sigma_f=2.0(2)\times10^{2}$			
^{228}Th		1.913 y	$1.2(2)\times10^{2}$,$\sigma_f<0.3$	1014.(400)		
^{229}Th		7.9×10^{3} y	$\approx 60.$ $\sigma_f=30(3)$	$1.0(2)\times10^{3}$ $RI_f=466.(75)$		
^{230}Th		7.54×10^{4} y	23.4(5) $\sigma_f<0.5$mb	$1.0(1)\times10^{3}$		
^{232}Th	100.	1.4×10^{10}y	7.37(4) $\sigma_f=3.(1)\ \mu b$ $\sigma_\alpha<1.\ \mu b$	85.(3)	10.31(3)	
^{233}Th		22.3 m	$1.5(1)\times10^{3}$ $\sigma_f=15.(2)$	$4.(1)\times10^{2}$		
^{234}Th		24.10 d	1.8(5) $\sigma_f<0.01$			
$_{91}$Pa						
^{230}Pa		17.4 d	$1.5(3)\times10^{3}$			
^{231}Pa		3.25×10^{4} y	$2.0(1)\times10^{2}$ $\sigma_f=20.(1)$ mb	750.(80) $RI_f=0.05(1)$	9.1(3)	
^{232}Pa		1.31 d	$4.6(10)\times10^{2}$ $\sigma_f=7.(1)\times10^{2}$	300.(70)		
^{233}Pa		27.0 d	39.(2) $\sigma_m=20.(4)$ $\sigma_g=19.(3)$ $\sigma_f< 0.1$	(460.+440)		
$_{92}$U			3.4(3);$\sigma_f=4.2(1)$	280.(20),$RI_f=2.0$	8.417(5)	
^{230}U		20.8 d	$\sigma_f\approx 25.$			
^{231}U		4.2 d	$\sigma_f\approx 250.$			
^{232}U		68.9 y	73.(2) $\sigma_f=74.(8)$	280.(15) $RI_f=350.(30)$		
^{233}U		1.59×10^{5} y	47.(2) $\sigma_f=5.3(1)\times10^{2}$ $\sigma_\alpha<0.2$ mb	137.(6) $RI_f=760.(17)$	10.1(2)	
^{234}U	0.0055(5)	2.45×10^{5} y	96.(2) $\sigma_f< 5.$ mb	660.(70) $RI_f=6.5$	12.(4)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{235}U	0.720(1)	7.04x10^{8} y	95.(5) σ_f=586.(2) σ_α< 0.1 mb	144.(6) RI_f=275(5)	10.47(4)	
^{236}U		2.34x10^{7} y	5.1(3) σ_f=0.04	360.(15) RI_f=4.38(50)		
^{237}U		6.75 d	≈ 10^{2} σ_f< 0.35	1200.(200)		
^{238}U	99.2745(15)	4.46x10^{9} y	2.7(1) σ_f≈3.μb σ_α=1.4(5) μb	277.(3) 1.54(15) mb	8.402(5)	
^{239}U		23.5 m	22.(2) σ_f=15.(3)			
$_{93}$Np						
^{234}Np		4.4 d	σ_f=9.(3)x10^{2}			
^{235}Np		1.085 y	1.6(1)x10^{2}			
^{236m}Np		22.5 h	σ_f=2.7(2)x10^{3}	700.(400)		
^{236}Np		1.55x10^{5} y	σ_f=2.6(5)x10^{3}	1030.(100)		
^{237}Np		2.14x10^{6} y	160.(10) σ_f=20.(1)mb	8.(2)x10^{2} RI_f=0.32	10.6(1)	
^{238}Np		2.117 d	σ_f=2.1(1)x10^{3}	9.(1)x10^{2}		
^{239}Np		2.355 d	(32.+19.) σ_f<1.			
$_{94}$Pu						
^{236}Pu		2.87 y	σ_f=1.6(3)x10^{2}	1000.(60)		
^{237}Pu		45.7 d	σ_f=2.3(3)x10^{3}			
^{238}Pu		87.74 y	5.1(2)x10^{2} σ_f=17.(1)	1.6(2)x10^{2} RI_f=33.(5)	14.1(5)	
^{239}Pu		2.411 x 10^{4}y	2.7(1)x10^{2} σ_f=752.(3) σ_α≤0.3 mb	2.0(2)x10^{2} 3.0(1)x10^{2}	7.7(1)	
^{240}Pu		6537. y	2.9(1)x10^{2} σ_f≈44.mb	8.4(3)x10^{3} RI_f=2.4	3.5(1)	
^{241}Pu		14.4 y	3.7(1)x10^{2},σ_α<0.2mb σ_f=1.01(1)x10^{3}	1.6(1)x10^{2} 5.7(4)x10^{2}		
^{242}Pu		3.76 x 10^{5} y	19.(1) σ_f<0.2	1.1(1)x10^{3} RI_f=0.23	8.1(1)	
^{243}Pu		4.956 h	<100. σ_f=2.0(2)x10^{2}			
^{244}Pu		8.2x10^{7} y	1.7(1)	41.(3)		
^{245}Pu		10.5 h	1.5(3)x10^{2}	220(40)		
$_{95}$Am						
^{241}Am		432.2 y	(0.5+5.7)x10^{2} σ_f=3.1(2)	(2.0+12.3)x10^{2} 14.(1)		
^{242m}Am		141. y	1.7(4)x10^{3} σ_f=7.0(3)x10^{3}	≈ 200. RI_f=1.8(1)x10^{3}		
^{242}Am		16.02 h	σ_f=2.1(2)x10^{3}	RI_f=< 300.		
^{243}Am		7.37x10^{3}y	(75.+5.) σ_f=74.(4) mb	(17.1+1.0)x10^{2} RI_f=0.056	8.3(2)	

Elem. or Isot.	Natural Abundance (%)	Half-life	Thermal Neut. Cross Section (barns)	Resonance Integral (barns)	Coh. Scat. Length (fm)	σ(30KEV) Maxw. Avg. (barns)
^{244m}Am		≈ 26. m	σ_f=1.6(3)x10^3			
^{244}Am		10.1 h	σ_f=2.2(3)x10^3			
$_{96}$Cm						
^{242}Cm		162.8 d	≈ 20. σ_f≈ 5.	120.(50)		
^{243}Cm		28.5 y	1.3(1)x10^2 σ_f=6.2(2)x10^2	214.(20) RI$_f$=1.6(1)x10^3		
^{244}Cm		18.11 y	15.(1) σ_f=1.1(2)	640.(50) RI$_f$=10.8(8)	9.5(3)	
^{245}Cm		8.5x10^3 y	3.5(2)x10^2 σ_f=2.1(1)x10^3	110(10) RI$_f$=8.(1)x10^2		
^{246}Cm		4.78x10^{3}y	1.2(2) σ_f=0.16(7)	120.(10) 13.(2)	9.3(2)	
^{247}Cm		1.56x10^{7}y	60.(30) σ_f=82.(5)	5.(1)x10^2 7.3(7)x10^2		
^{248}Cm		3.4x10^5 y	2.6(3) σ_f=0.36(7)	270.(30) 13.(2)	7.7(2)	
^{249}Cm		64.15 m	≈1.6			
^{250}Cm		≈ 9.7x10^3 y	≈80.			
$_{97}$Bk						
^{249}Bk		320. d	7.(1)x10^2 σ_f≈0.1	9.(1)x10^2		
^{250}Bk		3.217 h	σ_f=1.0(2)x10^3			
$_{98}$Cf						
^{249}Cf		351. y	5.0(3)x10^2 σ_f=1.7(1)x10^3	7.7(4)x10^2 RI$_f$=2.1(3)x10^3		
^{250}Cf		13.1 y	2.0(2)x10^3 σ_f=110.(90)	12.(2)x10^3 RI$_f$=160.(40)		
^{251}Cf		9.0x10^2 y	2.9(2)x10^3 σ_f=4.5(5)x10^3	1.6(1)x10^3 RI$_f$=5.5(3)x10^3		
^{252}Cf		2.65 y	20.(2) σ_f=32.(4)	43.(3) RI$_f$=1.1(3)x10^2		
^{253}Cf		17.8 d	18.(2) σ_f=1.3(2)x10^3	8.(1)		
^{254}Cf		60.5 d	4.5(10)	2.		
$_{99}$Es						
^{253}Es		20.47 d	(180.+5.8)	(37.5+1.1)x10^2		
^{254m}Es		1.64 d	σ_f=1.8(1)x10^3			
^{254}Es		276. d	28.(3) σ_f=1.8(2)x10^3	18.(2) RI$_f$=1.2(3)x10^3		
^{255}Es		40. d	≈ 55.			
$_{100}$Fm						
^{255}Fm		20.1 h	26.(3) σ_f=3.3(2)x10^3	14.(2)		
^{257}Fm		100.5 d	σ_f=3.0(2)x10^3			