

NUCLEAR WALLET CARDS

April 2005

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NUCLEAR WALLET CARDS

(Seventh edition)

April 2005

JAGDISH K. TULI

NATIONAL NUCLEAR DATA CENTER

(www.nndc.bnl.gov)

for

The U.S. Nuclear Data Program

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Upton, New York 11973-5000, USA

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U.S. Nuclear Data Program

(www.nndc.bnl.gov/usndp/)

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INTRODUCTION

This is an updated edition of the 2000 booklet of the same name[†]. The 2000 edition is being archived for the US, DOE nuclear material inventory control (see p. vii).

This booklet presents selected properties of all known nuclides and their known isomeric states. Properties of ionized atoms are not included.

The data given here are taken mostly from the adopted properties of the various nuclides as given in the *Evaluated Nuclear Structure Data File* (ENSDF)[1]. The data in ENSDF are based on experimental results and are published in *Nuclear Data Sheets*[2] for $A > 20$ and in *Nuclear Physics*[3] for $A \leq 20$. For nuclides for which either there are no data in ENSDF or those data that have since been superseded, the half-life and the decay modes are taken either from recent literature[4] or from other sources, *e.g.*, [5].

For other references, experimental data, and information on the data measurements, please refer to the original evaluations [1–3]. The data were updated to **January 15, 2005**.

[†]The first *Nuclear Wallet Cards* was produced by F. Ajzenberg-Selove and C. L. Busch in 1971. The Isotopes Project, Lawrence Berkeley National Laboratory, produced the next edition in 1979 based upon the *Table of Isotopes*, 7th edition (1978)[9]. The subsequent editions, the third in 1985, the fourth in 1990, the fifth in 1995, and the sixth in 2000 were produced by J.K. Tuli, NNDC. In 2004, **Nuclear Wallet Cards for Radioactive Nuclides** aimed at Homeland Security personnel was produced by J.K. Tuli, NNDC (see p. vii).

Explanation of Table

Column 1, Nuclide (Z, El, A):

Nuclides are listed in order of increasing atomic number (Z), and are subordered by increasing mass number (A). All isotopic species, as well as all isomers with half-life ≥ 0.1 s, and some with half-life ≥ 1 ms which decay by SF, α or p emissions, are included. A nuclide is given even if only its mass estimate or its production cross section is available. For the latter nuclides half-life limit or an approximate value is given as estimated from systematics [5].

Isomeric states are denoted by the symbol "m" after the mass number and are given in the order of increasing excitation energy.

The ^{235}U thermal fission products, with fractional cumulative yields $\geq 10^{-6}$, are *italicized* in the table. The information on fission products is taken from the ENDF/B-VI fission products file [8].

The names and symbols for elements are those adopted by the International Union of Pure and Applied Chemistry (2004). No names and symbols have as yet been adopted for $Z > 111$.

Column 2, $J\pi$:

Spin and parity assignments, without and with parentheses, are based upon strong and weak arguments, respectively. See the introductory pages of any issue of *Nuclear Data Sheets* [2] for description of strong and weak arguments for $J\pi$ assignments.

Explanation of Table (cont.)

Column 3, Mass Excess, Δ :

Mass excesses, $M-A$, are given in MeV (from [6]) with $\Delta(^{12}\text{C})=0$, by definition. For isomers the values are obtained by adding the excitation energy to the $\Delta(\text{g.s.})$ values. Wherever the excitation energy is not known, the mass excess for the next lower isomer (or the g.s.) is given. The values are given to the accuracy determined by uncertainty in $\Delta(\text{g.s.})$ (maximum of three figures after the decimal). The uncertainty is ≤ 9 in the last significant figure. An appended "s" denotes that the value is obtained from systematics [6].

Column 4, $T_{1/2}$, Γ or Abundance:

The half-life and the abundance (in **bold face** from [7]) are shown followed by their units ("% symbol in the case of abundance) which are followed by the uncertainty, in *italics*, in the last significant figures. For example, $8.1 \text{ s } 10$ means $8.1 \pm 1.0 \text{ s}$. For some very short-lived nuclei, level widths rather than half-lives are given. There also, the width is followed by units (*e.g.*, eV, keV, or MeV) which are followed by the uncertainty in *italics*, if known. As stated above when a limit or an approximate value is given it is based on systematics (*sy*), mostly from [5]. A "?" in this field indicates that $T_{1/2}$ is not known.

For $2\beta^-$ and 2ε decay only the lowest value of their several limits (*e.g.*, for 0ν or 2ν , etc.) is given.

If a new measurement of half-life, has since become available it is presented in place of the evaluated value in ENSDF.

Explanation of Table (cont.)

Column 5, Decay Mode:

Decay modes are given in decreasing strength from left to right, followed by the percentage branching, if known ("w" indicates a weak branch). The percentage branching is omitted where there is no competing mode of decay or no other mode has been observed. A "?" indicates an expected but not observed mode of decay[5]. The various modes of decay are given below:

β^-	β^- decay
ϵ	ϵ (electron capture), or $\epsilon + \beta^+$, or β^+ decay
IT	isomeric transition (through γ or conversion-electron decay)
n, p, α , ...	neutron, proton, alpha, ... decay
SF	spontaneous fission
$2\beta^-$, 3α , ...	double β^- decay ($\beta^-\beta^-$), decay through emission of 3 α 's, ...
β^- -n, β^- -p, β^- - α , ...	delayed n, p, α , ... (emission following β^- decay)
ϵ p, $\epsilon\alpha$, ϵ SF, ...	delayed p, α , SF, ... (emission following ϵ or β^+ decay)

NNDC Web Services

The centerfold presents the NNDC home page on the web (*www.nndc.bnl.gov*). The greatly expanded NNDC web service offers a wealth of Nuclear Physics information which includes analysis programs, reference data, and custom-tailored retrievals from its many databases.

DOE Standard for Nuclear Material Inventory

The 2000 edition was adopted as the standard by the the Department of Energy for the purposes of their nuclear material inventory. The 2000 edition, as well as, the current version are available through the NNDC web site, *www.nndc.bnl.gov/wallet/*.

Homeland Security

Nuclear Wallet Cards for Radioactive Nuclides, a reference for homeland security personnel based on this booklet was published in March 2004. The booklet, although limited to radioactive nuclides, contains additional radiation information. It is available on the web as well as in printed form from NNDC.

Acknowledgements

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3. *Nuclear Physics* — North Holland Publishing Co., Amsterdam — Evaluations for $A = 3$ to 20.
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9. *Table of Isotopes* (1978), 7th edition, Editors: C.M. Lederer, V.S. Shirley, Authors: E. Browne, J.M. Dairiki, R.E. Doebler, A.A. Shihab-Eldin, J. Jardine, J.K. Tuli, and A.B. Buyrn, John Wiley, New York.

Nuclear Wallet Cards

Nuclide			Δ	T½, Γ , or			
Z	El	A	(MeV)	Abundance	Decay Mode		
0	n	1	1/2+	8.071	10.24 m 2 β^-		
1	H	1	1/2+	7.289	99.985% 1		
		2	1+	13.136	0.015% 1		
		3	1/2+	14.950	12.32 y 2 β^-		
		4	2-	25.9	4.6 MeV 9 n		
		5		32.9	5.7 MeV 21 n		
		6	(2-)	41.9	1.6 MeV 4 n		
		7		49s	29×10 ⁻²³ y 7		
2	He	3	1/2+	14.931	0.000137% 3		
		4	0+	2.425	99.999863% 3		
		5	3/2-	11.39	0.60 MeV 2 α , n		
		6	0+	17.595	806.7 ms 15 β^-		
		7	(3/2)-	26.10	150 keV 20 n		
		8	0+	31.598	119.0 ms 15 β^- , β^- -n 16%		
		9	(1/2-)	40.94	65 keV 37 n		
		10	0+	48.81	0.17 MeV 11 2n?		
		3	Li	3		29s	unstable p?
				4	2-	25.3	6.03 MeV p
5	3/2-			11.68	=1.5 MeV α , p		
6	1+			14.087	7.59% 4		
7	3/2-			14.908	92.41% 4		
8	2+			20.947	838 ms 6 β^- , β^- - α		
9	3/2-			24.954	178.3 ms 4 β^- , β^- -n 50.8%		
10	(1-, 2-)			33.05	1.2 MeV 3 n		
11	3/2-			40.80	8.59 ms 14 β^- , β^- -n α 0.027%, β^- -n		
12				50.1s	<10 ns n?		
4	Be			5	(1/2+)	38s	? p
				6	0+	18.375	92 keV 6 p, α
		7	3/2-	15.770	53.22 d 6 ϵ		
		8	0+	4.942	6.8 eV 17 α		
		9	3/2-	11.348	100%		
		10	0+	12.607	1.51×10 ⁶ y 6 β^-		
		11	1/2+	20.174	13.81 s 8 β^- , β^- - α 3.1%		
		12	0+	25.08	21.49 ms 3 β^- , β^- -n ≤ 1%		
		13	(1/2-)	33.25	2.7×10 ⁻²¹ s 18 n		
		14	0+	40.0	4.84 ms 10 β^- , β^- -n 94%, β^- -2n 6%		
		15		49.8s	<200 ns n?		
		16	0+	57.7s	<200 ns 2n?		
		5	B	6		43.6s	unstable 2p?
				7	(3/2-)	27.87	1.4 MeV 2 p, α
8	2+			22.921	770 ms 3 ϵ , $\epsilon\alpha$		
9	3/2-			12.416	0.54 keV 21 p,		
10	3+			12.051	19.8% 3		
11	3/2-			8.668	80.2% 3		
12	1+			13.369	20.20 ms 2 β^- , β^- -3 α 1.58%		
13	3/2-			16.562	17.33 ms 17 β^-		
14	2-			23.66	12.5 ms 5 β^- , β^- -n 6.04%		
15				28.97	9.93 ms 7 β^- , β^- -n 93.6%, β^- -2n 0.4%		

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or		Decay Mode
Z	El A	(MeV)	Abundance	Abundance	
5 B	16	0-	37.08	<190 ps	n
	17	(3/2-)	43.8	5.08 ms 5	β^- , β^-n 63%, β^-2n 11%, β^-3n 3.5%, β^-4n 0.4%
	18	(4-)	52.3s	<26 ns	n?
	19	(3/2-)	59.4s	2.92 ms 13	β^- , β^-n 72%, β^-2n 16%
6 C	8	0+	35.09	230 keV 50	p, α
	9	(3/2-)	28.910	126.5 ms 9	ϵ , ϵp 83%, $\epsilon\alpha$ 17%
	10	0+	15.699	19.26 s 5	ϵ
	11	3/2-	10.650	20.334 m 24	ϵ
	12	0+	0.000	98.89% 1	
	13	1/2-	3.125	1.11% 1	
	14	0+	3.020	5700 y 30	β^-
	15	1/2+	9.873	2.449 s 5	β^-
	16	0+	13.694	0.747 s 8	β^- , β^-n 99%
	17		21.04	193 ms 13	β^- , β^-n 32%
	18	0+	24.93	92 ms 2	β^- , β^-n 31.5%
	19		32.42	49 ms 4	β^-n 61%, β^-
20	0+	37.6	14 ms +6-5	β^- , β^-n 72%	
21	(1/2+)	46.0s	<30 ns	n?	
22	0+	53.3s	6.1 ms +14-12	β^- , β^-n 61%, β^-2n >0%	
7 N	10	(1-)	38.8	20×10 ⁻²³ y 14	p?
	11m	1/2+	24.62	1.58 MeV +75-52	p
	12	1+	17.338	11.000 ms 16	ϵ
	13	1/2-	5.345	9.965 m 4	ϵ
	14	1+	2.863	99.634% 20	
	15	1/2-	0.101	0.366% 20	
	16	2-	5.684	7.13 s 2	β^- , $\beta^- \alpha$ 1.2×10 ^{-3%}
	17	1/2-	7.87	4.173 s 4	β^- , β^-n 95.1%
	18	1-	13.11	624 ms 12	β^- , β^-n 14.3%, $\beta^- \alpha$ 12.2%
	19		15.86	271 ms 8	β^- , β^-n 54.6%
	20		21.77	130 ms 7	β^- , β^-n 57%
	21	(1/2-)	25.25	85 ms 7	β^- , β^-n 81%
	22		32.0	18 ms 4	β^- , β^-n 36%, β^-2n <13%
23		38.4s	14.1 ms +12-15	β^- , β^-n 42%, β^-2n 8%	
24		47.5s	<52 ns	n?	
25		56.5s	<260 ns	n?	
8 O	12	0+	32.05	0.40 MeV 25	p
	13	(3/2-)	23.112	8.58 ms 5	ϵ , ϵp = 100%
	14	0+	8.007	70.641 s 20	ϵ
	15	1/2-	2.856	122.24 s 16	ϵ
	16	0+	-4.737	99.762% 16	
	17	5/2+	-0.809	0.038% 1	
	18	0+	-0.781	0.200% 14	
	19	5/2+	3.335	26.88 s 5	β^-
20	0+	3.797	13.51 s 5	β^-	

Nuclear Wallet Cards

Nuclide			Δ	T $\frac{1}{2}$, Γ , or		
Z	El	A	(MeV)	Abundance	Decay Mode	
8	O	21	(5/2+)	8.06	3.42 s 10	β^-
		22	0+	9.28	2.25 s 15	β^- , $\beta^-n < 22\%$
		23		14.6	82 ms 37	β^- , $\beta^-n 31\%$
		24	0+	19.1	65 ms 5	β^- , $\beta^-n 18\%$
		25	(3/2+)	27.4s	<50 ns	n
		26	0+	35.7s	<40 ns	n
		27		45.0s	<260 ns	n?
		28	0+	53.8s	<100 ns	n?
9	F	14	(2-)	32.7s	?	p
		15	(1/2+)	16.8	1.0 MeV 2	p
		16	0-	10.680	40 keV 20	p
		17	5/2+	1.952	64.49 s 16	ϵ
		18	1+	0.874	1.8291 h 4	ϵ
		19	1/2+	-1.487	100%	
		20	2+	-0.017	11.07 s 6	β^-
		21	5/2+	-0.048	4.158 s 20	β^-
		22	(4+)	2.79	4.23 s 4	β^- , $\beta^-n < 11\%$
		23	(3/2,5/2)+	3.33	2.23 s 14	β^-
		24	(1,2,3)+	7.56	400 ms 50	β^- , $\beta^-n < 5.9\%$
		25	(5/2+)	11.27	50 ms 6	β^- , $\beta^-n 14\%$
		26	1+	18.3	9.6 ms 8	β^- , $\beta^-n 11\%$
		27	(5/2+)	24.9	5.0 ms 2	β^- , $\beta^-n 77\%$
28		33.2s	<40 ns	n		
29	(5/2+)	40.3s	2.5 ms 4	β^- , β^-n , β^-		
30		48.9s	<260 ns	n?		
31		56.3s	>260 ns	$\beta^-?$, $\beta^-n?$		
10	Ne	16	0+	24.00	122 keV 37	p
		17	1/2-	16.46	109.2 ms 6	ϵ , $\epsilon p = 100\%$, $\epsilon\alpha$
		18	0+	5.317	1672 ms 8	ϵ
		19	1/2+	1.751	17.22 s 2	ϵ
		20	0+	-7.042	90.48% 3	
		21	3/2+	-5.732	0.27% 1	
		22	0+	-8.025	9.25% 3	
		23	5/2+	-5.154	37.24 s 12	β^-
		24	0+	-5.951	3.38 m 2	β^-
		25	(3/2)+	-2.11	602 ms 8	β^-
		26	0+	0.43	192 ms 6	β^- , $\beta^-n < 0.2\%$
		27	(3/2+)	7.1	32 ms 2	β^- , $\beta^-n 2\%$
		28	0+	11.2	19 ms 3	β^- , $\beta^-n 16\%$
		29	(3/2+)	18.1	15.6 ms 5	β^- , $\beta^-n 17\%$, $\beta^-2n < 2.9\%$
30	0+	23.1	5.8 ms 2	β^- , $\beta^-n < 26\%$		
31		30.8s	3.4 ms 8	β^-		
32	0+	37.3s	3.5 ms 9	β^-		
33		46.0s	<260 ns	n?		
34	0+	53.1s	>1.5 μ s	$\beta^-?$, $\beta^-n?$		
11	Na	18	(1-)	24.19	1.3×10^{-21} s 4	p?, $\epsilon?$
		19	(5/2+)	12.93	<40 ns	p
		20	2+	6.848	447.9 ms 23	ϵ , $\epsilon\alpha 20.05\%$
		21	3/2+	-2.184	22.49 s 4	ϵ
		22	3+	-5.182	2.6027 y 10	ϵ

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or					
Z	El	A	J π	(MeV)	Abundance	Decay Mode		
11	Na	23	3/2+	-9.530	100%			
		24	4+	-8.418	14.951 h	3 β^-		
		25	5/2+	-9.358	59.1 s	6 β^-		
		26	3+	-6.862	1.077 s	5 β^-		
		27	5/2+	-5.517	301 ms	6 β^- , β^-n 0.13%		
		28	1+	-0.99	30.5 ms	4 β^- , β^-n 0.58%		
		29	3/2+	2.66	44.9 ms	12 β^- , β^-n 21.5%		
		30	2+	8.36	48 ms	2 β^- , β^-n 30%, β^- 1.17%, $\beta^- \alpha$ 5.5 $\times 10^{-5}\%$		
		31	3/2+	12.7	17.0 ms	4 β^- , β^-n 37%, β^- 0.9%		
		32		19.1	13.2 ms	4 β^- , β^-n 24%, β^- 8%		
		33		24.9	8.1 ms	4 β^- , β^-n 47%, β^-2n 13%		
		34		32.8s	5.5 ms	10 β^- , $\beta^-n \leq 100\%$, β^-		
		35		39.6s	1.5 ms	5 β^- , β^-n		
		36		48.0s	<260 ns	n?		
		37		55.3s	>1.5 μ s	$\beta^-?$, $\beta^-n?$		
		12	Mg	19		33.0	?	2p?
				20	0+	17.57	90.8 ms	24 ϵ , $\epsilon p = 27\%$
				21	5/2+	10.91	122 ms	3 ϵ , ϵp 32.6%, $\epsilon \alpha < 0.5\%$
				22	0+	-0.397	3.8755 s	12 ϵ
23	3/2+			-5.474	11.317 s	11 ϵ		
24	0+			-13.934	78.99% 4			
25	5/2+			-13.193	10.00% 1			
26	0+			-16.215	11.01% 3			
27	1/2+			-14.587	9.458 m	12 β^-		
28	0+			-15.019	20.915 h	9 β^-		
29	3/2+			-10.62	1.30 s	12 β^-		
30	0+			-8.911	335 ms	17 β^-		
31				-3.22	230 ms	20 β^- , β^-n 1.7%		
32	0+			-0.95	86 ms	5 β^- , β^-n 5.5%		
33				4.89	90.5 ms	16 β^- , β^-n 17%		
34	0+			8.8	20 ms	10 β^- , β^-n		
35	(7/2-)			16.2s	70 ms	40 β^- , β^-n 52%		
36	0+			21.4s	3.9 ms	13 β^-		
37	(7/2-)			29.2s	>260 ns	β^- , β^-n		
38	0+	35.0s	>260 ns	$\beta^-?$				
39		43.6s	>260 ns	n?				
40	0+	50.2s	1 ms	sy $\beta^-?$, $\beta^-n?$				
13	Al	21	(5/2+)	26.1s	<35 ns	p		
		22	(3)+	18.18s	59 ms	3 ϵ , $\epsilon p = 60\%$, ϵ 0.9%, $\epsilon \alpha$ 0.31%		
		23	3/2+	6.77	0.47 s	3 ϵ , $\epsilon p = 1.1\%$		
		24	4+	-0.057	2.053 s	4 ϵ , $\epsilon \alpha$ 0.04%, ϵp 1.6 $\times 10^{-3}\%$		
		24m	1+	0.369	131.3 ms	25 IT 82%, ϵ 18%, $\epsilon \alpha$ 0.03%		
		25	5/2+	-8.916	7.183 s	12 ϵ		
		26	5+	-12.210	7.17 $\times 10^5$ y	24 ϵ		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	A	J π	(MeV)		
			Abundance	Decay Mode		
13	Al	26 _m	0+	-11.982	6.3452 s 19	ϵ
		27	5/2+	-17.197	100%	
		28	3+	-16.850	2.2414 m 12	β^-
		29	5/2+	-18.215	6.56 m 6	β^-
		30	3+	-15.87	3.60 s 6	β^-
		31	(3/2,5/2)+	-14.95	644 ms 25	β^-
		32	1+	-11.06	33 ms 4	β^-
		33	(5/2+)	-8.53	41.7 ms 2	β^- , β^- -n 8.5%
		34		-2.9	42 ms 6	β^- , β^- -n 27%
		35		-0.1	38.6 ms 4	β^- , β^- -n 41%
		36		5.8	90 ms 40	β^- , β^- -n < 31%
		37		9.9	10.7 ms 13	β^-
		38		16.1	7.6 ms 6	β^-
		39	(3/2+)	21	7.6 ms 16	β^-
		40		29.3s	>260 ns	β^- , β^- -n
		41		35.7s	>260 ns	β^-
42		43.7s	1 ms sy	β^- ?, β^- -n?		
14	Si	22	0+	32.2s	29 ms 2	ϵ , ϵ p 32%
		23		23.8s	42.3 ms 4	ϵ , ϵ p=73%, ϵ 2p<4%
		24	0+	10.75	140 ms 8	ϵ , ϵ p 38%
		25	5/2+	3.82	220 ms 3	ϵ , ϵ p
		26	0+	-7.145	2.234 s 13	ϵ
		27	5/2+	-12.384	4.16 s 2	ϵ
		28	0+	-21.493	92.230% 19	
		29	1/2+	-21.895	4.683% 8	
		30	0+	-24.433	3.087% 5	
		31	3/2+	-22.949	157.3 m 3	β^-
		32	0+	-24.081	132 y 13	β^-
		33	(3/2+)	-20.49	6.18 s 18	β^-
		34	0+	-19.96	2.77 s 20	β^-
		35		-14.36	0.78 s 12	β^-
		36	0+	-12.5	0.45 s 6	β^- , β^- -n < 10%
		37	(7/2-)	-6.6	90 ms 60	β^- , β^- -n 17%
38	0+	-4.1	>1 μ s	β^- , β^- -n		
39	(7/2-)	1.9	47.5 ms 20	β^-		
40	0+	5.5	33.0 ms 10	β^- , β^- -n		
41		14	20.0 ms 25			
42	0+	18.4s	13 ms 4	β^-		
43		26.7s	>260 ns	β^- ?, β^- -n?		
44	0+	32.8s	10 ms sy	β^- ?, β^- -n?		
15	P	24	(1+)	32.0s	?	p?, ϵ ?
		25	(1/2+)	18.9s	<30 ns	p
		26	(3+)	11.0s	43.7 ms 6	ϵ , ϵ p
		27	1/2+	-0.72	260 ms 80	ϵ , ϵ p 0.07%
		28	3+	-7.159	270.3 ms 5	ϵ , ϵ p 1.3 \times 10 ^{-3%} , $\epsilon\alpha$ 8.6 \times 10 ^{-4%}
		29	1/2+	-16.953	4.142 s 15	ϵ
		30	1+	-20.201	2.498 m 4	ϵ
		31	1/2+	-24.441	100%	
		32	1+	-24.305	14.262 d 14	β^-
		33	1/2+	-26.337	25.34 d 12	β^-
		34	1+	-24.558	12.43 s 8	β^-

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	A	$J\pi$	(MeV)		
			Abundance	Decay Mode		
15	P	35	1/2+	-24.858	47.3 s 7	β^-
		36	4-	-20.25	5.6 s 3	β^-
		37		-18.99	2.31 s 13	β^-
		38		-14.8	0.64 s 14	β^- , $\beta^-n < 10\%$
		39		-12.9	0.25 s 8	β^- , $\beta^-n 26\%$
		40	(2-,3-)	-8.1	125 ms 25	β^- , $\beta^-n 15.8\%$
		41		-5.3	100 ms 5	β^- , $\beta^-n 30\%$
		42		0.9	48.5 ms 15	β^- , $\beta^-n 50\%$
		43		5.8	36.5 ms 15	β^- , β^-n
		44		12.1s	18.5 ms 25	β^-
		45		17.9s	>200 ns	$\beta^-?$
		46		25.5s	>200 ns	β^-
		16	S	26	0+	26.0s
27	(5/2+)			17.5s	15.5 ms 15	ϵ , ϵp 2.3%, $\epsilon 2p$ 1.1%
28	0+			4.1	125 ms 10	ϵ , ϵp 21%
29	5/2+			-3.16	187 ms 4	ϵ , ϵp 47%
30	0+			-14.063	1.178 s 5	ϵ
31	1/2+			-19.045	2.572 s 13	ϵ
32	0+			-26.016	95.02% 9	
33	3/2+			-26.586	0.75% 1	
34	0+			-29.932	4.21% 8	
35	3/2+			-28.846	87.51 d 12	β^-
36	0+			-30.664	0.02% 1	
37	7/2-			-26.896	5.05 m 2	β^-
38	0+			-26.861	170.3 m 7	β^-
39	(3/2,5/2,7/2)-			-23.16	11.5 s 5	β^-
40	0+			-22.9	8.8 s 22	β^-
41	(7/2-)			-19.0	1.99 s 5	β^- , β^-n
42	0+			-17.7	1.013 s 15	β^-
43				-12.0	0.28 s 3	β^- , $\beta^-n 40\%$
44	0+			-9.1	100 ms 1	β^- , $\beta^-n 18\%$
45				-3	68 ms 2	β^- , $\beta^-n 54\%$
46	0+	0.7s	50 ms 8	β^-		
47		8.0s	>200 ns	$\beta^-?$		
48	0+	13.2s	≥ 200 ns	β^-		
49		22.0s	<200 ns	n		
17	Cl	28	(1+)	26.6s	?	p?
		29	(3/2+)	13.1s	<20 ns	p
		30	(3+)	4.4s	<30 ns	p
		31		-7.07	150 ms 25	ϵ , ϵp 0.7%
		32	1+	-13.330	298 ms 1	ϵ , $\epsilon \alpha$ 0.05%, ϵp 0.03%
		33	3/2+	-21.003	2.511 s 3	ϵ
		34	0+	-24.440	1.5264 s 14	ϵ
		34m	3+	-24.293	32.00 m 4	ϵ 55.4%, IT 44.6%
		35	3/2+	-29.014	75.77% 4	
		36	2+	-29.522	3.01×10^5 y 2	β^- 98.1%, ϵ 1.9%
		37	3/2+	-31.761	24.23% 4	
		38	2-	-29.798	37.24 m 5	β^-
		38m	5-	-29.127	715 ms 3	IT
39	3/2+	-29.800	55.6 m 2	β^-		

Nuclear Wallet Cards

Nuclide			Δ	T½, Γ , or		
Z	El	A	J π	(MeV)	Abundance	Decay Mode
17	Cl	40	2-	-27.56	1.35 m 2	β^-
		41	(1/2+, 3/2+)	-27.31	38.4 s 8	β^-
		42		-24.9	6.8 s 3	β^-
		43		-24.2	3.07 s 7	β^-
		44		-20.2	0.56 s 11	β^- , $\beta^-n < 8\%$
		45		-18.4	400 ms 43	β^- , $\beta^-n 24\%$
		46		-14.7	232 ms 2	β^- , $\beta^-n 60\%$
		47		-10.5s	101 ms 6	β^- , $\beta^-n > 0\%$
		48		-4.7s	≥ 200 ns	β^-
		49		0.3s	≥ 170 ns	
		50		7.3s	20 ms sy	$\beta^-?$
51	(3/2+)	13.5s	> 200 ns	β^-		
18	Ar	30	0+	20.1s	< 20 ns	p?
		31	5/2+	11.3s	15.1 ms 13	ϵ , $\epsilon p 69\%$, $\epsilon 7.6\%$
		32	0+	-2.200	98 ms 2	ϵ , $\epsilon p 43\%$
		33	1/2+	-9.384	173.0 ms 20	ϵ , $\epsilon p 38.7\%$
		34	0+	-18.377	844.5 ms 34	ϵ
		35	3/2+	-23.047	1.775 s 4	ϵ
		36	0+	-30.232	0.3365% 30	
		37	3/2+	-30.948	34.95 d 4	ϵ
		38	0+	-34.715	0.0632% 5	
		39	7/2-	-33.242	269 y 3	β^-
		40	0+	-35.040	99.6003% 30	
		41	7/2-	-33.068	109.61 m 4	β^-
		42	0+	-34.423	32.9 y 11	β^-
		43	(5/2-)	-32.010	5.37 m 6	β^-
		44	0+	-32.673	11.87 m 5	β^-
45		-29.771	21.48 s 15	β^-		
46	0+	-29.72	8.4 s 6	β^-		
47	(3/2-)	-25.9	1.23 s 3	β^- , $\beta^-n < 0.002\%$		
48	0+	-23.7s	0.48 s 40	β^-		
49		-18.1s	≥ 170 ns			
50	0+	-14.5s	≥ 170 ns			
51		-7.8s	> 200 ns	$\beta^-?$		
52	0+	-3.0s	10 ms	β^-		
53	(5/2-)	4.6s	3 ms sy	β^- , β^-n		
19	K	32		20.4s	?	p?
		33	(3/2+)	6.8s	< 25 ns	p
		34	(1+)	-1.5s	< 25 ns	p
		35	3/2+	-11.17	178 ms 8	ϵ , $\epsilon p 0.37\%$
		36	2+	-17.426	342 ms 2	ϵ , $\epsilon p 0.05\%$, $\epsilon \alpha 3.4 \times 10^{-3}\%$
		37	3/2+	-24.800	1.226 s 7	ϵ
		38	3+	-28.801	7.636 m 18	ϵ
		38 _m	0+	-28.670	924.2 ms 3	ϵ
		39	3/2+	-33.807	93.2581% 44	
		40	4-	-33.535	1.248 $\times 10^9$ y 3	$\beta^- 89.28\%$, $\epsilon 10.72\%$
					0.0117% 1	
		41	3/2+	-35.559	6.7302% 44	
		42	2-	-35.022	12.321 h 25	β^-
43	3/2+	-36.593	22.3 h 1	β^-		
44	2-	-35.81	22.13 m 19	β^-		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or					
Z	El	A	J π	(MeV)				
			Abundance	Decay Mode				
19	K	45	3/2+	-36.61	17.3 m 6	β^-		
		46	(2-)	-35.42	105 s 10	β^-		
		47	1/2+	-35.696	17.50 s 24	β^-		
		48	(2-)	-32.12	6.8 s 2	β^- , β^-n 1.14%		
		49	(3/2+)	-30.32	1.26 s 5	β^- , β^-n 86%		
		50	(0-, 1, 2-)	-25.4	472 ms 4	β^- , β^-n 29%		
		51	(1/2+, 3/2+)	-22.0s	365 ms 5	β^- , β^-n 47%		
		52	(2-)	-16.2s	105 ms 5	β^- , β^-n =64%, β^-		
		53	(3/2+)	-12.0s	30 ms 5	β^- , β^-n =67%, β^-2n =17%		
		54		-5.4s	10 ms 5	β^- , β^-n >0%		
		55		-0.3s	3 ms sy	$\beta^-?$, $\beta^-n?$		
		20	Ca	34	0+	13.2s	<35 ns	p
				35		4.6s	25.7 ms 2	ϵ , ϵp 95.7%, $\epsilon 2p$ 4.2%
36	0+			-6.44	102 ms 2	ϵ , ϵp 57%		
37	3/2+			-13.16	181.1 ms 10	ϵ , ϵp 82.1%		
38	0+			-22.059	440 ms 8	ϵ		
39	3/2+			-27.274	859.6 ms 14	ϵ		
40	0+			-34.846	>3.0×10 ²¹ y	2 ϵ		
					96.94% 16			
41	7/2-			-35.138	1.02×10 ⁵ y 7	ϵ		
42	0+			-38.547	0.647% 23			
43	7/2-			-38.409	0.135% 10			
44	0+			-41.468	2.09% 11			
45	7/2-			-40.812	162.61 d 9	β^-		
46	0+			-43.135	>0.28×10 ¹⁶ y	2 β^-		
					0.004% 3			
47	7/2-			-42.340	4.536 d 3	β^-		
48	0+			-44.214	2.3×10 ¹⁹ y +12-6	2 β^- 84%, 0.187% 21 β^- <25%		
49	3/2-			-41.289	8.718 m 6	β^-		
50	0+			-39.571	13.9 s 6	β^-		
51	(3/2-)			-35.86	10.0 s 8	β^- , β^-n		
52	0+	-32.5	4.6 s 3	β^- , β^-n ≤2%				
53	(3/2-, 5/2-)	-27.9s	90 ms 15	β^- , β^-n >30%				
54	0+	-23.9s	>300 ns	β^-				
55		-18.1s	>300 ns	$\beta^-?$				
56	0+	-13.4s	10 ms sy	$\beta^-?$				
57		-7s	5 ms sy	$\beta^-?$, $\beta^-n?$				
21	Sc	36		13.9s	?	p?		
		37		2.8s	?	p?		
		38	(2-)	-4.9s	<300 ns	p		
		39	(7/2-)	-14.17	<300 ns	p		
		40	4-	-20.523	182.3 ms 7	ϵ , ϵp 0.44%, $\epsilon \alpha$ 0.02%		
		41	7/2-	-28.642	596.3 ms 17	ϵ		
		42	0+	-32.121	681.3 ms 7	ϵ		
		42m	(7)+	-31.505	61.7 s 4	ϵ		
		43	7/2-	-36.188	3.891 h 12	ϵ		
		44	2+	-37.816	3.97 h 4	ϵ		
		44m	6+	-37.545	58.61 h 10	IT 98.8%, ϵ 1.2%		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El	(MeV)	Abundance	Decay Mode
21 Sc	45	7/2-	-41.068	100%
	45m	3/2+	-41.056	318 ms 7 IT
	46	4+	-41.757	83.79 d 4 β^-
	46m	1-	-41.615	18.75 s 4 IT
	47	7/2-	-44.332	3.3492 d 6 β^-
	48	6+	-44.496	43.67 h 9 β^-
	49	7/2-	-46.552	57.2 m 2 β^-
	50	5+	-44.54	102.5 s 5 β^-
	50m	(2,3)+	-44.28	0.35 s 4 IT>97.5%, β^- <2.5%
	51	(7/2)-	-43.22	12.4 s 1 β^-
	52	3(+)	-40.4	8.2 s 2 β^-
	53	(7/2-)	-37.6s	>3 s β^- , β^-n
	54	(3,4+)	-34.2	0.36 s 6 β^-
	55	(7/2-)	-29.6	0.115 s 15 β^- , β^-n
	56	(1+)	-25.3s	35 ms 5 β^- , β^-n
	56	(6+,7+)	-25.3s	60 ms 7 β^- , β^-n
	57		-20.7s	13 ms 4 β^-
	57	(7/2-)	-20.7s	13 ms 4 β^-n
	58	(3+)	-15.2s	12 ms 5 β^-
	59		-10.0s	10 ms sy $\beta^-?$, $\beta^-n?$
60		-4.0s	3 ms sy β^-	
22 Ti	38	0+	9.1s	<120 ns 2p?
	39	(3/2+)	1.5s	31 ms +6-4 ϵ , ϵp 14%
	40	0+	-8.9	53.3 ms 15 ϵ , ϵp
	41	3/2+	-15.7s	80.4 ms 9 ϵ , $\epsilon p=100%$
	42	0+	-25.122	199 ms 6 ϵ
	43	7/2-	-29.321	509 ms 5 ϵ
	44	0+	-37.549	60.0 y 11 ϵ
	45	7/2-	-39.006	184.8 m 5 ϵ
	46	0+	-44.123	8.25% 3
	47	5/2-	-44.932	7.44% 2
	48	0+	-48.488	73.72% 3
	49	7/2-	-48.559	5.41% 2
	50	0+	-51.427	5.18% 2
	51	3/2-	-49.728	5.76 m 1 β^-
	52	0+	-49.465	1.7 m 1 β^-
	53	(3/2)-	-46.8	32.7 s 9 β^-
	54	0+	-45.6	1.5 s 4 β^-
	55	(3/2-)	-41.7	1.3 s 1 β^-
	56	0+	-38.9	200 ms 5 β^- , β^-n
	57		-33.5	60 ms 16 β^- , β^-n
58	0+	-30.8s	59 ms 9 β^-	
59	(5/2-)	-25.2s	30 ms 3 β^-	
60	0+	-21.6s	22 ms 2 β^-	
61		-15.6s	>300 ns $\beta^-?$	
62	0+	-11.7s	10 ms sy $\beta^-?$	
63		-5.2s	3 ms sy $\beta^-?$, $\beta^-n?$	
23 V	40		10.3s	? p?
	41		-0.2s	? p?
	42		-8.2s	<55 ns p
	43		-18.0s	>800 ms ϵ
	44	(2+)	-24.1	111 ms 7 ϵ , $\epsilon\alpha$

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or				
Z	El	A	$J\pi$	(MeV)	Abundance	Decay Mode	
23	V	44m	(6+)	-24.1	150 ms	3 ϵ	
		45	7/2-	-31.88	547 ms	6 ϵ	
		46	0+	-37.073	422.50 ms	11 ϵ	
		47	3/2-	-42.002	32.6 m	3 ϵ	
		48	4+	-44.475	15.9735 d	25 ϵ	
		49	7/2-	-47.957	329 d	3 ϵ	
		50	6+	-49.222	1.4 \times 10 ¹⁷ y	4 ϵ 83%, 0.250% 2	β - 17%
		51	7/2-	-52.201		99.750% 2	
		52	3+	-51.441	3.743 m	5 β -	
		53	7/2-	-51.849	1.60 m	4 β -	
		54	3+	-49.89	49.8 s	5 β -	
		55	(7/2-)	-49.2	6.54 s	15 β -	
		56	(1+)	-46.1	216 ms	4 β -	
		56	1+	-46.1	216 ms	4 β -n 0.06%	
		57	(3/2-)	-44.2	0.35 s	1 β -	β -n 0.04%
		58	(1+)	-40.2	185 ms	10 β -	
		59	(5/2-,3/2-)	-37.1	75 ms	7 β -	
		60		-32.6	68 ms	5 β -	
		60m		-32.6	122 ms	18 β -	β -n
		61	(3/2-)	-29.4s	47 ms	1 β -	
		62		-24.4s	33.5 ms	2 β -	
		63	(7/2-)	-20.9s	17 ms	3 β -	
		64		-15.4s	>150 ns	β -	
		65		-11.3s	10 ms	sy β -?	β -n?
		24	Cr	42	0+	6.0s	13 ms +4-2
43	(3/2+)			-2.1s	21.6 ms	7 ϵ , ϵ p 23%, ϵ 6%	
44	0+			-13.46s	53 ms +4-3	ϵ , ϵ p >7%	
45				-19.0	50 ms	6 ϵ , ϵ p >27%	
46	0+			-29.47	0.26 s	6 ϵ	
47	3/2-			-34.56	500 ms	15 ϵ	
48	0+			-42.819	21.56 h	3 ϵ	
49	5/2-			-45.331	42.3 m	1 ϵ	
50	0+			-50.259	>1.3 \times 10 ¹⁸ y	2 ϵ	
					4.345% 13		
51	7/2-			-51.449	27.7025 d	24 ϵ	
52	0+			-55.417		83.789% 18	
53	3/2-			-55.285		9.501% 17	
54	0+			-56.932		2.365% 7	
55	3/2-			-55.107	3.497 m	3 β -	
56	0+			-55.281	5.94 m	10 β -	
57	3/2-,5/2-,7/2-			-52.524	21.1 s	10 β -	
58	0+			-51.8	7.0 s	3 β -	
59	(1/2-)			-47.9	0.46 s	5 β -	
60	0+			-46.5	0.57 s	6 β -	
61				-42.2	0.27 s	2 β -	
62	0+			-40.4	209 ms	12 β -	β -n
63	(1/2-)	-35.5s	129 ms	2 β -	β -n		
64	0+	-33.2s	43 ms	1 β -			
65	(1/2-)	-27.8s	27 ms	3 β -	β -n?		
66	0+	-24.8s	10 ms	6 β -			
67		-19.0s	=50 ms	β -?			

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	(MeV)	Abundance	Decay Mode
25 Mn	44	(2-)	6.4s	<105 ns ϵ, p
	45	(7/2-)	-5.1s	<70 ns p
	46	[4+]	-12.4s	34 ms +5-4 $\epsilon, \epsilon p$ 22%
	47		-22.3s	100 ms 50 $\epsilon, \epsilon p$ >3.4%
	48	4+	-29.3	158.1 ms 22 $\epsilon, \epsilon p$ 0.28%, $\epsilon\alpha$ <6.0×10 ⁻⁴ %
	49	5/2-	-37.62	382 ms 7 ϵ
	50	0+	-42.627	283.29 ms 8 ϵ
	50m	5+	-42.398	1.75 m 3 ϵ
	51	5/2-	-48.241	46.2 m 1 ϵ
	52	6+	-50.705	5.591 d 3 ϵ
	52m	2+	-50.328	21.1 m 2 ϵ 98.25%, IT 1.75%
	53	7/2-	-54.688	3.74×10 ⁶ y 4 ϵ
	54	3+	-55.555	312.12 d 6 ϵ, β - <2.9×10 ⁻⁴ %
	55	5/2-	-57.711	100%
	56	3+	-56.910	2.5789 h 1 β -
	57	5/2-	-57.487	85.4 s 18 β -
	58	1+	-55.91	3.0 s 1 β -
	58m	(4+)	-55.83	65.2 s 5 β - = 80%, IT = 20%
	59	(5/2)-	-55.48	4.59 s 5 β -
	60	0+	-53.18	51 s 6 β -
	60m	3+	-52.91	1.77 s 2 β - 88.5%, IT 11.5%
	61	(5/2)-	-51.6	0.67 s 4 β -
	62	1+	-48.0	92 ms 13 β -
	62	(3+, 4+)	-48.0	671 ms 5 β -, β -n
	63	(5/2)-	-46.4	0.29 s 2 β -
	64		-42.6	89 ms 4 β -, β -n 1.42%
	65		-40.7	92 ms 1 β -, β -n 6.92%
	66		-36.3s	64 ms 2 β -, β -n 10.88%
	67	(5/2-)	-33.4s	47 ms 4 β -, β -n
69	5/2-	-25.3s	14 ms 4 β -	
26 Fe	45	(3/2+)	13.6s	3.8 ms +20-8 2p
	46	0+	0.8s	12 ms +4-3
	47		-6.6s	21.8 ms 7 $\epsilon, \epsilon p$
	48	0+	-18.16s	44 ms 7 $\epsilon, \epsilon p$ >3.6%
	49	(7/2-)	-24.6s	70 ms 3 $\epsilon, \epsilon p$ ≥ 52%
	50	0+	-34.48	155 ms 11 $\epsilon, \epsilon p$ = 0%
	51	5/2-	-40.22	305 ms 5 ϵ
	52	0+	-48.332	8.275 h 8 ϵ
	52m	(12+)	-41.512	45.9 s 6 ϵ
	53	7/2-	-50.945	8.51 m 2 ϵ
	53m	19/2-	-47.905	2.526 m 24 IT
	54	0+	-56.252	5.845% 35
	55	3/2-	-57.479	2.737 y 11 ϵ
	56	0+	-60.605	91.754% 36
	57	1/2-	-60.180	2.119% 10
58	0+	-62.153	0.282% 4	
59	3/2-	-60.663	44.495 d 9 β -	
60	0+	-61.412	1.5×10 ⁶ y 3 β -	
61	3/2-, 5/2-	-58.92	5.98 m 6 β -	
62	0+	-58.90	68 s 2 β -	
63	(5/2)-	-55.5	6.1 s 6 β -	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
26	Fe	64	0+	-54.8	2.0 s 2	β^-
		65		-50.9	1.3 s 3	β^-
		66	0+	-49.6	0.44 s 6	β^-
		67		-45.7	0.47 s 5	β^- , β^-n 1.13%
		68	0+	-43.1	187 ms 6	β^-
		69	1/2-	-38.4s	109 ms 9	β^-
		70	0+	-35.9s	94 ms 17	β^-
		71	(7/2+)	-31.0s	>150 ns	β^-
	72	0+	-28.3s	>150 ns	β^-	
27	Co	47		10.7s	?	p?
		49		-9.6s	<35 ns	ϵ , p
		50	(6+)	-17.2s	44 ms 4	ϵ , ϵp >54%
		51	(7/2-)	-27.3s	>200 ns	ϵ
		52	(6+)	-33.92s	115 ms 23	ϵ
		53	(7/2-)	-42.64	240 ms 9	ϵ
		53m	(19/2-)	-39.45	247 ms 12	ϵ = 98.5%, p = 1.5%
		54	0+	-48.009	193.28 ms 7	ϵ
		54m	(7+)	-47.812	1.48 m 2	ϵ
		55	7/2-	-54.028	17.53 h 3	ϵ
		56	4+	-56.039	77.233 d 27	ϵ
		57	7/2-	-59.344	271.74 d 6	ϵ
		58	2+	-59.846	70.86 d 6	ϵ
		58m	5+	-59.821	9.04 h 11	IT
		59	7/2-	-62.228	100%	
		60	5+	-61.649	1925.28 d 14	β^-
		60m	2+	-61.590	10.467 m 6	IT 99.76%, β^- 0.24%
		61	7/2-	-62.898	1.650 h 5	β^-
		62	2+	-61.43	1.50 m 4	β^-
		62m	5+	-61.41	13.91 m 5	β^- >99%, IT <1%
	63	7/2-	-61.84	27.4 s 5	β^-	
	64	1+	-59.79	0.30 s 3	β^-	
	65	(7/2)-	-59.17	1.20 s 6	β^-	
	66	(3+)	-56.1	0.18 s 1	β^-	
	67	(7/2-)	-55.1	0.425 s 20	β^-	
	68	(7-)	-51.4	0.199 s 21	β^-	
	68m	(3+)	-51.4	1.6 s 3	β^-	
	69	7/2-	-50.0	0.22 s 2	β^-	
	70	(6-)	-45.6	119 ms 6	β^-	
	70m	(3+)	-45.6	0.50 s 18	β^-	
	71		-43.9	79 ms 5	β^- , β^-n 2.61%	
	72	(6-, 7-)	-39.3s	62 ms 3	β^- , β^-n 4.8%	
	73		-37.0s	41 ms 4	β^-	
	74	0+	-32.2s	>150 ns	β^-	
	75	(7/2-)	-29.5s	>150 ns	β^-	
28	Ni	48	0+	18.4s	>0.5 μ s	ϵ
		49		9.0s	12 ms +5-3	ϵ , ϵp ?
		50	0+	-3.8s	12 ms 3	ϵp 70%, ϵ
		51	(7/2-)	-11.4s	>200 ns	ϵ
		52	0+	-22.65s	38 ms 5	ϵ , ϵp 17%
		53	(7/2-)	-29.4s	45 ms 15	ϵ , ϵp = 45%
		54	0+	-39.21	104 ms 7	ϵ
		55	7/2-	-45.34	202 ms 3	ϵ

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or			
Z	El	A	$J\pi$	(MeV)	Abundance	Decay Mode
28	Ni	56	0+	-53.90	6.075 d 10	ϵ
		57	3/2-	-56.082	35.60 h 6	ϵ
		58	0+	-60.228	68.077% 9	
		59	3/2-	-61.156	7.6 $\times 10^4$ y 5	ϵ
		60	0+	-64.472	26.223% 8	
		61	3/2-	-64.221	1.140% 1	
		62	0+	-66.746	3.634% 2	
		63	1/2-	-65.513	100.1 y 20	β^-
		64	0+	-67.099	0.926% 1	
		65	5/2-	-65.126	2.5172 h 3	β^-
		66	0+	-66.006	54.6 h 3	β^-
		67	(1/2)-	-63.743	21 s 1	β^-
		68	0+	-63.464	29 s 2	β^-
		69	9/2+	-59.979	11.4 s 3	β^-
		69m	1/2-	-59.658	3.5 s 5	β^-
		70	0+	-59.1	6.0 s 3	β^-
		71		-55.2	2.56 s 3	β^-
		72	0+	-53.9	1.57 s 5	β^- , β^-n
		73	(9/2+)	-49.9s	0.84 s 3	β^-
74	0+	-48.4s	0.68 s 18	β^- , β^-n		
75	(7/2+)	-43.9s	0.6 s 2	β^- , β^-n 8.43%		
76	0+	-41.6s	0.24 s +55-24	β^- , β^-n		
77		-36.7s	>150 ns	$\beta^-?$		
78	0+	-34s	>150 ns	β^-		
29	Cu	52	(3+)	-2.6s	?	p
		53	(3/2-)	-13.5s	<300 ns	ϵ , p
		54	(3+)	-21.7s	<75 ns	p
		55	3/2-	-31.6s	>200 ns	ϵ
		56	4+	-38.6s	94 ms 3	ϵ
		57	3/2-	-47.31	196.3 ms 7	ϵ
		58	1+	-51.662	3.204 s 7	ϵ
		59	3/2-	-56.357	81.5 s 5	ϵ
		60	2+	-58.344	23.7 m 4	ϵ
		61	3/2-	-61.984	3.333 h 5	ϵ
		62	1+	-62.798	9.67 m 3	ϵ
		63	3/2-	-65.579	69.17% 3	
		64	1+	-65.424	12.700 h 2	ϵ 61%, β^- 39%
		65	3/2-	-67.264	30.83% 3	
		66	1+	-66.258	5.120 m 14	β^-
		67	3/2-	-67.319	61.83 h 12	β^-
		68	1+	-65.567	31.1 s 15	β^-
		68m	(6-)	-64.845	3.75 m 5	IT 84%, β^- 16%
		69	3/2-	-65.736	2.85 m 15	β^-
		70	(6-)	-62.976	44.5 s 2	β^-
		70m	(3-)	-62.875	33 s 2	β^- 52%, IT 48%
		70m	1+	-62.734	6.6 s 2	β^- 93.2%, IT 6.8%
		71	(3/2-)	-62.711	19.5 s 16	β^-
72	(1+)	-59.783	6.6 s 1	β^-		
73	(3/2-)	-58.987	4.2 s 3	β^-		
74	(1+,3+)	-56.006	1.594 s 10	β^-		
75	(3/2-)	-54.1	1.224 s 3	β^- , β^-n 3.5%		
76m		-50.976	0.641 s 6	β^- , β^-n 3%		

Nuclear Wallet Cards

Nuclide			Δ	T½, Γ , or	
Z	El	A	(MeV)	Abundance	Decay Mode
29 Cu	76m		-50.976	1.27 s 30	β^-
	77		-48.6s	0.469 s 8	β^-
	78		-44.7s	342 ms 11	β^-
	79		-42.3s	188 ms 25	β^- , β^-n 55%
	80		-36.4s	>300 ns	β^-
30 Zn	54	0+	-6.6s	?	2p?
	55		-14.9s	>0.5 μ s	ϵ , p
	56	0+	-25.7s	>0.5 μ s	ϵ , p
	57	(7/2-)	-32.8s	38 ms 4	ϵ , $\epsilon p \geq 65\%$
	58	0+	-42.30	84 ms 9	ϵ
	59	3/2-	-47.26	182.0 ms 18	ϵ , ϵp 0.1%
	60	0+	-54.19	2.38 m 5	ϵ
	61	3/2-	-56.35	89.1 s 2	ϵ
	61m	1/2-	-56.26	<430 ms	IT
	61m	3/2-	-55.93	0.14 s 7	IT
	61m	5/2-	-55.59	<0.13 s	IT
	62	0+	-61.17	9.186 h 13	ϵ
	63	3/2-	-62.213	38.47 m 5	ϵ
	64	0+	-66.004	>2.8 $\times 10^{16}$ y	2 ϵ
				48.63% 60	
	65	5/2-	-65.912	243.66 d 9	ϵ
	66	0+	-68.899	27.90% 27	
	67	5/2-	-67.880	4.10% 13	
	68	0+	-70.007	18.75% 51	
	69	1/2-	-68.418	56.4 m 9	β^-
	69m	9/2+	-67.979	13.76 h 2	IT 99.97%, β^- 0.03%
	70	0+	-69.565	>1.3 $\times 10^{16}$ y	2 β^-
				0.62% 3	
	71	1/2-	-67.33	2.45 m 10	β^-
	71m	9/2+	-67.17	3.96 h 5	β^- , IT \leq 0.05%
	72	0+	-68.131	46.5 h 1	β^-
	73	(1/2)-	-65.41	23.5 s 10	β^-
73m		-65.41	5.8 s 8	IT, β^-	
74	0+	-65.71	95.6 s 12	β^-	
75	(7/2+)	-62.47	10.2 s 2	β^-	
76	0+	-62.14	5.7 s 3	β^-	
77	(7/2+)	-58.7	2.08 s 5	β^-	
77m	(1/2-)	-57.9	1.05 s 10	IT>50%, β^- <50%	
78	0+	-57.34	1.47 s 15	β^-	
79	(9/2+)	-53.4s	0.995 s 19	β^- , β^-n 1.3%	
80	0+	-51.8	0.54 s 2	β^- , β^-n 1%	
81		-46.1s	0.29 s 5	β^- , β^-n 7.5%	
82	0+	-42.5s	>150 ns	β^-	
83	(5/2+)	-36.3s	>150 ns	β^-	
31 Ga	56		-4.7s	?	p?
	57		-15.9s	?	p?
	58		-24.0s	?	p?
	59		-34.1s	?	p?
	60	(2+)	-40.0s	70 ms 13	ϵ 98.4%, ϵp 1.6%, $\epsilon\alpha$ <0.02%
	61	3/2-	-47.09	168 ms 3	ϵ
	62	0+	-52.00	116.18 ms 4	ϵ

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El	(MeV)	Abundance	Decay Mode
31 Ga	63	(3/2-)	-56.547	32.4 s 5 ϵ
	64	0+	-58.834	2.627 m 12 ϵ
	65	3/2-	-62.657	15.2 m 2 ϵ
	66	0+	-63.724	9.49 h 7 ϵ
	67	3/2-	-66.880	3.2623 d 15 ϵ
	68	1+	-67.086	67.71 m 9 ϵ
	69	3/2-	-69.328	60.108% 9
	70	1+	-68.910	21.14 m 3 β^- 99.59%, ϵ 0.41%
	71	3/2-	-70.140	39.892% 9
	72	3-	-68.589	14.095 h 3 β^-
	73	3/2-	-69.699	4.86 h 3 β^-
	74	(3-)	-68.050	8.12 m 12 β^-
	74m	(0)	-67.990	9.5 s 10 IT 75%, β^- <50%
	75	(3/2)-	-68.465	126 s 2 β^-
	76	(2+,3+)	-66.297	32.6 s 6 β^-
	77	(3/2-)	-65.992	13.2 s 2 β^-
	78	(3+)	-63.707	5.09 s 5 β^-
	79	(3/2-)	-62.51	2.847 s 3 β^- , β^- -n 0.09%
	80	(3)	-59.1	1.676 s 14 β^- , β^- -n 0.86%
	81	(5/2-)	-58.0	1.217 s 5 β^- , β^- -n 11.9%
82	(1,2,3)	-53.1s	0.599 s 2 β^- , β^- -n 19.8%	
83		-49.4s	0.308 s 1 β^- , β^- -n 37%	
84		-44.1s	0.085 s 10 β^- , β^- -n 70%	
85	(3/2-)	-40.1s	>150 ns β^-	
86		-34.4s	>150 ns β^-	
32 Ge	58	0+	-8.4s	? 2p?
	59		-17.0s	? 2p?
	60	0+	-27.8s	=30 ms ϵ ?, 2p?
	61	(3/2-)	-33.7s	39 ms 12 ϵ , ϵ p=80%
	62	0+	-42.2s	129 ns 35 ϵ
	63	(3/2-)	-46.9s	142 ms 8 ϵ
	64	0+	-54.35	63.7 s 25 ϵ
	65	(3/2)-	-56.4	30.9 s 5 ϵ
	66	0+	-61.62	2.26 h 5 ϵ
	67	1/2-	-62.658	18.9 m 3 ϵ
	68	0+	-66.980	270.95 d 16 ϵ
	69	5/2-	-67.101	39.05 h 10 ϵ
	70	0+	-70.563	20.37% 18
	71	1/2-	-69.908	11.43 d 3 ϵ
	72	0+	-72.586	27.31% 26
	73	9/2+	-71.298	7.76% 8
	73m	1/2-	-71.231	0.499 s 11 IT
	74	0+	-73.422	36.73% 15
	75	1/2-	-71.856	82.78 m 4 β^-
	75m	7/2+	-71.717	47.7 s 5 IT 99.97%, β^- 0.03%
76	0+	-73.213	1.2×10 ²⁵ y 14 2 β^-	
			7.83% 7	
77	7/2+	-71.214	11.30 h 1 β^-	
77m	1/2-	-71.054	52.9 s 6 β^- 81%, IT 19%	
78	0+	-71.862	88.0 m 10 β^-	
79	(1/2)-	-69.49	18.98 s 3 β^-	
79m	(7/2+)	-69.30	39.0 s 10 β^- 96%, IT 4%	

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
32	Ge	80	0+	-69.52	29.5 s 4	β^-
		81	(9/2+)	-66.3	7.6 s 6	β^-
		81m	(1/2+)	-65.6	7.6 s 6	β^-
		82	0+	-65.6	4.55 s 5	β^-
		83	(5/2+)	-60.9s	1.85 s 6	β^-
		84	0+	-58.2s	0.947 s 11	β^- , β^- -n 10.8%
		85		-53.1s	535 ms 47	β^- , β^- -n 14%
		86	0+	-49.8s	>150 ns	β^-
		87	(5/2+)	-44.2s	=0.14 s	β^- , β^- -n
		88	0+	-40.1s	\geq 300 ns	β^- ?
		89		-33.7s	>150 ns	β^-
33	As	60		-6.4s	?	p?
		61		-18.1s	?	p?
		62		-25.0s	?	p
		63	(3/2-)	-33.8s	?	p
		64		-39.5s	18 ms +43-7	ϵ ?
		65		-47.0s	128 ms 16	ϵ
		66		-51.5	95.79 ms 22	ϵ
		67	(5/2-)	-56.6	42.5 s 12	ϵ
		68	3+	-58.90	151.6 s 8	ϵ
		69	5/2-	-63.09	15.2 m 2	ϵ
		70	4+	-64.34	52.6 m 3	ϵ
		71	5/2-	-67.894	65.28 h 15	ϵ
		72	2-	-68.230	26.0 h 1	ϵ
		73	3/2-	-70.957	80.30 d 6	ϵ
		74	2-	-70.860	17.77 d 2	ϵ 66%, β^- 34%
		75	3/2-	-73.032	100%	
		76	2-	-72.289	1.0942 d 7	β^-
		77	3/2-	-73.917	38.83 h 5	β^-
		78	2-	-72.817	90.7 m 2	β^-
		79	3/2-	-73.636	9.01 m 15	β^-
		80	1+	-72.16	15.2 s 2	β^-
	81	3/2-	-72.533	33.3 s 8	β^-	
	82	(1+)	-70.3	19.1 s 5	β^-	
	82m	(5-)	-70.3	13.6 s 4	β^-	
	83	(5/2-, 3/2-)	-69.9	13.4 s 3	β^-	
	84	(3-)	-66.1s	3.24 s 26	β^- , β^- -n 0.28%	
	85	(3/2-)	-63.3s	2.021 s 10	β^- , β^- -n 59.4%	
	86		-59.2s	0.945 s 8	β^- , β^- -n 33%	
	87	(3/2-)	-56.0s	0.56 s 8	β^- , β^- -n 15.4%	
	88		-51.3s	\geq 300 ns	β^- ?, β^- -n?	
	89		-47.1s	\geq 300 ns	β^- ?	
	90		-41.5s	>150 ns	β^- ?	
	91		-36.9s	>150 ns	β^-	
	92		-30.9s	>300 ns	β^-	
34	Se	65		-32.9s	<50 ms	ϵ
		66	0+	-41.7s	33 ms 12	ϵ
		67		-46.5s	133 ms 11	ϵ , ϵ p 0.5%
		68	0+	-54.21	35.5 s 7	ϵ
		69	(1/2-, 3/2-)	-56.30	27.4 s 2	ϵ , ϵ p 0.05%
		70	0+	-62.05	41.1 m 3	ϵ
		71	5/2-	-63.12	4.74 m 5	ϵ

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or	
Z	El	(MeV)	Abundance	Decay Mode
34	Se			
	72	0+	-67.89	8.40 d 8 ϵ
	73	9/2+	-68.22	7.15 h 8 ϵ
	73m	3/2-	-68.19	39.8 m 13 IT 72.6%, ϵ 27.4%
	74	0+	-72.213	0.89% 4
	75	5/2+	-72.169	119.779 d 4 ϵ
	76	0+	-75.252	9.37% 29
	77	1/2-	-74.600	7.63% 16
	77m	7/2+	-74.438	17.36 s 5 IT
	78	0+	-77.026	23.77% 28
	79	7/2+	-75.918	2.95 \times 10 ⁵ y 38 β -
	79m	1/2-	-75.822	3.92 m 1 IT 99.94%, β - 0.06%
	80	0+	-77.760	49.61% 41
	81	1/2-	-76.390	18.45 m 12 β -
	81m	7/2+	-76.286	57.28 m 2 IT 99.95%, β - 0.05%
	82	0+	-77.594	9.1 \times 10 ¹⁹ y 9 2 β - 8.73% 22
	83	9/2+	-75.341	22.3 m 3 β -
	83m	1/2-	-75.112	70.1 s 4 β -
	84	0+	-75.95	3.10 m 10 β -
	85	(5/2+)	-72.43	31.7 s 9 β -
	86	0+	-70.54	15.3 s 9 β -
	87	(5/2+)	-66.58	5.50 s 12 β -, β -n 0.2%
	88	0+	-63.88	1.53 s 6 β -, β -n 0.99%
	89	(5/2+)	-59.2s	0.41 s 4 β -, β -n 7.8%
90	0+	-55.9s	>150 ns β -?	
91		-50.3s	0.27 s 5 β -, β -n 21%	
92	0+	-46.6s	>300 ns β -	
93	(1/2+)	-40.7s	>150 ns β -	
94	0+	-36.8s	>150 ns β -	
35	Br			
	67		-32.8s	? p?
	68		-38.6s	<1.2 μ s p?
	69		-46.5s	<24 ns p
	70	0+	-51.4s	79.1 ms 8 ϵ
	70m	9+	-49.1s	2.2 s 2 ϵ
	71	(5/2)-	-57.1	21.4 s 6 ϵ
	72	1+	-59.02	78.6 s 24 ϵ
	72m	1-	-58.91	10.6 s 3 IT=100%, ϵ
	73	1/2-	-63.63	3.4 m 2 ϵ
	74	(0-)	-65.31	25.4 m 3 ϵ
	74m	4(+)	-65.29	46 m 2 ϵ
	75	3/2-	-69.14	96.7 m 13 ϵ
	76	1-	-70.289	16.2 h 2 ϵ
	76m	(4)+	-70.186	1.31 s 2 IT>99.4%, ϵ <0.6%
	77	3/2-	-73.235	57.036 h 6 ϵ
	77m	9/2+	-73.129	4.28 m 10 IT
78	1+	-73.452	6.46 m 4 ϵ \geq 99.99%, β - \leq 0.01%	
79	3/2-	-76.068	50.69% 7	
79m	9/2+	-75.861	4.86 s 4 IT	
80	1+	-75.890	17.68 m 2 β - 91.7%, ϵ 8.3%	
80m	5-	-75.804	4.4205 h 8 IT	
81	3/2-	-77.975	49.31% 7	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or	
Z	El	(MeV)	Abundance	Decay Mode
35 Br	82	5-	-77.496	35.282 h 7 β^-
	82m	2-	-77.451	6.13 m 5 IT 97.6%, β^- 2.4%
	83	3/2-	-79.009	2.40 h 2 β^-
	84	2-	-77.80	31.80 m 8 β^-
	84m	6-	-77.48	6.0 m 2 β^-
	85	3/2-	-78.61	2.90 m 6 β^-
	86	(2-)	-75.64	55.1 s 4 β^-
	87	3/2-	-73.86	55.65 s 13 β^- , β^- -n 2.6%
	88	(2-)	-70.73	16.29 s 6 β^- , β^- -n 6.58%
	89	(3/2-, 5/2-)	-68.57	4.40 s 3 β^- , β^- -n 13.8%
	90		-64.62	1.91 s 1 β^- , β^- -n 25.2%
	91		-61.51	0.541 s 5 β^- , β^- -n 20%
	92	(2-)	-56.58	0.343 s 15 β^- , β^- -n 33.1%
	93	(5/2-)	-53.0s	102 ms 10 β^- , β^- -n 68%
	94		-47.8s	70 ms 20 β^- , β^- -n 70%
	95	(3/2-)	-43.9s	>150 ns β^-
	96		-38.6s	>150 ns β^-
97	(3/2-)	-34.7s	>150 ns β^-	
36 Kr	69		-32.4s	32 ms 10 ϵ
	70	0+	-41.7s	52 ms 17 ϵ , ϵ p \leq 1.3%
	71	(5/2)-	-46.9	100 ms 3 ϵ , ϵ p 5.2%
	72	0+	-53.941	17.1 s 2 ϵ
	73	3/2-	-56.552	27.3 s 10 ϵ , ϵ p 0.25%
	74	0+	-62.332	11.50 m 11 ϵ
	75	5/2+	-64.324	4.29 m 17 ϵ
	76	0+	-69.014	14.8 h 1 ϵ
	77	5/2+	-70.169	74.4 m 6 ϵ
	78	0+	-74.180	$\geq 2.3 \times 10^{20}$ y 2 ϵ
				0.35% 1
	79	1/2-	-74.443	35.04 h 10 ϵ
	79m	7/2+	-74.313	50 s 3 IT
	80	0+	-77.893	2.28% 6
	81	7/2+	-77.694	2.29×10^5 y 11 ϵ
	81m	1/2-	-77.503	13.10 s 3 IT, ϵ $2.5 \times 10^{-3}\%$
	82	0+	-80.590	11.58% 14
	83	9/2+	-79.982	11.49% 6
	83m	1/2-	-79.940	1.83 h 2 IT
	84	0+	-82.431	57.00% 4
	85	9/2+	-81.480	3916.8 d 25 β^-
	85m	1/2-	-81.175	4.480 h 8 β^- 78.6%, IT 21.4%
	86	0+	-83.266	17.30% 22
87	5/2+	-80.709	76.3 m 5 β^-	
88	0+	-79.69	2.84 h 3 β^-	
89	3/2(+)	-76.73	3.15 m 4 β^-	
90	0+	-74.97	32.32 s 9 β^-	
91	5/2(+)	-71.31	8.57 s 4 β^-	
92	0+	-68.79	1.840 s 8 β^- , β^- -n 0.03%	
93	1/2+	-64.0	1.286 s 10 β^- , β^- -n 1.95%	
94	0+	-61.1s	212 ms 5 β^- , β^- -n 1.26%	
95	1/2	-56.0s	114 ms 3 β^- , β^- -n 2.87%	
96	0+	-53.0s	80 ms 8 β^- , β^- -n 3.8%	
97		-47.9s	63 ms 4 β^- , β^- -n 8.2%	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	(MeV)	Abundance	Decay Mode
36 Kr	98	0+	-44.8s	46 ms 8 β^- , β^-n 7%
	99	(3/2+)	-39.5s	40 ms 11 β^- , β^-n 11%
	100	0+	-36.2s	>150 ns β^-
37 Rb	71		-32.3s	? p?
	72	(3+)	-38.1s	<1.2 μ s p
	73		-46.1s	>30 ns ϵ , $p > 0\%$
	74	(0+)	-51.917	64.9 ms 5 ϵ
	75	(3/2-)	-57.222	19.0 s 12 ϵ
	76	1(-)	-60.480	36.5 s 6 ϵ , $\epsilon\alpha$ 3.8 $\times 10^{-7}\%$
	77	3/2-	-64.825	3.77 m 4 ϵ
	78	0(+)	-66.936	17.66 m 8 ϵ
	78m	4(-)	-66.833	5.74 m 5 ϵ 90%, IT 10%
	79	5/2+	-70.803	22.9 m 5 ϵ
	80	1+	-72.173	33.4 s 7 ϵ
	81	3/2-	-75.455	4.570 h 4 ϵ
	81m	9/2+	-75.368	30.5 m 3 IT 97.6%, ϵ 2.4%
	82	1+	-76.188	1.273 m 2 ϵ
	82m	5-	-76.119	6.472 h 5 ϵ , IT < 0.33%
	83	5/2-	-79.075	86.2 d 1 ϵ
	84	2-	-79.750	33.1 d 1 ϵ 96.2%, β^- 3.8%
	84m	6-	-79.286	20.26 m 4 IT
	85	5/2-	-82.167	72.17% 2
	86	2-	-82.747	18.642 d 18 β^- 99.99%, ϵ 5.2 $\times 10^{-3}\%$
	86m	6-	-82.191	1.017 m 3 IT, $\beta^- < 0.3\%$
	87	3/2-	-84.598	4.97 $\times 10^{10}$ y 3 β^-
				27.83% 2
	88	2-	-82.609	17.773 m 11 β^-
	89	3/2-	-81.713	15.15 m 12 β^-
	90	0-	-79.362	158 s 5 β^-
	90m	3-	-79.255	258 s 4 β^- 97.4%, IT 2.6%
91	3/2(-)	-77.745	58.4 s 4 β^-	
92	0-	-74.772	4.492 s 20 β^- , β^-n 0.01%	
93	5/2-	-72.618	5.84 s 2 β^- , β^-n 1.39%	
94	3(-)	-68.553	2.702 s 5 β^- , β^-n 10.01%	
95	5/2-	-65.85	377.5 ms 8 β^- , β^-n 8.73%	
96	2+	-61.22	202.8 ms 33 β^- , β^-n 14%	
97	3/2+	-58.36	169.9 ms 7 β^- , β^-n 25.1%	
98	(0,1)	-54.22	114 ms 5 β^- , β^-n 13.8%, β^- 0.05%	
99	(5/2+)	-50.9	50.3 ms 7 β^- , β^-n 15.9%	
100		-46.7s	51 ms 8 β^- , β^-n 6%, β^-2n 0.16%	
101	(3/2+)	-43.6	32 ms 5 β^- , β^-n 28%	
38 Sr	73		-31.7s	>25 ms ϵ , $\epsilon p > 0\%$
	74	0+	-40.7s	>1.2 μ s ϵ
	75	(3/2-)	-46.6	88 ms 3 ϵ , ϵp 5.2%
	76	0+	-54.24	7.89 s 7 ϵ , ϵp 0.34%
	77	5/2+	-57.804	9.0 s 2 ϵ , $\epsilon p < 0.25\%$
	78	0+	-63.174	2.5 m 3 ϵ
	79	3/2(-)	-65.477	2.25 m 10 ϵ
	80	0+	-70.308	106.3 m 15 ϵ

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	A	J π	(MeV)	Abundance	Decay Mode
38	Sr	81	1/2-	-71.528	22.3 m 4	ϵ
		82	0+	-76.008	25.55 d 15	ϵ
		83	7/2+	-76.80	32.41 h 3	ϵ
		83m	1/2-	-76.54	4.95 s 12	IT
		84	0+	-80.644	0.56% 1	
		85	9/2+	-81.103	64.84 d 2	ϵ
		85m	1/2-	-80.864	67.63 m 4	IT 86.6%, ϵ 13.4%
		86	0+	-84.524	9.86% 1	
		87	9/2+	-84.880	7.00% 1	
		87m	1/2-	-84.492	2.815 h 12	IT 99.7%, ϵ 0.3%
		88	0+	-87.922	82.58% 1	
		89	5/2+	-86.209	50.57 d 3	β -
		90	0+	-85.942	28.90 y 3	β -
		91	5/2+	-83.645	9.63 h 5	β -
		92	0+	-82.868	2.66 h 4	β -
		93	5/2+	-80.085	7.423 m 24	β -
		94	0+	-78.840	75.3 s 2	β -
		95	1/2+	-75.117	23.90 s 14	β -
		96	0+	-72.94	1.07 s 1	β -
		97	1/2+	-68.79	429 ms 5	β -, β -n \leq 0.05%
		98	0+	-66.65	0.653 s 2	β -, β -n 0.25%
99	3/2+	-62.19	0.269 s 1	β -, β -n 0.1%		
100	0+	-60.2	202 ms 3	β -, β -n 0.78%		
101	(5/2-)	-55.4	118 ms 3	β -, β -n 2.37%		
102	0+	-53.1	69 ms 6	β -, β -n 4.8%		
103		-47.6s	>150 ns	β -		
104	0+	-44.4s	>300 ns			
105		-38.6s	>150 ns	β -		
39	Y	76		-38.7s	>200 ns	ϵ ?, p?
		77		-46.90s	=0.06 s	ϵ , ϵ p
		78	(0+)	-52.5s	50 ms 8	ϵ
		78m	(5+)	-52.5s	5.7 s 7	ϵ
		79	(5/2+)	-58.4	14.8 s 6	ϵ , ϵ p
		80	(4-)	-61.2	30.1 s 5	ϵ , ϵ p
		80m	(1-)	-61.0	4.8 s 3	IT 81%, ϵ 19%
		81	(5/2+)	-66.02	70.4 s 10	ϵ
		82	1+	-68.2	8.30 s 20	ϵ
		83	9/2+	-72.33	7.08 m 6	ϵ
		83m	3/2-	-72.26	2.85 m 2	ϵ 60%, IT 40%
		84	1+	-74.16	4.6 s 2	ϵ
		84m	(5-)	-74.16	39.5 m 8	ϵ
		85	(1/2)-	-77.84	2.68 h 5	ϵ
		85m	9/2+	-77.82	4.86 h 13	ϵ , IT < 2.0 \times 10 ⁻³ %
		86	4-	-79.28	14.74 h 2	ϵ
		86m	(8+)	-79.07	48 m 1	IT 99.31%, ϵ 0.69%
		87	1/2-	-83.019	79.8 h 3	ϵ
		87m	9/2+	-82.638	13.37 h 3	IT 98.43%, ϵ 1.57%
		88	4-	-84.299	106.616 d 13	ϵ
		89	1/2-	-87.702	100%	
89m	9/2+	-86.793	15.28 s 17	IT		
90	2-	-86.488	64.053 h 20	β -		
90m	7+	-85.806	3.19 h 6	IT, β - 1.8 \times 10 ⁻³ %		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
39	Y 91	1/2-	-86.345	58.51 d 6 β^-
	91m	9/2+	-85.789	49.71 m 4 IT, $\beta^- < 1.5\%$
	92	2-	-84.813	3.54 h 1 β^-
	93	1/2-	-84.22	10.18 h 8 β^-
	93m	7/2+	-83.46	0.82 s 4 IT
	94	2-	-82.349	18.7 m 1 β^-
	95	1/2-	-81.207	10.3 m 1 β^-
	96	0-	-78.35	5.34 s 5 β^-
	96m	(8)+	-78.35	9.6 s 2 β^-
	97	(1/2-)	-76.26	3.75 s 3 β^- , β^- -n 0.058%
	97m	(9/2)+	-75.59	1.17 s 3 $\beta^- > 99.3\%$, IT < 0.7%, β^- -n < 0.08%
	97m	(27/2-)	-72.73	142 ms 8 IT > 80%, $\beta^- < 20\%$
	98	(0-)	-72.47	0.548 s 2 β^- , β^- -n 0.33%
	98m	(4,5)	-72.06	2.0 s 2 $\beta^- > 80\%$, IT < 20%, β^- -n 3.4%
	99	(5/2+)	-70.20	1.470 s 7 β^- , β^- -n 1.9%
	100	1-, 2-	-67.29	735 ms 7 β^- , β^- -n 0.92%
	100m	(3,4,5)	-67.29	0.94 s 3 β^-
	101	(5/2+)	-64.91	0.45 s 2 β^- , β^- -n 1.5%
	102m		-61.89	0.30 s 1 β^- , β^- -n 4%
	102m		-61.89	0.36 s 4 β^- , β^- -n 4%
	103	(5/2+)	-58.9s	0.23 s 2 β^- , β^- -n 8%
	104		-54.9s	180 ms 60 β^- , β^- -n?
	105		-51.4s	>300 ns $\beta^-?$
106		-46.8s	>150 ns β^-	
107	(5/2+)	-42.7s	=30 ms β^-	
108		-37.7s	20 ms sy β^- , β^- -n	
40	Zr 78	0+	-41.7s	>200 ns $\epsilon?$, ϵ p?
	79		-47.4s	56 ms 30 ϵ , ϵ p
	80	0+	-56	4.6 s 6 ϵ , ϵ p
	81	(3/2-)	-58.5	5.5 s 4 ϵ , ϵ p 0.12%
	82	0+	-64.2s	32 s 5 ϵ
	83	(1/2-)	-66.46	41.6 s 24 ϵ , ϵ p
	84	0+	-71.5s	25.9 m 7 ϵ
	85	7/2+	-73.1	7.86 m 4 ϵ
	85m	(1/2-)	-72.9	10.9 s 3 IT $\leq 92\%$, $\epsilon > 8\%$
	86	0+	-77.80	16.5 h 1 ϵ
	87	(9/2)+	-79.348	1.68 h 1 ϵ
	87m	(1/2-)	-79.012	14.0 s 2 IT
	88	0+	-83.62	83.4 d 3 ϵ
	89	9/2+	-84.869	78.41 h 12 ϵ
	89m	1/2-	-84.281	4.161 m 17 IT 93.77%, ϵ 6.23%
	90	0+	-88.767	51.45% 40
	90m	5-	-86.448	809.2 ms 20 IT
91	5/2+	-87.890	11.22% 5	
92	0+	-88.454	17.15% 8	
93	5/2+	-87.117	1.53×10^6 y 10 β^-	
94	0+	-87.267	17.38% 28	
95	5/2+	-85.658	64.032 d 6 β^-	
96	0+	-85.443	$> 3.9 \times 10^{20}$ y $2\beta^-$ 2.80% 9	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
40	Zr	97	1/2+	-82.947 16.744 h 11 β^-
		98	0+	-81.29 30.7 s 4 β^-
		99	(1/2+)	-77.77 2.1 s 1 β^-
		100	0+	-76.60 7.1 s 4 β^-
		101	(3/2+)	-73.46 2.3 s 1 β^-
		102	0+	-71.74 2.9 s 2 β^-
		103	(5/2-)	-68.4 1.3 s 1 β^-
		104	0+	-66.3s 1.2 s 3 β^-
		105		-62.4s 0.6 s 1 β^-
		106	0+	-59.7s >150 ns $\beta^-?$
		107		-55.2s =150 ms β^-
	108	0+	-52.2s 80 ms sy β^- , β^-n	
	109		-47.3s >150 ns β^- , β^-n	
	110	0+	-43.9s >150 ns β^-	
41	Nb	81		-47s =0.8 s $\epsilon?$, $\epsilon p?$, $p?$
		82	0+	-53.0s 50 ms 5 ϵ
		83	(5/2+)	-59.0 4.1 s 3 ϵ
		84	3+	-61.9s 9.5 s 10 ϵ , ϵp
		85	(9/2+)	-67.1 20.9 s 7 ϵ
		86?		-69.83 56 s 8 ϵ
		86m	(6+)	-69.83 88 s 1 ϵ
		87	(1/2-)	-74.18 3.75 m 9 ϵ
		87m	(9/2+)	-74.18 2.6 m 1 ϵ
		88	(8+)	-76.1 14.55 m 6 ϵ
		88m	(4-)	-76.1 7.78 m 5 ϵ
		89	(9/2+)	-80.65 2.03 h 7 ϵ
		89m	(1/2)-	-80.62 66 m 2 ϵ
		90	8+	-82.656 14.60 h 5 ϵ
		90m	4-	-82.532 18.81 s 6 IT
		91	9/2+	-86.632 6.8×10^2 y 13 ϵ
		91m	1/2-	-86.528 60.86 d 22 IT 96.6%, ϵ 3.4%
		92	(7+)	-86.448 3.47×10^7 y 24 ϵ , $\beta^- < 0.05\%$
		92m	(2+)	-86.313 10.15 d 2 ϵ
		93	9/2+	-87.208 100%
		93m	1/2-	-87.177 16.13 y 14 IT
		94	(6+)	-86.365 2.03×10^4 y 16 β^-
		94m	3+	-86.324 6.263 m 4 IT 99.5%, β^- 0.5%
	95	9/2+	-86.782 34.991 d 6 β^-	
	95m	1/2-	-86.546 3.61 d 3 IT 94.4%, β^- 5.6%	
	96	6+	-85.604 23.35 h 5 β^-	
	97	9/2+	-85.606 72.1 m 7 β^-	
	97m	1/2-	-84.863 58.7 s 18 IT	
	98	1+	-83.529 2.86 s 6 β^-	
	98m	(5+)	-83.445 51.3 m 4 β^- 99.9%, IT < 0.2%	
	99	9/2+	-82.33 15.0 s 2 β^-	
	99m	1/2-	-81.96 2.6 m 2 $\beta^- > 96.2\%$, IT < 3.8%	
	100	1+	-79.94 1.5 s 2 β^-	
	100m	(4+,5+)	-79.44 2.99 s 11 β^-	
	101	(5/2+)	-78.94 7.1 s 3 β^-	
	102m	1+	-76.35 1.3 s 2 β^-	
	102m		-76.35 4.3 s 4 β^-	
	103	(5/2+)	-75.32 1.5 s 2 β^-	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or					
Z	El A	(MeV)	Abundance	Decay Mode				
41	Nb	104	(1+)	-72.2	4.9 s 3	β^- , β^- -n 0.06%		
		104m		-72.0	0.94 s 4	β^- , β^- -n 0.05%		
		105	(5/2+)	-70.85	2.95 s 6	β^- , β^- -n 1.7%		
		106		-67.1s	1.02 s 5	β^- , β^- -n 4.5%		
		107		-64.9s	330 ms 50	β^-		
		108	(2+)	-60.7s	0.193 s 17	β^- , β^- -n 6.2%		
		109	(5/2)	-58.1s	0.19 s 3	β^- , β^- -n 31%		
		110		-53.6s	0.17 s 2	β^- , β^- -n 40%		
		111	(5/2+)	-50.6s	80. ms sy	β^-		
		112	(2+)	-45.8s	>150 ns	β^-		
		113		-42.2s	30 ms sy	β^-		
		42	Mo	83		-47.7s	6 ms +30-3	ϵ
				84	0+	-55.8s	3.7 s +10-8	ϵ
85	(1/2-)			-59.1s	3.2 s 2	ϵ p 0.14%, ϵ		
86	0+			-64.6	19.6 s 11	ϵ		
87	7/2+			-67.7	14.02 s 26	ϵ , ϵ p 15%		
88	0+			-72.70	8.0 m 2	ϵ		
89	(9/2+)			-75.00	2.11 m 10	ϵ		
89m	(1/2-)			-74.62	190 ms 15	IT		
90	0+			-80.167	5.56 h 9	ϵ		
91	9/2+			-82.20	15.49 m 1	ϵ		
91m	1/2-			-81.55	64.6 s 6	ϵ 50%, IT 50%		
92	0+			-86.805	14.84% 35			
93	5/2+			-86.803	4.0 \times 10 ³ y 8	ϵ		
93m	21/2+			-84.379	6.85 h 7	IT 99.88%, ϵ 0.12%		
94	0+			-88.410	9.25% 12			
95	5/2+			-87.707	15.92% 13			
96	0+			-88.790	16.68% 2			
97	5/2+			-87.540	9.55% 8			
98	0+			-88.112	24.13% 31			
99	1/2+			-85.966	2.7489 d 6	β^-		
100	0+			-86.184	0.78 \times 10 ¹⁹ y 8	2 β^-		
					9.63% 23			
101	1/2+			-83.511	14.61 m 3	β^-		
102	0+			-83.56	11.3 m 2	β^-		
103	(3/2+)			-80.85	67.5 s 15	β^-		
104	0+			-80.33	60 s 2	β^-		
105	(5/2-)	-77.34	35.6 s 16	β^-				
106	0+	-76.26	8.4 s 5	β^-				
107	(7/2-)	-72.9	3.5 s 5	β^-				
108	0+	-71.3s	1.09 s 2	β^-				
109	(7/2-)	-67.2s	0.53 s 6	β^-				
110	0+	-65.5s	0.27 s 1	β^-				
111		-61.1s	200. ms sy	β^-				
112	0+	-58.8s	>150 ns	β^- ?				
113		-54.1s	100 ms sy	β^-				
114	0+	-51.3s	80 ms sy	β^-				
115		-46.3s	60 ms sy	β^- , β^- -n				
43	Tc	85		-47.7s	=0.5 s	ϵ ?		
		86	(0+)	-53.2s	54 ms 7	ϵ		
		87	(9/2+)	-59.1s	2.2 s 2	ϵ		
		88	(3+)	-62.7s	5.8 s 2	ϵ		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	A	J π	(MeV)		
			Abundance	Decay Mode		
43	Tc	88m	(6+)	-62.7s	6.4 s 8	ϵ
		89	(9/2+)	-67.8s	12.8 s 9	ϵ
		89m	(1/2-)	-67.8s	12.9 s 8	ϵ , IT<0.01%
		90m	1+	-71.2	8.7 s 2	ϵ
		90m	(6+)	-70.7	49.2 s 4	ϵ
		91	(9/2+)	-76.0	3.14 m 2	ϵ
		91m	(1/2-)	-75.8	3.3 m 1	ϵ , IT<1%
		92	(8+)	-78.93	4.25 m 15	ϵ
		93	9/2+	-83.603	2.75 h 5	ϵ
		93m	1/2-	-83.211	43.5 m 10	IT 76.6%, ϵ 23.4%
		94	7+	-84.154	293 m 1	ϵ
		94m	(2+)	-84.079	52.0 m 10	ϵ , IT<0.1%
		95	9/2+	-86.017	20.0 h 1	ϵ
		95m	1/2-	-85.978	61 d 2	ϵ 96.12%, IT 3.88%
		96	7+	-85.817	4.28 d 7	ϵ
		96m	4+	-85.783	51.5 m 10	IT 98%, ϵ 2%
		97	9/2+	-87.220	4.21×10 ⁶ y 16	ϵ
		97m	1/2-	-87.123	91.4 d 8	IT, ϵ 3.94%
		98	(6+)	-86.428	4.2×10 ⁶ y 3	β -
		99	9/2+	-87.323	2.111×10 ⁵ y 12	β -
		99m	1/2-	-87.180	6.0058 h 12	IT, β - 3.7×10 ⁻³ %
		100	1+	-86.016	15.8 s 1	β -, ϵ 1.8×10 ⁻³ %
		101	9/2+	-86.34	14.22 m 1	β -
		102	1+	-84.566	5.28 s 15	β -
		102m	(4,5)	-84.566	4.35 m 7	β - 98%, IT 2%
		103	5/2+	-84.60	54.2 s 8	β -
		104	(3+)	-82.49	18.3 m 3	β -
		105	(3/2-)	-82.29	7.6 m 1	β -
		106	(1,2)	-79.78	35.6 s 6	β -
		107	(3/2-)	-79.1	21.2 s 2	β -
108	(2+)	-76.0	5.17 s 7	β -		
109	(5/2+)	-74.54	0.86 s 4	β -, β -n 0.08%		
110	(2+)	-70.96	0.92 s 3	β - 99.96%, β -n 0.04%		
	111	(7/2+,9/2+)	-69.2	290 ms 20	β -, β -n 0.85%	
	112		-66.0	0.29 s 2	β -, β -n 1.5%	
	113		-63.7s	170 ms 20	β -, β -n 2.1%	
	114		-59.7s	150 ms 30	β -, β -n	
	115		-57.1s	100 ms sy	β -, β -n	
	116		-52.8s	90 ms sy	β -	
	117		-49.9s	40 ms sy	β -	
	118		-45.2s	>150 ns	β -	
44	Ru	87		-47.3s	>1.5 μ s	ϵ ?
		88	0+	-55.6s	1.2 s +3-2	ϵ , ϵ p
		89		-59.5s	1.5 s 2	ϵ , ϵ p<0.15%
		90	0+	-65.3s	11.7 s 9	ϵ
		91	(9/2+)	-68.7s	7.9 s 4	ϵ
		91m	(1/2-)	-68.7s	7.6 s 8	ϵ >0%, ϵ p>0%, IT
		92	0+	-74.4s	3.65 m 5	ϵ
		93	(9/2+)	-77.27	59.7 s 6	ϵ
		93m	(1/2-)	-76.53	10.8 s 3	ϵ 78%, IT 22%, ϵ p 0.03%

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
44	Ru	94	0+	-82.57	51.8 m 6	ϵ
		95	5/2+	-83.45	1.643 h 14	ϵ
		96	0+	-86.072	5.54% 14	
		97	5/2+	-86.112	2.791 d 4	ϵ
		98	0+	-88.225	1.87% 3	
		99	5/2+	-87.617	12.76% 14	
		100	0+	-89.219	12.60% 7	
		101	5/2+	-87.950	17.06% 2	
		102	0+	-89.098	31.55% 14	
		103	3/2+	-87.259	39.26 d 2	β^-
		104	0+	-88.089	18.62% 27	
		105	3/2+	-85.928	4.44 h 2	β^-
		106	0+	-86.322	373.59 d 15	β^-
		107	(5/2)+	-83.9	3.75 m 5	β^-
		108	0+	-83.7	4.55 m 5	β^-
		109	(5/2+)	-80.85	34.5 s 10	β^-
		110	0+	-79.98	11.6 s 6	β^-
		111	(5/2+)	-76.67	2.12 s 7	β^-
		112	0+	-75.48	1.75 s 7	β^-
		113	(5/2+)	-72.20	0.80 s 5	β^-
	113m	(11/2-)	-72.07	510 ms 30	β^- 92%, IT 8%	
	114	0+	-70.5s	0.53 s 6	β^-	
	115		-66.4	740 ms 80	β^- , β^-n	
	116	0+	-64.4s	400 ms sy	$\beta^-?$	
	117		-60.0s	300 ms sy	β^-	
	118	0+	-57.9s	>150 ns	$\beta^-?$	
	119		-53.2s	>150 ns	β^-	
	120	0+	-50.9s	>150 ns	β^-	
45	Rh	89		-47.7s	>1.5 μ s	ϵ
		90		-53.2s	12 ms +9-4	$\epsilon?$
		90m		-53.2s	1.0 s +3-2	$\epsilon?$
		91	(9/2+)	-59.1s	1.47 s 22	ϵ
		91m	(1/2-)	-59.1s	1.46 s 11	ϵ
		92	(2+)	-63.4s	0.5 s 4	ϵ
		92	($\geq 6+$)	-63.4s	4.66 s 25	ϵ
		93	(9/2+)	-69.2s	11.9 s 7	ϵ
		94m	(8+)	-72.9s	25.8 s 2	ϵ
		94m	(3+)	-72.9s	70.6 s 6	ϵ
		95	(9/2+)	-78.3	5.02 m 10	ϵ
		95m	(1/2-)	-77.8	1.96 m 4	IT 88%, ϵ 12%
		96	(6+)	-79.68	9.90 m 10	ϵ
		96m	(3+)	-79.63	1.51 m 2	IT 60%, ϵ 40%
		97	9/2+	-82.59	30.7 m 6	ϵ
		97m	1/2-	-82.33	46.2 m 16	ϵ 94.4%, IT 5.6%
		98	(2+)	-83.17	8.72 m 12	ϵ
		98m	(5+)	-83.17	3.6 m 2	IT 89%, ϵ 11%
	99	1/2-	-85.574	16.1 d 2	ϵ	
	99m	9/2+	-85.510	4.7 h 1	ϵ >99.84%, IT <0.16%	
	100	1-	-85.58	20.8 h 1	ϵ	
	100m	(5+)	-85.58	4.6 m 2	IT=98.3%, ϵ =1.7%	
	101	1/2-	-87.41	3.3 y 3	ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
45	Rh			
	101m	9/2+	-87.25	4.34 d 1 ϵ 92.8%, IT 7.2%
	102	(1-,2-)	-86.775	207 d 3 ϵ 78%, β - 22%
	102m	6(+)	-86.634	=2.9 y ϵ 99.77%, IT 0.23%
	103	1/2-	-88.022	100%
	103m	7/2+	-87.982	56.114 m 9 IT
	104	1+	-86.950	42.3 s 4 β - 99.55%, ϵ 0.45%
	104m	5+	-86.821	4.34 m 3 IT 99.87%, β - 0.13%
	105	7/2+	-87.846	35.36 h 6 β -
	105m	1/2-	-87.716	42.9 s 3 IT
	106	1+	-86.362	29.80 s 8 β -
	106m	(6)+	-86.225	131 m 2 β -
	107	7/2+	-86.86	21.7 m 4 β -
	108	1+	-85.0	16.8 s 5 β -
	108m	(5+)	-85.0	6.0 m 3 β -
	109	7/2+	-85.01	80 s 2 β -
	110m	1+	-82.78	3.2 s 2 β -
	110m	(\geq 4)	-82.78	28.5 s 15 β -
	111	(7/2+)	-82.36	11 s 1 β -
	112m	1+	-79.74	3.45 s 37 β -
	112m	(4,5,6)	-79.74	6.73 s 15 β -
	113	(7/2+)	-78.68	2.80 s 12 β -
114	1+	-75.6	1.85 s 5 β -	
114m	(4,5)	-75.6	1.85 s 5 β -	
115	(7/2+)	-74.21	0.99 s 5 β -	
116	1+	-70.7	0.68 s 6 β -	
116m	(6-)	-70.6	0.57 s 5 β -	
117	(7/2+)	-68.9s	0.44 s 4 β -	
118	0+	-65.1s	0.30 s 6 β -	
119		-63.2s	>150 ns β -	
120		-59.2s	>150 ns β -?	
121		-57.1s	>150 ns β -?	
122		-52.9s	=50 ms β -?	
46	Pd			
	91		-47.4s	>1 μ s ϵ ?
	92	0+	-55.5s	0.7 s +4-2 ϵ
	93	(7/2+,9/2+)	-59.7s	1.3 s 2 ϵ , ϵ p 1.5%
	93m		-59.7s	9.3 s +25-17 ϵ , IT
	94	0+	-66.3s	9.0 s 5 ϵ
	95		-70.2s	10 s sy ϵ
	95m	(21/2+)	-68.2s	13.3 s 3 $\epsilon \geq 91.3%$, IT $\leq 9.7%$, ϵ p 0.9%
	96	0+	-76.2	122 s 2 ϵ
	97	5/2+	-77.8	3.10 m 9 ϵ
	98	0+	-81.30	17.7 m 3 ϵ
	99	(5/2)+	-82.19	21.4 m 2 ϵ
	100	0+	-85.23	3.63 d 9 ϵ
	101	5/2+	-85.43	8.47 h 6 ϵ
	102	0+	-87.925	1.02% 1
103	5/2+	-87.479	16.991 d 19 ϵ	
104	0+	-89.390	11.14% 8	
105	5/2+	-88.413	22.33% 8	
106	0+	-89.902	27.33% 3	
107	5/2+	-88.368	6.5×10^6 y 3 β -	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El	A	$J\pi$	(MeV)	
			Abundance	Decay Mode	
46 Pd	107m	11/2-	-88.153	21.3 s 5	IT
	108	0+	-89.524	26.46% 9	
	109	5/2+	-87.607	13.7012 h 24	β^-
	109m	11/2-	-87.418	4.696 m 3	IT
	110	0+	-88.35	11.72% 9	
	111	5/2+	-86.00	23.4 m 2	β^-
	111m	11/2-	-85.83	5.5 h 1	IT 73%, β^- 27%
	112	0+	-86.34	21.03 h 5	β^-
	113	(5/2+)	-83.69	93 s 5	β^-
	113m		-83.69	≥ 100 s	
	113m	(9/2-)	-83.61	0.3 s 1	IT
	114	0+	-83.50	2.42 m 6	β^-
	115	(5/2+)	-80.40	25 s 2	β^-
	115m	(11/2-)	-80.31	50 s 3	β^- 92%, IT 8%
	116	0+	-79.96	11.8 s 4	β^-
	117	(5/2+)	-76.53	4.3 s 3	β^-
	118	0+	-75.5	1.9 s 1	β^-
	119		-71.6s	0.92 s 13	β^-
	120	0+	-70.1	0.5 s 1	β^-
	121		-66.3s	>150 ns	β^- ?
122	0+	-64.7s	>150 ns	β^- , β^- n	
123		-60.6s	>150 ns	β^-	
124	0+	-58.8s	=0.2 s	β^- ?	
47 Ag	93		-46.8s	>1.5 μ s	ϵ ?, p?
	94	(0+)	-53.3s	26 ms +26-9	ϵ , ϵ p
	94m	(21+)	-53.3s	0.47 s 8	ϵ , ϵ p
	94m	(7+)	-53.3s	0.59 s 2	ϵ , ϵ p>0%
	95		-60.1s	2.0 s 1	ϵ , ϵ p
	96	(8+)	-64.6s	4.40 s 6	ϵ , ϵ p 8.15%
	96	(2+)	-64.6s	6.9 s 6	ϵ , ϵ p 18%
	97	9/2+	-70.8	25.9 s 4	ϵ
	98	(6+)	-73.06	47.5 s 3	ϵ , ϵ p $1.1 \times 10^{-3}\%$
	99	(9/2+)	-76.8	124 s 3	ϵ
	99m	(1/2-)	-76.3	10.5 s 5	IT
	100	(5+)	-78.15	2.01 m 9	ϵ
	100m	(2+)	-78.13	2.24 m 13	ϵ , IT
	101	9/2+	-81.2	11.1 m 3	ϵ
	101m	(1/2-)	-81.0	3.10 s 10	IT
	102	5+	-82.26	12.9 m 3	ϵ
	102m	2+	-82.26	7.7 m 5	ϵ 51%, IT 49%
	103	7/2+	-84.79	65.7 m 7	ϵ
	103m	1/2-	-84.66	5.7 s 3	IT
	104	5+	-85.111	69.2 m 10	ϵ
	104m	2+	-85.104	33.5 m 20	ϵ 99.93%, IT<0.07%
	105	1/2-	-87.07	41.29 d 7	ϵ
	105m	7/2+	-87.04	7.23 m 16	IT 99.66%
106	1+	-86.937	23.96 m 4	ϵ 99.5%, β^- <1%	
106m	6+	-86.847	8.28 d 2	ϵ	
107	1/2-	-88.402	51.839% 8		
107m	7/2+	-88.309	44.5 s 8	IT	
108	1+	-87.602	2.37 m 1	β^- 97.15%, ϵ 2.85%	
108m	6+	-87.492	438 y 9	ϵ 91.3%, IT 8.7%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
47	Ag	109	1/2-	-88.723	48.161% 8	
	109m	7/2+	-88.635	38.0 s	12 IT	
	110	1+	-87.461	24.6 s	2 β^- 99.7%, ϵ 0.3%	
	110m	6+	-87.343	249.76 d	4 β^- 98.64%, IT 1.36%	
	111	1/2-	-88.221	7.45 d	1 β^-	
	111m	7/2+	-88.161	64.8 s	8 IT 99.3%, β^- 0.7%	
	112	2(-)	-86.62	3.130 h	9 β^-	
	113	1/2-	-87.03	5.37 h	5 β^-	
	113m	7/2+	-86.99	68.7 s	16 IT 64%, β^- 36%	
	114	1+	-84.95	4.6 s	1 β^-	
	115	1/2-	-84.99	20.0 m	5 β^-	
	115m	7/2+	-84.95	18.0 s	7 β^- 79%, IT 21%	
	116	(2)-	-82.57	2.68 m	10 β^-	
	116m	(5+)	-82.49	8.6 s	3 β^- 94%, IT 6%	
	117	(1/2-)	-82.27	72.8 s	+20-7 β^- = 100%	
	117m	(7/2+)	-82.24	5.34 s	5 β^- 94%, IT 6%	
	118	1(-)	-79.57	3.76 s	15 β^-	
	118m	4(+)	-79.44	2.0 s	2 β^- 59%, IT 41%	
	119m	(7/2+)	-78.56	2.1 s	1 β^-	
	119m	(1/2-)	-78.56	6.0 s	5 β^-	
	120	3(+)	-75.65	1.23 s	4 β^- , β^- -n < 3.0 × 10 ⁻³ %	
	120m	6(-)	-75.45	0.40 s	3 β^- = 63%, IT = 37%	
	121	(7/2+)	-74.7	0.79 s	2 β^- , β^- -n 0.08%	
	122	(3+)	-71.2s	0.529 s	13 β^- , β^- -n 0.19%	
	122m	(8-)	-71.2s	1.5 s	5 β^- , β^- -n	
	123	(7/2+)	-70.0s	0.300 s	5 β^- , β^- -n 0.55%	
	124		-66.5s	0.172 s	5 β^- , β^- -n > 0.1%	
	125	(7/2+)	-64.8s	166 ms	7 β^- , β^- -n	
126		-61.0s	107 ms	12 β^- , β^- -n		
127	(1/2-)	-58.9s	79 ms	3 β^-		
128		-54.8s	58 ms	5 β^- , β^- -n		
129	(9/2+)	-52.5s	46 ms	+5-9 β^- , β^- -n		
129m	(1/2-)	-52.5s	=160 ms	β^- , β^- -n		
130		-46.2s	=50 ms	β^-		
48	Cd	95		-46.7s	5 ms	sy ϵ ?, ϵ p?
	96	0+	-56.1s	=1 s	ϵ ?	
	97		-60.6s	2.8 s	6 ϵ , ϵ p	
	98	0+	-67.63	9.2 s	3 ϵ , ϵ p < 0.03%	
	99	(5/2+)	-69.9s	16 s	3 ϵ , ϵ p 0.17%, $\epsilon\alpha$ < 1.0 × 10 ⁻⁴ %	
	100	0+	-74.25	49.1 s	5 ϵ	
	101	(5/2+)	-75.7	1.36 m	5 ϵ	
	102	0+	-79.68	5.5 m	5 ϵ	
	103	5/2+	-80.65	7.3 m	1 ϵ	
	104	0+	-83.975	57.7 m	10 ϵ	
	105	5/2+	-84.33	55.5 m	4 ϵ	
	106	0+	-87.132	$\geq 2.6 \times 10^{17}$ y	2 ϵ	
				1.25% 6		
	107	5/2+	-86.985	6.50 h	2 ϵ	
	108	0+	-89.252	> 1.0 × 10 ¹⁸ y	2 ϵ	
				0.89% 3		
	109	5/2+	-88.508	461.4 d	12 ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
48	Cd	110	0+	-90.353	12.49% 18	
		111	1/2+	-89.257	12.80% 12	
		111m	11/2-	-88.861	48.50 m 9	IT
		112	0+	-90.580	24.13% 21	
		113	1/2+	-89.049	7.7×10 ¹⁵ y 3	β^-
					12.22% 12	
		113m	11/2-	-88.786	14.1 y 5	β^- 99.86%, IT 0.14%
		114	0+	-90.021	>6.4×10 ¹⁸ y	2 β^-
					28.73% 42	
		115	1/2+	-88.090	53.46 h 5	β^-
		115m	(11/2)-	-87.910	44.56 d 24	β^-
		116	0+	-88.719	3.1×10 ¹⁹ y 4	2 β^-
					7.49% 18	
		117	1/2+	-86.425	2.49 h 4	β^-
		117m	(11/2)-	-86.289	3.36 h 5	β^-
		118	0+	-86.71	50.3 m 2	β^-
		119	3/2+	-83.91	2.69 m 2	β^-
		119m	(11/2)-	-83.76	2.20 m 2	β^-
		120	0+	-83.97	50.80 s 21	β^-
		121	(3/2+)	-81.06	13.5 s 3	β^-
		121m	(11/2)-	-80.85	8.3 s 8	β^-
		122	0+	-80.73	5.24 s 3	β^-
		123	(3/2+)	-77.31	2.10 s 2	β^-
		123m	(11/2)-	-76.99	1.82 s 3	$\beta^- \leq 100\%$, IT
		124	0+	-76.71	1.25 s 2	β^-
		125	(3/2+)	-73.36	0.65 s 2	β^-
		125m	(11/2)-	-73.31	0.48 s 3	β^-
		126	0+	-72.33	0.515 s 17	β^-
		127	(3/2+)	-68.52	0.37 s 7	β^-
		128	0+	-67.3	0.28 s 4	β^-
		129	(3/2+)	-63.2s	0.27 s 4	β^-
		130	0+	-61.6	162 ms 7	β^- , $\beta^-n=3.5\%$
		131		-55.3s	68 ms 3	β^- , $\beta^-n=3.5\%$
	132	0+	-50.7s	97 ms 10	β^- , $\beta^-n=60\%$	
49	In	97		-47.0s	5 ms sy	p?, ϵ ?
		98		-53.9s	32 ms +32-11	ϵ
		98m		-53.9s	1.2 s +12-4	ϵ
		99	(9/2+)	-61.3s	3.0 s +8-7	ϵ
		100	(6,7)+	-64.2	5.9 s 2	ϵ , ϵp 1.6%
		101		-68.6s	15.1 s 3	$\epsilon=100\%$, ϵp
		102	(6+)	-70.7	23.3 s 1	ϵ , ϵp 9.3×10 ^{-3%}
		103	(9/2+)	-74.60	65 s 7	ϵ
		103m	(1/2-)	-73.97	34 s 2	ϵ 67%, IT 33%
		104	5,6(+)	-76.11	1.80 m 3	ϵ
		104m	(3+)	-76.01	15.7 s 5	IT 80%, ϵ 20%
		105	9/2+	-79.48	5.07 m 7	ϵ
		105m	(1/2-)	-78.81	48 s 6	IT
		106	7+	-80.61	6.2 m 1	ϵ
		106m	(3+)	-80.58	5.2 m 1	ϵ
	107	9/2+	-83.56	32.4 m 3	ϵ	
	107m	1/2-	-82.88	50.4 s 6	IT	
	108	7+	-84.116	58.0 m 12	ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
49	In			
	108m	2+	-84.086	39.6 m 7 ϵ
	109	9/2+	-86.489	4.2 h 1 ϵ
	109m	1/2-	-85.839	1.34 m 7 IT
	109m(19/2+)		-84.387	0.209 s 6 IT
	110	7+	-86.47	4.9 h 1 ϵ
	110m	2+	-86.41	69.1 m 5 ϵ
	111	9/2+	-88.396	2.8047 d 5 ϵ
	111m	1/2-	-87.859	7.7 m 2 IT
	112	1+	-87.996	14.97 m 10 ϵ 56%, β - 44%
	112m	4+	-87.840	20.56 m 6 IT
	113	9/2+	-89.370	4.29% 5
	113m	1/2-	-88.978	99.476 m 23 IT
	114	1+	-88.572	71.9 s 1 β - 99.5%, ϵ 0.5%
	114m	5+	-88.382	49.51 d 1 IT 96.75%, ϵ 3.25%
	115	9/2+	-89.537	4.41 \times 10 ¹⁴ y 25 β -
				95.71% 5
	115m	1/2-	-89.200	4.486 h 4 IT 95%, β - 5%
	116	1+	-88.250	14.10 s 3 β - 99.98%, ϵ 0.02%
	116m	5+	-88.123	54.29 m 17 β -
	116m	8-	-87.960	2.18 s 4 IT
	117	9/2+	-88.945	43.2 m 3 β -
	117m	1/2-	-88.630	116.2 m 3 β - 52.9%, IT 47.1%
	118	1+	-87.230	5.0 s 5 β -
	118m	5+	-87.170	4.45 m 5 β -
	118m	8-	-87.030	8.5 s 3 IT 98.6%, β - 1.4%
	119	9/2+	-87.704	2.4 m 1 β -
	119m	1/2-	-87.393	18.0 m 3 β - 94.4%, IT 5.6%
	120	1+	-85.74	3.08 s 8 β -
	120m	(8-)	-85.74	47.3 s 5 β -
	120m	(5+)	-85.67	46.2 s 8 β -
	121	9/2+	-85.84	23.1 s 6 β -
	121m	1/2-	-85.53	3.88 m 10 β - 98.8%, IT 1.2%
	122	1+	-83.58	1.5 s 3 β -
	122m	5+	-83.54	10.3 s 6 β -
	122m	8-	-83.29	10.8 s 4 β -
	123	(9/2)+	-83.43	6.17 s 5 β -
	123m	(1/2)-	-83.10	47.4 s 4 β -
	124	3+	-80.88	3.11 s 10 β -
	124m	(8-)	-80.83	3.7 s 2 β -
	125	9/2+	-80.48	2.36 s 4 β -
	125m	1/2(-)	-80.12	12.2 s 2 β -
	126	3(+)	-77.81	1.53 s 1 β -
	126m	(8-)	-77.71	1.64 s 5 β -
	127	(9/2+)	-76.99	1.09 s 1 β -, β -n \leq 0.03%
	127m	(1/2-)	-76.52	3.67 s 4 β -, β -n 0.69%
	128	(3+)	-74.36	0.84 s 6 β -, β -n $<$ 0.05%
128m	(8-)	-74.02	0.72 s 10 β -, β -n $<$ 0.05%	
129	(9/2+)	-72.94	0.61 s 1 β -, β -n 0.25%	
129m	(1/2-)	-72.56	1.23 s 3 β - $>$ 99.7%, β -n 2.5%, IT $<$ 0.3%	
130	1(-)	-69.89	0.29 s 2 β -, β -n 0.93%	
130m	(10-)	-69.84	0.54 s 1 β -, β -n 1.65%	

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
49 In	130m (5+)	-69.49	0.54 s 1	β^- , β^-n 1.65%
	131 (9/2+)	-68.14	0.28 s 3	β^- , $\beta^-n \leq 2\%$
	131m (1/2-)	-67.77	0.35 s 5	$\beta^- \geq 99.98\%$, $\beta^-n \leq 2\%$, IT $\leq 0.02\%$
	131m	-63.87	0.32 s 6	$\beta^- > 99\%$, IT $< 1\%$, β^-n 0.03%
	132 (7-)	-62.42	0.207 s 6	β^- , β^-n 6.3%
	133 (9/2+)	-57.9s	165 ms 3	β^- , β^-n 85%
	134 (4- to 7-)	-52.0s	140 ms 4	β^- , β^-n 65%
135	-47.2s	92 ms 10	β^- , $\beta^-n > 0\%$	
50 Sn	99	-47.2s	5 ms sy	$\epsilon?$, $\epsilon p?$
	100 0+	-56.8	0.94 s +54-27	ϵ , $\epsilon p < 17\%$
	101	-59.6s	3 s 1	ϵ , ϵp
	102 0+	-64.9	4.5 s 7	ϵ
	103	-67.0s	7.0 s 6	ϵ , ϵp
	104 0+	-71.6	20.8 s 5	ϵ
	105 (5/2+)	-73.26	34 s 1	ϵ , ϵp
	106 0+	-77.43	115 s 5	ϵ
	107 (5/2+)	-78.58	2.90 m 5	ϵ
	108 0+	-82.04	10.30 m 8	ϵ
	109 5/2(+)	-82.64	18.0 m 2	ϵ
	110 0+	-85.84	4.11 h 10	ϵ
	111 7/2+	-85.945	35.3 m 6	ϵ
	112 0+	-88.661	0.97% 1	
	113 1/2+	-88.333	115.09 d 3	ϵ
	113m 7/2+	-88.256	21.4 m 4	IT 91.1%, ϵ 8.9%
	114 0+	-90.561	0.66% 1	
	115 1/2+	-90.036	0.34% 1	
	116 0+	-91.528	14.54% 9	
	117 1/2+	-90.400	7.68% 7	
	117m 11/2-	-90.085	13.76 d 4	IT
	118 0+	-91.656	24.22% 9	
	119 1/2+	-90.068	8.59% 4	
	119m 11/2-	-89.979	293.1 d 7	IT
	120 0+	-91.105	32.58% 9	
	121 3/2+	-89.204	27.03 h 4	β^-
	121m 11/2-	-89.198	43.9 y 5	IT 77.6%, β^- 22.4%
	122 0+	-89.946	4.63% 3	
	123 11/2-	-87.821	129.2 d 4	β^-
	123m 3/2+	-87.796	40.06 m 1	β^-
	124 0+	-88.237	5.79% 5	
	125 11/2-	-85.898	9.64 d 3	β^-
125m 3/2+	-85.871	9.52 m 5	β^-	
126 0+	-86.02	2.30×10^5 y 14	β^-	
127 (11/2-)	-83.50	2.10 h 4	β^-	
127m (3/2+)	-83.49	4.13 m 3	β^-	
128 0+	-83.33	59.07 m 14	β^-	
128m (7-)	-81.24	6.5 s 5	IT	
129 (3/2+)	-80.59	2.23 m 4	β^-	
129m (11/2-)	-80.56	6.9 m 1	β^- , IT $< 2.0 \times 10^{-3}\%$	
130 0+	-80.14	3.72 m 7	β^-	
130m (7-)	-78.19	1.7 m 1	β^-	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
50	Sn				
	131	(3/2+)	-77.31	56.0 s 5	β^-
	131m	(11/2-)	-77.07	58.4 s 5	β^- , IT $\leq 4.0 \times 10^{-4}\%$
	132	0+	-76.55	39.7 s 8	β^-
	133	(7/2-)	-70.95	1.45 s 3	β^- , β^- -n 0.08%
	134	0+	-66.80	1.050 s 11	β^- , β^- -n 17%
	135	(7/2-)	-60.8s	530 ms 20	β^- , β^- -n 21%
	136	0+	-56.5s	0.25 s 3	β^- , β^- -n 30%
137		-50.3s	190 ms 60	β^- , β^- -n 58%	
51	Sb				
	103		-56.2s	>1.5 μ s	ϵ ?
	104		-59.2s	0.44 s +15-11	ϵ , ϵ p < 7%, p < 1%
	105	(5/2+)	-63.8	1.12 s 16	ϵ 99%, p 1%
	106	(4+)	-66.3s	0.6 s 2	ϵ
	107	(5/2+)	-70.7s	4.0 s 2	ϵ
	108	(4+)	-72.5s	7.4 s 3	ϵ
	109	(5/2+)	-76.26	17.3 s 5	ϵ
	110	(3+, 4+)	-77.5s	23.0 s 4	ϵ
	111	(5/2+)	-80.89	75 s 1	ϵ
	112	3+	-81.60	51.4 s 10	ϵ
	113	5/2+	-84.42	6.67 m 7	ϵ
	114	3+	-84.52	3.49 m 3	ϵ
	115	5/2+	-87.00	32.1 m 3	ϵ
	116	3+	-86.821	15.8 m 8	ϵ
	116m	8-	-86.438	60.3 m 6	ϵ
	117	5/2+	-88.645	2.80 h 1	ϵ , ϵ 1.7%
	118	1+	-87.999	3.6 m 1	ϵ
	118m	8-	-87.749	5.00 h 2	ϵ
	119	5/2+	-89.477	38.19 h 22	ϵ
	119m	(27/2+)	-86.636	0.85 s 9	IT
	120	1+	-88.424	15.89 m 4	ϵ
	120m	8-	-88.424	5.76 d 2	ϵ
	121	5/2+	-89.595	57.21% 5	
	122	2-	-88.330	2.7238 d 2	β^- 97.59%, ϵ 2.41%
	122m	(8)-	-88.167	4.191 m 3	IT
	123	7/2+	-89.224	42.79% 5	
	124	3-	-87.620	60.11 d 7	β^-
	124m	5+	-87.609	93 s 5	IT 75%, β^- 25%
	124m	(8)-	-87.584	20.2 m 2	IT
	125	7/2+	-88.256	2.7586 y 3	β^-
	126	(8-)	-86.40	12.35 d 6	β^-
	126m	(5+)	-86.38	19.15 m 8	β^- 86%, IT 14%
126m	(3-)	-86.36	=11 s	IT	
127	7/2+	-86.700	3.85 d 5	β^-	
128	8-	-84.61	9.01 h 4	β^-	
128m	5+	-84.61	10.4 m 2	β^- 96.4%, IT 3.6%	
129	7/2+	-84.63	4.40 h 1	β^-	
129m	(19/2-)	-82.78	17.7 m 1	β^- 85%, IT 15%	
130	(8-)	-82.29	39.5 m 8	β^-	
130m	(4,5)+	-82.29	6.3 m 2	β^-	
131	(7/2+)	-81.99	23.03 m 4	β^-	
132	(4+)	-79.67	2.79 m 7	β^-	
132m	(8-)	-79.67	4.10 m 5	β^-	
133	(7/2+)	-78.94	2.5 m 1	β^-	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
51	Sb 134	(0-)	-74.17	0.78 s 6	β^-
	134m	(7-)	-74.17	10.07 s 5	β^- , β^-n 0.09%
	135	(7/2+)	-69.7	1.68 s 2	β^- , β^-n 22%
	136	1-	-64.9s	0.923 s 14	β^- , β^-n 16.3%
	137		-60.3s	>150 ns	$\beta^-?$, $\beta^-n?$
	138		-55.2s	>300 ns	$\beta^-?$, $\beta^-n?$
	139		-50.3s	>150 ns	$\beta^-?$
52	Te 105		-52.5s	1 μ s sy	$\alpha?$, $\epsilon?$
	106	0+	-58.2	70 μ s +20-10	α
	107		-60.5s	3.1 ms 1	α 70%, ϵ 30%
	108	0+	-65.7	2.1 s 1	ϵ 51%, α 49%, ϵp 2.4%
	109	(5/2+)	-67.61	4.6 s 3	ϵ 96.1%, ϵp 9.4%, α 3.9%, $\epsilon\alpha < 5.0 \times 10^{-3}\%$
	110	0+	-72.28	18.6 s 8	$\epsilon = 100\%$, $\alpha = 3.0 \times 10^{-3}\%$
	111	(5/2)+	-73.48	19.3 s 4	ϵ , ϵp
	112	0+	-77.3	2.0 m 2	ϵ
	113	(7/2+)	-78.35	1.7 m 2	ϵ
	114	0+	-81.89	15.2 m 7	ϵ
	115	7/2+	-82.06	5.8 m 2	ϵ
	115m	(1/2)+	-82.04	6.7 m 4	$\epsilon \leq 100\%$, IT
	116	0+	-85.27	2.49 h 4	ϵ
	117	1/2+	-85.10	62 m 2	ϵ , ϵ 25%
	117m	(11/2-)	-84.80	103 ms 3	IT
	118	0+	-87.72	6.00 d 2	ϵ
	119	1/2+	-87.184	16.05 h 5	ϵ , ϵ 2.06%
	119m	11/2-	-86.923	4.70 d 4	ϵ , ϵ 0.41%, IT < 8.0 $\times 10^{-3}\%$
	120	0+	-89.405	>2.2 $\times 10^{16}$ y 0.09% 1	2 ϵ
	121	1/2+	-88.55	19.16 d 5	ϵ
	121m	11/2-	-88.26	154 d 7	IT 88.6%, ϵ 11.4%
	122	0+	-90.314	2.55% 12	
	123	1/2+	-89.172	>9.2 $\times 10^{16}$ y 0.89% 3	ϵ
	123m	11/2-	-88.924	119.2 d 1	IT
	124	0+	-90.524	4.74% 14	
	125	1/2+	-89.022	7.07% 15	
	125m	11/2-	-88.877	57.40 d 15	IT
	126	0+	-90.065	18.84% 25	
	127	3/2+	-88.281	9.35 h 7	β^-
	127m	11/2-	-88.193	109 d 2	IT 97.6%, β^- 2.4%
	128	0+	-88.992	8.8 $\times 10^{18}$ y 4 31.74% 8	2 β^-
129	3/2+	-87.003	69.6 m 3	β^-	
129m	11/2-	-86.898	33.6 d 1	IT 63%, β^- 37%	
130	0+	-87.351	>5 $\times 10^{23}$ y 34.08% 62	2 β^-	
131	3/2+	-85.210	25.0 m 1	β^-	
131m	11/2-	-85.027	30 h 2	β^- 77.8%, IT 22.2%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
52	Te			
	132	0+	-85.182	3.204 d 13 β^-
	133	(3/2+)	-82.94	12.5 m 3 β^-
	133m	(11/2-)	-82.61	55.4 m 4 β^- 82.5%, IT 17.5%
	134	0+	-82.56	41.8 m 8 β^-
	135	(7/2-)	-77.83	19.0 s 2 β^-
	136	0+	-74.43	17.63 s 8 β^- , β^- -n 1.31%
	137	(7/2-)	-69.6	2.49 s 5 β^- , β^- -n 2.69%
	138	0+	-65.9s	1.4 s 4 β^- , β^- -n 6.3%
	139	(7/2-)	-60.8s	>150 ns β^- , β^- -n
	140	0+	-57.0s	>150 ns $\beta^-?$, β^- -n?
	141		-51.6s	>150 ns $\beta^-?$, β^- -n?
	142	0+	-47.4s	>150 ns $\beta^-?$
	53	I		
108		(1)	-52.7s	36 ms 6 α 91%, ϵ 9%, p <1%
109		1/2+	-57.6	103 μ s 5 p
110			-60.3s	0.65 s 2 ϵ 83%, α 17%, ϵ p 11%, ϵ α 1.1%
111		(5/2+)	-64.9s	2.5 s 2 ϵ 99.9%, α =0.1%
112			-67.1s	3.42 s 11 ϵ , α =1.2 \times 10 ⁻³ %
113		5/2+	-71.13	6.6 s 2 ϵ , α 3.3 \times 10 ⁻⁷ %
114		1+	-72.8s	2.1 s 2 ϵ , ϵ p
114m		(7)	-72.5s	6.2 s 5 ϵ 91%, IT 9%
115		(5/2+)	-76.34	1.3 m 2 ϵ
116		1+	-77.49	2.91 s 15 ϵ
117		(5/2)+	-80.43	2.22 m 4 ϵ
118		2-	-80.97	13.7 m 5 ϵ
118m		(7-)	-80.87	8.5 m 5 ϵ <100%, IT >0%
119		5/2+	-83.77	19.1 m 4 ϵ
120		2-	-83.79	81.6 m 2 ϵ
120m		(7-)	-83.47	53 m 4 ϵ
121		5/2+	-86.29	2.12 h 1 ϵ
122		1+	-86.080	3.63 m 6 ϵ
123		5/2+	-87.943	13.232 h 6 ϵ
124		2-	-87.365	4.1760 d 3 ϵ
125		5/2+	-88.836	59.400 d 10 ϵ
126		2-	-87.910	12.93 d 5 ϵ 52.7%, β^- 47.3%
127		5/2+	-88.983	100%
128		1+	-87.738	24.99 m 2 β^- 93.1%, ϵ 6.9%
129		7/2+	-88.503	1.57 \times 10 ⁷ y 4 β^-
130		5+	-86.932	12.36 h 1 β^-
130m		2+	-86.892	8.84 m 6 IT 84%, β^- 16%
131		7/2+	-87.444	8.02070 d 11 β^-
132		4+	-85.700	2.295 h 13 β^-
132m	(8-)	-85.580	1.387 h 15 IT 86%, β^- 14%	
133	7/2+	-85.887	20.8 h 1 β^-	
133m	(19/2-)	-84.252	9 s 2 IT	
134	(4+)	-84.073	52.5 m 2 β^-	
134m	(8-)	-83.756	3.52 m 4 IT 97.7%, β^- 2.3%	
135	7/2+	-83.790	6.57 h 2 β^-	
136	(1-)	-79.50	83.4 s 10 β^-	
136m	(6-)	-78.86	46.9 s 10 β^-	
137	(7/2+)	-76.50	24.5 s 2 β^- , β^- -n 6.97%	
138	(2-)	-72.33	6.23 s 3 β^- , β^- -n 5.56%	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El A	(MeV)	Abundance	Decay Mode	
53	I	139 (7/2+)	-68.84	2.280 s 11	β^- , β^-n 10%
		140 (3)	-64.3s	0.86 s 4	β^- , β^-n 9.3%
		141	-60.5s	0.43 s 2	β^- , β^-n 21.2%
		142	-55.7s	=0.2 s	β^-
		143	-51.6s	>150 ns	$\beta^-?$
		144	-46.6s	>300 ns	$\beta^-?$
54	Xe	110 0+	-51.9	105 ms +35-25	$\alpha=64\%$
		110 0+	-51.9	=0.2 s	ϵ
		111	-54.4s	0.74 s 20	α 8%, ϵ
		112 0+	-60.0	2.7 s 8	ϵ 99.16%, α 0.84%
		113 (5/2+)	-62.09	2.74 s 8	$\epsilon=100\%$, ϵp 7%, $\alpha=0.01\%$, $\epsilon\alpha=7.0\times 10^{-3}\%$
		114 0+	-67.09	10.0 s 4	ϵ
		115 (5/2+)	-68.66	18 s 4	ϵ , ϵp 0.34%, α 3.0 $\times 10^{-4}\%$
		116 0+	-73.05	59 s 2	ϵ
		117 5/2(+)	-74.19	61 s 2	ϵ , ϵp 2.9 $\times 10^{-3}\%$
		118 0+	-78.08	3.8 m 9	ϵ
		119 (5/2+)	-78.79	5.8 m 3	ϵ
		120 0+	-82.17	40 m 1	ϵ
		121 (5/2+)	-82.47	40.1 m 20	ϵ
		122 0+	-85.36	20.1 h 1	ϵ
		123 (1/2)+	-85.249	2.08 h 2	ϵ
		124 0+	-87.660	$\geq 1.1\times 10^{17}$ y	2 ϵ
					0.095% 3
		125 1/2(+)	-87.192	16.9 h 2	ϵ
		125m 9/2(-)	-86.939	56.9 s 9	IT
		126 0+	-89.169	0.089% 1	
		127 1/2+	-88.321	36.4 d 1	ϵ
		127m 9/2-	-88.024	69.2 s 9	IT
		128 0+	-89.860	1.910% 22	
		129 1/2+	-88.697	26.40% 18	
		129m 11/2-	-88.461	8.88 d 2	IT
		130 0+	-89.882	4.071% 53	
		131 3/2+	-88.415	21.232% 62	
		131m 11/2-	-88.251	11.934 d 21	IT
		132 0+	-89.281	26.909% 68	
		133 3/2+	-87.644	5.243 d 1	β^-
133m 11/2-	-87.410	2.19 d 1	IT		
134 0+	-88.124	$>5.8\times 10^{22}$ y	2 $\beta^- \geq 0\%$		
			10.436% 29		
134m 7-	-86.159	290 ms 17	IT		
135 3/2+	-86.417	9.14 h 2	β^-		
135m 11/2-	-85.890	15.29 m 5	IT>99.4%, $\beta^- < 0.6\%$		
136 0+	-86.425	$>2.4\times 10^{21}$ y	2 β^-		
			8.857% 33		
137 7/2-	-82.379	3.818 m 13	β^-		
138 0+	-80.15	14.08 m 8	β^-		
139 3/2-	-75.64	39.68 s 14	β^-		
140 0+	-72.99	13.60 s 10	β^-		
141 5/2(-)	-68.33	1.73 s 1	β^- , β^-n 0.04%		

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, T, or		
Z	El A	(MeV)	Abundance	Decay Mode	
54 Xe	142	0+	-65.5	1.250 s 25	β^- , β^-n 0.21%
	143	5/2-	-60.4s	0.511 s 6	β^- , β^-n 1%
	144	0+	-57.3s	0.388 s 7	β^- , β^-n 3%
	145	(3/2-)	-52.1s	188 ms 4	β^-
	145		-52.1s	188 ms 4	β^-n 5%
	146	0+	-48.7s	146 ms 6	β^- , β^-n 6.9%
	147		-43.3s	0.10 s +10-5	β^-n <8%
55 Cs	112	(0+,3+)	-46.3s	0.5 ms 1	p
	113	(3/2+)	-51.7	16.7 μ s 7	p, α
	114	(1+)	-54.5s	0.57 s 2	ϵ = 100%, ϵp 8.7%, $\epsilon\alpha$ 0.19%, α 0.02%
	115		-59.7s	1.4 s 8	ϵ , ϵp = 0.07%
	116	(1+)	-62.1s	0.70 s 4	ϵ , ϵp >0%, $\epsilon\alpha$ >0%
	116m	4+,5,6	-62.0s	3.85 s 13	ϵ , ϵp >0%, $\epsilon\alpha$ >0%
	117	(9/2+)	-66.44	8.4 s 6	ϵ
	117m	(3/2+)	-66.29	6.5 s 4	ϵ
	118	2	-68.41	14 s 2	ϵ , ϵp < 0.04%, $\epsilon\alpha$ < 2.4 $\times 10^{-3}\%$
	118m	6,7,8	-68.41	17 s 3	ϵ , ϵp < 0.04%, $\epsilon\alpha$ < 2.4 $\times 10^{-3}\%$
	119	9/2+	-72.31	43.0 s 2	ϵ
	119m	3/2(+)	-72.31	30.4 s 1	ϵ
	120	2(+)	-73.89	61.3 s 11	ϵ , $\epsilon\alpha$ 2.0 $\times 10^{-5}\%$, ϵp 7.0 $\times 10^{-6}\%$
	120m	(7-)	-73.89	57 s 6	ϵ
	121	3/2(+)	-77.10	155 s 4	ϵ
	121m	9/2(+)	-77.03	122 s 3	ϵ 83%, IT 17%
	122	1+	-78.14	21.18 s 19	ϵ
	122m	8-	-78.02	3.70 m 11	ϵ
	122m	(5)-	-78.01	0.36 s 2	IT
	123	1/2+	-81.04	5.88 m 3	ϵ
	123m	(11/2)-	-80.89	1.64 s 12	IT
	124	1+	-81.731	30.8 s 5	ϵ
	124m	(7+)	-81.269	6.3 s 2	IT
	125	1/2(+)	-84.088	46.7 m 1	ϵ
	126	1+	-84.34	1.64 m 2	ϵ
	127	1/2+	-86.240	6.25 h 10	ϵ
	128	1+	-85.931	3.66 m 2	ϵ
	129	1/2+	-87.500	32.06 h 6	ϵ
	130	1+	-86.900	29.21 m 4	ϵ 98.4%, β^- 1.6%
	130m	5-	-86.737	3.46 m 6	IT 99.84%, ϵ 0.16%
	131	5/2+	-88.060	9.689 d 16	ϵ
	132	2+	-87.156	6.480 d 6	ϵ 98.13%, β^- 1.87%
	133	7/2+	-88.071	100%	
134	4+	-86.891	2.0652 y 4	β^- , ϵ 3.0 $\times 10^{-4}\%$	
134m	8-	-86.753	2.912 h 2	IT	
135	7/2+	-87.582	2.3 $\times 10^6$ y 3	β^-	
135m	19/2-	-85.949	53 m 2	IT	
136	5+	-86.339	13.04 d 3	β^-	
136m	8-	-86.339	19 s 2	IT >0%, β^-	
137	7/2+	-86.546	30.03 y 5	β^-	
138	3-	-82.887	33.41 m 18	β^-	

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
55 Cs	138m	6-	-82.808	2.91 m 8 IT 81%, β - 19%
	139	7/2+	-80.701	9.27 m 5 β -
	140	1-	-77.051	63.7 s 3 β -
	141	7/2+	-74.48	24.84 s 16 β -, β -n 0.04%
	142	0-	-70.52	1.684 s 14 β -, β -n 0.09%
	143	3/2+	-67.67	1.791 s 7 β -, β -n 1.64%
	144	1	-63.27	0.994 s 4 β -, β -n 3.2%
	144m	(\geq 4)	-63.27	<1 s β -
	145	3/2+	-60.06	0.594 s 13 β -, β -n 14.3%
	146	1-	-55.62	0.321 s 2 β -, β -n 14.2%
	147	(3/2+)	-52.02	0.235 s 3 β -, β -n 43%
	148		-47.3	146 ms 6 β -, β -n 25.1%
	149		-43.8s	>50 ms β -, β -n
	150		-39.0s	>50 ms β -, β -n
	151		-35.2s	>50 ms β ?, β -n?
56 Ba	114	0+	-45.9	0.43 s +30-15 ϵ = 100%, ϵ p 20%, α $9.0 \times 10^{-5}\%$, $12 = 3.0 \times 10^{-5}\%$
	115	(5/2+)	-49.0s	0.45 s 5 ϵ , ϵ p >15%
	116	0+	-54.6s	1.3 s 2 ϵ , ϵ p 3%
	117	(3/2)	-57.3s	1.75 s 7 ϵ , ϵ p >0%, $\epsilon\alpha$ >0%
	118	0+	-62.4s	5.2 s 2 ϵ
	119	(5/2+)	-64.6	5.4 s 3 ϵ , ϵ p <25%
	120	0+	-68.9	24 s 2 ϵ
	121	5/2(+)	-70.7	29.7 s 15 ϵ
	122	0+	-74.61	1.95 m 15 ϵ
	123	5/2(+)	-75.65	2.7 m 4 ϵ
	124	0+	-79.09	11.0 m 5 ϵ
	125	1/2(+)	-79.67	3.5 m 4 ϵ
	126	0+	-82.67	100 m 2 ϵ
	127	1/2+	-82.82	12.7 m 4 ϵ
	127m	7/2-	-82.74	1.9 s 2 IT
	128	0+	-85.40	2.43 d 5 ϵ
	129	1/2+	-85.06	2.23 h 11 ϵ
	129m	7/2+	-85.06	2.16 h 2 ϵ \leq 100%, IT
	130	0+	-87.262	$\geq 3.5 \times 10^{14}$ y 2 ϵ
				0.106% I
	131	1/2+	-86.684	11.50 d 6 ϵ
	131m	9/2-	-86.497	14.6 m 2 IT
	132	0+	-88.435	$> 3.0 \times 10^{21}$ y 2 ϵ
			0.101% I	
133	1/2+	-87.553	3841 d 7 ϵ	
133m	11/2-	-87.265	38.9 h 1 IT 99.99%, ϵ $9.6 \times 10^{-3}\%$	
134	0+	-88.950	2.417% 18	
135	3/2+	-87.851	6.592% 12	
135m	11/2-	-87.582	28.7 h 2 IT	
136	0+	-88.887	7.854% 24	
136m	7-	-86.856	0.3084 s 19 IT	
137	3/2+	-87.721	11.232% 24	
137m	11/2-	-87.060	2.552 m 1 IT	
138	0+	-88.262	71.698% 42	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
56 Ba	139	7/2-	-84.914	83.06 m 28	β^-
	140	0+	-83.271	12.752 d 3	β^-
	141	3/2-	-79.726	18.27 m 7	β^-
	142	0+	-77.823	10.6 m 2	β^- , β^-n 0.09%
	143	5/2-	-73.94	14.5 s 3	β^-
	144	0+	-71.77	11.5 s 2	β^- , β^-n 3.6%
	145	5/2-	-67.42	4.31 s 16	β^-
	146	0+	-65.00	2.22 s 7	β^-
	147	(3/2+)	-60.6s	0.893 s 1	β^- , β^-n 0.06%
	148	0+	-58.01	0.612 s 17	β^- , β^-n 0.4%
	149		-53.5s	0.344 s 7	β^- , β^-n 0.43%
	150	0+	-50.6s	0.3 s	β^-
	151		-45.8s	>150 ms	$\beta^-?$
	152	0+	-42.6s	=0.1 s	$\beta^-?$
	153		-37.6s	=0.08 s	$\beta^-?$
57 La	117	(3/2+, 3/2-)	-46.5s	23.5 ms 26	p 93.9%, ϵ 6.1%
	117m	(9/2+)	-46.4s	10 ms 5	p 97.4%, ϵ 2.6%
	118		-49.6s	=1 s	$\epsilon?$
	119		-55.0s	=2 s	$\epsilon?$
	120m		-57.7s	2.8 s 2	ϵ , $\epsilon p > 0\%$
	121		-62.4s	5.3 s 2	ϵ
	122		-64.5s	8.6 s 5	ϵ , ϵp
	123		-68.7s	17 s 3	ϵ
	124m	low	-70.26	<1 s	ϵ
	124m	(7,8-)	-70.26	29 s 1	ϵ
	125		-73.76	64.8 s 12	ϵ
	125m		-73.65	0.4 s 2	IT
	126m	(0-, 1, 2-)	-74.97	<50 s	ϵ , IT
	126m	(5+)	-74.97	54 s 2	$\epsilon > 0\%$
	127	(11/2-)	-77.90	5.1 m 1	ϵ
	127m	(3/2+)	-77.88	3.7 m 4	ϵ , IT
	128	(5+)	-78.63	5.18 m 14	ϵ
	128m	(1+, 2-)	-78.63	<1.4 m	ϵ
	129	3/2+	-81.33	11.6 m 2	ϵ
	129m	11/2-	-81.15	0.56 s 5	IT
	130	3(+)	-81.63	8.7 m 1	ϵ
	131	3/2+	-83.77	59 m 2	ϵ
	132	2-	-83.74	4.8 h 2	ϵ
	132m	6-	-83.55	24.3 m 5	IT 76%, ϵ 24%
	133	5/2+	-85.49	3.912 h 8	ϵ
	134	1+	-85.22	6.45 m 16	ϵ
	135	5/2+	-86.65	19.5 h 2	ϵ
136	1+	-86.04	9.87 m 3	ϵ	
136m	(8+)	-85.81	114 ms 3	IT	
137	7/2+	-87.10	6×10^4 y 2	ϵ	
138	5+	-86.525	1.02×10^{11} y 1	ϵ 65.6%, 0.090% I β^- 34.4%	
139	7/2+	-87.231	99.910% I		
140	3-	-84.321	1.6781 d 3	β^-	
141	(7/2+)	-82.938	3.92 h 3	β^-	
142	2-	-80.035	91.1 m 5	β^-	
143	(7/2+)	-78.19	14.2 m 1	β^-	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
57	La 144	(3-)	-74.89	40.8 s 4	β^-	
	145	(5/2+)	-72.99	24.8 s 20	β^-	
	146	2-	-69.12	6.27 s 10	β^-	
	146m	(6-)	-69.12	10.0 s 1	β^-	
	147	(5/2+)	-66.85	4.015 s 8	β^- , β^- -n 0.04%	
	148	(2-)	-63.13	1.26 s 8	β^- , β^- -n 0.15%	
	149	(3/2,5/2)	-60.8s	1.05 s 3	β^- , β^- -n 1.43%	
	150	(3-)	-57.0s	0.51 s 3	β^- , β^- -n 2.7%	
	151		-54.3s	>150 ns	$\beta^-?$	
	152		-50.1s	>150 ns	$\beta^-?$	
	153		-46.9s	>100 ns		
	154		-42.4s	=0.1 s	$\beta^-?$	
	155		-38.8s	=0.06 s	$\beta^-?$	
	58	Ce 119		-44.0s	=0.2 s	$\epsilon?$
		120	0+	-49.7s	=0.25 s	$\epsilon?$
121			-52.7s	1.1 s 1	ϵ , ϵ p=1%	
122		0+	-57.8s	=2 s	$\epsilon?$, ϵ p?	
123		(5/2)	-60.2s	3.8 s 2	ϵ , ϵ p>0%	
124		0+	-64.8s	6 s 2	ϵ	
125		(5/2+)	-66.7s	10.2 s 4	ϵ , ϵ p	
126		0+	-70.82	51.0 s 3	ϵ	
127		(5/2+)	-71.98	31 s 2	ϵ	
128		0+	-75.53	3.93 m 2	ϵ	
129		5/2+	-76.29	3.5 m 5	ϵ >0%	
130		0+	-79.42	22.9 m 5	ϵ	
131		(7/2+)	-79.72	10.2 m 3	ϵ	
131m		(1/2+)	-79.72	5.0 m 10	ϵ	
132		0+	-82.47	3.51 h 11	ϵ	
133		1/2+	-82.42	97 m 4	ϵ	
133m		9/2-	-82.39	4.9 h 4	ϵ	
134		0+	-84.84	3.16 d 4	ϵ	
135		1/2(+)	-84.62	17.7 h 3	ϵ	
135m		(11/2-)	-84.18	20 s 1	IT	
136		0+	-86.47	>0.7×10 ¹⁴ y	2 ϵ	
				0.185% 2		
137		3/2+	-85.88	9.0 h 3	ϵ	
137m		11/2-	-85.62	34.4 h 3	IT 99.22%, ϵ 0.78%	
138		0+	-87.57	≥0.9×10 ¹⁴ y	2 ϵ	
				0.251% 2		
139		3/2+	-86.952	137.641 d 20	ϵ	
139m		11/2-	-86.198	54.8 s 10	IT	
140		0+	-88.083	88.450% 18		
141	7/2-	-85.440	32.508 d 13	β^-		
142	0+	-84.538	>2.6×10 ¹⁷ y	2 β^-		
			11.114% 17			
143	3/2-	-81.612	33.039 h 6	β^-		
144	0+	-80.437	284.91 d 5	β^-		
145	(3/2-)	-77.10	3.01 m 6	β^-		
146	0+	-75.68	13.52 m 13	β^-		
147	(5/2-)	-72.03	56.4 s 10	β^-		
148	0+	-70.39	56 s 1	β^-		
149	(3/2-)	-66.70	5.3 s 2	β^-		

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
58	Ce 150	0+	-64.82	4.0 s 6	β^-
	151		-61.5	1.02 s 6	β^-
	152	0+	-59.1s	1.4 s 2	β^-
	153		-55.3s	>100 ns	$\beta^-?$
	154	0+	-52.7s	>150 ns	$\beta^-?$
	155		-48.4s	>300 ns	$\beta^-?$
	156	0+	-45.4s	=0.15 s	$\beta^-?$
	157		-40.7s	=0.05 s	$\beta^-?$
59	Pr 121	(3/2-)	-41.6s	1.4 s 8	p
	122		-44.9s	=0.5 s	$\epsilon?$
	123		-50.3s	=0.8 s	$\epsilon?$
	124		-53.1s	1.2 s 2	ϵ , ϵp
	125		-57.9s	3.3 s 7	ϵ , ϵp
	126	≥ 4	-60.3s	3.14 s 22	ϵ
	126	≥ 4	-60.3s	3.14 s 22	ϵp
	127		-64.4s	4.2 s 3	ϵ
	128	4,5,6	-66.33	2.84 s 9	ϵ
	129	(11/2-)	-69.77	32 s 3	$\epsilon > 0\%$
	130?	(4,5)+	-71.18	40 s 4	ϵ
	131	(3/2+)	-74.28	94 s 4	ϵ
	131m	(11/2-)	-74.13	5.7 s 2	IT 96.4%, ϵ 3.6%
	132	(2)+	-75.21	1.6 m 3	ϵ
	133	(3/2+)	-77.94	6.5 m 3	ϵ
	134m	(6-)	-78.51	=11 m	ϵ
	134m	2-	-78.51	17 m 2	ϵ
	135	3/2(+)	-80.94	24 m 2	ϵ
	136	2+	-81.33	13.1 m 1	ϵ
	137	5/2+	-83.18	1.28 h 3	ϵ
	138	1+	-83.13	1.45 m 5	ϵ
	138m	7-	-82.77	2.12 h 4	ϵ
	139	5/2+	-84.823	4.41 h 4	ϵ
	140	1+	-84.695	3.39 m 1	ϵ
	141	5/2+	-86.021	100%	
	142	2-	-83.793	19.12 h 4	β^- 99.98%, ϵ 0.02%
	142m	5-	-83.789	14.6 m 5	IT
	143	7/2+	-83.074	13.57 d 2	β^-
	144	0-	-80.756	17.28 m 5	β^-
	144m	3-	-80.697	7.2 m 3	IT 99.93%, β^- 0.07%
	145	7/2+	-79.632	5.984 h 10	β^-
	146	(2)-	-76.71	24.15 m 18	β^-
147	(3/2+)	-75.45	13.4 m 4	β^-	
148	1-	-72.53	2.29 m 2	β^-	
148m	(4)	-72.44	2.01 m 7	β^-	
149	(5/2+)	-71.06	2.26 m 7	β^-	
150	(1)-	-68.30	6.19 s 16	β^-	
151	(3/2-)	-66.77	18.90 s 7	β^-	
152	(4-)	-63.8	3.63 s 12	β^-	
153		-61.6	4.28 s 11	β^-	
154	(3+,2+)	-58.2	2.3 s 1	β^-	
155		-55.8s	>300 ns	$\beta^-?$	
156		-51.9s	>300 ns	$\beta^-?$	
157		-49.0s	=0.3 s	$\beta^-?$	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El A	(MeV)	Abundance	Decay Mode	
59 Pr	158	-44.7s	=0.2 s	β^- ?	
	159	-41.5s	=0.1 s	β^- ?	
60 Nd	124	0+	0.5 s sy	ϵ ?	
	125	(5/2)	0.60 s 15	$\epsilon, \epsilon p > 0\%$	
	126	0+	>200 ns	$\epsilon, \epsilon p$	
	127		1.8 s 4	$\epsilon, \epsilon p$	
	128	0+	5 s	$\epsilon, \epsilon p$	
	129	(5/2+)	7 s 1	$\epsilon, \epsilon p$	
	130	0+	21 s 3	ϵ	
	131	(5/2)	-67.77	33 s 3	$\epsilon, \epsilon p$
	132	0+	-71.43	94 s 8	ϵ
	133	(7/2+)	-72.33	70 s 10	ϵ
	133m	(1/2)+	-72.20	=70 s	ϵ, IT
	134	0+	-75.65	8.5 m 15	ϵ
	135	9/2(-)	-76.21	12.4 m 6	ϵ
	135m	(1/2+)	-76.15	5.5 m 5	$\epsilon > 99.97\%$, IT < 0.03%
	136	0+	-79.20	50.65 m 33	ϵ
	137	1/2+	-79.58	38.5 m 15	ϵ
	137m	11/2-	-79.06	1.60 s 15	IT
	138	0+	-82.02	5.04 h 9	ϵ
	139	3/2+	-81.99	29.7 m 5	ϵ
	139m	11/2-	-81.76	5.50 h 20	ϵ 88.2%, IT 11.8%
	140	0+	-84.25	3.37 d 2	ϵ
	141	3/2+	-84.198	2.49 h 3	ϵ
	141m	11/2-	-83.441	62.0 s 8	IT, $\epsilon < 0.05\%$
	142	0+	-85.955	27.2% 5	
	143	7/2-	-84.007	12.2% 2	
	144	0+	-83.753	2.29 $\times 10^{15}$ y 16	α
				23.8% 3	
	145	7/2-	-81.437	8.3% 1	
	146	0+	-80.931	17.2% 3	
	147	5/2-	-78.152	10.98 d 1	β^-
	148	0+	-77.413	5.7% 1	
	149	5/2-	-74.381	1.728 h 1	β^-
150	0+	-73.690	0.79 $\times 10^{19}$ y 7	2 β^-	
			5.6% 2		
151	3/2+	-70.953	12.44 m 7	β^-	
152	0+	-70.16	11.4 m 2	β^-	
153	(3/2)-	-67.35	31.6 s 10	β^-	
154	0+	-65.7	25.9 s 2	β^-	
155		-62.5s	8.9 s 2	β^-	
156	0+	-60.5	5.49 s 7	β^-	
157		-56.8s	>100 ns	β^- ?	
158	0+	-54.4s	>50 ns	β^-	
159		-50.2s	=0.7 s	β^- ?	
160	0+	-47.4s	=0.3 s	β^- ?	
161		-43.0s	=0.2 s	β^- ?	
61 Pm	126	-39.6s	0.5 s sy	ϵ ?	
	127	-45.1s	1 s sy	$\epsilon?$, p?	
	128	-48.0s	1.0 s 3	$\epsilon, \alpha, \epsilon p$	
	129	5/2-)	-52.9s	2.4 s 9	ϵ

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
61 Pm	130	(4,5,6)	-55.5s	2.6 s 2	ϵ , ϵp
	131	(11/2)	-59.7s	6.3 s 8	ϵ
	132	(3+)	-61.7s	6.2 s 6	ϵ , $\epsilon\text{p}=5.0\times 10^{-5}\%$
	133	(11/2-)	-65.41	15 s 3	ϵ
	134	(2+)	-66.74	=5 s	ϵ
	134m	(5+)	-66.74	22 s 1	ϵ
	135m	(11/2-)	-69.98	45 s 4	ϵ
	135m	3/2+,5/2+	-69.98	49 s 3	ϵ
	136m	(2+)	-71.20	47 s 2	ϵ
	136m	(5-)	-71.20	107 s 6	ϵ
	137	11/2-	-74.07	2.4 m 1	ϵ
	138		-74.94	10 s 2	ϵ
	138m		-74.92	3.24 m 5	ϵ
	139	(5/2)+	-77.50	4.15 m 5	ϵ
	139m	(11/2)-	-77.31	180 ms 20	IT 99.94%, ϵ 0.06%
	140	1+	-78.21	9.2 s 2	ϵ
	140m	8-	-78.21	5.95 m 5	ϵ
	141	5/2+	-80.52	20.90 m 5	ϵ
	142	1+	-81.16	40.5 s 5	ϵ
	143	5/2+	-82.966	265 d 7	ϵ , $\epsilon < 5.7\times 10^{-6}\%$
	144	5-	-81.421	363 d 14	ϵ
	145	5/2+	-81.274	17.7 y 4	ϵ , $\alpha 3\times 10^{-7}\%$
	146	3-	-79.460	5.53 y 5	ϵ 66%, β - 34%
	147	7/2+	-79.048	2.6234 y 2	β -
	148	1-	-76.872	5.368 d 2	β -
	148m	5-,6-	-76.734	41.29 d 11	β - 95.8%, IT 4.2%
	149	7/2+	-76.071	53.08 h 5	β -
	150	(1-)	-73.60	2.68 h 2	β -
	151	5/2+	-73.395	28.40 h 4	β -
	152	1+	-71.26	4.12 m 8	β -
	152m	4-	-71.11	7.52 m 8	β -
	152m	(8)	-71.11	13.8 m 2	β - $\leq 100\%$, IT $\geq 0\%$
153	5/2-	-70.68	5.25 m 2	β -	
154	(3,4)	-68.50	2.68 m 7	β -	
154m	(0,1)	-68.50	1.73 m 10	β -	
155	5/2-	-66.97	41.5 s 2	β -	
156m	4-	-64.22	26.70 s 10	β -	
157	(5/2-)	-62.4	10.56 s 10	β -	
158		-59.1	4.8 s 5	β -	
159		-56.8s	1.47 s 15	β -	
160		-53.1s	=2 s	β -?	
161		-50.4s	=0.7 s	β -?	
162		-46.3s	=0.5 s	β -?	
163		-43.1s	=0.2 s	β -?	
62 Sm	128	0+	-39.0s	0.5 s sy	ϵ ?, p?
	129	(1/2+)	-42.3s	0.55 10	ϵ , ϵp
	130	0+	-47.6s	1 s sy	ϵ
	131		-50.2s	1.2 s 2	ϵ , $\epsilon\text{p}>0\%$
	132	0+	-55.2s	4.0 s 3	ϵ , ϵp
	133	(5/2+)	-57.1s	3.7 s 7	ϵ , $\epsilon\text{p}>0\%$
	134	0+	-61.5s	9.5 s 8	ϵ
	135	(3/2+,5/2+)	-62.9	10.3 s 5	ϵ , ϵp 0.02%

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
62 Sm	136	0+	-66.81	47 s 2 ϵ
	137	(9/2-)	-68.03	45 s 1 ϵ
	138	0+	-71.50	3.1 m 2 ϵ
	139	1/2+	-72.38	2.57 m 10 ϵ
	139m	11/2-	-71.92	10.7 s 6 IT 93.7%, ϵ 6.3%
	140	0+	-75.46	14.82 m 12 ϵ
	141	1/2+	-75.939	10.2 m 2 ϵ
	141m	11/2-	-75.763	22.6 m 2 ϵ 99.69%, IT 0.31%
	142	0+	-78.993	72.49 m 5 ϵ
	143	3/2+	-79.523	8.75 m 8 ϵ
	143m	11/2-	-78.769	66 s 2 IT 99.76%, ϵ 0.24%
	144	0+	-81.972	3.07% 7
	145	7/2-	-80.658	340 d 3 ϵ
	146	0+	-81.002	10.3×10 ⁷ y 5 α
	147	7/2-	-79.272	1.06×10 ¹¹ y 2 α
				14.99% 18
	148	0+	-79.342	7×10 ¹⁵ y 3 α
				11.24% 10
	149	7/2-	-77.142	13.82% 7
	150	0+	-77.057	7.38% 1
	151	5/2-	-74.582	90 y 8 β^-
	152	0+	-74.769	26.75% 16
	153	3/2+	-72.566	46.284 h 4 β^-
	154	0+	-72.462	22.75% 29
	155	3/2-	-70.197	22.3 m 2 β^-
	156	0+	-69.370	9.4 h 2 β^-
	157	(3/2-)	-66.73	8.03 m 7 β^-
	158	0+	-65.21	5.30 m 3 β^-
	159	5/2-	-62.2	11.37 s 15 β^-
	160	0+	-60.4s	9.6 s 3 β^-
161		-57.0s	4.8 s 8 β^-	
162	0+	-54.8s	=2 s $\beta^-?$	
163		-50.9s	=1 s $\beta^-?$	
164	0+	-48.2s	=0.5 s $\beta^-?$	
165		-43.8s	=0.2 s β^-	
63 Eu	130	(1+)	-33.9s	0.9 ms +5-3 p
	131	3/2+	-39.4s	17.8 ms 19 p 87.9%, ϵ 12.1%
	132		-42.5s	200 ms sy ϵ
	133		-47.3s	=1 s $\epsilon?$
	134		-49.8s	0.5 s 2 ϵ , $\epsilon p > 0\%$
	135		-54.2s	1.5 s 2 ϵ , ϵp
	136m	(7+)	-56.3s	3.3 s 3 ϵ , ϵp 0.09%
	136m	(3+)	-56.3s	3.8 s 3 ϵ , ϵp 0.09%
	137	(11/2-)	-60.0s	11 s 2 ϵ
	138	(6-)	-61.75	12.1 s 6 ϵ
	139	(11/2-)	-65.40	17.9 s 6 ϵ
	140	1+	-66.99	1.51 s 2 ϵ
	140m	(5-)	-66.80	125 ms 2 IT, $\epsilon < 1\%$
	141	5/2+	-69.93	40.7 s 7 ϵ
	141m	11/2-	-69.83	2.7 s 3 IT 87%, ϵ 13%
142	1+	-71.32	2.34 s 12 ϵ	
142m	8-	-71.32	1.223 m 8 ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or				
Z	El	(MeV)	Abundance	Decay Mode			
63	Eu	143	5/2+	-74.24	2.59 m 2	ϵ	
		144	1+	-75.62	10.2 s 1	ϵ	
		145	5/2+	-77.998	5.93 d 4	ϵ	
		146	4-	-77.122	4.61 d 3	ϵ	
		147	5/2+	-77.550	24.1 d 6	ϵ , α 2.2×10 ⁻³ %	
		148	5-	-76.30	54.5 d 5	ϵ , α 9.4×10 ⁻⁷ %	
		149	5/2+	-76.447	93.1 d 4	ϵ	
		150	5(-)	-74.797	36.9 y 9	ϵ	
		150m	0-	-74.755	12.8 h 1	β - 89%, ϵ 11%, IT ≤ 5.0×10 ⁻⁸ %	
		151	5/2+	-74.659	47.81% 3		
		152	3-	-72.895	13.506 y 6	ϵ 72.1%, β - 27.9%	
		152m	0-	-72.849	9.3116 h 13	β - 72%, ϵ 28%	
		152m	8-	-72.747	96 m 1	IT	
		153	5/2+	-73.373	52.19% 3		
		154	3-	-71.744	8.590 y 3	β - 99.98%, ϵ 0.02%	
		154m	(8-)	-71.599	46.3 m 4	IT	
		155	5/2+	-71.825	4.753 y 14	β -	
		156	0+	-70.093	15.19 d 8	β -	
		157	5/2+	-69.467	15.18 h 3	β -	
		158	(1-)	-67.21	45.9 m 2	β -	
		159	5/2+	-66.053	18.1 m 1	β -	
		160	1	-63.4s	38 s 4	β -	
		161		-61.8s	26 s 3	β -	
		162		-58.6s	10.6 s 10	β -	
		163		-56.6s	6 s sy	β -?	
		164		-53.1s	=2 s	β -?	
		165		-50.6s	=1 s	β -?	
		166		-46.6s	=0.4 s	β -	
		167		-43.6s	=0.2 s	β -?	
	64	Gd	134	0+	-41.6s	0.4 s sy	ϵ ?
			135		-44.2s	1.1 s 2	ϵ , ϵ p=2%
			136	0+	-49.1s	≥200 ns	
			137	(7/2)	-51.2s	2.2 s 2	ϵ , ϵ p
		138	0+	-55.8s	4.7 s 9	ϵ	
		139	(9/2-)	-57.5s	5.8 s 9	ϵ >0%, ϵ p>0%	
		139m		-57.5s	4.8 s 9	ϵ >0%, ϵ p>0%	
		140	0+	-61.78	15.8 s 4	ϵ	
		141	1/2+	-63.22	14 s 4	ϵ , ϵ p 0.03%	
		141m	11/2-	-62.85	24.5 s 5	ϵ 89%, IT 11%	
		142	0+	-66.96	70.2 s 6	ϵ	
		143	(1/2)+	-68.2	39 s 2	ϵ	
		143m	(11/2-)	-68.1	110.0 s 14	ϵ	
		144	0+	-71.76	4.47 m 6	ϵ	
		145	1/2+	-72.93	23.0 m 4	ϵ	
		145m	11/2-	-72.18	85 s 3	IT 94.3%, ϵ 5.7%	
		146	0+	-76.093	48.27 d 10	ϵ	
		147	7/2-	-75.363	38.06 h 12	ϵ	
	148	0+	-76.276	70.9 y 10	α		
	149	7/2-	-75.133	9.28 d 10	ϵ , α 4.3×10 ⁻⁴ %		
	150	0+	-75.769	1.79×10 ⁶ y 8	α		
	151	7/2-	-74.195	124 d 1	ϵ , α =8.0×10 ⁻⁷ %		

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
64	Gd	152	0+	-74.714 1.08×10 ¹⁴ y 8 α
				0.20% 1
		153	3/2-	-72.890 240.4 d 10 ϵ
		154	0+	-73.713 2.18% 3
		155	3/2-	-72.077 14.80% 12
		156	0+	-72.542 20.47% 9
		157	3/2-	-70.831 15.65% 2
		158	0+	-70.697 24.84% 7
		159	3/2-	-68.568 18.479 h 4 β^-
		160	0+	-67.949 >3.1×10 ¹⁹ y 2 β^-
				21.86% 19
		161	5/2-	-65.513 3.66 m 5 β^-
		162	0+	-64.287 8.4 m 2 β^-
		163	(5/2-, 7/2+)	-61.5s 68 s 3 β^-
		164	0+	-59.7s 45 s 3 β^-
		165		-56.5s 10.3 s 16 β^-
		166	0+	-54.4s =7 s β^-
		167		-50.7s =3 s $\beta^-?$
		168	0+	-48.1s =0.3 s $\beta^-?$
	169		-43.9s =1 s $\beta^-?$	
65	Tb	135	(7/2-)	0.94 ms +33-22 p
		136		-36.0s 0.2 s sy $\epsilon?$
		137		-41.0s 0.6 s sy p?, $\epsilon?$
		138?		-43.6s ≥ 200 ns ϵ , p
		139		-48.2s 1.6 s 2 ϵ , $\epsilon p?$
		140	(7+)	-50.5 2.1 s 4 ϵ , ϵp 0.26%
		141	(5/2-)	-54.5 3.5 s 2 ϵ
		141m		-54.5 7.9 s 6 ϵ
		142	1+	-57.1s 597 ms 17 ϵ , ϵp 2.2×10 ^{-3%}
		142m	(5-)	-56.8s 303 ms 17 IT
		143	(11/2-)	-60.43 12 s 1 ϵ
		143m		-60.43 <21 s ϵ
		144	1+	-62.37 =1 s ϵ
		144m	(6-)	-61.97 4.25 s 15 IT 66%, ϵ 34%
		145	(3/2+)	-65.88 =20 m $\epsilon?$
		145m	(11/2-)	-65.88 30.9 s 7 ϵ
		146	1+	-67.77 8 s 4 ϵ
		146m	5-	-67.77 23 s 2 ϵ
		147	(1/2+)	-70.75 1.7 h 1 ϵ
		147m	(11/2-)	-70.70 1.83 m 6 ϵ
		148	2-	-70.54 60 m 1 ϵ
		148m	(9+)	-70.45 2.20 m 5 ϵ
		149	1/2+	-71.496 4.118 h 25 ϵ 83.3%, α 16.7%
	149m	11/2-	-71.460 4.16 m 4 ϵ 99.98%, α 0.02%	
	150	(2-)	-71.110 3.48 h 16 ϵ , α <0.05%	
	150m	9+	-70.637 5.8 m 2 ϵ	
	151	1/2(+)	-71.630 17.609 h 1 ϵ , α 9.5×10 ^{-3%}	
	151m	(11/2-)	-71.530 25 s 3 IT 93.8%, ϵ 6.2%	
	152	2-	-70.72 17.5 h 1 ϵ , α <7.0×10 ^{-7%}	
	152m	8+	-70.22 4.2 m 1 IT 78.8%, ϵ 21.2%	
	153	5/2+	-71.320 2.34 d 1 ϵ	
	154	0	-70.16 21.5 h 4 ϵ , β^- <0.1%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
65 Tb	154m	3-	-70.16	9.4 h 4 ϵ 78.2%, IT 21.8%, β -<0.1%
	154m	7-	-70.16	22.7 h 5 ϵ 98.2%, IT 1.8%
	155	3/2+	-71.25	5.32 d 6 ϵ
	156	3-	-70.098	5.35 d 10 ϵ
	156m	(7-)	-70.048	24.4 h 10 IT
	156m	(0+)	-70.009	5.3 h 2 IT<100%, ϵ >0%
	157	3/2+	-70.771	71 y 7 ϵ
	158	3-	-69.477	180 y 11 ϵ 83.4%, β - 16.6%
	158m	0-	-69.367	10.70 s 17 IT, β -<0.6%, ϵ <0.01%
	159	3/2+	-69.539	100%
	160	3-	-67.843	72.3 d 2 β -
	161	3/2+	-67.468	6.906 d 19 β -
	162	1-	-65.68	7.60 m 15 β -
	163	3/2+	-64.601	19.5 m 3 β -
	164	(5+)	-62.1	3.0 m 1 β -
	165	(3/2+)	-60.7s	2.11 m 10 β -
	166		-57.8	21 s 6 β -
	167	(3/2+)	-55.8s	19.4 s 27 β -
	168	(4-)	-52.5s	8.2 s 13 β -
	169		-50.1s	=2 s β -?
	170		-46.3s	=3 s β -?
171		-43.5s	=0.5 s β -	
66 Dy	138	0+	-34.9s	200 ms sy ϵ ?
	139	(7/2+)	-37.7s	0.6 s 2 ϵ , $\epsilon\epsilon$
	141	(9/2-)	-45.3s	0.9 s 2 ϵ , $\epsilon\epsilon$
	142	0+	-50.0s	2.3 s 3 ϵ , $\epsilon\epsilon$ 0.06%
	143	(1/2+)	-52.3s	5.6 s 10 ϵ , $\epsilon\epsilon$
	143m	(11/2-)	-52.3s	3.0 s 3 ϵ , $\epsilon\epsilon$
	144	0+	-56.58	9.1 s 4 ϵ , $\epsilon\epsilon$
	145	(1/2+)	-58.29	10.5 s 15 ϵ
	145m	(11/2-)	-58.29	13.6 s 10 ϵ
	146	0+	-62.55	29 s 3 ϵ
	146m	(10+)	-59.62	150 ms 20 IT
	147	1/2+	-64.19	40 s 10 ϵ , $\epsilon\epsilon$ >0%
	147m	11/2-	-63.44	55.7 s 7 ϵ 65%, IT 35%
	148	0+	-67.86	3.3 m 2 ϵ
	149	(7/2-)	-67.715	4.20 m 14 ϵ
	149m	(27/2-)	-65.054	0.490 s 15 IT 99.3%, ϵ 0.7%
	150	0+	-69.317	7.17 m 5 ϵ 64%, α 36%
	151	7/2(-)	-68.759	17.9 m 3 ϵ 94.4%, α 5.6%
	152	0+	-70.124	2.38 h 2 ϵ 99.9%, α 0.1%
	153	7/2(-)	-69.150	6.4 h 1 ϵ 99.99%, α 9.4 \times 10 ⁻³ %
154	0+	-70.398	3.0 \times 10 ⁶ y 15 α	
155	3/2-	-69.16	9.9 h 2 ϵ	
156	0+	-70.530	0.06% 1	
157	3/2-	-69.428	8.14 h 4 ϵ	
158	0+	-70.412	0.10% 1	
159	3/2-	-69.174	144.4 d 2 ϵ	
160	0+	-69.678	2.34% 8	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
66 Dy	161	5/2+	-68.061	18.91% 24	
	162	0+	-68.187	25.51% 26	
	163	5/2-	-66.386	24.90% 16	
	164	0+	-65.973	28.18% 37	
	165	7/2+	-63.618	2.334 h 1	β^-
	165m	1/2-	-63.510	1.257 m 6	IT 97.76%, β^- 2.24%
	166	0+	-62.590	81.6 h 1	β^-
	167	(1/2-)	-59.94	6.20 m 8	β^-
	168	0+	-58.6	8.7 m 3	β^-
	169	(5/2-)	-55.6	39 s 8	β^-
	170	0+	-53.7s	=30 s	$\beta^-?$
	171		-50.1s	=6 s	β^-
	172	0+	-47.7s	=3 s	β^-
173		-43.8s	=2 s	$\beta^-?$	
67 Ho	140 (6-,0-,8+)	-29.3s	6 ms 3	p	
	141	7/2-	-34.4s	4.1 ms 3	p
	142		-37.5s	=0.3 s	ϵ , ϵp
	143		-42.3s	>200 ns	$\epsilon?$, $\epsilon p?$
	144		-45.2s	0.7 s 1	ϵ , ϵp
	145		-49.2s	2.4 s 1	ϵ
	146	(10+)	-51.6s	3.6 s 3	ϵ
	147	(11/2-)	-55.84	5.8 s 4	ϵ
	148	(1+)	-58.0	2.2 s 11	ϵ
	148m	(6-)	-58.0	9.59 s 15	ϵ , ϵp 0.08%
	149	(11/2-)	-61.69	21.1 s 2	ϵ
	149m	(1/2+)	-61.64	56 s 3	ϵ
	150	2-	-61.95	72 s 4	ϵ
	150m	(9+)	-61.15	23.3 s 3	ϵ
	151	(11/2-)	-63.63	35.2 s 1	ϵ 78%, α 22%
	151m	(1/2+)	-63.59	47.2 s 10	α 80%, ϵ 20%
	152	2-	-63.61	161.8 s 3	ϵ 88%, α 12%
	152m	9+	-63.45	50.0 s 4	ϵ 89.2%, α 10.8%
	153	11/2-	-65.019	2.01 m 3	ϵ 99.95%, α 0.05%
	153m	1/2+	-64.951	9.3 m 5	ϵ 99.82%, α 0.18%
	154	2-	-64.644	11.76 m 19	ϵ 99.98%, α 0.02%
	154m	8+	-64.644	3.10 m 14	ϵ , $\alpha < 1.0 \times 10^{-3}\%$, IT?
	155	5/2+	-66.04	48 m 1	ϵ
	156	4-	-65.35	56 m 1	ϵ
	156m	1-	-65.30	9.5 s 15	IT
	156m	9+	-65.30	7.8 m 3	ϵ 75%, IT 25%
	157	7/2-	-66.83	12.6 m 2	ϵ
	158	5+	-66.19	11.3 m 4	ϵ
	158m	2-	-66.12	28 m 2	IT > 81%, $\epsilon < 19\%$
	158m	(9+)	-66.01	21.3 m 23	$\epsilon \geq 93\%$, IT $\leq 7\%$
	159	7/2-	-67.336	33.05 m 11	ϵ
159m	1/2+	-67.130	8.30 s 8	IT	
160	5+	-66.39	25.6 m 3	ϵ	
160m	2-	-66.33	5.02 h 5	IT 73%, ϵ 27%	
160m	(9+)	-66.22	3 s	IT	
161	7/2-	-67.203	2.48 h 5	ϵ	
161m	1/2+	-66.992	6.76 s 7	IT	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El	A	J π	(MeV)	
			Abundance	Decay Mode	
67 Ho	162	1+	-66.047	15.0 m 10	ϵ
	162m	6-	-65.941	67.0 m 7	IT 62%, ϵ 38%
	163	7/2-	-66.384	4570 y 25	ϵ
	163m	1/2+	-66.086	1.09 s 3	IT
	164	1+	-64.987	29 m 1	ϵ 60%, β - 40%
	164m	6-	-64.847	37.5 m +15-5	IT
	165	7/2-	-64.905	100%	
	166	0-	-63.077	26.83 h 2	β -
	166m	(7)-	-63.071	1.20×10 ³ y 18	β -
	167	7/2-	-62.287	3.003 h 18	β -
	168	3+	-60.07	2.99 m 7	β -
	168m	(6+)	-60.01	132 s 4	IT≥99.5%, β -≤0.5%
	169	7/2-	-58.80	4.72 m 10	β -
	170	(6+)	-56.24	2.76 m 5	β -
	170m	(1+)	-56.12	43 s 2	β -
	171	(7/2-)	-54.5	53 s 2	β -
	172		-51.4s	25 s 3	β -
	173		-49.1s	=10 s	β -?
	174		-45.5s	=8 s	β -?
175		-42.8s	=5 s	β -?	
68 Er	143		-31.4s	0.2 s sy	ϵ ?
	144	0+	-36.9s	≥200 ns	ϵ
	145	(11/2-)	-39.7s	0.9 s 3	ϵ , ϵ p
	146	0+	-44.7s	1.7 s 6	ϵ , ϵ p
	147	(11/2-)	-47.0s	2.5 s 2	ϵ , ϵ p>0%
	147m	(1/2+)	-47.0s	=2.5 s	ϵ , ϵ p>0%
	148	0+	-51.7s	4.6 s 2	ϵ
	149	(1/2+)	-53.74	4 s 2	ϵ , ϵ p 7%
	149m	(11/2-)	-53.00	8.9 s 2	ϵ 96.5%, IT 3.5%, ϵ p 0.18%
	150	0+	-57.83	18.5 s 7	ϵ
	151	(7/2-)	-58.27	23.5 s 13	ϵ
	151m	(27/2-)	-55.68	0.58 s 2	IT 95.3%, ϵ 4.7%
	152	0+	-60.50	10.3 s 1	α 90%, ϵ 10%
	153	(7/2-)	-60.488	37.1 s 2	α 53%, ϵ 47%
	154	0+	-62.612	3.73 m 9	ϵ 99.53%, α 0.47%
	155	7/2-	-62.215	5.3 m 3	ϵ 99.98%, α 0.02%
	156	0+	-64.21	19.5 m 10	ϵ =100%, α 1.7×10 ⁻⁵ %
	157	3/2-	-63.42	18.65 m 10	ϵ =100%
	158	0+	-65.30	2.29 h 6	ϵ
	159	3/2-	-64.567	36 m 1	ϵ
	160	0+	-66.06	28.58 h 9	ϵ
	161	3/2-	-65.209	3.21 h 3	ϵ
	162	0+	-66.343	0.139% 5	
	163	5/2-	-65.174	75.0 m 4	ϵ
	164	0+	-65.950	1.601% 3	
	165	5/2-	-64.528	10.36 h 4	ϵ
166	0+	-64.932	33.503% 36		
167	7/2+	-63.297	22.869% 9		
167m	1/2-	-63.089	2.269 s 6	IT	
168	0+	-62.997	26.978% 18		

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
68 Er	169	1/2-	-60.929	9.392 d 18 β -
	170	0+	-60.115	14.910% 36
	171	5/2-	-57.725	7.516 h 2 β -
	172	0+	-56.489	49.3 h 3 β -
	173	(7/2-)	-53.7s	1.4 m 1 β -
	174	0+	-51.9s	3.2 m 2 β -
	175	(9/2+)	-48.7s	1.2 m 3 β -
	176	0+	-46.5s	=20 s β -?
	177		-42.8s	=3 s β -?
69 Tm	145	(11/2-)	-27.9s	3.1 μ s 3 p
	146	(5-)	-31.3s	80 ms 10 p, ϵ
	146m	(8+)	-31.1s	200 ms 10 p, ϵ
	147	11/2-	-36.4s	0.58 s 3 ϵ 85%, p 15%
	148m	(10+)	-39.3s	0.7 s 2 ϵ
	149	(11/2-)	-44.0s	0.9 s 2 ϵ , ϵ p 0.2%
	150	(6-)	-46.6s	2.2 s 2 ϵ
	151	(11/2-)	-50.78	4.17 s 10 ϵ
	151m	(1/2+)	-50.78	6.6 s 14 ϵ
	152	(2-)	-51.77	8.0 s 10 ϵ
	152m	(9+)	-51.77	5.2 s 6 ϵ
	153	(11/2-)	-54.02	1.48 s 1 α 91%, ϵ 9%
	153m	(1/2+)	-53.97	2.5 s 2 α 92%, ϵ 8%
	154	(2-)	-54.43	8.1 s 3 α 54%, ϵ 46%
	154m	(9+)	-54.43	3.30 s 7 α 58%, ϵ 42%, IT
	155	11/2-	-56.64	21.6 s 2 ϵ 99.11%, α 0.89%
	155m	1/2+	-56.59	45 s 3 ϵ >98%, α <2%
	156	2-	-56.84	83.8 s 18 ϵ 99.94%, α 0.06%
	157	1/2+	-58.71	3.63 m 9 ϵ
	158	2-	-58.70	3.98 m 6 ϵ
	158m	(5+)	-58.70	=20 s IT?
	159	5/2+	-60.57	9.13 m 16 ϵ
	160	1-	-60.30	9.4 m 3 ϵ
	160m	5	-60.23	74.5 s 15 IT 85%, ϵ 15%
	161	7/2+	-61.90	30.2 m 8 ϵ
	162	1-	-61.48	21.70 m 19 ϵ
	162m	5+	-61.48	24.3 s 17 IT 82%, ϵ 18%
	163	1/2+	-62.735	1.810 h 5 ϵ
	164	1+	-61.89	2.0 m 1 ϵ , ϵ 39%
	164m	6-	-61.89	5.1 m 1 IT=80%, ϵ =20%
	165	1/2+	-62.936	30.06 h 3 ϵ
	166	2+	-61.89	7.70 h 3 ϵ
167	1/2+	-62.548	9.25 d 2 ϵ	
168	3+	-61.318	93.1 d 2 ϵ 99.99%, β - 0.01%	
169	1/2+	-61.280	100%	
170	1-	-59.801	128.6 d 3 β - 99.87%, ϵ 0.13%	
171	1/2+	-59.216	1.92 y 1 β -	
172	2-	-57.380	63.6 h 2 β -	
173	(1/2+)	-56.259	8.24 h 8 β -	
174	(4-)	-53.87	5.4 m 1 β -	
175	(1/2+)	-52.32	15.2 m 5 β -	
176	(4+)	-49.4	1.9 m 1 β -	
177m	(7/2-)	-47.5s	90 s 6 β - \leq 100%	

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
69 Tm	178	-44.1s	=30 s	β^- ?	
	179	-41.6s	=20 s	β^- ?	
70 Yb	148	0+	=0.25 s	ϵ ?	
	149	(1/2+, 3/2+)	0.7 s 2	ϵ , ϵ p=100%	
	150	0+	>200 ns	ϵ ?	
	151	(1/2+)	-41.5	1.6 s 1	ϵ , ϵ p
	151m	(11/2-)	-41.5	1.6 s 1	ϵ =100%, ϵ p, IT?
	152	0+	-46.3	3.04 s 6	ϵ , ϵ p
	153	7/2-	-47.1s	4.2 s 2	α 60%, ϵ 40%
	154	0+	-49.93	0.409 s 2	α 92.6%, ϵ 7.4%
	155	(7/2-)	-50.50	1.793 s 19	α 89%, ϵ 11%
	156	0+	-53.26	26.1 s 7	ϵ 90%, α 10%
	157	7/2-	-53.44	38.6 s 10	ϵ 99.5%, α 0.5%
	158	0+	-56.015	1.49 m 13	ϵ , α = $2.1 \times 10^{-3}\%$
	159	5/2(-)	-55.84	1.67 m 9	ϵ
	160	0+	-58.17	4.8 m 2	ϵ
	161	3/2-	-57.84	4.2 m 2	ϵ
	162	0+	-59.83	18.87 m 19	ϵ
	163	3/2-	-59.30	11.05 m 35	ϵ
	164	0+	-61.02	75.8 m 17	ϵ
	165	5/2-	-60.29	9.9 m 3	ϵ
	166	0+	-61.589	56.7 h 1	ϵ
	167	5/2-	-60.594	17.5 m 2	ϵ
	168	0+	-61.575	0.13% 1	
	169	7/2+	-60.370	32.018 d 5	ϵ
	169m	1/2-	-60.346	46 s 2	IT
	170	0+	-60.769	3.04% 15	
	171	1/2-	-59.312	14.28% 57	
	172	0+	-59.260	21.83% 67	
	173	5/2-	-57.556	16.13% 27	
	174	0+	-56.950	31.83% 92	
	175	(7/2-)	-54.701	4.185 d 1	β^-
	176	0+	-53.494	$\geq 1.6 \times 10^{17}$ y	2 β^-
			12.76% 41		
176m	(8)-	-52.444	11.4 s 3	IT \geq 90%, $\beta^- \leq$ 10%	
177	(9/2+)	-50.989	1.911 h 3	β^-	
177m	(1/2-)	-50.658	6.41 s 2	IT	
178	0+	-49.70	74 m 3	β^-	
179	(1/2-)	-46.4s	8.0 m 4	β^-	
180	0+	-44.4s	2.4 m 5	β^-	
181		-40.8s	1 m sy	β^- ?	
71 Lu	150	(2+)	-24.9s	p 68%, ϵ 32%	
	151	11/2-	-30.2s	p 63.4%, ϵ 36.6%	
	152	(5-, 6-)	-33.4s	0.7 s 1	ϵ , ϵ p 15%
	153	11/2-	-38.4	0.9 s 2	α =70%, ϵ =30%
	154	(2-)	-39.6s	=2 s	ϵ ?
	154m	(9+)	-39.6s	1.12 s 8	ϵ =100%
	155	11/2-	-42.55	68 ms 1	α 90%, ϵ 10%
	155m	1/2+	-42.53	138 ms 8	α 76%, ϵ 24%
	156	(2)-	-43.75	494 ms 12	α =95%, ϵ =5%
	156m	9+	-43.75	198 ms 2	α
157	(1/2+, 3/2+)	-46.48	6.8 s 18	$\alpha > 0\%$	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
71	Lu	157m (11/2-)	-46.46	4.79 s 12	ϵ 94%, α 6%	
		158	-47.21	10.6 s 3	ϵ 99.09%, α 0.91%	
		159	-49.72	12.1 s 10	ϵ , α 0.1%	
		160	-50.27	36.1 s 3	ϵ , $\alpha \leq 1.0 \times 10^{-4}\%$	
		160m	-50.27	40 s 1	$\epsilon \leq 100\%$, α	
		161	1/2+	-52.56	77 s 2	ϵ
		161m	(9/2-)	-52.43	7.3 ms 4	IT
		162	(1-)	-52.84	1.37 m 2	$\epsilon \leq 100\%$
		162m	(4-)	-52.84	1.5 m	$\epsilon \leq 100\%$
		162m		-52.84	1.9 m	$\epsilon \leq 100\%$
		163	1/2(+)	-54.79	3.97 m 13	ϵ
		164	1	-54.64	3.14 m 3	ϵ
		165	1/2+	-56.44	10.74 m 10	ϵ
		166	(6-)	-56.02	2.65 m 10	ϵ
		166m	(3-)	-55.99	1.41 m 10	ϵ 58%, IT 42%
		166m	(0-)	-55.98	2.12 m 10	$\epsilon > 80\%$, IT < 20%
		167	7/2+	-57.50	51.5 m 10	ϵ
		167m	1/2+	-57.50	≥ 1 m	ϵ , IT
		168	(6-)	-57.06	5.5 m 1	ϵ
		168m	3+	-56.84	6.7 m 4	$\epsilon > 95\%$, IT < 5%
		169	7/2+	-58.077	34.06 h 5	ϵ
		169m	1/2-	-58.048	160 s 10	IT
		170	0+	-57.31	2.012 d 20	ϵ
		170m	(4-)	-57.22	0.67 s 10	IT
		171	7/2+	-57.833	8.24 d 3	ϵ
		171m	1/2-	-57.762	79 s 2	IT
		172	4-	-56.741	6.70 d 3	ϵ
		172m	1-	-56.699	3.7 m 5	IT
		173	7/2+	-56.886	1.37 y 1	ϵ
		174	(1-)	-55.575	3.31 y 5	ϵ
		174m	(6-)	-55.404	142 d 2	IT 99.38%, ϵ 0.62%
		175	7/2+	-55.171	97.41% 2	
		176	7-	-53.387	3.76×10^{10} y 7	β -
				2.59% 2		
	176m	1-	-53.264	3.664 h 19	β - 99.91%, ϵ 0.1%	
	177	7/2+	-52.389	6.6475 d 20	β -	
	177m	23/2-	-51.419	160.44 d 6	β - 78.6%, IT 21.4%	
	177m	(39/2-)	-49.689	6 m +3-2	β - $\leq 100\%$, IT	
	178	1(+)	-50.343	28.4 m 2	β -	
	178m	(9-)	-50.223	23.1 m 3	β -	
	179	7/2(+)	-49.064	4.59 h 6	β -	
	180	5+	-46.69	5.7 m 1	β -	
	181	(7/2+)	-44.7s	3.5 m 3	β -	
	182	(0,1,2)	-41.9s	2.0 m 2	β -	
	183	(7/2+)	-39.5s	58 s 4	β -	
	184	(3+)	-36.4s	20 s 3	β -	
72	Hf	153	-27.3s	>60 ns	ϵ ?	
		154	0+	2 s 1	$\epsilon = 100\%$, $\alpha = 0\%$	
		155		-34.1s	0.89 s 12	ϵ
		156	0+	-37.9	23 ms 1	α
		157	7/2-	-38.8s	110 ms 6	α 86%, ϵ 14%
		158	0+	-42.10	2.85 s 7	ϵ 55.7%, α 44.3%

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El A	(MeV)	Abundance	Decay Mode			
72	Hf	159	7/2-	-42.85	5.6 s 4	ϵ 65%, α 35%	
		160	0+	-45.94	13.6 s 2	ϵ 99.3%, α 0.7%	
		161		-46.32	18.2 s 5	ϵ >99.87%, α <0.13%	
		162	0+	-49.173	39.4 s 9	ϵ 99.99%, α $8.0 \times 10^{-3}\%$	
		163		-49.29	40.0 s 6	ϵ , α < $1.0 \times 10^{-4}\%$	
		164	0+	-51.82	111 s 8	ϵ	
		165	(5/2-)	-51.64	76 s 4	ϵ	
		166	0+	-53.86	6.77 m 30	ϵ	
		167	(5/2-)	-53.47	2.05 m 5	ϵ	
		168	0+	-55.36	25.95 m 20	ϵ	
		169	(5/2-)	-54.72	3.24 m 4	ϵ	
		170	0+	-56.25	16.01 h 13	ϵ	
		171	7/2(+)	-55.43	12.1 h 4	ϵ	
		171m	1/2(-)	-55.41	29.5 s 9	IT \leq 100%, ϵ	
		172	0+	-56.40	1.87 y 3	ϵ	
		173	1/2-	-55.41	23.6 h 1	ϵ	
		174	0+	-55.847	2.0×10^{15} y 4	α	
					0.16% 1		
			175	5/2(-)	-54.484	70 d 2	ϵ
			176	0+	-54.577	5.26% 7	
			177	7/2-	-52.890	18.60% 9	
			177m	23/2+	-51.574	1.09 s 5	IT
			177m	37/2-	-50.150	51.4 m 5	IT
			178	0+	-52.444	27.28% 7	
			178m	8-	-51.297	4.0 s 2	IT
			178m	16+	-49.998	31 y 1	IT
			179	9/2+	-50.472	13.62% 2	
			179m	1/2-	-50.097	18.67 s 4	IT
			179m	25/2-	-49.366	25.05 d 25	IT
			180	0+	-49.788	35.08% 16	
			180m	8-	-48.647	5.47 h 4	IT 99.7%, β - 0.3%
			181	1/2-	-47.412	42.39 d 6	β -
		182	0+	-46.059	8.90×10^6 y 9	β -	
		182m	8-	-44.886	61.5 m 15	β - 58%, IT 42%	
		183	(3/2-)	-43.29	1.067 h 17	β -	
		184	0+	-41.50	4.12 h 5	β -	
		184m	8-	-40.23	48 s 10	β -	
		185		-38.4s	3.5 m 6	β -	
		186	0+	-36.4s	2.6 m 12	β -	
		187		-33.0s	30 s sy	β -?	
		188	0+	-30.9s	20 s sy	β -	
73	Ta	155m	11/2-	-23.7s	12 μ s +4-3	p	
		156	(2-)	-25.8s	144 ms 24	p = 100%, ϵ	
		156m	9+	-25.7s	0.36 s 4	ϵ 95.8%, p 4.2%	
		157	1/2+	-29.6	10.1 ms 4	ϵ 96.6%, p 3.4%	
		157m	11/2-	-29.6	4.3 ms 1	α	
		157m	(25/2-)	-28.0	1.7 ms 1	α	
		158	(2-)	-31.0s	55 ms 15	α = 91%, ϵ = 9%	
		158m	(9+)	-30.9s	36.7 ms 15	α 95%, ϵ 5%	
		159	(1/2-)	-34.45	0.83 s 18	ϵ 66%, α 34%	
		159m	(11/2-)	-34.38	515 ms 20	α 55%, ϵ 45%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
73	Ta	160	-35.88	1.55 s 4	ϵ 66%, α 34%	
		160m	-35.88	1.7 s 2	α ?	
		161	-38.73s	2.89 s 12	ϵ 95%, α ?	
		162	-39.78	3.57 s 12	ϵ 99.93%, α 0.07%	
		163	-42.54	10.6 s 18	ϵ = 99.8%, α = 0.2%	
		164	(3+)	-43.28	14.2 s 3	ϵ
		165		-45.86	31.0 s 15	ϵ
		166	(2+)	-46.10	34.4 s 5	ϵ
		167	(3/2+)	-48.35	80 s 4	ϵ
		168	(2-,3+)	-48.39	2.0 m 1	ϵ
		169	(5/2+)	-50.29	4.9 m 4	ϵ
		170	(3+)	-50.14	6.76 m 6	ϵ
		171	(5/2-)	-51.72	23.3 m 3	ϵ
		172	(3+)	-51.33	36.8 m 3	ϵ
		173	5/2-	-52.40	3.14 h 13	ϵ
		174	3+	-51.74	1.14 h 8	ϵ
		175	7/2+	-52.41	10.5 h 2	ϵ
		176	(1)-	-51.37	8.09 h 5	ϵ
		177	7/2+	-51.724	56.56 h 6	ϵ
		178	1+	-50.51	9.31 m 3	ϵ
		178	(7)-	-50.51	2.36 h 8	ϵ
		179	7/2+	-50.366	1.82 y 3	ϵ
		180	1+	-48.936	8.154 h 6	ϵ 86%, β - 14%
		180m	9-	-48.859	$>1.2 \times 10^{15}$ y	2 ϵ ?
		181	7/2+	-48.442	99.988% 2	
		182	3-	-46.433	114.43 d 3	β -
		182m	5+	-46.417	283 ms 3	IT
		182m	10-	-45.913	15.84 m 10	IT
		183	7/2+	-45.296	5.1 d 1	β -
		184	(5-)	-42.84	8.7 h 1	β -
	185	(7/2+)	-41.40	49.4 m 15	β -	
	186	(2-,3-)	-38.61	10.5 m 3	β -	
	186m		-38.61	1.54 m 5	β -	
	187		-36.8s	=2 m	β -?	
	188		-33.8s	=20 s	β -	
	189	(7/2+)	-31.8s	3 s sy	β -?	
	190		-28.7s	0.3 s sy	β -?	
74	W	158	0+	-23.7s	1.25 ms 21	α
		159		-25.2s	7.3 ms 27	α = 99.9%, ϵ = 0.1%
		160	0+	-29.4	91 ms 5	α 87%
		161		-30.4s	409 ms 18	α 73%
		162	0+	-34.00	1.36 s 7	ϵ 54.8%, α 45.2%
		163		-34.91	2.8 s 2	ϵ 87%, α 13%
		164	0+	-38.23	6.3 s 2	ϵ 96.2%, α 3.8%
		165	(5/2-)	-38.86	5.1 s 5	ϵ , α < 0.2%
		166	0+	-41.89	19.2 s 6	ϵ 99.97%, α 0.04%
		167	(+)	-42.09	19.9 s 5	ϵ 99.96%, α 0.04%
		168	0+	-44.89	53 s 2	ϵ = 100%, α $3.2 \times 10^{-3}\%$
		169	(5/2-)	-44.92	74 s 6	ϵ
	170	0+	-47.29	2.42 m 4	ϵ	
	171	(5/2-)	-47.09	2.38 m 4	ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
74	W	172	0+	-49.10	6.6 m 9	ϵ
		173	5/2-	-48.73	7.6 m 2	ϵ
		174	0+	-50.23	33.2 m 21	ϵ
		175	(1/2-)	-49.63	35.2 m 6	ϵ
		176	0+	-50.64	2.5 h 1	ϵ
		177	1/2-	-49.70	132 m 2	ϵ
		178	0+	-50.42	21.6 d 3	ϵ
		179	(7/2-)	-49.30	37.05 m 16	ϵ
		179m	(1/2-)	-49.08	6.40 m 7	IT 99.72%, ϵ 0.28%
		180	0+	-49.645	1.8 \times 10 ¹⁸ y 2	α
					0.12% 1	
		181	9/2+	-48.254	121.2 d 2	ϵ
		182	0+	-48.248	>8.3 \times 10 ¹⁸ y	α
					26.50% 16	
		183	1/2-	-46.367	>1.3 \times 10 ¹⁹ y	α
					14.31% 4	
		183m	11/2+	-46.057	5.2 s 3	IT
		184	0+	-45.707	>2.9 \times 10 ¹⁹ y	α
					30.64% 2	
		185	3/2-	-43.390	75.1 d 3	β -
	185m	11/2+	-43.192	1.67 m 3	IT	
	186	0+	-42.509	>2.7 \times 10 ¹⁹ y	α	
				28.43% 19		
	187	3/2-	-39.905	23.72 h 6	β -	
	188	0+	-38.667	69.78 d 5	β -	
	189	(3/2-)	-35.5	10.7 m 5	β -	
	190	0+	-34.3	30.0 m 15	β -	
	191		-31.1s	>300 ns	β -?	
	192	0+	-29.6s	>300 ns	β -?	
75	Re	160	(2-)	-16.7s	0.82 ms +15-9	p 91%, α 9%
		161	1/2+	-20.9	0.37 ms 4	p
		161m	11/2-	-20.8	15.6 ms 9	α 95.2%, p 4.8%
		162	(2-)	-22.4s	107 ms 13	α 94%, ϵ 6%
		162m	(9+)	-22.2s	77 ms 9	α 91%, ϵ 9%
		163	(1/2+)	-26.01	390 ms 72	ϵ 68%, α 32%
		163m	(11/2-)	-25.89	214 ms 5	α 66%, ϵ 34%
		164		-27.6s	0.53 s 23	α =58%, ϵ =42%
		165	(1/2+)	-30.66	=1 s	ϵ , α
		165m	(11/2-)	-30.61	2.1 s 3	ϵ 87%, α 13%
		166		-31.85s	2.8 s 3	α \geq 8%
		167	(9/2-)	-34.84s	5.9 s 3	ϵ =99%, α =1%
		167m		-34.84s	3.4 s 4	α =100%
		168	(5+, 6+, 7+)	-35.79	4.4 s 1	ϵ =100%, α =5.0 \times 10 ⁻³ %
		169	(9/2-)	-38.39	8.1 s 5	ϵ , α <0.01%
		169m		-38.39	15.1 s 15	α =0.2%
		170	(5+)	-38.92	9.2 s 2	ϵ
		171	(9/2-)	-41.25	15.2 s 4	ϵ
		172m	(5)	-41.52	15 s 3	ϵ
		172m	(2)	-41.52	55 s 5	ϵ
	173	(5/2-)	-43.55	1.98 m 26	ϵ	
	174		-43.67	2.40 m 4	ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
75 Re	175	(5/2-)	-45.29	5.89 m 5 ϵ
	176	3+	-45.06	5.3 m 3 ϵ
	177	5/2-	-46.27	14 m 1 ϵ
	178	(3+)	-45.65	13.2 m 2 ϵ
	179	(5/2)+	-46.59	19.5 m 1 ϵ
	180	(1)-	-45.84	2.44 m 6 ϵ
	181	5/2+	-46.51	19.9 h 7 ϵ
	182	7+	-45.4	64.0 h 5 ϵ
	182m	2+	-45.4	12.7 h 2 ϵ
	183	5/2+	-45.811	70.0 d 14 ϵ
	184	3(-)	-44.227	38.0 d 5 ϵ
	184m	8(+)	-44.039	169 d 8 IT 75.4%, ϵ 24.6%
	185	5/2+	-43.822	37.40% 2
	186	1-	-41.930	3.7186 d 5 β - 92.53%, ϵ 7.47%
	186m	(8+)	-41.781	2.0×10^5 y IT
	187	5/2+	-41.216	4.12×10^{10} y 11 β -, 62.60% 2 , $\alpha < 1.0 \times 10^{-4}\%$
	188	1-	-39.016	17.003 h 3 β -
	188m	(6)-	-38.844	18.59 m 4 IT
	189	5/2+	-37.978	24.3 h 4 β -
	190	(2)-	-35.6	3.1 m 3 β -
190m	(6-)	-35.4	3.2 h 2 β - 54.4%, IT 45.6%	
191	(3/2+, 1/2+)	-34.35	9.8 m 5 β -	
192		-31.7s	16 s 1 β -	
193		-30.3s	30 s sy β -?	
194		-27.6s	>300 ns β -	
76 Os	162	0+	-14.5s	1.9 ms 2 α
	163		-16.1s	5.5 ms 6 $\alpha = 100\%$, ϵ
	164	0+	-20.5	21 ms 1 $\alpha 98\%$, $\epsilon 2\%$
	165	(7/2-)	-21.6s	71 ms 3 $\alpha > 60\%$, $\epsilon < 40\%$
	166	0+	-25.44	181 ms 38 $\alpha 72\%$, $\epsilon 18\%$
	167		-26.50	0.81 s 6 $\alpha 57\%$, $\epsilon 43\%$
	168	0+	-29.99	2.1 s 1 $\alpha 40\%$, ϵ
	169		-30.72	3.40 s 9 $\epsilon 88.8\%$, $\alpha 11.2\%$
	170	0+	-33.93	7.46 s 23 $\epsilon 91.4\%$, $\alpha 8.6\%$
	171	(5/2-)	-34.29	8.3 s 2 $\epsilon 98.2\%$, $\alpha 1.8\%$
	172	0+	-37.24	19.2 s 5 $\alpha 1.1\%$, ϵ
	173	(5/2-)	-37.44	22.4 s 9 $\alpha 0.4\%$, ϵ
	174	0+	-40.00	44 s 4 $\epsilon 99.98\%$, $\alpha 0.02\%$
	175	(5/2-)	-40.10	1.4 m 1 ϵ
	176	0+	-42.10	3.6 m 5 ϵ
	177	1/2-	-41.95	3.0 m 2 ϵ
	178	0+	-43.55	5.0 m 4 ϵ
	179	(1/2-)	-43.02	6.5 m 3 ϵ
	180	0+	-44.36	21.5 m 4 ϵ
	181	1/2-	-43.55	105 m 3 ϵ
181m	7/2-	-43.50	2.7 m 1 $\epsilon = 100\%$, IT $\leq 3\%$	
182	0+	-44.61	22.10 h 25 ϵ	
183	9/2+	-43.66	13.0 h 5 ϵ	
183m	1/2-	-43.49	9.9 h 3 $\epsilon 85\%$, IT 15%	
184	0+	-44.256	$> 5.6 \times 10^{13}$ y α 0.02% 1	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
76	Os	185	1/2-	-42.809	93.6 d 5	ϵ
		186	0+	-43.000	2.0×10 ¹⁵ y 11	α
					1.59% 3	
		187	1/2-	-41.218		1.6% 3
		188	0+	-41.136		13.29% 8
		189	3/2-	-38.985		16.21% 5
		189m	9/2-	-38.955	5.81 h 6	IT
		190	0+	-38.706		26.36% 2
		190m	(10)-	-37.001	9.9 m 1	IT
		191	9/2-	-36.394	15.4 d 1	β^-
		191m	3/2-	-36.320	13.10 h 5	IT
		192	0+	-35.881		40.93% 19
		192m	(10-)	-33.865	5.9 s 1	IT>87%, β^- <13%
		193	3/2-	-33.393	30.11 h 1	β^-
		194	0+	-32.433	6.0 y 2	β^-
		195		-29.7	=9 m	$\beta^-?$
		196	0+	-28.28	34.9 m 2	β^-
		197			2.8 m 6	β^-
	77	Ir	164	(9+)	-7.3s	0.11 ms +6-3
		165	(1/2+)	-11.6s	<1 μ s	p?, $\alpha?$
		166	(2-)	-13.2s	10.5 ms 22	α 93.1%, p 6.9%
		166m	(9+)	-13.0s	15.1 ms 9	α 98.2%, p 1.8%
		167	1/2+	-17.08	35.2 ms 20	α 48%, p 32%, ϵ 20%
		167m	11/2-	-16.90	25.7 ms 8	α 80%, ϵ 20%, p 0.4%
		168		-18.7s	0.161 ms 21	α 82%
		169	(1/2+)	-22.08	0.64 s +46-24	α 50%, ϵ , p
		169m	(11/2-)	-21.93	0.308 s 22	α 81%
		170		-23.3s	0.87 s +18-12	ϵ 94.8%, α 5.2%
		170m		-23.3s	0.44 s 6	ϵ ≤64%, IT≤64%, α 36%
		171	(1/2+)	-26.43	3.2 s +13-7	ϵ , α >0%, p
		171m	(11/2-)	-26.43	1.40 s 10	α 58%, ϵ ≤42%, p≤42%
		172	(3+)	-27.5s	4.4 s 3	ϵ 98%, α =2%
		172m	(7+)	-27.4s	2.0 s 1	ϵ 77%, α 23%
		173m	(11/2-)	-30.27	2.4 s 9	α 7%, ϵ
		173m	(3/2+, 5/2+)	-30.27	9.0 s 8	ϵ >93%, α <7%
		174	(3+)	-30.87	7.9 s 6	ϵ 99.5%, α 0.5%
		174m	(7+)	-30.68	4.9 s 3	ϵ 97.5%, α 2.5%
		175	(5/2-)	-33.43	9 s 2	ϵ 99.15%, α 0.85%
		176		-33.86	8.3 s 6	ϵ 96.9%, α 3.1%
		177	5/2-	-36.05	30 s 2	ϵ 99.94%, α 0.06%
		178		-36.25	12 s 2	ϵ
		179	(5/2-)	-38.08	79 s 1	ϵ
		180	(4,5)	-37.98	1.5 m 1	ϵ
		181	5/2-	-39.47	4.90 m 15	ϵ
		182	(5+)	-39.05	15 m 1	ϵ
		183	5/2-	-40.20	57 m 4	ϵ
		184	5-	-39.61	3.09 h 3	ϵ
		185	5/2-	-40.34	14.4 h 1	ϵ
	186	5+	-39.17	16.64 h 3	ϵ	
	186m	2-	-39.17	1.90 h 5	ϵ =75%, IT=25%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El	(MeV)	Abundance	Decay Mode		
77	Ir	187	3/2+	-39.716	10.5 h 3	ϵ
		188	1-	-38.328	41.5 h 5	ϵ
		189	3/2+	-38.45	13.2 d 1	ϵ
		190	4-	-36.751	11.78 d 10	ϵ , $\epsilon < 2.0 \times 10^{-3}\%$
		190m	(1-)	-36.725	1.120 h 3	IT
		190m	(11-)	-36.375	3.087 h 12	ϵ 91.4%, IT 8.6%
		191	3/2+	-36.706	37.3% 2	
		191m	11/2-	-36.535	4.94 s 3	IT
		191m		-34.659	5.5 s 7	IT
		192	4+	-34.833	73.827 d 13	β - 95.13%, ϵ 4.87%
		192m	1-	-34.777	1.45 m 5	IT 99.98%, β - 0.02%
		192m	(11-)	-34.665	241 y 9	IT
		193	3/2+	-34.534	62.7% 2	
		193m	11/2-	-34.454	10.53 d 4	IT
		194	1-	-32.529	19.28 h 13	β -
		194m	(10,11)	-32.339	171 d 11	β -
		195	3/2+	-31.690	2.5 h 2	β -
		195m	11/2-	-31.590	3.8 h 2	β - 95%, IT 5%
		196	(0-)	-29.44	52 s 1	β -
		196m	(10,11-)	-29.03	1.40 h 2	β - = 100%, IT < 0.3%
	197	3/2+	-28.27	5.8 m 5	β -	
	197m	11/2-	-28.15	8.9 m 3	β - 99.75%, IT 0.25%	
	198		-25.8s	8 s 1	β -	
	199		-24.40	20 s sy	β -	
78	Pt	166	0+	-4.8s	300 μ s 100	α
		167		-6.5s	0.9 ms 3	α
		168	0+	-11.0	2.1 ms 2	$\alpha \leq 100\%$
		169		-12.4s	7.0 ms 2	$\alpha = 100\%$
		170	0+	-16.31	14.0 ms 2	α
		171		-17.47	51 ms 2	$\alpha = 98\%$, ϵ 2%
		172	0+	-21.10	104 ms 7	α 94%, ϵ 6%
		173		-21.94	370 ms 13	α 83%, ϵ
		174	0+	-25.32	0.889 s 17	α 76%, ϵ 24%
		175	(7/2-)	-25.69	2.53 s 6	α 64%, ϵ 36%
		176	0+	-28.93	6.33 s 15	ϵ 62%, α 38%
		177	5/2-	-29.37	10.6 s 4	ϵ 94.3%, α 5.7%
		178	0+	-32.00	21.1 s 6	ϵ 92.3%, α 7.7%
		179	1/2-	-32.264	21.2 s 4	ϵ 99.76%, α 0.24%
		180	0+	-34.44	56 s 2	ϵ , $\alpha = 0.3\%$
		181	1/2-	-34.37	52.0 s 22	ϵ , $\alpha = 0.08\%$
		182	0+	-36.17	3.0 m 2	ϵ 99.96%, α 0.04%
		183	1/2-	-35.77	6.5 m 10	ϵ , $\alpha = 1.3 \times 10^{-3}\%$
		183m	(7/2-)	-35.74	43 s 5	$\epsilon = 100\%$, $\alpha < 4.0 \times 10^{-4}\%$, IT
		184	0+	-37.33	17.3 m 2	ϵ , $\alpha = 0.001\%$
	185	9/2+	-36.68	70.9 m 24	ϵ	
	185m	1/2-	-36.58	33.0 m 8	ϵ 99%, IT < 2%	
	186	0+	-37.86	2.08 h 5	ϵ , $\alpha = 1.4 \times 10^{-4}\%$	
	187	3/2-	-36.71	2.35 h 3	ϵ	
	188	0+	-37.823	10.2 d 3	ϵ , α $2.6 \times 10^{-5}\%$	
	189	3/2-	-36.48	10.87 h 12	ϵ	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
78	Pt 190	0+	-37.323	6.5×10 ¹¹ y 3 0.014% 1	α
	191	3/2-	-35.698	2.862 d 7	ϵ
	192	0+	-36.293	0.782% 7	
	193	1/2-	-34.477	50 y 6	ϵ
	193m	13/2+	-34.327	4.33 d 3	IT
	194	0+	-34.763	32.967% 99	
	195	1/2-	-32.797	33.832% 10	
	195m	13/2+	-32.537	4.010 d 5	IT
	196	0+	-32.647	25.242% 41	
	197	1/2-	-30.422	19.8915 h 19	β^-
	197m	13/2+	-30.023	95.41 m 18	IT 96.7%, β^- 3.3%
	198	0+	-29.908	7.163% 55	
	199	5/2-	-27.392	30.80 m 21	β^-
	199m	(13/2)+	-26.968	13.6 s 4	IT
	200	0+	-26.60	12.5 h 3	β^-
	201	(5/2-)	-23.74	2.5 m 1	β^-
	202	0+	-22.6s	44 h 15	β^-
79	Au 169		-1.8s	150 μ s sy	$\alpha?$, p?
	170	(2-)	-3.6s	286 μ s +50-40	p 89%, α 11%
	171	(1/2+)	-7.56	22 μ s +3-2	p=100%
	171m	(11/2-)	-7.31	1.09 ms 3	α 66%, p 36%
	172		-9.3s	6.3 ms 15	$\alpha \leq 100\%$, p < 2%
	173	(1/2+)	-12.82	25 ms 1	α 94%, ϵ , p
	173m	(11/2-)	-12.61	14.0 ms 9	α 92%, ϵ , p
	174		-14.2s	139 ms 3	$\alpha > 0\%$
	175	(1/2+)	-17.44	0.1 s sy	$\alpha?$, $\epsilon?$
	175m	(11/2-)	-17.44	156 ms 5	α 94%, ϵ 6%
	176		-18.5s	0.84 s +17-14	α , ϵ
	177	(1/2+, 3/2+)	-21.55	1462 ms 32	$\alpha \leq 100\%$, ϵ
	177m	11/2-	-21.39	1180 ms 12	$\alpha \leq 100\%$, ϵ
	178		-22.33	2.6 s 5	$\epsilon \leq 60\%$, $\alpha \geq 40\%$
	179		-24.95	3.3 s 13	ϵ 78%, α 22%
	180		-25.60	8.1 s 3	$\epsilon \leq 98.2\%$, $\alpha \geq 1.8\%$
	181	(3/2-)	-27.87	13.7 s 14	ϵ 97.3%, α 2.7%
	182		-28.30	15.6 s 4	ϵ 99.87%, α 0.13%
	183	(5/2-)	-30.19	42.8 s 10	ϵ 99.45%, α 0.55%
	184	5+	-30.32	20.6 s 9	$\alpha \leq 0.02\%$, ϵ
	184m	2+	-30.25	47.6 s 14	ϵ 70%, IT 30%, $\alpha \leq 0.02\%$
	185	5/2-	-31.87	4.25 m 6	ϵ 99.74%, α 0.26%
	185m		-31.87	6.8 m 3	$\epsilon < 100\%$, IT
	186	3-	-31.71	10.7 m 5	ϵ , α 8.0×10 ⁻⁴ %
	187	1/2+	-33.01	8.4 m 3	ϵ , α 3.0×10 ⁻³ %
	187m	9/2-	-32.88	2.3 s 1	IT
	188	1(-)	-32.30	8.84 m 6	ϵ
	189	1/2+	-33.58	28.7 m 3	ϵ , $\alpha < 3.0 \times 10^{-5}\%$
	189m	11/2-	-33.33	4.59 m 11	ϵ
	190	1-	-32.88	42.8 m 10	ϵ , $\alpha < 1.0 \times 10^{-6}\%$
	190m	(11-)	-32.88	125 ms 20	IT=100%
	191	3/2+	-33.81	3.18 h 8	ϵ
	191m	(11/2-)	-33.54	0.92 s 11	IT

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
79 Au	192	1-	-32.78	4.94 h 9 ϵ
	192m	(11-)	-32.34	160 ms 20 IT
	193	3/2+	-33.39	17.65 h 15 ϵ
	193m	11/2-	-33.10	3.9 s 3 IT 99.97%, $\epsilon=0.03\%$
	194	1-	-32.26	38.02 h 10 ϵ
	194m	(5+)	-32.15	600 ms 8 IT
	194m	(11-)	-31.79	420 ms 10 IT
	195	3/2+	-32.570	186.098 d 47 ϵ
	195m	11/2-	-32.251	30.5 s 2 IT
	196	2-	-31.140	6.1669 d 6 ϵ 92.8%, β^- 7.2%
	196m	5+	-31.055	8.1 s 2 IT
	196m	12-	-30.544	9.6 h 1 IT
	197	3/2+	-31.141	100%
	197m	11/2-	-30.732	7.73 s 6 IT
	198	2-	-29.582	2.6956 d 3 β^-
	198m	(12-)	-28.770	2.27 d 2 IT
	199	3/2+	-29.095	3.139 d 7 β^-
	200	1(-)	-27.27	48.4 m 3 β^-
	200m	12-	-26.31	18.7 h 5 β^- 82%, IT 18%
	201	3/2+	-26.401	26 m 1 β^-
	202	(1-)	-24.4	28.8 s 19 β^-
	203	(3/2+)	-23.143	60 s 6 β^-
	204	(2-)	-20.8s	39.8 s 9 β^-
	205	(3/2+)	-18.8s	31 s 2 β^-
	80 Hg	171		3.5s
172		0+	-1.1	0.25 ms +35-9 α
173			-2.6s	0.6 ms +5-2 $\alpha=100\%$
174		0+	-6.65	2.1 ms +18-7 α 99.6%
175		(7/2-,9/2-)	-8.0	10.8 ms 4 α
176		0+	-11.78	20 ms 2 $\alpha=100\%$
177		(13/2+)	-12.78	127.3 ms 18 α 85%, ϵ 15%
178		0+	-16.32	0.269 s 3 $\alpha=70\%$, $\epsilon=30\%$
179			-16.92	1.08 s 9 $\alpha=53\%$, $\epsilon=47\%$, $\epsilon p=0.15\%$
180		0+	-20.24	2.58 s 1 ϵ 52%, α 48%
181		1/2-	-20.66	3.6 s 1 ϵ 73%, α 27%, ϵp 0.01%, $\epsilon \alpha$ $9.0 \times 10^{-6}\%$
182		0+	-23.576	10.83 s 6 ϵ 84.8%, α 15.2%
183		1/2-	-23.800	9.4 s 7 ϵ 88.3%, α 11.7%, ϵp $2.6 \times 10^{-4}\%$
184		0+	-26.35	30.9 s 3 ϵ 98.89%, α 1.11%
185		1/2-	-26.18	49.1 s 10 ϵ 94%, α 6%
185m		13/2+	-26.08	21.6 s 15 IT 54%, ϵ 46%, $\alpha=0.03\%$
186		0+	-28.54	1.38 m 6 ϵ 99.98%, α 0.02%
187		13/2+	-28.12	2.4 m 3 ϵ , $\alpha > 1.2 \times 10^{-4}\%$
187m		3/2-	-28.12	1.9 m 3 ϵ , $\alpha > 2.5 \times 10^{-4}\%$
188		0+	-30.20	3.25 m 15 ϵ , α $3.7 \times 10^{-5}\%$
189		3/2-	-29.63	7.6 m 1 ϵ , $\alpha < 3.0 \times 10^{-5}\%$
189m		13/2+	-29.63	8.6 m 1 ϵ , $\alpha < 3.0 \times 10^{-5}\%$
190		0+	-31.37	20.0 m 5 ϵ , $\alpha < 3.4 \times 10^{-7}\%$

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
80 Hg	191 (3/2-)	-30.59	49 m 10	ϵ
	191m 13/2+	-30.59	50.8 m 15	ϵ
	192 0+	-32.01	4.85 h 20	ϵ
	193 3/2-	-31.05	3.80 h 15	ϵ
	193m 13/2+	-30.91	11.8 h 2	ϵ 92.8%, IT 7.2%
	194 0+	-32.19	444 y 77	ϵ
	195 1/2-	-31.00	10.53 h 3	ϵ
	195m 13/2+	-30.82	41.6 h 8	IT 54.2%, ϵ 45.8%
	196 0+	-31.827	0.15% 1	
	197 1/2-	-30.541	64.14 h 5	ϵ
	197m 13/2+	-30.242	23.8 h 1	IT 91.4%, ϵ 8.6%
	198 0+	-30.954	9.97% 20	
	199 1/2-	-29.547	16.87% 22	
	199m 13/2+	-29.015	42.67 m 9	IT
	200 0+	-29.504	23.10% 19	
	201 3/2-	-27.663	13.18% 9	
	202 0+	-27.346	29.86% 26	
	203 5/2-	-25.269	46.595 d 6	β^-
	204 0+	-24.690	6.87% 15	
	205 1/2-	-22.288	5.14 m 9	β^-
	206 0+	-20.95	8.15 m 10	β^-
207 (9/2+)	-16.2	2.9 m 2	β^-	
208 0+	-13.1s	41 m +5-4	β^-	
209	-8.3s	37 s 8	β^-	
210 0+	-5.1s	>300 ns	β^- ?	
81 Tl	176 (3-,4-,5-)	1.4s	5.2 ms +30-14	p=100%
	177 (1/2+)	-3.33	18 ms 5	α 73%, p 27%
	178	-4.8s	=60 ms	α ?, ϵ ?
	179 (1/2+)	-8.30	0.42 s 6	α <100%, ϵ
	179m (11/2-)	-8.30	1.7 ms 2	α ≤100%, IT, ϵ
	180	-9.4s	1.5 s 2	α 7%, ϵ SF=1.0×10 ⁻⁴ %, ϵ
	181 1/2+	-12.801	1.4 ms 5	ϵ , α ≤10%
	181m 9/2-	-11.951	3.2 s 3	α
	182 (7+)	-13.35	3.1 s 10	ϵ >96%, α <4%
	183 (1/2+)	-16.587	6.9 s 7	ϵ >0%, α
	183m (9/2-)	-15.957	53.3 ms 3	α 2%, ϵ , IT
	184 (2+)	-16.89	11 s 1	ϵ 97.9%, α 2.1%
	185 (1/2+)	-19.76	19.5 s 5	ϵ
	185m (9/2-)	-19.30	1.93 s 8	IT, α
	186m (7+)	-20.2	27.5 s 10	ϵ , α =6.0×10 ⁻³ %
	186m (10-)	-19.8	2.9 s 2	IT
	187 (1/2+)	-22.444	=51 s	ϵ <100%, α >0%
	187m (9/2-)	-22.108	15.60 s 12	ϵ <99.9%, IT<99.9%, α 0.15%
	188m (2-)	-22.35	71 s 2	ϵ
	188m (7+)	-22.35	71 s 1	ϵ
	189 (1/2+)	-24.60	2.3 m 2	ϵ
189m (9/2-)	-24.34	1.4 m 1	ϵ <100%, IT<4%	
190m 2(-)	-24.33	2.6 m 3	ϵ	
190m 7(+)	-24.33	3.7 m 3	ϵ	
191 (1/2+)	-26.281	?	ϵ ?	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$			
Z	El	A	J^{π}	(MeV)		
			Abundance	Decay Mode		
81	Tl	191m	9/2(-)	-25.982	5.22 m 16	ϵ
		192	(2-)	-25.87	9.6 m 4	ϵ
		192m	(7+)	-25.72	10.8 m 2	ϵ
		193	1/2+	-27.3	21.6 m 8	ϵ
		193m	9/2-	-27.0	2.11 m 15	IT $\leq 75\%$, $\epsilon \leq 25\%$
		194	2-	-26.8	33.0 m 5	ϵ , $\alpha < 1.0 \times 10^{-7}\%$
		194m	(7+)	-26.8	32.8 m 2	ϵ
		195	1/2+	-28.16	1.16 h 5	ϵ
		195m	9/2-	-27.67	3.6 s 4	IT
		196	2-	-27.50	1.84 h 3	ϵ
		196m	(7+)	-27.10	1.41 h 2	ϵ 95.5%, IT 4.5%
		197	1/2+	-28.34	2.84 h 4	ϵ
		197m	9/2-	-27.73	0.54 s 1	IT
		198	2-	-27.49	5.3 h 5	ϵ
		198m	7+	-26.95	1.87 h 3	ϵ 54%, IT 46%
		199	1/2+	-28.06	7.42 h 8	ϵ
		200	2-	-27.048	26.1 h 1	ϵ
		201	1/2+	-27.18	72.912 h 17	ϵ
		202	2-	-25.98	12.23 d 2	ϵ
		203	1/2+	-25.761	29.524% 14	
		204	2-	-24.346	3.78 y 2	β - 97.1%, ϵ 2.9%
		205	1/2+	-23.821	70.476% 14	
		206	0-	-22.253	4.200 m 17	β -
		206m	(12-)	-19.610	3.74 m 3	IT
		207	1/2+	-21.034	4.77 m 2	β -
		207m	11/2-	-19.686	1.33 s 11	IT
208	5(+)	-16.750	3.053 m 4	β -		
209	(1/2+)	-13.638	2.161 m 7	β -		
210	(5+)	-9.25	1.30 m 3	β -, β -n $7.0 \times 10^{-3}\%$		
211		-6.1s	>300 ns	β -?		
212		-1.7s	>300 ns	β -?		
82	Pb	178	0+	3.57	0.23 ms 15	α , ϵ ?
		179		2.0s	3 ms sy	α ?
		180	0+	-1.94	4.5 ms 11	$\alpha \leq 100\%$
		181m	(13/2+)	-3.14	45 ms 20	$\alpha < 100\%$
		182	0+	-6.83	55 ms +40-35	$\alpha \leq 100\%$
		183	(3/2-)	-7.57	535 ms 30	$\alpha = 90\%$
		183m	(13/2+)	-7.47	415 ms 20	$\alpha = 100\%$
		184	0+	-11.05	490 ms 25	ϵ 77%, α 23%
		185m	13/2+	-11.54	4.24 s 17	$\alpha = 50\%$, ϵ ?
		185m	3/2-	-11.54	6.3 s 4	$\alpha = 50\%$, ϵ ?
		186	0+	-14.68	4.82 s 3	ϵ 60%, α 40%
		187	(3/2-)	-14.980	15.2 s 3	ϵ 93%, α 7%
		187m	(13/2+)	-14.899	18.3 s 3	ϵ 88%, α 12%
		188	0+	-17.82	25.1 s 1	ϵ 90.7%, α 9.3%
		189	(3/2-)	-17.88	51 s 3	$\epsilon > 99\%$, $\alpha = 0.4\%$
		190	0+	-20.42	71 s 1	ϵ 99.6%, α 0.4%
		191	(3/2-)	-20.25	1.33 m 8	ϵ 99.99%, α 0.01%
		191m	(13/2+)	-20.11	2.18 m 8	ϵ , $\alpha = 0.02\%$
		192	0+	-22.56	3.5 m 1	ϵ 99.99%, α $5.9 \times 10^{-3}\%$
193	(3/2-)	-22.19	5 m sy	ϵ		

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
82 Pb	193m (13/2+)	-22.19	5.8 m 2	ϵ	
	194	0+	10.7 m 6	ϵ , α 7.3×10 ⁻⁶ %	
	195	3/2-	=15 m	ϵ	
	195m	13/2+	-23.51	15.0 m 12	ϵ
	196	0+	-25.36	37 m 3	ϵ = 100%, α ≤ 3.0×10 ⁻⁵ %
	197	3/2-	-24.749	8.1 m 17	ϵ
	197m	13/2+	-24.429	42.9 m 9	ϵ 81%, IT 19%
	198	0+	-26.05	2.4 h 1	ϵ
	199	3/2-	-25.23	90 m 10	ϵ
	199m	(13/2+)	-24.80	12.2 m 3	IT < 100%, ϵ > 0%
	200	0+	-26.24	21.5 h 4	ϵ
	201	5/2-	-25.26	9.33 h 3	ϵ
	201m	13/2+	-24.63	61 s 2	IT > 99%, ϵ < 1%
	202	0+	-25.934	52.5×10 ³ y 28	ϵ , α < 1%
	202m	9-	-23.764	3.53 h 1	IT 90.5%, ϵ 9.5%
	203	5/2-	-24.787	51.92 h 3	ϵ
	203m	13/2+	-23.961	6.21 s 8	IT
	203m	29/2-	-21.837	480 ms 7	IT
	204	0+	-25.110	≥ 1.4×10 ¹⁷ y	α ?
				1.4% I	
	204m	9-	-22.924	1.14 h 4	IT
	205	5/2-	-23.770	1.73×10 ⁷ y 7	ϵ
	206	0+	-23.785	24.1% I	
	207	1/2-	-22.452	22.1% I	
	207m	13/2+	-20.819	0.806 s 6	IT
208	0+	-21.749	52.4% I		
209	9/2+	-17.614	3.253 h 14	β -	
210	0+	-14.728	22.20 y 22	β -, α 1.9×10 ⁻⁶ %	
211	9/2+	-10.491	36.1 m 2	β -	
212	0+	-7.547	10.64 h 1	β -	
213	(9/2+)	-3.184	10.2 m 3	β -	
214	0+	-0.181	26.8 m 9	β -	
215		4.5s	36 s 1	β -	
83 Bi	184m		1.0s	α = 100%	
	184m		1.0s	α = 100%	
	185	1/2+	-2.21s	63 μ s 3	p 90%, α 10%
	186	(3+)	-3.17	15.0 ms 17	α = 100%
	186m	(10-)	-3.17	9.8 ms 13	α = 100%
	187	(9/2-)	-6.37	32 ms 3	α
	188m	(3+)	-7.20	60 ms 3	α , ϵ ?
	188m	(10-)	-7.20	265 ms 15	α , ϵ ?
	189	(9/2-)	-10.06	674 ms 11	α > 50%, ϵ < 50%
	189m	(1/2+)	-9.88	5.0 ms 1	α > 50%, ϵ < 50%
	190m	(10-)	-10.9	6.2 s 1	α 70%, ϵ 30%
	190m	(3+)	-10.9	6.3 s 1	α 90%, ϵ 10%
	191	(9/2-)	-13.240	12.4 s 4	α 51%, ϵ 49%
	191m	(1/2+)	-13.000	121 ms 8	α 68%, ϵ 32%
	192	(3+)	-13.55	34.6 s 9	ϵ 88%, α 12%
	192m	(10-)	-13.55	39.6 s 4	ϵ 90%, α 10%
	193	(9/2-)	-15.873	63 s 3	ϵ 96.2%, α 3.8%
193m	(1/2+)	-15.566	3.2 s 6	α 84%, ϵ 16%	

Nuclear Wallet Cards

Nuclide		Δ	T $\frac{1}{2}$, Γ , or		
Z	El A	(MeV)	Abundance	Decay Mode	
83	Bi				
	194	(3+)	-15.99	95 s 3	ϵ 99.54%, α 0.46%
	194m	(10-)	-15.99	115 s 4	ϵ 99.8%, α 0.2%
	194m	(6+, 7+)	-15.99	125 s 2	ϵ
	195	(9/2-)	-18.024	183 s 4	ϵ 99.97%, α 0.03%
	195m	(1/2+)	-17.623	87 s 1	ϵ 67%, α 33%
	196	(3+)	-18.01	308 s 12	ϵ = 100%, α $1.2 \times 10^{-3}\%$
	196m	(7+)	-17.84	0.6 s 5	IT, ϵ
	196m	(10-)	-17.74	240 s 3	ϵ 74.2%, IT 25.8%, α $3.8 \times 10^{-4}\%$
	197	(9/2-)	-19.688	9.33 m 50	ϵ , α $1.0 \times 10^{-4}\%$
	197m	(1/2+)	-19.188	5.04 m 16	α 55%, ϵ 45%, IT < 0.3%
	198	(2+, 3+)	-19.37	10.3 m 3	ϵ
	198m	(7+)	-19.37	11.6 m 3	ϵ
	198m	10-	-19.12	7.7 s 5	IT
	199	9/2-	-20.80	27 m 1	ϵ
	199m	(1/2+)	-20.12	24.70 m 15	ϵ \geq 98%, IT \leq 2%, α = 0.01%
	200	7+	-20.37	36.4 m 5	ϵ
	200m	(2+)	-20.37	31 m 2	ϵ > 90%, IT < 10%
	200m	(10-)	-19.94	0.40 s 5	IT
	201	9/2-	-21.42	108 m 3	ϵ , α < $1.0 \times 10^{-4}\%$
	201m	1/2+	-20.57	59.1 m 6	ϵ > 93%, IT \leq 6.8%, α = 0.3%
	202	5+	-20.73	1.72 h 5	ϵ , α < $1.0 \times 10^{-5}\%$
	203	9/2-	-21.54	11.76 h 5	ϵ
	203m	1/2+	-20.44	305 ms 5	IT
	204	6+	-20.67	11.22 h 10	ϵ
	205	9/2-	-21.062	15.31 d 4	ϵ
	206	6(+)	-20.028	6.243 d 3	ϵ
	207	9/2-	-20.054	32.9 y 14	ϵ
	208	(5)+	-18.870	3.68×10^5 y 4	ϵ
	209	9/2-	-18.258	1.9×10^{19} y 2	α
	100%				
	210	1-	-14.792	5.012 d 5	β^- , α $1.3 \times 10^{-4}\%$
	210m	9-	-14.521	3.04×10^6 y 6	α
211	9/2-	-11.858	2.14 m 2	α 99.72%, β^- 0.28%	
212	1(-)	-8.117	60.55 m 6	β^- 64.06%, α 35.94%	
212m	(8-, 9-)	-7.867	25.0 m 2	α 67%, β^- 33%, β^- α 30%	
212m	\geq 16	-6.207	7.0 m 3	β^- = 100%	
213	9/2-	-5.231	45.59 m 6	β^- 97.91%, α 2.09%	
214	1-	-1.20	19.9 m 4	β^- 99.98%, α 0.02%	
215	(9/2-)	1.65	7.6 m 2	β^-	
215m	(25/2-)	3.00	36.4 s	IT, β^-	
216	(1-)	5.87	2.17 m 5	β^- \leq 100%	
217		8.8s	98.5 s 8	β^-	
218		13.3s	33 s 1	β^-	
84	Po				
	188	0+	-0.54	0.40 ms +20-15	ϵ < 100%, α > 0%
	189		-1.42	5 ms 1	α
190	0+	-4.56	2.46 ms 5	α	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
84	Po			
	191	(3/2-)	-5.05	22 ms 1 α
	191m	(13/2+)	-4.92	93 ms 3 α
	192	0+	-8.07	33.2 ms 14 $\alpha=99.5\%$, $\epsilon=0.5\%$
	193m	(13/2+)	-8.36	243 ms +11-10 $\alpha\leq 100\%$
	193m	(3/2-)	-8.36	370 ms +46-40 $\alpha\leq 100\%$
	194	0+	-11.01	0.392 s 4 $\alpha=100\%$, ϵ
	195	(3/2-)	-11.07	4.64 s 9 $\alpha 75\%$, $\epsilon 25\%$
	195m	(13/2+)	-10.84	1.92 s 2 $\alpha=90\%$, $\epsilon=10\%$, IT<0.01%
	196	0+	-13.47	5.8 s 2 $\alpha=98\%$, $\epsilon=2\%$
	197	(3/2-)	-13.36	84 s 16 $\epsilon 56\%$, $\alpha 44\%$
	197m	(13/2+)	-13.15	32 s 2 $\alpha 84\%$, $\epsilon 16\%$, IT 0.01%
	198	0+	-15.47	1.77 m 3 $\alpha 57\%$, $\epsilon 43\%$
	199	(3/2-)	-15.22	4.58 m 52 $\epsilon 92.5\%$, $\alpha 7.5\%$
	199m	13/2+	-14.90	4.13 m 43 $\epsilon 73.5\%$, $\alpha 24\%$, IT 2.5%
	200	0+	-16.95	10.9 m 11 $\epsilon 88.9\%$, $\alpha 11.1\%$
	201	3/2-	-16.525	15.3 m 2 $\epsilon 98.4\%$, $\alpha 1.6\%$
	201m	13/2+	-16.101	8.9 m 2 IT 56%, $\epsilon 41\%$, $\alpha=2.9\%$
	202	0+	-17.92	44.7 m 5 $\epsilon 98.08\%$, $\alpha 1.92\%$
	203	5/2-	-17.31	36.7 m 5 $\epsilon 99.89\%$, $\alpha 0.11\%$
	203m	13/2+	-16.67	45 s 2 IT
	204	0+	-18.33	3.53 h 2 $\epsilon 99.34\%$, $\alpha 0.66\%$
205	5/2-	-17.51	1.74 h 8 $\epsilon 99.96\%$, $\alpha 0.04\%$	
206	0+	-18.182	8.8 d 1 $\epsilon 94.55\%$, $\alpha 5.45\%$	
207	5/2-	-17.146	5.80 h 2 $\epsilon 99.98\%$, $\alpha 0.02\%$	
207m	19/2-	-15.763	2.79 s 8 IT	
208	0+	-17.469	2.898 y 2 α, ϵ	
209	1/2-	-16.366	102 y 5 $\alpha 99.52\%$, $\epsilon 0.48\%$	
210	0+	-15.953	138.376 d 2 α	
211	9/2+	-12.432	0.516 s 3 α	
211m	(25/2+)	-10.970	25.2 s 6 $\alpha 99.98\%$, IT 0.02%	
212m	(18+)	-7.447	45.1 s 6 $\alpha 99.93\%$	
213	9/2+	-6.653	3.65 μ s 4 α	
214	0+	-4.470	164.3 μ s 20 α	
215	9/2+	-0.540	1.781 ms 4 $\alpha, \beta- 2.3\times 10^{-4}\%$	
216	0+	1.784	0.145 s 2 α	
217	(9/2+)	5.901	1.53 s 5 α	
218	0+	8.358	3.10 m 2 $\alpha 99.98\%$, $\beta- 0.02\%$	
219		12.8s	=2 m $\alpha?, \beta-?$	
220	0+	15.5s	>300 ns $\beta-?$	
85	At			
	191	(1/2+)		1.7 ms +11-5 α
	191m	(7/2-)		2.1 ms +4-3 α
	193	(1/2+)	-0.15	28 ms +5-4 $\alpha=100\%$
	193m	(7/2-)	-0.14	21 ms 5 $\alpha=100\%$
	193m	(13/2+)	-0.11	27 ms +4-5 $\alpha 24\%$
	194m		-1.2	=40 ms α, ϵ
	194m		-1.2	=250 ms α, ϵ, IT
	195	(1/2+)	-3.476	328 ms +20 α
	195m	(7/2-)	-3.439	147 ms +5 α

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Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
85	At 196	-3.92	0.39 s 5	α 94%, ϵ
	197 (9/2-)	-6.34	0.390 s 16	α 96.1%, ϵ 3.9%
	197m (1/2+)	-6.29	2.0 s 2	$\alpha \leq 100\%$, IT $\leq 4.0 \times 10^{-3}\%$, ϵ
	198 (3+)	-6.67	4.2 s 3	α 90%, ϵ 10%
	198m (10-)	-6.57	1.0 s 2	α 84%, ϵ 16%
	199 (9/2-)	-8.82	6.92 s 13	α 90%, ϵ 10%
	200 (3+)	-8.99	43 s 1	α 57%, ϵ 43%
	200m (7+)	-8.88	47 s 1	$\epsilon \leq 57\%$, α 43%
	200m (10-)	-8.65	3.5 s 2	IT = 84%, $\alpha = 10.5\%$, $\epsilon = 4.5\%$
	201 (9/2-)	-10.790	89 s 3	α 71%, ϵ 29%
	202 (2,3)+	-10.59	184 s 1	ϵ 82%, α 18%
	202m (7+)	-10.59	182 s 2	ϵ 91.3%, α 8.7%
	202m (10-)	-10.20	0.46 s 5	IT 99.7%, ϵ 0.25%, α 0.1%
	203 9/2-	-12.16	7.37 m 13	ϵ 69%, α 31%
	204 7+	-11.88	9.2 m 2	ϵ 96.2%, α 3.8%
	204m (10-)	-11.29	108 ms 10	IT
	205 9/2-	-12.97	26.9 m 8	ϵ 90%, α 10%
	206 (5)+	-12.42	30.6 m 13	ϵ 99.11%, α 0.89%
	207 9/2-	-13.24	1.80 h 4	ϵ 91.4%, α 8.6%
	208 6+	-12.49	1.63 h 3	ϵ 99.45%, α 0.55%
	209 9/2-	-12.880	5.41 h 5	ϵ 95.9%, α 4.1%
	210 (5)+	-11.972	8.1 h 4	ϵ 99.82%, α 0.18%
	211 9/2-	-11.647	7.214 h 7	ϵ 58.2%, α 41.8%
	212 (1-)	-8.621	0.314 s 2	α , $\epsilon < 0.03\%$, $\beta^- < 2.0 \times 10^{-6}\%$
	212m (9-)	-8.398	0.119 s 3	$\alpha > 99\%$, IT < 1%
	213 9/2-	-6.580	125 ns 6	α
214 1-	-3.380	558 ns 10	α	
215 9/2-	-1.255	0.10 ms 2	α	
216 1-	2.257	0.30 ms 3	α , $\beta^- < 6.0 \times 10^{-3}\%$, $\epsilon < 3.0 \times 10^{-7}\%$	
217 9/2-	4.396	32.3 ms 4	α 99.99%, $\beta^- 7.0 \times 10^{-3}\%$	
218	8.10	1.5 s 3	α 99.9%, $\beta^- 0.1\%$	
219	10.397	56 s 3	$\alpha = 97\%$, $\beta^- = 3\%$	
220 3	14.35	3.71 m 4	$\beta^- 92\%$, α 8%	
221	16.8s	2.3 m 2	β^-	
222	20.8s	54 s 10	β^-	
223	23.5s	50 s 7	β^-	
86	Rn 195	5.07	6 ms +3-2	α
	195m	5.12	5 ms +3-2	α
	196 0+	1.97	4.4 ms +13-9	α
	197 (3/2-)	1.48	65 ms +25-14	$\alpha = 100\%$
	197m (13/2+)	1.48	19 ms +8-4	$\alpha = 100\%$
	198 0+	-1.23	65 ms 3	α , ϵ
	199 (3/2-)	-1.52	0.62 s 3	α 94%, ϵ 6%
	199m (13/2+)	-1.52	0.32 s 2	α 97%, ϵ 3%
	200 0+	-4.01	0.96 s 3	$\alpha = 98\%$, $\epsilon = 2\%$
	201 (3/2-)	-4.07	7.1 s 8	$\alpha = 80\%$, $\epsilon = 20\%$

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Nuclide		Δ	T½, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
86 Rn	201m (13/2+)	-3.79	3.8 s 1	$\alpha=90\%$, $\epsilon=10\%$, IT=0%
	202 0+	-6.28	10.0 s 3	$\alpha 86\%$, $\epsilon 14\%$
	203 (3/2-)	-6.16	44.2 s 16	$\alpha 66\%$, $\epsilon 34\%$
	203m (13/2+)	-5.80	26.9 s 5	$\alpha 75\%$, $\epsilon 25\%$
	204 0+	-7.98	1.17 m 18	$\alpha 73\%$, $\epsilon 27\%$
	205 5/2-	-7.71	170 s 4	$\epsilon 75.4\%$, $\alpha 24.6\%$
	206 0+	-9.12	5.67 m 17	$\alpha 62\%$, $\epsilon 38\%$
	207 5/2-	-8.63	9.25 m 17	$\epsilon 79\%$, $\alpha 21\%$
	208 0+	-9.65	24.35 m 14	$\alpha 62\%$, $\epsilon 38\%$
	209 5/2-	-8.93	28.5 m 10	$\epsilon 83\%$, $\alpha 17\%$
	210 0+	-9.598	2.4 h 1	$\alpha 96\%$, $\epsilon 4\%$
	211 1/2-	-8.756	14.6 h 2	$\epsilon 72.6\%$, $\alpha 27.4\%$
	212 0+	-8.660	23.9 m 12	α
	213 (9/2+)	-5.698	19.4 ms 1	α
	214 0+	-4.320	0.27 μ s 2	α
	215 9/2+	-1.169	2.30 μ s 10	α
	216 0+	0.256	45 μ s 5	α
	217 9/2+	3.659	0.54 ms 5	α
	218 0+	5.218	35 ms 5	α
	219 5/2+	8.831	3.96 s 1	α
	220 0+	10.613	55.6 s 1	α
	221 7/2(+)	14.472	25.7 m 5	$\beta- 78\%$, $\alpha 22\%$
	222 0+	16.374	3.8235 d 4	α
	223 7/2	20.3s	24.3 m 4	$\beta-$
	224 0+	22.4s	107 m 3	$\beta-$
	225 7/2-	26.5s	4.66 m 4	$\beta-$
	226 0+	28.8s	7.4 m 1	$\beta-$
	227	33.0s	20.8 s 7	$\beta-$
	228 0+	35.4s	65 s 2	$\beta-$
87 Fr	199	6.76	12 ms +10-4	$\alpha > 0\%$, ϵ
	200 (3+)	6.12	49 ms 4	α
	200m (10-)	6.32	0.57 s +27-14	α
	201 (9/2-)	3.60	67 ms 3	α , $\epsilon < 1\%$
	201m	3.60	19 ms +19-6	α
	202 (3+)	3.14	0.23 s +8-4	$\alpha=97\%$, $\epsilon=3\%$
	202m (10-)	3.24	0.23 s +14-5	$\alpha=97\%$, $\epsilon=3\%$
	203 (9/2-)	0.86	0.55 s 2	$\alpha \leq 100\%$
	204 (3+)	0.61	1.7 s 3	$\alpha=80\%$, $\epsilon=20\%$
	204m (7+)	0.65	2.6 s 3	$\alpha \leq 100\%$
	204m (10-)	0.92	=1 s	$\alpha \leq 100\%$, IT
	205 (9/2-)	-1.310	3.80 s 3	$\alpha \leq 100\%$
	206 (2+,3+)	-1.24	=16 s	$\alpha=84\%$, $\epsilon=16\%$
	206m (7+)	-1.24	15.9 s 1	$\alpha 84\%$, $\epsilon 16\%$
	206m (10-)	-0.71	0.7 s 1	$\alpha=12\%$, IT
	207 9/2-	-2.84	14.8 s 1	$\alpha 95\%$, $\epsilon 5\%$
	208 7+	-2.67	59.1 s 3	$\alpha 90\%$, $\epsilon 10\%$
	209 9/2-	-3.77	50.0 s 3	$\alpha 89\%$, $\epsilon 11\%$
	210 6+	-3.35	3.18 m 6	$\alpha 60\%$, $\epsilon 40\%$
	211 9/2-	-4.16	3.10 m 2	$\alpha > 80\%$, $\epsilon < 20\%$
	212 5+	-3.54	20.0 m 6	$\epsilon 57\%$, $\alpha 43\%$
	213 9/2-	-3.550	34.6 s 3	$\alpha 99.45\%$, $\epsilon 0.55\%$

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or				
Z	El A	(MeV)	Abundance	Decay Mode			
87	Fr	214	(1-)	-0.958	5.0 ms 2	α	
		214m	(8-)	-0.836	3.35 ms 5	α	
		215	9/2-	0.318	86 ns 5	α	
		216	(1-)	2.98	0.70 μ s 2	α , $\epsilon < 2.0 \times 10^{-7}\%$	
		217	9/2-	4.315	19 μ s 3	α	
		218	1-	7.059	1.0 ms 6	α	
		218m			7.145	22.0 ms 5	$\alpha \leq 100\%$, IT
		219	9/2-	8.618	20 ms 2	α	
		220	1+	11.483	27.4 s 3	α 99.65%, β - 0.35%	
		221	5/2-	13.278	4.9 m 2	α , β - < 0.1%, ^{14}C $9 \times 10^{-13}\%$	
		222	2-	16.35	14.2 m 3	β -	
		223	3/2(-)	18.384	22.00 m 7	β - 99.99%, α $6.0 \times 10^{-3}\%$	
		224	1-	21.66	3.33 m 10	β -	
		225	3/2-	23.81	4.0 m 2	β -	
		226	1-	27.4	49 s 1	β -	
		227	1/2+	29.7	2.47 m 3	β -	
		228	2-	33.3s	38 s 1	β - $\leq 100\%$	
		229	(1/2+)	35.82	50.2 s 4	β -	
		230			39.6s	19.1 s 5	β -
		231	(1/2+)	42.3s	17.6 s 6	β -	
		232			46.4s	5 s 1	β -
	88	Ra	202	0+	9.21	0.7 ms +33-3	α
			203	(3/2-)	8.64	1.0 ms +50-5	$\alpha = 100\%$
		203m	(13/2+)	8.64	33 ms +22-10	$\alpha = 100\%$	
		204	0+	6.05	59 ms +12-9	α	
		205	(3/2-)	5.84	210 ms +60-40	$\alpha \leq 100\%$, ϵ	
		205m	(13/2+)	5.84	170 ms +60-40	$\alpha \leq 100\%$, ϵ	
		206	0+	3.57	0.24 s 2	α	
		207	(5/2-, 3/2-)	3.54	1.3 s 2	$\alpha = 90\%$, $\epsilon = 10\%$	
		207m	(13/2+)	4.01	55 ms 10	IT 85%, α 15%, $\epsilon = 0.35\%$	
		208	0+	1.71	1.3 s 2	α 95%, ϵ 5%	
		209	5/2-	1.86	4.6 s 2	$\alpha = 90\%$, $\epsilon = 10\%$	
		210	0+	0.46	3.7 s 2	$\alpha = 96\%$, $\epsilon = 4\%$	
		211	5/2(-)	0.84	13 s 2	$\alpha > 93\%$, $\epsilon < 7\%$	
		212	0+	-0.19	13.0 s 2	$\alpha = 85\%$, $\epsilon = 15\%$	
		213	1/2-	0.36	2.74 m 6	α 80%, ϵ 20%	
		213m			2.13	2.1 ms 1	IT=99%, $\alpha = 1\%$
		214	0+	0.101	2.46 s 3	α 99.94%, ϵ 0.06%	
		215	(9/2+)	2.533	1.55 ms 7	α	
		216	0+	3.291	182 ns 10	α , $\epsilon < 1.0 \times 10^{-8}\%$	
		217	(9/2+)	5.887	1.6 μ s 2	$\alpha = 100\%$	
		218	0+	6.65	25.2 μ s 3	α	
		219	(7/2)+	9.394	10 ms 3	α	
		220	0+	10.273	18 ms 2	α	
		221	5/2+	12.964	28 s 2	α , ^{14}C $1 \times 10^{-12}\%$	
		222	0+	14.321	38.0 s 5	α , ^{14}C $3.0 \times 10^{-8}\%$	
	223	3/2+	17.235	11.43 d 5	α , ^{14}C $8.9 \times 10^{-8}\%$		
	224	0+	18.827	3.6319 d 23	α , ^{14}C $4.0 \times 10^{-9}\%$		
	225	1/2+	21.994	14.9 d 2	β -		

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
88 Ra	226	0+	23.669	1600 y 7 α , ^{14}C 3.2×10 ⁻⁹ %
	227	3/2+	27.179	42.2 m 5 β -
	228	0+	28.942	5.75 y 3 β -
	229	5/2(+)	32.56	4.0 m 2 β -
	230	0+	34.52	93 m 2 β -
	231	(5/2+)	38.4s	103 s 3 β -
	232	0+	40.6s	250 s 50 β -
	233		44.8s	30 s 5 β -
	234	0+	47.2s	30 s 10 β -
89 Ac	206m		13.51	11 ms +9-3 α
	206m (3+)		13.51	22 ms +9-5 α
	206m (10-)		13.51	33 ms +22-9 α
	207 (9/2-)		11.13	27 ms +11-6 α
	208 (3+)		10.76	95 ms +24-16 ϵ 1%, α
	208m (10-)		11.27	25 ms +9-5 IT<10%, ϵ 1%, α
	209 (9/2-)		8.84	0.10 s 5 ϵ =99%, ϵ =1%
	210		8.79	0.35 s 5 α 91%, ϵ =9%
	211		7.20	0.21 s 3 α =100%
	212		7.28	0.93 s 5 α =57%, ϵ =43%
	213		6.16	0.731 s 17 α ≤100%
	214		6.43	8.2 s 2 α ≥89%, ϵ ≤11%
	215 9/2-		6.01	0.17 s 1 α 99.91%, ϵ 0.09%
	216 (1-)		8.12	0.440 ms 16 α
	217 9/2-		8.71	69 ns 4 α =100%, ϵ ≤2%
	218 (1-)		10.84	1.08 μ s 9 α
	219 9/2-		11.57	11.8 μ s 15 α
	220 (3-)		13.75	26.4 ms 2 α , ϵ 5.0×10 ⁻⁴ %
	221		14.52	52 ms 2 α
	222 1-		16.621	5.0 s 5 α 99%, ϵ 1%
	222m		16.621	63 s 3 α ≥88%, IT≤10%, ϵ ≥0.7%
		223 (5/2-)	17.826	2.10 m 5 α 99%, ϵ 1%
		224 0-	20.235	2.78 h 17 ϵ 90.9%, α 9.1%, β -<1.6%
		225 (3/2-)	21.638	10.0 d 1 α , ^{14}C 5×10 ⁻¹⁰ %
		226 (1)	24.310	29.37 h 12 β - 83%, ϵ 17%, α 6.0×10 ⁻³ %
		227 3/2-	25.851	21.772 y 3 β - 98.62%, α 1.38%
	228 3+	28.896	6.15 h 2 β -	
	229 (3/2+)	30.75	62.7 m 5 β -	
	230 (1+)	33.8	122 s 3 β -	
	231 (1/2+)	35.9	7.5 m 1 β -	
	232 (1+)	39.1	119 s 5 β -	
	233 (1/2+)	41.5s	145 s 10 β -	
	234	45.1s	44 s 7 β -	
	235	47.7s	=40 s β -?	
	236	51.5s	=2 m β -?	
90 Th	209 (5/2-)	16.50	3.8 ms +69-15 α	
	210 0+	14.04	9 ms +17-4 α 99%, ϵ =1%	
	211	13.91	0.04 s +3-1 α	
	212 0+	12.09	30 ms +20-10 α , ϵ =0.3%	
	213	12.12	140 ms 25 α ≤100%	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El A	(MeV)	Abundance	Decay Mode
90 Th	214	0+	10.71	100 ms 25 α
	215	(1/2-)	10.93	1.2 s 2 α
	216	0+	10.30	0.028 s 2 $\alpha, \epsilon = 0.01\%$
	217	(9/2+)	12.22	0.241 ms 5 α
	218	0+	12.37	109 ns 13 α
	219		14.47	1.05 μ s 3 α
	220	0+	14.67	9.7 μ s 6 $\alpha, \epsilon = 2.0 \times 10^{-7}\%$
	221	(7/2+)	16.938	1.73 ms 3 α
	222	0+	17.20	2.237 ms 13 α
	223	(5/2+)	19.386	0.60 s 2 α
	224	0+	20.00	0.81 s 10 α
	225	(3/2+)	22.310	8.72 m 4 $\alpha = 90\%, \epsilon = 10\%$
	226	0+	23.197	30.57 m 10 α
	227	1/2+	25.806	18.68 d 9 α
	228	0+	26.772	1.9116 y 16 $\alpha, {}^{20}\text{O} 1 \times 10^{-11}\%$
	229	5/2+	29.587	7340 y 160 α
	229m		29.590	13.9 h 30 α
	230	0+	30.864	7.538×10^4 y 30 $\alpha, \text{SF} < 4. \times 10^{-11}\%$
	231	5/2+	33.817	25.52 h 1 $\beta-, \alpha = 4 \times 10^{-11}\%$
	232	0+	35.448	1.405×10^{10} y 6 $\alpha, \text{SF} 1.2 \times 10^{-8}\%, \text{Ne}$
	233	1/2+	38.733	21.83 m 4 $\beta-$
	234	0+	40.614	24.10 d 3 $\beta-$
	235	(1/2+)	44.26	7.2 m 1 $\beta-$
236	0+	46.5s	37.5 m 2 $\beta-$	
237	(5/2+)	50.2s	4.7 m 6 $\beta-$	
238	0+	52.6s	9.4 m 20 $\beta-$	
91 Pa	212		21.61	5.1 ms +61-19 $\alpha = 100\%$
	213	(9/2-)	19.66	5.3 ms +40-16 α
	214		19.49	17 ms 3 α
	215		17.87	14 ms 2 α
	216		17.80	105 ms 12 $\alpha = 98\%, \epsilon = 2\%$
	217		17.07	3.6 ms 8 α
	217m		18.92	1.2 ms 2 $\alpha 73\%, \text{IT} 27\%$
	218		18.67	0.113 ms 1 α
	219m	9/2-	18.52	53 ns 10 α
	220?		20.38	0.78 μ s 16 $\alpha, \epsilon = 3.0 \times 10^{-7}\%$
	221	9/2-	20.38	4.9 μ s 8 α
	222		22.12s	3.3 ms 3 α
	223		22.32	5.1 ms 6 α
	224		23.87	0.85 s 2 α
	225		24.34	1.7 s 2 α
	226		26.03	1.8 m 2 $\alpha 74\%, \epsilon 26\%$
	227	(5/2-)	26.832	38.3 m 3 $\alpha 85\%, \epsilon 15\%$
228	3+	28.924	22 h 1 $\epsilon 98\%, \alpha 2\%$	
229	(5/2+)	29.898	1.50 d 5 $\epsilon 99.52\%, \alpha 0.48\%$	
230	(2-)	32.174	17.4 d 5 $\epsilon 91.6\%, \beta- 8.4\%, \alpha 3.2 \times 10^{-3}\%$	
231	3/2-	33.426	3.276×10^4 y 11 $\alpha, \text{SF} \leq 3 \times 10^{-10}\%$	
232	(2-)	35.948	1.31 d 2 $\beta-, \epsilon = 3.0 \times 10^{-3}\%$	
233	3/2-	37.490	26.975 d 13 $\beta-$	
234	4+	40.341	6.70 h 5 $\beta-$	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma,$ or		
Z	El A	(MeV)	Abundance	Decay Mode	
91 Pa	234 _m	(0-)	40.415	1.17 m 3	β^- 99.84%, IT 0.16%
	235	(3/2-)	42.33	24.44 m 11	β^-
	236	1(-)	45.3	9.1 m 1	β^-
	237	(1/2+)	47.6	8.7 m 2	β^-
	238	(3-)	50.77	2.27 m 9	β^- , SF < 2.6 × 10 ⁻⁶ %
	239	(3/2)	53.3s	1.8 h 5	β^-
	240		56.8s	= 2 m	β^- ?
92 U	217		22.70	16 ms +21-6	α < 100%
	218	0+	21.92	1.5 ms +73-7	α
	219		23.21	42 μ s +34-13	α
	220	0+	23.0s	= 60 ns	$\alpha?$, $\epsilon?$
	221		24.6s	= 0.7 μ s	$\alpha?$, $\epsilon?$
	222	0+	24.3s	1.0 μ s +10-4	α
	223		25.84	18 μ s +10-5	α , ϵ 0.2%
	224	0+	25.71	0.9 ms 3	α
	225		27.38	84 ms 4	α
	226	0+	27.33	0.26 s 2	α
	227	(3/2+)	29.02	1.1 m 1	α
	228	0+	29.22	9.1 m 2	α > 95%, ϵ < 5%
	229	(3/2+)	31.211	58 m 3	ϵ = 80%, α = 20%
	230	0+	31.615	20.8 d	α , SF < 1 × 10 ⁻¹⁰ %
	231	(5/2-)	33.807	4.2 d 1	ϵ , α = 4.0 × 10 ⁻³ %
	232	0+	34.611	68.9 y 4	α , Ne 9 × 10 ⁻¹⁰ % , Mg < 5 × 10 ⁻¹² % , SF 3 × 10 ⁻¹² %
	233	5/2+	36.920	1.592 × 10 ⁵ y 2	α , SF < 6.0 × 10 ⁻⁹ %
	234	0+	38.147	2.455 × 10 ⁵ y 6	α , SF 1.6 × 10 ⁻⁹ % , Mg 1 × 10 ⁻¹¹ % , Ne 9 × 10 ⁻¹² %
	235	7/2-	40.921	7.04 × 10 ⁸ y 1	α , SF 7.0 × 10 ⁻⁹ % , Ne = 8. × 10 ⁻¹⁰ % , 28 8. × 10 ⁻¹⁰ %
	235 _m	1/2+	40.921	= 26 m	IT
	236	0+	42.446	2.342 × 10 ⁷ y 3	α , SF 9.4 × 10 ⁻⁸ % , ³⁰ Mg
	237	1/2+	45.392	6.75 d 1	β^-
	238	0+	47.309	4.468 × 10 ⁹ y 3	α , SF 5.5 × 10 ⁻⁵ %
239	5/2+	50.574	23.45 m 2	β^-	
240	0+	52.715	14.1 h 1	β^-	
241		56.2s	= 5 m	β^- ?	
242	0+	58.6s	16.8 m 5	β^-	
93 Np	225	(9/2-)	31.59	> 2 μ s	α
	226		32.74s	35 ms 10	α
	227		32.56	0.51 s 6	α
	228		33.7s	61.4 s 14	ϵ 60%, α 40%
	229		33.78	4.0 m 4	α 68%, ϵ 32%
	230		35.24	4.6 m 3	ϵ ≤ 97%, α ≥ 3%
	231	(5/2)	35.63	48.8 m 2	ϵ 98%, α 2%
	232	(4+)	37.4s	14.7 m 3	ϵ

Nuclear Wallet Cards

Nuclide		Δ	$T\frac{1}{2}$, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
93 Np	233	(5/2+)	37.95	36.2 m 1	ϵ , $\alpha \leq 1.0 \times 10^{-3}\%$	
	234	(0+)	39.957	4.4 d 1	ϵ	
	235	5/2+	41.045	396.1 d 12	ϵ , $\alpha 2.6 \times 10^{-3}\%$	
	236	(6-)	43.38	154×10^3 y 6	$\epsilon 87.3\%$, $\beta- 12.5\%$, $\alpha 0.16\%$	
	236m	1	43.44	22.5 h 4	$\epsilon 52\%$, $\beta- 48\%$	
	237	5/2+	44.873	2.144×10^6 y 7	α , SF $\leq 2 \times 10^{-10}\%$	
	238	2+	47.456	2.117 d 2	$\beta-$	
	239	5/2+	49.312	2.356 d 3	$\beta-$	
	240	(5+)	52.31	61.9 m 2	$\beta-$	
	240m	(1+)	52.31	7.22 m 2	$\beta- 99.88\%$, IT 0.12%	
	241	(5/2+)	54.26	13.9 m 2	$\beta-$	
	242	(1+)	57.4	2.2 m 2	$\beta-$	
	242m	(6+)	57.4	5.5 m 1	$\beta-$	
	243	(5/2-)	59.88s	1.85 m 15	$\beta-$	
	244	(7-)	63.2s	2.29 m 16	$\beta-$	
	94 Pu	228	0+	36.09	1.1 s +20-5	α
		229	(3/2+)	37.40	>2 μ s	α
		230	0+	36.93	1.70 m 17	$\alpha 84\%$, $\epsilon 16\%$
		231	(3/2+)	38.29	8.6 m 5	$\epsilon \leq 99.8\%$, $\alpha > 0.2\%$
		232	0+	38.37	33.1 m 8	$\epsilon 80\%$, $\alpha 20\%$
		233		40.05	20.9 m 4	$\epsilon 99.88\%$, $\alpha 0.12\%$
		234	0+	40.350	8.8 h 1	$\epsilon = 94\%$, $\alpha = 6\%$
		235	(5/2+)	42.18	25.3 m 5	ϵ , $\alpha 2.8 \times 10^{-3}\%$
		236	0+	42.903	2.858 y 8	α , SF $1.9 \times 10^{-7}\%$
237		7/2-	45.093	45.2 d 1	ϵ , $\alpha 4.2 \times 10^{-3}\%$	
237m		1/2+	45.239	0.18 s 2	IT	
238		0+	46.165	87.7 y 1	α , SF $1.9 \times 10^{-7}\%$	
239		1/2+	48.590	24110 y 30	α , SF $3. \times 10^{-10}\%$	
240		0+	50.127	6561 y 7	α , SF $5.7 \times 10^{-6}\%$	
241		5/2+	52.957	14.290 y 6	$\beta-$, $\alpha 2.5 \times 10^{-3}\%$, SF $> 2. \times 10^{-14}\%$	
242		0+	54.718	3.75×10^5 y 2	α , SF $5.5 \times 10^{-4}\%$	
243		7/2+	57.756	4.956 h 3	$\beta-$	
244	0+	59.806	8.00×10^7 y 9	$\alpha 99.88\%$, SF 0.12%		
245	(9/2-)	63.11	10.5 h 1	$\beta-$		
246	0+	65.40	10.84 d 2	$\beta-$		
247		69.0s	2.27 d 23	$\beta-$		
95 Am	231		42.4s	=10 s	$\epsilon?$, $\alpha?$	
	232		43.4s	79 s 2	$\epsilon = 98\%$, $\alpha = 2\%$	
	233		43.2s	3.2 m 8	$\alpha > 3\%$, ϵ	
	234		44.5s	2.32 m 8	$\epsilon > 99.96\%$, $\alpha < 0.04\%$	
	235m		44.7s	10.3 m 6	$\epsilon 99.6\%$, $\alpha 0.4\%$	
	236?		46.2s	3.6 m 1	$\alpha 0.004\%$, ϵ	
	236m		46.2s	0.6 y 2	ϵ	
	237	5/2(-)	46.57s	73.0 m 10	$\epsilon 99.98\%$, $\alpha 0.03\%$	
	238	1+	48.42	98 m 2	ϵ , $\alpha 1.0 \times 10^{-4}\%$	
	238m		48.42	3.8 y	α	
	239	(5/2)-	49.392	11.9 h 1	$\epsilon 99.99\%$, $\alpha 0.01\%$	
	240	(3-)	51.51	50.8 h 3	ϵ , $\alpha 1.9 \times 10^{-4}\%$	
	241	5/2-	52.936	432.2 y 7	α , SF $4 \times 10^{-10}\%$	
	242	1-	55.470	16.02 h 2	$\beta- 82.7\%$, $\epsilon 17.3\%$	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
95 Am	242m	5-	55.518	141 y 2	IT 99.55%, α 0.45%, SF < 4.7 × 10 ⁻³ %	
	242m	(2+, 3-)	57.670	14.0 ms 10	SF = 100%, α < 5.0 × 10 ⁻³ %, IT	
	243	5/2-	57.176	7370 y 40	α , SF 3.7 × 10 ⁻³ %	
	244	(6-)	59.881	10.1 h 1	β -	
	244m		59.881	0.90 ms 15	SF ≤ 100%	
	244m	1+	59.967	26 m 1	β - 99.96%, ϵ 0.04%	
	245	(5/2)+	61.900	2.05 h 1	β -	
	246	(7-)	64.99	39 m 3	β -	
	246m	2(-)	64.99	25.0 m 2	β -, IT < 0.02%	
	247	(5/2)	67.2s	23.0 m 13	β -	
	248		70.6s	=10 m	β -	
	249		73.1s	=2 m	β -?	
	96 Cm	232	0+		1 m ?	SF < 30.3%
		233		47.29		α , ϵ
234		0+	46.72	=2 m	ϵ ?, α ?	
235			47.9s	5 m sy	ϵ ?, α ?	
236		0+	47.9s	=10 m	ϵ , α	
237			49.3s	=20 m	ϵ ?, α ?	
238		0+	49.40	2.4 h 1	ϵ ≥ 90%, α ≤ 10%	
239		(7/2-)	51.2s	=2.9 h	ϵ , α < 0.1%	
240		0+	51.725	27 d 1	α > 99.5%, ϵ < 0.5%, SF 3.9 × 10 ⁻⁶ %	
241		1/2+	53.703	32.8 d 2	ϵ 99%, α 1%	
242		0+	54.805	162.8 d 2	α , SF 6.2 × 10 ⁻⁶ %, 34 1. × 10 ⁻¹⁴ %	
243		5/2+	57.184	29.1 y 1	α 99.71%, ϵ 0.29%, SF 5.3 × 10 ⁻³ %	
244		0+	58.454	18.1 y 1	α , SF 1.4 × 10 ⁻⁴ %	
245		7/2+	61.005	8500 y 100	α , SF 6.1 × 10 ⁻⁷ %	
246		0+	62.618	4760 y 40	α 99.97%, SF 0.03%	
247		9/2-	65.534	1.56 × 10 ⁷ y 5	α	
248		0+	67.392	3.48 × 10 ⁵ y 6	α 91.61%, SF 8.39%	
249	1/2(+)	70.750	64.15 m 3	β -		
250	0+	72.99	= 8.3 × 10 ³ y	SF = 74%, α = 18%, β = 8%		
251	(1/2+)	76.65	16.8 m 2	β -		
252	0+	79.1s	< 2 d	β -		
97 Bk	235		52.7s	=20 s	ϵ ?, α ?	
	236		53.4s	=42 s	α ?, ϵ ?	
	236m		46.2s	≥ 30 d	ϵ	
	237		53.1s	=1 m	ϵ ?, α ?	
	238		54.3s	144 s 5	ϵ , ϵ SF 0.048%	
	240		55.7s	4.8 m 8	ϵ SF 2.0 × 10 ⁻³ %, ϵ	
	241	(7/2+)	56.1s	=3 m	α ?, ϵ ?	
	242		57.7s	7.0 m 13	ϵ ≤ 100%	
	243	(3/2-)	58.691	4.5 h 2	ϵ = 99.85%, α = 0.15%	
	244	(4-)	60.72	4.35 h 15	ϵ 99.99%, α 6.0 × 10 ⁻³ %	
	245	3/2-	61.815	4.94 d 3	ϵ 99.88%, α 0.12%	
	246m	2(-)	63.97	1.80 d 2	ϵ , α < 0.2%	

Nuclear Wallet Cards

Nuclide		Δ	T½, Γ , or			
Z	El A	(MeV)	Abundance	Decay Mode		
97 Bk	247	(3/2-)	65.491	1380 y 250	$\alpha \leq 100\%$	
	248		68.08s	>9 y	α	
	248m	1(-)	68.08s	23.7 h 2	β^- 70%, ϵ 30%	
	249	7/2+	69.850	330 d 4	β^- , α 1.4 $\times 10^{-3}\%$, SF 4.7 $\times 10^{-8}\%$	
	250	2-	72.951	3.212 h 5	β^-	
	251	(3/2-)	75.23	55.6 m 11	β^-	
	252		78.5s	=2 m	$\beta^-?$, $\alpha?$	
	253		80.9s	=10 m	$\beta^-?$	
	254		84.4s	=2 m	$\beta^-?$	
	98 Cf	237		57.8s	2.1 s 3	SF=10%, $\alpha?$
		238	0+	57.2s	21 ms 2	SF=100%
239			58.1s	39 s +37-12	ϵ , α	
240		0+	58.0s	0.96 m 15	α =98%, SF=2%, ϵ	
241			59.4s	3.78 m 70	ϵ =75%, α =25%	
242		0+	59.34	3.7 m 5	α 80%, ϵ 20%, SF $\leq 0.01\%$	
243		(1/2+)	60.9s	10.7 m 5	ϵ =86%, α =14%	
244		0+	61.479	19.4 m 6	$\alpha \leq 100\%$	
245		(1/2+,5/2+)	63.387	45.0 m 15	ϵ 64%, α 36%	
246		0+	64.092	35.7 h 5	α , ϵ <4.0 $\times 10^{-3}\%$, SF 2.5 $\times 10^{-4}\%$	
247		(7/2+)	66.137	3.11 h 3	ϵ 99.97%, α 0.04%	
248		0+	67.240	333.5 d 28	α , SF 2.9 $\times 10^{-3}\%$	
249		9/2-	69.726	351 y 2	α , SF 5.0 $\times 10^{-7}\%$	
250		0+	71.172	13.08 y 9	α 99.92%, SF 0.08%	
251		1/2+	74.135	898 y 44	α , SF	
252		0+	76.034	2.645 y 8	α 96.91%, SF 3.09%	
253	(7/2+)	79.301	17.81 d 8	β^- 99.69%, α 0.31%		
254	0+	81.34	60.5 d 2	SF 99.69%, α 0.31%		
255	(7/2+)	84.8s	85 m 18	β^-		
256	0+	87.0s	12.3 m 12	SF, β^- <1%, α =1.0 $\times 10^{-6}\%$		
99 Es	240		64.2s	1 s sy	$\alpha?$, $\epsilon?$	
	241	(3/2-)	63.8s	8 s +6-5	α	
	242		65.0s	13.5 s 25	$\alpha > 0\%$, $\epsilon > 0\%$	
	243		64.8s	21 s 2	$\epsilon \leq 70\%$, $\alpha \geq 30\%$	
	244		66.0s	37 s 4	ϵ 96%, α 4%	
	245	(3/2-)	66.4s	1.1 m 1	ϵ 60%, α 40%	
	246m		67.9s	7.7 m 5	ϵ 90.1%, α 9.9%, ϵ 3.0 $\times 10^{-3}\%$	
	247	(7/2+)	68.61s	4.55 m 26	ϵ =93%, α =7%	
	247m		68.61s	625 d 84	α	
	248	(2-,0+)	70.30s	27 m 5	ϵ 99.7%, α =0.25%	
	249	7/2+	71.18s	102.2 m 6	ϵ 99.43%, α 0.57%	
	250	(6+)	73.2s	8.6 h 1	$\epsilon > 97\%$, $\alpha < 3\%$	
	250m	1(-)	73.2s	2.22 h 5	$\epsilon \leq 100\%$	
	251	(3/2-)	74.512	33 h 1	ϵ 99.5%, α 0.5%	
	252	(5-)	77.29	471.7 d 19	α 78%, ϵ 22%, β^- =0.01%	
253	7/2+	79.014	20.47 d 3	α , SF 8.7 $\times 10^{-6}\%$		
254	(7+)	81.992	275.7 d 5	α =100%, β^- 1.7 $\times 10^{-4}\%$, SF <3.0 $\times 10^{-6}\%$, ϵ		

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or		Decay Mode		
Z	El A	(MeV)	Abundance				
99	Es	254m	2+	82.072	39.3 h 2	β^- 98%, IT < 3%, α 0.32%, ϵ 0.08%, SF < 0.05%	
		255	(7/2+)	84.09	39.8 d 12	β^- 92%, α 8%, SF $4.1 \times 10^{-3}\%$	
		256	(1+, 0-)	87.2s	25.4 m 24	β^-	
		256m	(8+)	87.2s	7.6 h	β^-	
		257		89.4s	7.7 d 2	β^- , SF	
		258		92.7s	3 m sy	$\epsilon?$, $\alpha?$	
	100	Fm	242	0+	68.4s	0.8 ms 2	SF $\leq 100\%$
			243	(7/2+)	69.3s	0.18 s +8-4	$\alpha \leq 100\%$
		244	0+	69.0s	3.3 ms 5	SF $\leq 100\%$	
		245		70.2s	4.2 s 13	$\alpha \leq 100\%$, SF $\leq 0.1\%$	
		246	0+	70.14	1.1 s 2	α 92%, SF 8%, $\epsilon \leq 1\%$	
		247	(7/2+)	71.6s	29 s 1	$\alpha \geq 50\%$, $\epsilon \leq 50\%$	
		247m	(1/2+)	71.6s	4.3 s 4	$\alpha \leq 100\%$	
		248	0+	71.91	36 s 2	α 93%, ϵ 7%, SF 0.1%	
		249	(7/2+)	73.6s	2.6 m 7	ϵ 67%, α 33%	
		250	0+	74.07	30 m 3	$\alpha > 90\%$, $\epsilon < 10\%$, SF $6.9 \times 10^{-3}\%$	
		250m	0+	74.07	1.8 s 1	IT $\geq 80\%$, $\alpha < 20\%$, SF $\leq 8.2 \times 10^{-5}\%$, ϵ	
		251	(9/2-)	75.987	5.30 h 8	ϵ 98.2%, α 1.8%	
		252	0+	76.817	25.39 h 4	α , SF $2.3 \times 10^{-3}\%$	
		253	(1/2)+	79.350	3.00 d 12	ϵ 88%, α 12%	
		254	0+	80.904	3.240 h 2	α 99.94%, SF 0.06%	
		255	7/2+	83.799	20.07 h 7	α , SF $2.4 \times 10^{-5}\%$	
		256	0+	85.486	157.6 m 13	SF 91.9%, α 8.1%	
		257	(9/2+)	88.590	100.5 d 2	α 99.79%, SF 0.21%	
		258	0+	90.4s	370 μ s 43	SF $\leq 100\%$	
		259		93.7s	1.5 s 3	SF	
	260	0+	95.6s	=4 ms	SF		
101	Md	245	(1/2-)	75.3s	0.90 ms 25	α , SF	
		245m		75.6s	0.35 s +23-16	α , ϵ	
		246m		76.3s	1.0 s 4	SF, $\alpha > 0\%$, $\epsilon > 0\%$	
		247		76.0s	1.12 s 22	$\alpha \leq 100\%$	
		248		77.1s	7 s 3	ϵ 80%, α 20%, SF $\leq 0.05\%$	
		249		77.3s	24 s 4	$\alpha > 60\%$, $\epsilon \leq 40\%$	
		250		78.6s	52 s 6	ϵ 93%, α 7%	
		251		79.0s	4.0 m 5	$\epsilon \geq 90\%$, $\alpha \leq 10\%$	
		252		80.6s	2.3 m 8	$\epsilon \leq 100\%$	
		253	(1/2-)	81.3s	6 m +12-3	$\epsilon \leq 100\%$, α	
		254m		83.5s	10 m 3	$\epsilon \leq 100\%$	
		254m		83.5s	28 m 8	$\epsilon \leq 100\%$	
		255	(7/2-)	84.843	27 m 2	ϵ 92%, α 8%, SF < 0.15%	
		256	(1-)	87.62	77 m 2	ϵ 90.8%, α 9.2%, SF < 3%	
		257	(7/2-)	88.996	5.52 h 5	ϵ 85%, α 15%, SF < 1%	
		258		91.688	51.5 d 3	α , SF	
		258m		91.688	57.0 m 9	$\epsilon \geq 70\%$, SF	

Nuclear Wallet Cards

Nuclide	Δ	T½, Γ , or	Decay Mode
Z El A	(MeV)	Abundance	
101Md 259	93.6s	96 m 3	SF=100%, $\alpha < 1.3\%$
260	96.6s	31.8 d 5	SF $\geq 42\%$, $\alpha \leq 25\%$, $\epsilon \leq 23\%$, $\beta^- \leq 10\%$
261	98.5s	40 m sy	$\alpha?$
262	101.4s	3 m sy	SF?, $\alpha?$
102No 248	0+	$< 2 \mu\text{s}$	SF?
249		$54 \mu\text{s} + 15-10$	SF
250	0+	$6 \mu\text{s} 1$	SF $\leq 100\%$, $\alpha 0.1\%$, $\epsilon 1.0 \times 10^{-3}\%$
251 (7/2+)	82.9s	0.78 s 2	$\alpha \leq 100\%$, SF $\leq 8\%$, ϵ
251m (1/2+)	83.0s	0.93 s 6	$\alpha \leq 100\%$
252 0+	82.88	2.27 s 14	$\alpha 58\%$, $\epsilon 23\%$, SF 19%
252m	82.88	26 d 7	α
253 (9/2-)	84.5s	1.62 m 15	$\alpha \leq 100\%$, ϵ
254 0+	84.72	51 s 10	$\alpha 90\%$, $\epsilon 10\%$, SF 0.17%
254m 0+	84.72	0.28 s 4	IT $> 80\%$
255 (1/2+)	86.85	3.1 m 2	$\alpha 61\%$, $\epsilon 39\%$
256 0+	87.824	2.91 s 5	$\alpha 99.47\%$, SF 0.53%
257 (7/2+)	90.24	25 s 3	$\alpha \leq 100\%$, SF $\leq 1.5\%$
258 0+	91.5s	1.2 ms 2	SF $\leq 100\%$
259	94.1s	58 m 5	$\alpha 75\%$, $\epsilon 25\%$, SF $< 10\%$
260 0+	95.6s	106 ms 8	SF
261	98.5s		β^- , α
262 0+	100.0s	=5 ms	SF
263	103.0s	20 m sy	$\alpha?$, SF?
264 0+	104.6s	1 m sy	$\alpha?$
103Lr 251	87.9s		$\epsilon?$, $\alpha?$
252	88.8s	$0.36 \text{ s} + 11-7$	$\alpha = 90\%$, $\epsilon = 10\%$, SF $< 1\%$
253	88.7s	$0.57 \text{ s} + 7-6$	α , SF $< 2\%$
253m	88.7s	$1.5 \text{ s} + 3-2$	$\alpha 90\%$, SF $< 2\%$
254	89.8s	13 s 3	$\alpha 76\%$, $\epsilon 24\%$
255	90.1s	22 s 4	$\alpha 85\%$, $\epsilon < 30\%$, SF $\leq 0.1\%$
256	91.9s	27 s 3	$\alpha 85\%$, $\epsilon 15\%$, SF $< 0.03\%$
257	92.7s	$0.646 \text{ s} 25$	$\alpha \leq 100\%$, SF $\leq 0.03\%$
258	94.8s	4.1 s 3	$\alpha > 95\%$, SF $< 5\%$
259	95.85s	6.2 s 3	$\alpha 78\%$, SF 22%
260	98.3s	180 s 30	$\alpha 80\%$, $\epsilon < 40\%$, SF $< 10\%$
261	99.6s	39 m 12	SF
262	102.1s	=4 h	SF $< 10\%$, ϵ , α
263	103.7s	5 h sy	$\alpha?$
264	106.2s	10 h sy	$\alpha?$, SF?
265	107.9s	10 h sy	$\alpha?$, SF?
266	111.1s	1 h sy	$\alpha?$, SF?
104Rf 253m	93.8s	$48 \mu\text{s} + 17-10$	SF $\leq 100\%$, α
253m	93.8s	=1.8 s	SF = 50%, $\alpha = 50\%$

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or		Decay Mode	
Z	El A	(MeV)	Abundance			
104 Rf	254	0+	93.3s	23 μ s 3	SF \leq 100%	
	255	(9/2-)	94.4s	1.64 s 11	SF 52%, α 48%	
	255m		94.4s	0.8 s +5-2	$\alpha \leq$ 100%	
	256	0+	94.24	6.4 ms 2	SF 99.68%, α 0.32%	
	257	(1/2+)	95.9s	4.7 s 3	$\alpha <$ 100%, SF \leq 1.4%, $\epsilon >$ 0%	
	257m		95.9s	3.9 s 4	$\alpha <$ 100%, SF \leq 1.4%, $\epsilon >$ 0%	
	258	0+	96.4s	12 ms 2	SF 87%, α 13%	
	259		98.40s	3.2 s 6	α 92%, SF 8%	
	260	0+	99.1s	21 ms 1	SF \leq 100%, α ?	
	261		101.32	65 s 10	$\alpha >$ 80%, $\epsilon <$ 15%, SF $<$ 10%	
	262	0+	102.4s	2.3 s 4	SF \leq 100%, $\alpha <$ 3%	
	263		104.8s	10 m 2	SF = 100%, α	
	264	0+	106.2s	1 h sy	α ?	
	265		108.7s	=13 h	α ?	
	266	0+	109.9s	10 h sy	α ?, SF?	
	267?		113.2s	2.3 h +980-17	SF	
	268	0+	115.2s	6 h sy	α ?, SF?	
	105 Db	255		100.0s	1.6 s +6-4	α = 80%, SF = 20%
		256		100.7s	1.6 s +5-3	α = 64%, ϵ = 36%, SF = 0.02%
257			100.3s	1.50 s +19-15	$\alpha >$ 94%, SF $<$ 6%	
257m			100.3s	0.76 s +15-11	$\alpha \geq$ 87%, SF \leq 13%	
258			101.7s	4.0 s 10	α 67%, ϵ 33%, SF $<$ 1%	
258m			101.7s	20 s 10	ϵ = 100%	
259			102.1s	0.51 s 16	α	
260			103.7s	1.52 s 13	$\alpha \geq$ 90.4%, SF \leq 9.6%, $\epsilon <$ 2.5%	
261			104.4s	1.8 s 4	$\alpha \geq$ 82%, SF \leq 18%	
262			106.3s	35 s 5	α = 67%, SF	
263			107.1s	27 s +10-7	SF 55%, α 41%, ϵ 3%	
264			109.4s	3 m sy	α ?	
265			110.5s	15 m sy	α ?	
266			112.7s	20 m sy	α ?, SF?	
267?			114.0s	73 m +350-33	SF $>$ 0%	
268?			116.9s	32 h +11-7	SF	
269		118.7s	3 h sy	α ?, SF?		
106 Sg	258	0+	105.4s	2.9 ms +13-7	SF \leq 100%, α ?	
	259	(1/2+)	106.7s	0.48 s +28-13	α 90%, SF $<$ 20%	
	260	0+	106.58	3.6 ms 9	α 50%, SF 50%	
	261		108.2s	0.23 s 6	α = 100%, SF $<$ 1%	
	262	0+	108.4s	6.9 ms +38-18	SF \geq 78%, $\alpha \leq$ 22%	
	263		110.2s	1.0 s 2	$\alpha >$ 70%, SF $<$ 30%	
	263m		110.2s	0.12 s	α , IT	
	264	0+	110.8s	0.4 s sy	α ?	
	265	(9/2+)	112.82	8 s 3	SF \leq 57%, $\alpha \geq$ 43%	
	266	0+	113.7s	21 s +20-12	SF \geq 50%, $\alpha \leq$ 50%	
	268	0+	117.0s	30 s sy	α ?, SF?	
	270	0+	121.4s	10 m sy	α ?, SF?	
	271?		124.3s	2.4 m +43-10	α 50%, SF 50%	

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}$, Γ , or	
Z	El A	(MeV)	Abundance	Decay Mode
106 Sg	272	0+	125.9s	1 h sy $\alpha?$, SF?
	273		128.8s	1 m sy SF?
107 Bh	260		113.6s	0.3 ms sy $\alpha \leq 100\%$
	261		113.3s	12 ms +5-3 α 95%, SF < 10%
	262m		114.5s	8.0 ms 21 $\alpha \leq 100\%$
	262m		114.5s	102 ms 26 $\alpha \leq 100\%$
	263		114.6s	0.2 ms sy $\alpha?$
	264		116.1s	0.44 s +60-16 $\alpha \leq 100\%$
	265		116.6s	0.9 s +7-3 α
	266?		118.2s	1.7 ms +82-8 α
	267?		118.9s	17 s +14-6 α
	271?		125.9s	40 s sy $\alpha?$
	272?		128.6s	10 s +12-4 α
	273		130.1s	90 m sy $\alpha?$, SF?
	274		132.7s	90 m sy $\alpha?$, SF?
	275		134.4s	40 m sy SF?
108 Hs	263		119.8s	$\alpha \leq 100\%$
	264	0+	119.60	=0.8 ms $\alpha = 50\%$, SF = 50%
	265		121.2s	2.0 ms +3-2 $\alpha = 100\%$, SF $\leq 1\%$
	266	0+	121.2s	2.3 ms +13-6 $\alpha = 100\%$, SF < 1.4%
	267		122.8s	52 ms +13-8 $\alpha \geq 80\%$, SF < 20%
	267m		122.8s	0.80 s +380-37 $\alpha > 0\%$
	269?		124.9s	9.7 s +97-33 α
	270?	0+	125.4s	3.6 s +8-14 α
	271		128.2s	40 s sy $\alpha?$, SF?
	272	0+	129.5s	40 s sy $\alpha?$, SF?
	273	(3/2+)	132.3s	50 s sy $\alpha?$
	274	0+	133.3s	1 m sy $\alpha?$, SF?
	275?		136.0s	0.15 s +27-6 α
	276	0+	137.1s	1 h sy $\alpha?$, SF?
109 Mt	265		126.8s	2 m sy $\alpha?$
	266?		127.9s	1.7 ms +18-16 $\alpha \leq 100\%$
	267		127.9s	10 ms sy $\alpha?$
	268?		129.2s	21 ms +8-5 α
	270?		131.0s	4.96 ms α
	271		131.5s	5 s sy $\alpha?$
	272		133.9s	10 s sy $\alpha?$, SF?
	273		135.0s	20 s sy $\alpha?$, SF?
	274		137.4s	20 s sy $\alpha?$, SF?
	275?		138.5s	9.7 ms +460-44 α
	276?		140.8s	0.72 s +87-25 α
	279		145.5s	6 m sy $\alpha?$, SF?
	110 Ds	267?		134.5s
268		0+	133.9s	100 μ s sy
269?			135.2s	179 μ s +245-66 α
270		0+	134.8s	0.10 ms +14-4 α , SF < 0.2%
270m			135.9s	6.0 ms +82-22 $\alpha > 70\%$, IT $\leq 30\%$
271			136.1s	1.63 ms +44-29 α
271m			136.1s	69 ms +56-21 $\alpha > 0\%$, IT?
272		0+	136.3s	1 s sy SF
273			138.7s	0.17 ms +17-6 α

Nuclear Wallet Cards

Nuclide		J^{π}	Δ (MeV)	$T_{1/2}$, Γ , or Abundance	Decay Mode
Z	El A				
110 Ds	274	0+	139.3s	2 s sy	$\alpha?$, SF?
	275		141.8s	2 s sy	$\alpha?$
	276	0+	142.6s	5 s sy	$\alpha?$, SF?
	277		145.0s	5 s sy	$\alpha?$
	278	0+	145.8s	10 s sy	$\alpha?$, SF?
	279?		148.0s	0.18 s +5-3	SF 90%, α 10%
	281?		151.0s	11.1 s +50-27	SF
111 Rg	272?		143.1s	3.8 ms +14-8	α
	273		143.2s	5 ms sy	$\alpha?$
	274?		145.1s	6.4 ms +307-29	α
	275		145.4s	10 ms sy	$\alpha?$
	276		147.6s	100 ms sy	$\alpha?$, SF?
	277		148.6s	1 s sy	$\alpha?$, SF?
	278		150.5s	1 s sy	$\alpha?$, SF?
	279?		151.3s	0.17 s +81-8	α
	280?		153.2s	3.6 s +43-13	α
	281		154.0s	1 m sy	$\alpha?$, SF?
	282		156.0s	4 m sy	$\alpha?$, SF?
283		156.9s	10 m sy	$\alpha?$, SF?	
112	277		152.7s	0.69 ms +69-24	α
	278	0+	153.1s	10 ms sy	$\alpha?$, SF?
	279		155.1s	0.1 s sy	$\alpha?$, SF?
	280	0+	155.6s	1 s sy	$\alpha?$, SF?
	282?		158.1s	0.50 ms +33-14	SF
	283?		160.0s	4.0 s +13-7	$\alpha \geq 99\%$, SF $\leq 1\%$
	284?		160.6s	97 ms +31-19	SF
285?		162.2s	29 s +13-7	α	
113	278?			0.24 ms +114-11	α
	283?		164.4s	100 ms +490-45	α
	284?		165.9s	0.48 s +58-17	α
	285		166.5s	2 m sy	$\alpha?$, SF?
	286		168.1s	5 m sy	$\alpha?$, SF?
	287		168.6s	20 m sy	$\alpha?$, SF?
114	286?		171.3s	0.16 ms +7-3	SF 60%, α 40%
	287?		172.9s	0.51 s +18-10	α
	288?		173.0s	0.8 s +27-16	α
	289?		174.4s	2.6 s +12-7	α
115	287?		178.1s	32 ms +155-14	α
	288?		179.3s	87 ms +105-30	α
	289		180s	10 s sy	$\alpha?$, SF?
	290		180.8s	10 s sy	$\alpha?$, SF?
	291		181.1s	1 m sy	$\alpha?$, SF?
116	290	0+	185.0s	15 ms +26-6	α
	291		186.3s	6.3 ms +116-25	α
	292?	0+	186.1s	18.0 ms +16-6	α
	293?			61 ms +57-20	α
117	291		192.4s	10 ms sy	$\alpha?$, SF?
	292		193.3s	50 ms sy	$\alpha?$, SF?
118	294?	0+		1.8 ms +84-8	$\alpha > 0\%$, SF?

Appendix-I Table of Elemental Properties

Z	El	Atomic Weight ^a	Density (g/cc) ^b	Melting Pt. (°C) ^b	Boiling Pt. (°C) ^b	Valence ^b
1	H	1.00794 7	8.988×10 ^{-5d}	-259.34	-252.87	1
2	He	4.002602 2	1.785×10 ^{-4f}	<-272.2 (26 atm)	-268.93	0
3	Li	6.941 2	0.534 ^c	180.5	1342	1
4	Be	9.012182 3	1.848 ^c	1287	2471 (5 mm)	2
5	B	10.811 7	2.34 ^h	2075	4000 (subl.)	3
6	C	12.0107 8	1.8 to 2.1 ⁱ	=3550	4827	2,3,4
7	N	14.0067 2	0.0012506 ^j	-210.00	-198.79	3,5
8	O	15.9994 3	0.001308 ^k	-218.79	-182.953	2
9	F	18.9984032 5	0.001696	-219.62 ^g	-188.12 ^g	1
10	Ne	20.1797 6	8.9990×10 ⁻⁴	-248.59	-246.08 ^g	0
11	Na	22.989770 2	0.971 ^c	97.80	883	1
12	Mg	24.3050 6	1.738 ^c	650	1090	2
13	Al	26.981538 2	2.6989 ^c	660.32	2519	3
14	Si	28.0855 3	2.33 ^e	1414	3265	4
15	P	30.973761 2	1.82 ^l	44.15 ^l	280.5 ^l	3,5
16	S	32.065 5	2.07 ^{cm}	115.21 ^m	444.60	2,4,6
17	Cl	35.453 2	0.003214	-101.5	-34.04	1,3,5,7
18	Ar	39.948	0.0017837	-189.35	-185.85	0
19	K	39.0983	0.862 ^c	63.38	759	1
20	Ca	40.078 4	1.55 ^c	842	1484	2
21	Sc	44.955910 8	2.989 ^e	1541	2836	3
22	Ti	47.867	4.54	1668	3287	2 to 4
23	V	50.9415	6.11 (18.7°C)	1910	3407	2 to 5
24	Cr	51.9961 6	7.18 to 7.20 ^c	1907	2671	2,3,6
25	Mn	54.938049 9	7.21 to 7.44 ⁿ	1246	2061	1 to 4,6,7
26	Fe	55.845 2	7.874 ^c	1538	2861	2,3,4,6
27	Co	58.933200 9	8.9 ^c	1495	2927	2,3
28	Ni	58.6934 2	8.902 ^e	1455	2913	0 to 3
29	Cu	63.546 3	8.96 ^c	1084.62	2562	1,2
30	Zn	65.39 2	7.133 ^e	419.53	907	2
31	Ga	69.723	5.904 (29.6°C)	29.76	2204	2,3
32	Ge	72.64	5.323 ^e	938.25	2833	2,4
33	As	74.92160 2	5.73 ^o	817 ^o	614 ^o (28 atm) (subl.)	0,±3,5
34	Se	78.96 3	4.79 ^p	221 ^p	685 ^p	-2,4,6
35	Br	79.904	3.12 ^u	-7.2	58.8	1,3,5,7
36	Kr	83.80	0.003733	-157.36	-153.22	0
37	Rb	85.4678 3	1.532 ^c	39.31	688	1
38	Sr	87.62	2.54	777	1382	2
39	Y	88.90585 2	4.469 ^e	1522	3345	3
40	Zr	91.224 2	6.506 ^c	1855	4409	2 to 4
41	Nb	92.90638 2	8.57 ^c	2477	4744	2,3,4?,5
42	Mo	95.94	10.22 ^c	2623	4639	2 to 6
43	Tc (98)		11.50 ^t	2157	4265	0,2,4 to 7
44	Ru	101.07 2	12.41 ^c	2334	4150	0 to 8
45	Rh	102.90550 2	12.41 ^c	1964	3695	3

Appendix-I Table of Elemental Properties

Z	El	Atomic Weight ^a	Density (g/cc) ^b	Melting Pt. (°C) ^b	Boiling Pt. (°C) ^b	Valence ^b
46	Pd	106.42	12.02 ^c	1554.9	2963	2 to 4
47	Ag	107.8682 2	10.50 ^c	961.78	2162	1
48	Cd	112.411 8	8.65 ^c	321.07	767	2
49	In	114.818 3	7.31 ^c	156.60	2072	1 to 3
50	Sn	118.710 7	5.75 ^q	231.93	2602	2,4
51	Sb	121.760	6.691 ^c	630.63	1587	0,±3,5
52	Te	127.60 3	6.24 ^c	449.51	988	2,4,6
53	I	126.90447 3	4.93 ^v	113.7	184.4	1,3,5,7
54	Xe	131.293 6	0.005887	-111.79	-108.12	0
55	Cs	132.90545 2	1.873 ^c	28.44	671	1
56	Ba	137.327 7	3.5 ^c	727	1897	2
57	La	138.9055 2	6.145 ^e	918	3464	3
58	Ce	140.116	6.770 ^e	798	3424	3,4
59	Pr	140.90765 2	6.773 ^r 6.64 ^s	931	3520	3
60	Nd	144.24 3	7.008	1021	3074	3
61	Pm (145)		7.264 ^e	1042	3000	3
62	Sm	150.36 3	7.520 ^r 7.40 ^s	1072	1790	2,3
63	Eu	151.964	5.244 ^e	822	1596	2,3
64	Gd	157.25 3	7.901 ^e	1313	3273	3
65	Tb	158.92534 2	8.230	1356	3230	3,4
66	Dy	162.50 3	8.551 ^e	1412	2567	3
67	Ho	164.93032 2	8.795 ^e	1474	2700	3
68	Er	167.259 3	9.066 ^e	1529	2868	3
69	Tm	168.93421 2	9.321 ^e	1545	1950	3
70	Yb	173.04 3	6.903 ^r 6.966 ^s	819	1196	2,3
71	Lu	174.967	9.841 ^e	1663	3402	3
72	Hf	178.49 2	13.31 ^c	2233	4603	4
73	Ta	180.9479	16.654	3017	5458	2?,3,4?,5
74	W	183.84	19.3 ^c	3422	5555	2 to 6
75	Re	186.207	21.02 ^c	3186	5596 (est.)	4,6,7
76	Os	190.23 3	22.57	3033	5012	0 to 8
77	Ir	192.217 3	22.42 (17°C)	2446	4428	3,4
78	Pt	195.078 2	21.45 ^c	1768.4	3825	1?,2,3
79	Au	196.96655 2	=19.3 ^c	1064.18	2856	1,3
80	Hg	200.59 2	13.546 ^c	-38.83	356.73	1,2
81	Tl	204.3833 2	11.85 ^c	304	1473	1,3
82	Pb	207.2	11.35 ^c	327.46	1749	2,4
83	Bi	208.98038 2	9.747 ^c	271.40	1564	3,5
84	Po (209)		9.32 ^r	254	962	0,±2,3?,4,6
85	At (210)			300 ^t		1,3,5,7
86	Rn (222)		0.00973	-71	-61.7	0
87	Fr (223)			27		1
88	Ra (226)		5	700		2
89	Ac (227)		10.07 ^t	1051	3198	3
90	Th 232.03801		11.72	1750	4788	2?,3?,4
91	Pa (231)		15.37 ^t	1572		4,5

Appendix-I Table of Elemental Properties

Z	El	Atomic Weight ^a	Density (g/cc) ^b	Melting Pt. (°C) ^b	Boiling Pt. (°C) ^b	Valence ^b
92	U	238.02891 3	=18.95	1135	4131	2 to 6
93	Np (237)		20.25 ^c	644		3 to 6
94	Pu (244)		19.84 ^e	640	3228	3, to 6
95	Am (243)		13.67 ^c	1176	2011	2 to 6
96	Cm (247)		13.51 ^t	1345		3, 4
97	Bk (247)		14 ^t	1050		3, 4
98	Cf (251)			900		3
99	Es (252)			860 ^t		3
100	Fm (257)			1527		3
101	Md (258)			827		2, 3
102	No (259)			827		2, 3

Footnotes and References

a) Atomic weights of many elements are not invariant and depend on the origin and treatment of the material. The values given here apply to elements as they exist naturally on earth and are from N. E. Holden, *Handbook of Chemistry and Physics* (2002). Uncertainty is 1 in last significant figure, unless expressly given.

Masses are scaled to 12 for ¹²C.

Parenthetical whole numbers represent the mass numbers (A) of the longest lived isotopes for radioactive elements.

Isotopic masses (and more precise atomic weights for some mono-isotopic elements) may be calculated as $A + (\Delta/931.494)$, where A is the mass number and Δ is the mass excess as given in the *Nuclear Wallet Cards*.

b) C.R. Hammond, in *CRC Handbook of Chemistry and Physics, 85th edition, 2004*, 4-1, 4-121. Where specified, exact temperature and pressure conditions are given; the conditions for all gases have been inferred to be 0°C and 1 atm. The densities for the following gaseous elements are for diatomic molecules: H, N, O, F, Cl. In general, densities for gases (in g/cc) may be approximated by the formula: $\text{density} = MP/82.05T$, where M is the molecular weight in g, P the pressure in atm, and T the temperature in °K. The reported oxidation states do not include some uncommon states, or those states predicted by periodicity, but not confirmed chemically.

c) At 20°C.

d) For gas; density (liquid)=0.0708 g/cc at b.p.; density (solid)=0.0706 g/cc at -262°C.

f) For gas; density (liquid)=0.1221 g/cc at b.p.

e) At 25°C.

f) For gas; density (liquid)=1.221 g/cc at b.p.

g) At 1 atm.

Appendix-I Table of Elemental Properties

- h) For crystal form; density (amorphous)=2.37 g/cc.
- i) For amorphous carbon; density (graphite)=1.9 to 2.3 g/cc; density (gem diamond)=3.513 g/cc at 25°C; density (other diamond)=3.15 to 3.53 g/cc.
- j) For gas; density (liquid)=0.808 g/cc at b.p.; density (solid)=1.026 g/cc at -252°C.
- k) For gas; density (liquid)=1.14 g/cc at b.p.
- l) For white phosphorus; density (red)=2.20 g/cc; density (black)=2.25 to 2.69 g/cc.
- m) For rhombic sulfur; melting point (monoclinic)=119.0°C; density (monoclinic)=1.957 g/cc at 20°C.
- n) Depending on allotropic form.
- o) For gray arsenic; density (yellow)=1.97 g/cc.
- p) For gray selenium; density (vitreous)=4.28 g/cc.
- q) For gray tin; density (white)=7.13 g/cc.
- r) For α modification.
- s) For β modification.
- t) Calculated.
- u) For liquid at 20°C; 0.00759 g/cc for gas.
- v) For solid at 20°C; 0.01127 g/cc for gas.

Appendix-II Frequently-Used Constants

The frequently used constants are given below in familiar units. Only approximate values are given, see App-III for values to current known precision.

Symbol	Constant	Value
$1/\alpha = \hbar c/e^2$	Fine structure constant	137.0
c	Speed of light in vacuum	2.998×10^{10} cm/s
h	Planck constant	6.626×10^{-27} erg s
$\hbar = h/2\pi$		6.582×10^{-22} MeV s
$\hbar c$		197.3 MeV fm
$k = R/N_A$	Boltzmann constant	8.617×10^{-11} MeV/K
$r_e = e^2/m_e c^2$	Classical e^- radius	2.818 fm
$\lambda_{C,e} = \hbar/m_e c$	Compton wavelength of e^-	386.2 fm
$\lambda_{C,p} = \hbar/m_p c$	Compton wavelength of p	0.210 fm
$\lambda_{C,\pi} = \hbar/m_\pi c$	Compton wavelength of π	1.414 fm
u	Atomic mass unit	931.5 MeV/c ²
m_e	Electron mass	0.511 MeV/c ²
m_n	Neutron mass	939.6 MeV/c ²
m_p	Proton mass	938.3 MeV/c ²
m_d	Deuteron mass	1875.6 MeV/c ²
m_{π^\pm}	π^\pm mass	139.6 MeV/c ²
m_{π^0}	π^0 mass	135.0 MeV/c ²
m_W	W^\pm boson mass	80.2 GeV/c ²
m_Z	Z^0 boson mass	91.2 GeV/c ²
$\mu_N = \hbar e/2m_p c$	Nuclear magneton	3.152×10^{-18} MeV/Gauss
μ_p	Proton magnetic moment	2.793 μ_N
μ_n	Neutron magnetic moment	-1.913 μ_N
<hr/>		
1 fm = 10^{-13} cm	1 Å = 10^{-8} cm	$\pi = 3.1416$
1 barn = 10^{-24} cm ²	1 eV/c ² = 1.783×10^{-33} g	
1 joule = 10^7 erg	1 coulomb = 2.998×10^9 esu	
1 newton = 10^5 dyne	1 tesla = 10^4 gauss	

Appendix-IIa Fundamental Constants

Unless otherwise noted, the information presented in this table is from *CODATA Values of Fundamental Physical Constants: 1998*.^a The constants are arranged alphabetically according to the symbols by which they are denoted. The numbers in *italics* are the one-standard-deviation uncertainty in the last digits of the values given. The unified atomic mass scale ($^{12}\text{C}\equiv 12$) has been used throughout. Values are given for both SI and cgs units. In cgs units "permittivity of vacuum" μ_0 and "permeability of vacuum" ϵ_0 are dimensionless unit quantities; in SI units they have the values^f

$$\begin{aligned}\mu_0 &= 4\pi \times 10^{-7} \text{ m}\cdot\text{kg}\cdot\text{s}^{-2}\cdot\text{A}^{-2} = 4\pi \times 10^{-7} \text{ N}\cdot\text{A}^{-2} = 4\pi \times 10^{-7} \text{ T}\cdot\text{A}^{-1} \\ \epsilon_0 &= 1/\mu_0 c^2\end{aligned}$$

The factor in square brackets given in the definition of a quantity is to be omitted to obtain the expression in cgs units^f.

The following abbreviations are used:

A = ampere

C = coulomb

cm = centimeter

emu = electromagnetic unit

esu = electrostatic unit

G = gauss

g = gram

Hz = hertz = cycles/sec

J = joule

K = degree Kelvin

kg = kilogram

m = meter

mol = mole

N = newton

s = second

T = tesla

u = atomic mass unit (unified scale)

V = volt

W = watt

Wb = Weber

Appendix-IIa Fundamental Constants

Symbol	Constant	Value	Units (SI) ^b	Units (cgs) ^b
$a_0 = r_e / \alpha^2$	Bohr radius	5.291772083 19	10 ⁻¹¹ m	10 ⁻⁹ cm
$\alpha = e^2 / \hbar c [4\pi\epsilon_0]$ $1/\alpha$	Fine structure constant	0.007297352533 27 137.03599976 50		
c	Speed of light in vacuum	2.99792458 ^(e)	10 ⁸ m s ⁻¹	10 ¹⁰ cm s ⁻¹
$c_1 = 2\pi\hbar c^2$	First radiation constant	3.74177107 29	10 ⁻¹⁶ W m ²	10 ⁻⁵ erg cm ² s ⁻¹
$c_2 = \hbar c/k$	Second radiation constant	1.4387752 25	10 ⁻² m K	cm K
e	Elementary charge	4.80320420 19 1.602176462 63	10 ⁻¹⁰ esu 10 ⁻¹⁹ C	10 ⁻²⁰ emu
$2e/h$	Josephson frequency-voltage ratio	4.83597898 19	10 ¹⁴ Hz V ⁻¹	
$-e/m_e$	Electron specific charge	-1.758820174 71	10 ¹¹ C kg ⁻¹	10 ⁷ emu g ⁻¹
$F = N_{Ae}$	Faraday constant	9.64853415 39	10 ⁴ C mol ⁻¹	10 ³ emu mol ⁻¹
γ_p	Gyromagnetic ratio of proton	2.67522212 11	10 ⁸ s ⁻¹ T ⁻¹	10 ⁴ s ⁻¹ G ⁻¹
γ_p'	Gyromagnetic ratio of proton (uncorrected for diamagnetism of H ₂ O)	2.67515341 11	10 ⁸ s ⁻¹ T ⁻¹	10 ⁴ s ⁻¹ G ⁻¹
G	Gravitational constant	6.673 10	10 ⁻¹¹ m ³ kg ⁻¹ s ⁻²	10 ⁻⁸ cm ³ g ⁻¹ s ⁻²

Appendix-IIa Fundamental Constants

Symbol	Constant	Value	Units (SI) ^b	Units (cgs) ^b
h	Planck constant	6.62606876 52	10^{-34} J s	10^{-27} erg s
$\hbar = h/2\pi$		1.054571596 82	10^{-34} J s	10^{-27} erg s
$h/2e$	Quantum of magnetic flux	2.067833636 81	10^{-15} Wb	10^{-7} G cm ²
$k = R/N_A$	Boltzmann constant	1.3806503 24	10^{-23} J K ⁻¹	10^{-16} erg K ⁻¹
$\lambda_{C,e} = h/m_e c$	Compton wavelength of electron	2.426310215 18	10^{-12} m	10^{-10} cm
$\lambda_{C,p} = h/m_p c$	Compton wavelength of proton	1.321409847 10	10^{-15} m	10^{-13} cm
$\lambda_{C,n} = h/m_n c$	Compton wavelength of neutron	1.319590898 10	10^{-15} m	10^{-13} cm
m_e	Electron mass	5.485799110 12	10^{-4} u	10^{-4} u
m_H	Mass of hydrogen atom	1.007825032 1 ^(c)	u	u
m_μ	Muon mass	0.1134289168 34	u	u
m_n	Neutron mass	1.00866491578 55	u	u
m_p	Proton mass	1.00727646688 13	u	u
m_{π^\pm}	π^\pm mass	0.1498348 4 ^(d)	u	u

Appendix-IIa Fundamental Constants

Symbol	Constant	Value	Units (SI) ^b	Units (cgs) ^b
m_{π^0}	π^0 mass	0.1449034 6 ^(d)	u	u
$\mu_B = [c]e\hbar/2m_e c$	Bohr magneton	9.27400899 37	10^{-24} J T ⁻¹	10^{-21} erg G ⁻¹
μ_e/μ_B	Magnetic moment of electron in units of μ_B	-1.0011596521869 41		
μ_μ	Muon magnetic moment	-4.49044813 22	10^{-26} J T ⁻¹	10^{-23} erg Gs ⁻¹
$\mu_N = [c]e\hbar/2m_p c$	Nuclear magneton	5.05078317 20	10^{-27} J T ⁻¹	10^{-24} erg G ⁻¹
N_A	Avogadro constant	6.02214199 47	10^{23} mol ⁻¹	10^{23} mol ⁻¹
R	Molar gas constant	8.314472 15	J mol ⁻¹ K ⁻¹	10^7 erg mol ⁻¹ K ⁻¹
$R_\infty = m_e c \alpha^2 / 2\hbar$	Rydberg constant for infinite mass	1.0973731568549 83	10^7 m ⁻¹	10^5 cm ⁻¹
$r_e = \hbar \alpha / m_e c$	Classical e ⁻ radius	2.817940285 31	10^{-15} m	10^{-13} cm
$\sigma = (\pi^2/60)k^4/\hbar^3 c^2$	Stefan-Boltzmann constant	5.670400 40	10^{-8} W m ⁻² K ⁻⁴ erg cm ⁻² s ⁻¹ K ⁻⁴	10^{-5}
$u = 1/N_A$	Atomic mass unit	1.66053873 13 931.494013 37	10^{-27} kg MeV	10^{-24} g

1 year (sidereal) = 365.25636 days = 3.1558150×10^7 s, 1 year (tropical) = 365.242 days = 3.15569×10^7 s

Appendix-IIa Fundamental Constants

- a) P.J. Mohr and B.N. Taylor, *Jl. of Phys. and Chem. Ref. Data* 28, 1713 (1999); *Rev. Mod. Phys.* 72, 351 (2000). Data taken from *Physics Today* 56, BG6 (2003); <http://physics.nist.gov/constants>
- b) Quantities are given in the International System of Units (SI) except for the atomic mass unit; this unit is not part of the SI.
- c) The AME2003 atomic mass evaluation, G. Audi, A.H. Wapstra, and C. Thibault, *Nuclear Physics A* 729, 337 (2003)
- d) Review of Particle Physics, S. Eidelman, *et al.*, *Physics Letters B* 592, 1 (2004); <http://pdg.lbl.gov/>
- e) Speed of light in vacuum is an exact constant as a result of redefinition of meter [P. Giacomo, *Metrologia* 20, 25 (1984)].
- f) General Section by H.L. Anderson and E.R. Cohen in *A Physicist's Desk Reference*, H.L. Anderson, Editor-in-Chief, AIP, New York (1989)

Appendix-III Energy-Equivalent Factors†

units	erg	eV	s ⁻¹	cm ⁻¹
erg	1.0	$1.602176462 \times 10^{-12}$	$6.6260876 \times 10^{-27}$	$1.98644544 \times 10^{-16}$
eV	$6.24150974 \times 10^{11}$	1.0	$4.13566727 \times 10^{-15}$	$1.239841857 \times 10^{-4}$
s ⁻¹	$1.50919050 \times 10^{26}$	$2.417989491 \times 10^{14}$	1.0	$2.99792458 \times 10^{10}$
cm ⁻¹	$5.03411762 \times 10^{15}$	8.06554477×10^3	$3.335640952 \times 10^{-11}$	1.0
K	7.242964×10^{15}	1.1604506×10^4	$4.7992374 \times 10^{-11}$	1.4387752×10^5
g	$1.112650056 \times 10^{-21}$	$1.782661731 \times 10^{-33}$	$7.37249578 \times 10^{-48}$	$2.21021863 \times 10^{-37}$
u	6.70053662×10^2	$1.073544206 \times 10^{-9}$	$4.439821637 \times 10^{-24}$	$1.331025042 \times 10^{-13}$

(1 cal = 4.1840 J, 1 J = 10⁷ erg)

Note: In the above table all entries in the same column are equivalent. The various units of energy are connected as follows:

$$1 \text{ erg} = 1/c^2 \text{ g} = 1/(mc^2) \text{ u} = 1/(hc) \text{ cm}^{-1} = 1/h \text{ s}^{-1} = 1/k \text{ } ^\circ\text{K} = 1/e \text{ eV}$$

Examples: $1 \text{ eV} = 1.602 \times 10^{-12} \text{ erg} = 1.073 \times 10^{-9} \text{ u} = 3.829 \times 10^{-20} \text{ cal}$

$$e/h = 2.417 \times 10^{14} \text{ s}^{-1}, e/(hc) = 8.0654 \times 10^3 \text{ cm}^{-1}$$

$$e/c^2 = 1.782 \times 10^{-33} \text{ g}, e/mc^2 = 1.073 \times 10^{-9} \text{ u}$$

$$e/k = 1.160 \times 10^4 \text{ K}$$

Appendix-III Energy-Equivalent Factors†

units	deg K	g	u
erg	$1.3806503\ 24 \times 10^{-16}$	$8.987551787 \times 10^{20}$	$1.49241778\ 12 \times 10^{-3}$
eV	$8.617342\ 15 \times 10^{-5}$	$5.60958921\ 22 \times 10^{32}$	$9.31494013\ 37 \times 10^8$
s ⁻¹	$2.0836644\ 36 \times 10^{10}$	$1.35639277\ 11 \times 10^{47}$	$2.252342733\ 17 \times 10^{23}$
cm ⁻¹	$6.950356\ 12 \times 10^{-1}$	$4.52443929\ 35 \times 10^{36}$	$7.513006658\ 57 \times 10^{12}$
K	1.0	$6.509651\ 11 \times 10^{36}$	$1.0809528\ 19 \times 10^{13}$
g	$1.5361807\ 27 \times 10^{-37}$	1.0	$1.66053873\ 13 \times 10^{-24}$
u	$9.251098\ 16 \times 10^{-14}$	$6.02214199\ 47 \times 10^{23}$	1.0

Note: In the above table all entries in the same column are equivalent.

Example: $1\text{u} = 1.492 \dots \times 10^{-3}\text{ erg} = 9.314 \dots \times 10^8\text{ eV} = 3.567 \dots \times 10^{-11}\text{ cal, etc.}$

† From CODATA Values of Fundamental Physical Constants: 1998, P.J. Mohr and B.N. Taylor, *Jour. of Phys. and Chem. Ref. Data* 28, 1713 (1999), *Rev. Mod. Phys.* 72, 351 (2000), *Physics Today* 56, BG6 (2003); <http://physics.nist.gov/constants>.

Appendix-IV Observed Λ Hypernuclides†

El	A	J(g.s.)	B_{Λ} (g.s.) [*]	Excited (bound) states (MeV)
H	3	1/2	0.13 5	
	4	0	2.04 4	E=1.05 4
He	4	0	2.39 3	E=1.15 4
	5	1/2	3.12 2	
	6	(1)	4.18 10	
	8		7.16 70	
Li	6		4.50	E=8.3,18.3
	7	1/2+	5.58 3	E=0.692 4 3/2 ⁺ , 2.050 2 5/2 ⁺ , 2.521 7/2 ⁺ , 3.877 1/2 ⁺
	8	1	6.80 3	E=0.442 ^b , 1.22 4
	9		8.50 12	
Be	7	1/2	5.16 8	
	8		6.84 5	
	9	1/2	6.71 4	E ^b =3.079 4 [#] , 5.98 84, 10.59 72, 16.55 69, 22.93 71, 27.90 72
	10		9.11 22	
B	9		8.29 18	
	10		8.89 12	E ^c =2.5 2, 6.2 2, 9.5 3
	11	5/2	10.24 5	
	12	1	11.37 6 ^d	
C	12	1	10.80 18 ^d	E ^e =2.71 13 1-, 6.05 18 1-, 8.10 38, 10.97 5 2+, 12.0 3 ^b , 16.2 2 ^b
	13	1/2+	11.69 12	E ^e =4.9 1 3/2+, 9.6 3 3/2-, 11.6 2 1/2+, 15.4 1 [#]
	14		12.17 33	
	15		13.59 15	
N	14		12.17	E=10.5, 19, 22
	15		13.59 15	
O	16	1 ^{-e}	12.5	E ^e =6.3 1 1-, 10.6 1 2+, 0-, 16.7 1 2+, 0+, 20.0 4 ^b , 23.3 5 ^b
	18			E=13, 20, 24, 30
Al	27			E=7, 18 ^b
Si	28		16.6 ^c	E ^c =4.7 4, 9.6 3, 12.3 3, 17.6 8, 23.2 5 ^b
S	32		17.5 5	E=11.5, 22.5
Ca	40		20.0 5	E ^b =2.9 13, 6.1 13, 8.3 11, 13.9 11, 16.7 11, 19.8 11, 22.9 13
	51		19.5 ^f	E ^b =3.5 16, 5.7 10, 8.4 10, 12.1 11, 15.0 10, 18.3 11, 21.8 10, 26.0 10
Fe	56		21	
Y	89		23 2	E ^{b,c} =6.9 16, 13.4 16, 19.8 16, 27.2 16
La	139		23.8 10 ^c	E ^c =3.8 11
Pb	208		26.5 5 ^c	E ^c =5.2 9
Bi	209			E=32, 40

Appendix-IV Observed Λ Hypernuclides†

Footnotes and References

† This table has been prepared by R. Chrien (BNL). The data are mostly from D. Davis and J. Pniewski, *Contemp. Phys.* 27, 91 (1986), and H. Bando, T. Motoba, and J. Zofka, *Int. J. Mod. Phys. A5*, 4021 (1990), except where indicated otherwise.

Almost all recent data have come from (π^+ , K^+) reactions using magnetic spectrometers and Ge detectors at BNL and KEK. The early work is emulsion data while the later work is derived from magnetic spectrometers using (K^\pm , π^\pm) data.

The only confirmed example of a bound Σ hypernuclide is the $T=1/2$ isospin state in ${}^4\text{He}$ reported by Nagae *et al.*, *Phys. Rev. Lett.* 80, 1605 (1998).

In addition to these single Λ hypernuclides, several instances of double species have been reported. These are an observation of ${}_{\Lambda\Lambda}^6\text{He}$ by H. Takahashi, *et al.*, *Phys. Rev. Lett.* 87, 212502 (2001), and of ${}_{\Lambda\Lambda}^4\text{He}$ by J.K. Ahn, *et al.*, *Phys. Rev. Lett.* 87, 132504 (2001),

* Λ binding energy.

Possibly complex.

a K. Tanida, Proc. of APCTP workshop (1999), World Scientific Pub., Pvt. Ltd., Singapore; H. Tamura, *et al.*, *Phys. Rev. Lett.* 84, 5963 (2000); M. Ukai, "Cascade γ Decay in the ${}^7_{\Lambda}\text{Li}$ Hypernucleus", submitted for publication, April 2005.

b P.H. Pile, *et al.*, *Phys. Rev. Lett.* 66, 2585 (1991) and R.E. Chrien, priv. comm. (2000).

c T. Hasegawa *et al.*, *Phys. Rev. C* 53, 1210 (1996).

d P. Dluzewski *et al.*, *Nucl. Phys.* A484 520 (1988).

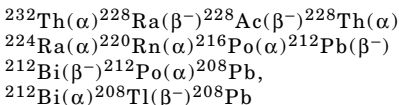
e O. Hashimoto, *et al.*, *Nucl. Phys.* A639, 93c (1998)

f Calculated.

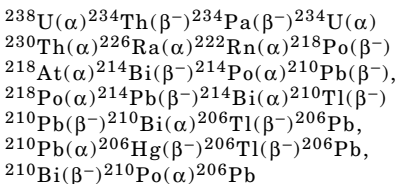
Radioactive Decay Chains in Nature

The following three radioactive decay chains occur in nature:

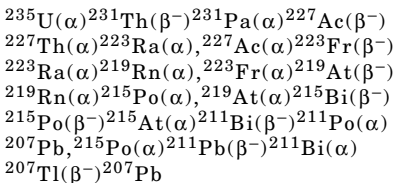
The Thorium Series:



The Uranium Series:



The Actinium Series



Radioactive Nuclides in Nature

Nuclide	Half-life	Decay Modes	Major γ -rays (keV) $I_{\gamma} > 2\%$
1 H 3	12.32 y	β^-	
4 Be 7	53.22 d	ϵ	
6 C 14	5700 y	β^-	
19 K 40	1.248×10^9 y	β^- , γ	1461
23 V 50	1.4×10^{17} y	ϵ	1554, 783
37 Rb 87	4.97×10^{10} y	β^-	
48 Cd 113	7.7×10^{15} y	β^-	
49 In 115	4.41×10^{14} y	β^-	
52 Te 123	$> 9.2 \times 10^{16}$ y	ϵ	
57 La 138	1.02×10^{11} y	ϵ	1436, 789
60 Nd 144	2.29×10^{15} y	α	
62 Sm 147	1.06×10^{11} y	α	
148	7×10^{15} y	α	
64 Gd 152	1.08×10^{14} y	α	
71 Lu 176	4.08×10^{10} 3	β^-	
72 Hf 174	2.0×10^{15} y	α	
73 Ta 180m	$> 1.2 \times 10^{15}$ y	2ϵ	
75 Re 187	4.12×10^{10} y	β^-	
76 Os 186	2.0×10^{15} y	α	
78 Pt 190	6.5×10^{11} y	α	
80 Hg 206	8.15 m	β^-	
81 Tl 206	4.2 m	β^-	
207	4.77 m	β^-	
208	3.053 m	β^- , γ	2615, 583, 511
210	1.3 m	β^- , γ	800, 296, 1316
82 Pb 210	22.2 y	β^-	
211	36.1 m	β^- , γ	405, 832
212	10.64 h	β^- , γ	239, 77, 75
214	26.8 m	β^- , γ	352, 295, 77
83 Bi 210	5.012 d	β^-	
211	2.14 m	α , γ	351
212	1.009 h	β^- , γ	727
214	19.9 m	β^- , γ	609, 1764, 1120
215	7.6 m	β^-	
84 Po 210	138.4 d	α	
211	0.516 s	α	
212	0.299 μ s	α	
214	164.3 μ s	α	
215	1.781 ms	α	
216	0.145 s	α	
218	3.1 m	α	
85 At 215	0.1 ms	α	
218	1.5 s	α	
219	56 s	α	
86 Rn 219	3.96 s	α , γ	271, 402

Radioactive Nuclides in Nature

Nuclide	Half-life	Decay Modes	Major γ -rays (keV) $I_{\gamma} > 2\%$
86 Rn	220	55.6 s	α
	222	3.823 d	α
87 Fr	223	22 m	β^{-}, γ 50, 80, 235
88 Ra	223	11.43 d	α, γ 84, 81, 269
	224	3.632 d	α, γ 241
	226	1600 y	α, γ 186
	228	5.75 y	β^{-}
89 Ac	227	21.77 y	β^{-}
	228	6.15 h	β^{-}, γ 911, 969, 338
90 Th	227	18.68 d	α, γ 236, 50, 256
	228	1.912 y	α
	230	7.538×10^4 y	α
	231	1.063 d	β^{-}, γ 84
	232	1.405×10^{10} y	α
	234	24.1 d	β^{-}, γ 63, 92, 93
91 Pa	231	3.276×10^4 y	α, γ 300, 303
	234	6.7 h	β^{-}, γ 98, 131, 946
	234m	1.17 m	β^{-}
92 U	234	2.455×10^5 y	α
	235	7.04×10^8 y	α, γ 186, 144, 93
	238	4.468×10^9 y	α

Appendix-VIa Periodic Table of Elements

IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII----	IB	IIB	IIIA	IVA	VA	VIA	VIIA	VIII	He	
1																2	
Li	Be									B	C	N	O	F	Ne		
3	4									5	6	7	8	9	10		
Na	Mg									Al	Si	P	S	Cl	Ar		
11	12									13	14	15	16	17	18		
K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Cs	Ba	*	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn
55	56	57-	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86
Fr	Ra	**	Rf	Db	Sg	Bh	Hs	Mt	Ds	Rg							
87	88	89-	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118
*	La	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	Lanthanides	
	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71		
**	Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr	Actinides	
	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103		

Appendix-VIb List of Elements - Alphabetical

Name	Symbol	Z	Name	Symbol	Z
Actinium	Ac	89	Mendelevium	Md	101
Aluminum	Al	13	Mercury	Hg	80
Americium	Am	95	Molybdenum	Mo	42
Antimony	Sb	51	Neodymium	Nd	60
Argon	Ar	18	Neon	Ne	10
Arsenic	As	33	Neptunium	Np	93
Astatine	At	85	Nickel	Ni	28
Barium	Ba	56	Niobium	Nb	41
Berkelium	Bk	97	Nitrogen	N	7
Beryllium	Be	4	Nobelium	No	102
Bismuth	Bi	83	Osmium	Os	76
Bohrium	Bh	107	Oxygen	O	8
Boron	B	5	Palladium	Pd	46
Bromine	Br	35	Phosphorus	P	15
Cadmium	Cd	48	Platinum	Pt	78
Calcium	Ca	20	Plutonium	Pu	94
Californium	Cf	98	Polonium	Po	84
Carbon	C	6	Potassium	K	19
Cerium	Ce	58	Praseodymium	Pr	59
Cesium	Cs	55	Promethium	Pm	61
Chlorine	Cl	17	Protactinium	Pa	91
Chromium	Cr	24	Radium	Ra	88
Cobalt	Co	27	Radon	Rn	86
Copper	Cu	29	Roentgenium	Rg	111
Curium	Cm	96	Rhenium	Re	75
Darmstadtium	Ds	110	Rhodium	Rh	45
Dubnium	Db	105	Rubidium	Rb	37
Dysprosium	Dy	66	Ruthenium	Ru	44
Einsteinium	Es	99	Rutherfordium	Rf	104
Erbium	Er	68	Samarium	Sm	62
Europium	Eu	63	Scandium	Sc	21
Fermium	Fm	100	Selenium	Se	34
Fluorine	F	9	Seaborgium	Sg	106
Francium	Fr	87	Silicon	Si	14
Gadolinium	Gd	64	Silver	Ag	47
Gallium	Ga	31	Sodium	Na	11
Germanium	Ge	32	Strontium	Sr	38
Gold	Au	79	Sulfur	S	16
Hafnium	Hf	72	Tantalum	Ta	73
Hassium	Hs	108	Technetium	Tc	43
Helium	He	2	Tellurium	Te	52
Holmium	Ho	67	Terbium	Tb	65
Hydrogen	H	1	Thallium	Tl	81
Indium	In	49	Thorium	Th	90
Iodine	I	53	Thulium	Tm	69
Iridium	Ir	77	Tin	Sn	50
Iron	Fe	26	Titanium	Ti	22
Krypton	Kr	36	Tungsten	W	74
Lanthanum	La	57	Uranium	U	92
Lawrencium	Lr	103	Vanadium	V	23
Lead	Pb	82	Xenon	Xe	54
Lithium	Li	3	Ytterbium	Yb	70
Lutetium	Lu	71	Yttrium	Y	39
Magnesium	Mg	12	Zinc	Zn	30
Manganese	Mn	25	Zirconium	Zr	40
Meitnerium	Mt	109			

Appendix-VIc List of Elements - by Z

Z	Symbol	Name	Z	Symbol	Name
1	H	Hydrogen	57	La	Lanthanum
2	He	Helium	58	Ce	Cerium
3	Li	Lithium	59	Pr	Praseodymium
4	Be	Beryllium	60	Nd	Neodymium
5	B	Boron	61	Pm	Promethium
6	C	Carbon	62	Sm	Samarium
7	N	Nitrogen	63	Eu	Europium
8	O	Oxygen	64	Gd	Gadolinium
9	F	Fluorine	65	Tb	Terbium
10	Ne	Neon	66	Dy	Dysprosium
11	Na	Sodium	67	Ho	Holmium
12	Mg	Magnesium	68	Er	Erbium
13	Al	Aluminum	69	Tm	Thulium
14	Si	Silicon	70	Yb	Ytterbium
15	P	Phosphorus	71	Lu	Lutetium
16	S	Sulfur	72	Hf	Hafnium
17	Cl	Chlorine	73	Ta	Tantalum
18	Ar	Argon	74	W	Tungsten
19	K	Potassium	75	Re	Rhenium
20	Ca	Calcium	76	Os	Osmium
21	Sc	Scandium	77	Ir	Iridium
22	Ti	Titanium	78	Pt	Platinum
23	V	Vanadium	79	Au	Gold
24	Cr	Chromium	80	Hg	Mercury
25	Mn	Manganese	81	Tl	Thallium
26	Fe	Iron	82	Pb	Lead
27	Co	Cobalt	83	Bi	Bismuth
28	Ni	Nickel	84	Po	Polonium
29	Cu	Copper	85	At	Astatine
30	Zn	Zinc	86	Rn	Radon
31	Ga	Gallium	87	Fr	Francium
32	Ge	Germanium	88	Ra	Radium
33	As	Arsenic	89	Ac	Actinium
34	Se	Selenium	90	Th	Thorium
35	Br	Bromine	91	Pa	Protactinium
36	Kr	Krypton	92	U	Uranium
37	Rb	Rubidium	93	Np	Neptunium
38	Sr	Strontium	94	Pu	Plutonium
39	Y	Yttrium	95	Am	Americium
40	Zr	Zirconium	96	Cm	Curium
41	Nb	Niobium	97	Bk	Berkelium
42	Mo	Molybdenum	98	Cf	Californium
43	Tc	Technetium	99	Es	Einsteinium
44	Ru	Ruthenium	100	Fm	Fermium
45	Rh	Rhodium	101	Md	Mendelevium
46	Pd	Palladium	102	No	Nobelium
47	Ag	Silver	103	Lr	Lawrencium
48	Cd	Cadmium	104	Rf	Rutherfordium
49	In	Indium	105	Db	Dubnium
50	Sn	Tin	106	Sg	Seaborgium
51	Sb	Antimony	107	Bh	Bohrium
52	Te	Tellurium	108	Hs	Hassium
53	I	Iodine	109	Mt	Meitnerium
54	Xe	Xenon	110	Ds	Darmstadtium
55	Cs	Cesium	111	Rg	Roentgenium
56	Ba	Barium			

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