

NUCLEAR WALLET CARDS

October 2011

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NUCLEAR WALLET CARDS

(Eighth edition)

October 2011

JAGDISH K. TULI

NATIONAL NUCLEAR DATA CENTER

(www.nndc.bnl.gov)

for

The U.S. Nuclear Data Program

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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 2005 booklet of the same name[†].

This booklet presents selected properties of all known nuclides and some of their isomeric states. Properties of ionized atoms are presented as an appendix.

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 For nuclides for which either there are no data in ENSDF or those data that have since been superseded, the half-life and the decay modes are taken from Experimental Unevaluated Nuclear Data List (XUNDL)[4] covering recent literature[5].

For other references, experimental data, and information on the data measurements, please refer to the original evaluations [1–4]. The data were updated to **September 1, 2011**.

[†]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: in years 1985, 1990, 1995, 2000, and the last in 2005, were produced by Jagdish K. Tuli, NNDC. In 2004, *Nuclear Wallet Cards for Radioactive Nuclides* aimed at Homeland Security personnel was also produced by Jagdish K. Tuli.

Explanation of Table

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

Nuclides are listed in the 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 [6] is known.

Isomeric states are denoted by the symbol "m" after the mass number and are given in the order of increasing excitation energy. Where the ground state is not well established all given states carry symbol "m".

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 (2010). No names and symbols have as yet been adopted for $Z > 112$.

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 the January 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 the 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 s *10* means 8.1 ± 1.0 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. This field is left blank when the half-life is not known.

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

If a new measurement of half-life or decay mode has since become available [4] then its value 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. 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 , $\beta^- \alpha$, ...	delayed n, p, α , ... (emission following β^- decay)
ϵp , $\epsilon \alpha$, ϵSF , ...	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*) and was prepared by Boris Pritychenko. The greatly expanded NNDC web services offer a wealth of Nuclear Physics information which includes analysis programs, reference data, and custom-tailored retrievals from its many databases. The ND2013 info is provided by Alejandro Sonzogni.

DOE Standard for Nuclear Material Inventory

The sixth edition (2000) of Nuclear Wallet Cards was adopted as the standard by the the US Department of Energy for the purposes of their nuclear material inventory. The sixth edition, as well as, the current edition are available through the NNDC web site.

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 only on the web and its printed form is no longer available.

Acknowledgements

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2. *Nuclear Data Sheets* — Elsevier, Amsterdam. Evaluations published by mass number for $A = 21$ to 294. See page ii of any issue for the index to A-chains.
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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			J^π	Δ (MeV)	$T_{1/2}$, Γ , or Abundance	Decay Mode		
Z	El	A						
0	n	1	1/2+	8.071	10.183 m 17	β^-		
1	H	1	1/2+	7.289	99.9885% 70			
		2	1+	13.136	0.0115% 70			
		3	1/2+	14.950	12.32 y 2	β^-		
		4	2-	24.6		n		
		5	(1/2+)	32.89	5.7 MeV 21	2n		
		6	(2-)	41.9	1.6 MeV 4	n		
		7	(1/2+)	47.9	29×10^{-23} y 7			
2	He	3	1/2+	14.931	0.000134% 3			
		4	0+	2.425	99.999866% 3			
		5	3/2-	11.23	0.60 MeV 2	α , n		
		6	0+	17.592	801 ms 10	β^-		
		7	(3/2)-	26.067	150 keV 20	n		
		8	0+	31.609	119.1 ms 12	β^- , β^- -n 16%		
		9	1/2+	39.78		n		
		10	0+	48.81	300 keV 200	n		
		3	Li	3		29s	unbound	p?
				4	2-	25.3	6.03 MeV	p
5	3/2-			11.68	≈ 1.5 MeV	p, α		
6	1+			14.087	7.59% 4			
7	3/2-			14.907	92.41% 4			
8	2+			20.945	839.9 ms 9	β^- , β^- - α		
9	3/2-			24.954	178.3 ms 4	β^- , β^- -n 50.8%		
10	(1-,2-)			33.05		n		
11	3/2-			40.728	8.75 ms 14	β^- , β^- -n 83%, β^- -2n 4.1%, β^- -n α 0.027%		
12				48.92	<10 ns	n?		
13				58.3				
4	Be			5	(1/2+)	37s		p
				6	0+	18.375	92 keV 6	p, α
		7	3/2-	15.768	53.24 d 4	ϵ		
		8	0+	4.941	5.57 eV 25	α		
		9	3/2-	11.348	100%			
		10	0+	12.607	1.387×10^6 y 12	β^-		
		11	1/2+	20.177	13.81 s 8	β^- , β^- - α 3.1%		
		12	0+	25.076	21.49 ms 3	β^- , β^- -n $\leq 1\%$		
		13	(1/2-)	33.21	2.7×10^{-21} s 18	n		
		14	0+	40.0	4.35 ms 17	β^- , β^- -n 81%, β^- -2n 5%		
		15		49.8s	<200 ns	n?		
		16	0+	57.7s	<200 ns	2n?		
		5	B	6		47s	unbound	2p?
				7	(3/2-)	27.87	1.4 MeV 2	α , p
8	2+			22.921	770 ms 3	ϵ , $\epsilon\alpha$		
9	3/2-			12.416	0.54 keV 21	p, 2 α		
10	3+			12.050	19.9% 7			
11	3/2-			8.667	80.1% 7			
12	1+			13.368	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^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	(MeV)	Abundance	Decay Mode			
5	B	15	28.96	9.93 ms 7	β^- , β^-n 93.6%, β^-2n 0.4%			
		16	0-	37.12	<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-)	51.9s	<26 ns	n?		
		19	(3/2-)	58.8s	2.92 ms 13	β^- , β^-n 72%, β^-2n 16%		
		20		67.1s				
		21		75.7s				
		6	C	8	0+	230 keV 50	p, α	
				9	(3/2-)	28.909	126.5 ms 9	ϵ , ϵp 61.6%, $\epsilon\alpha$ 38.4%
				10	0+	15.698	19.308 s 4	ϵ
11	3/2-			10.650	20.334 m 24	ϵ		
12	0+			0.000	98.93% 8			
13	1/2-			3.125	1.07% 8			
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	3/2+			21.03	193 ms 13	β^- , β^-n 32%		
18	0+			24.92	92 ms 2	β^- , β^-n 31.5%		
19	1/2+			32.41	49 ms 4	β^- , β^-n 61%		
20	0+			37.6	14 ms +6-5	β^- , β^-n 72%		
21	(1/2+)	45.6s	<30 ns	n?				
22	0+	52.1s	6.1 ms +14-12	β^- , β^-n 61%, β^-2n <37%				
23		62.7s						
7	N	10		38.8	p			
		11	1/2+	24.30	0.83 MeV 3	p		
		12	1+	17.338	11.000 ms 16	ϵ		
		13	1/2-	5.345	9.965 m 4	ϵ		
		14	1+	2.863	99.636% 20			
		15	1/2-	0.101	0.364% 20			
		16	2-	5.683	7.13 s 2	β^- , β^-n $1.2 \times 10^{-3}\%$		
		17	1/2-	7.87	4.173 s 4	β^- , β^-n 95.1%		
		18	1-	13.11	620 ms 8	β^- , β^-n 12.2%, β^-n 7%		
		19		15.86	336 ms 3	β^- , β^-n 41.8%		
		20	2-	21.76	136 ms 3	β^- , β^-n 42.9%		
		21	(1/2-)	25.25	83 ms 8	β^- , β^-n 90.5%		
		22	(0-,1-)	32.0	20 ms 2	β^- , β^-n 33%, β^-2n 12%		
23		38.4s	14.5 ms 14	β^- , β^-n , β^-2n				
24		47.5s	<52 ns	n?				
25		56.5s						
8	O	12	0+	32.05	0.40 MeV 25	p		
		13	(3/2-)	23.114	8.58 ms 5	ϵ , ϵp		
		14	0+	8.007	70.620 s 15	ϵ		
		15	1/2-	2.855	122.24 s 16	ϵ		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode			
Z	El	A	(MeV)	Abundance				
8	O	16	0+	-4.737	99.757% 16			
		17	5/2+	-0.809	0.038% 1			
		18	0+	-0.783	0.205% 14			
		19	5/2+	3.333	26.88 s 5	β^-		
		20	0+	3.796	13.51 s 5	β^-		
		21	(5/2+)	8.06	3.42 s 10	β^-		
		22	0+	9.28	2.25 s 9	β^- , $\beta^-n < 22\%$		
		23	1/2+	14.62	97 ms 8	β^- , $\beta^-n 7\%$		
		24	0+	18.5	65 ms 5	β^- , $\beta^-n 58\%$		
		25		27.3				
		26	0+	35.1s	<40 ns	n?		
		27		44.1s	<260 ns	n?		
		28	0+	52.9s	<100 ns	n?		
		9	F	14	(2-)	31.96		p
				15	(1/2+)	16.81	1.0 MeV 2	p
				16	0-	10.680	40 keV 20	p
17	5/2+			1.951	64.49 s 16	ϵ		
18	1+			0.873	109.77 m 5	ϵ		
19	1/2+			-1.487	100%			
20	2+			-0.017	11.07 s 6	β^-		
21	5/2+			-0.047	4.158 s 20	β^-		
22	(4+)			2.79	4.23 s 4	β^- , $\beta^-n < 11\%$		
23	5/2+			3.3	2.23 s 14	β^-		
24	(1,2,3)+			7.56	390 ms 70	β^- , $\beta^-n < 5.9\%$		
25	5/2+			11.36	80 ms 9	β^- , $\beta^-n 23.1\%$		
26	(1+)			18.67	9.7 ms 7	β^- , $\beta^-n 11\%$		
27	(5/2+)			24.6	5.0 ms 2	β^- , $\beta^-n 77\%$		
28				33.1s	<40 ns			
29	(5/2+)	40.0s	2.5 ms 3	β^- , β^-n				
30		48.4s		n				
31		55.9s	>250 ns	β^-n , β^-				
10	Ne	16	0+	24.00	9×10^{-21} s	2p		
		17	1/2-	16.500	109.2 ms 6	ϵ , ϵp , $\epsilon \alpha$		
		18	0+	5.317	1.6670 s 17	ϵ		
		19	1/2+	1.752	17.22 s 2	ϵ		
		20	0+	-7.042	90.48% 3			
		21	3/2+	-5.731	0.27% 1			
		22	0+	-8.024	9.25% 3			
		23	5/2+	-5.154	37.24 s 12	β^-		
		24	0+	-5.951	3.38 m 2	β^-		
		25	1/2+	-2.06	602 ms 8	β^-		
		26	0+	0.48	197 ms 1	β^- , $\beta^-n 0.13\%$		
		27	(3/2+)	7.03	31.5 ms 13	β^- , $\beta^-n 2\%$		
		28	0+	11.29	18.9 ms 4	β^- , $\beta^-n 12\%$, $\beta^- 3.6\%$		
		29	(3/2+)	18.40	14.8 ms 3	β^- , $\beta^-n 28\%$, $\beta^-2n 4\%$		
		30	0+	23.0	7.3 ms 3	β^- , $\beta^-n 13\%$, $\beta^- 8.9\%$		
31		31	3.4 ms 8	β^- , β^-n				
32	0+	37.0s	3.5 ms 9	β^- , β^-n				
33		46.0s	<180 ns	n				

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Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
10	Ne	34	0+	52.8s	>60 ns β^- -n, β^-
11	Na	18	1-	25.0	1.3×10^{-21} s 4 p
		19	(5/2+)	12.93	<40 ns p
		20	2+	6.850	447.9 ms 23 ϵ , $\epsilon\alpha$ 20.05%
		21	3/2+	-2.184	22.49 s 4 ϵ
		22	3+	-5.181	2.6027 y 10 ϵ
		23	3/2+	-9.530	100%
		24	4+	-8.417	14.997 h 12 β^-
		24m	1+	-7.945	20.18 ms 10 IT 99.95%, $\beta^- = 0.05%$
		25	5/2+	-9.357	59.1 s 6 β^-
		26	3+	-6.860	1.07128 s 25 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+	2.67	44.9 ms 12 β^- , β^- -n 21.5%
		30	2+	8.37	48 ms 2 β^- , β^- -n 30%, β^- -2n 1.15%, β^- - α $5.5 \times 10^{-5}\%$
		31	3/2(+)	12.5	17.0 ms 4 β^- , β^- -n 37%, β^- -2n 0.87%, β^- -3n < 0.05%
		32	(3-, 4-)	18.8	13.2 ms 4 β^- , β^- -n 24%, β^- -2n 8%
		33	(3/2+)	24.0s	8.0 ms 4 β^- , β^- -n 47%, β^- -2n 13%
34		31.3s	5.5 ms 10 β^- , β^- -2n = 50%, β^- -n = 15%		
35		37.8s	1.5 ms 5 β^- , β^- -n		
36		45.9s	<180 ns n		
37		53.1s	>60 ns β^- -n, β^-		
12	Mg	19		31.83	4.0 ps 15 2p
		20	0+	17.56	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+	-0.399	3.8755 s 12 ϵ
		23	3/2+	-5.473	11.317 s 11 ϵ
		24	0+	-13.933	78.99% 4
		25	5/2+	-13.192	10.00% 1
		26	0+	-16.214	11.01% 3
		27	1/2+	-14.586	9.458 m 12 β^-
		28	0+	-15.018	20.915 h 9 β^-
		29	3/2+	-10.60	1.30 s 12 β^-
		30	0+	-8.89	335 ms 17 β^-
		31	1/2(+)	-3.19	232 ms 15 β^- , β^- -n 1.7%
		32	0+	-0.91	86 ms 5 β^- , β^- -n 5.5%
		33	3/2-	4.95	90.5 ms 16 β^- , β^- -n 14%
		34	0+	8.56	20 ms 10 β^- , β^- -n
		35	(7/2-)	15.6	70 ms 40 β^- , β^- -n 52%
		36	0+	20.4	3.9 ms 13 β^- , β^- -n
		37	(7/2-)	28.3s	>260 ns β^- , β^- -n
		38	0+	34.1s	>260 ns β^- , β^- -n
		39		42.3s	<180 ns n

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode		
Z	El	A	(MeV)	Abundance			
12	Mg	40	0+	48.6s	>170 ns	β^- , β^-n	
13	Al	21	(5/2+)	27.1s	<35 ns	p	
		22	4+	18.2s	91.1 ms	5	ϵ , ϵp 54.5%, $\epsilon 2p$ 1.1%, $\epsilon \alpha$ 0.04%
		23	5/2+	6.748	446 ms	6	ϵ , ϵp 1.22%
		24	4+	-0.048	2.053 s	4	ϵ , ϵp $1.6 \times 10^{-3}\%$, $\epsilon \alpha$ 0.04%
		24m	1+	0.378	130 ms	3	IT 82.5%, ϵ 17.5%, $\epsilon \alpha$ 0.03%
		25	5/2+	-8.916	7.183 s	12	ϵ
		26	5+	-12.210	7.17×10^5 y	24	ϵ
		26m	0+	-11.982	6.3464 s	7	ϵ
		27	5/2+	-17.196	100%		
		28	3+	-16.850	2.2414 m	12	β^-
		29	5/2+	-18.215	6.56 m	6	β^-
		30	3+	-15.87	3.62 s	6	β^-
		31	(3/2,5/2)+	-14.95	644 ms	25	β^-
		32	1+	-11.06	33.0 ms	2	β^- , β^-n 0.7%
		33	(5/2)+	-8.44	41.7 ms	2	β^- , β^-n 8.5%
		34		-3.05	42 ms	6	β^- , β^-n 27%
35		-0.22	37.2 ms	8	β^- , β^-n 38%		
36		5.95	90 ms	40	β^- , β^-n <31%		
37		9.8	10.7 ms	13	β^-		
38		16.2	7.6 ms	6	β^- , β^-n		
39		21.0s	7.6 ms	16	β^- , β^-n		
40		28.0s	>260 ns		β^- , β^-n		
41		33.9s	>260 ns		β^-		
42		41.5s	>170 ns		β^- , β^-n		
43		48.4s	>170 ns		β^- , β^-n		
14	Si	22	0+	33.0s	29 ms	2	ϵ , ϵp 32%
		23	(5/2)+	23.1s	42.3 ms	4	ϵ , ϵp 71%, $\epsilon 2p$ 3.6%
		24	0+	10.75	140.5 ms	15	ϵ , ϵp 45%
		25	5/2+	3.83	220 ms	3	ϵ , ϵp 35%
		26	0+	-7.140	2.229 s	3	ϵ
		27	5/2+	-12.384	4.15 s	4	ϵ
		28	0+	-21.493	92.223%	19	
		29	1/2+	-21.895	4.685%	8	
		30	0+	-24.432	3.092%	11	
		31	3/2+	-22.949	157.3 m	3	β^-
		32	0+	-24.077	153 y	19	β^-
		33	3/2+	-20.514	6.11 s	21	β^-
		34	0+	-19.96	2.77 s	20	β^-
		35		-14.36	0.78 s	12	β^- , β^-n <5%
		36	0+	-12.42	0.45 s	6	β^- , β^-n <10%
		37	(7/2-)	-6.59	90 ms	60	β^- , β^-n 17%
		38	0+	-4.17	>1 μ s		β^- , β^-n
		39		2.32	47.5 ms	20	β^- , β^-n
40	0+	5.4	33.0 ms	10	β^- , β^-n		
41		12.1	20.0 ms	25	β^- , β^-n ?		
42	0+	16.6s	12.5 ms	35	β^- , β^-n		
43		23.1s	>60 ns		β^- , β^-n		
44	0+	28.5s	>360 ns		β^- , β^-n		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
14	Si	45		37.2s		
15	P	24	(1+)	32.8s	$\epsilon?$, p?	
		25	(1/2+)	19.7s	<30 ns	p
		26	(3+)	11.0s	43.7 ms	6 ϵ , ϵ p
		27	1/2+	-0.71	260 ms	80 ϵ , ϵ p 0.07%
		28	3+	-7.149	270.3 ms	5 ϵ , ϵ p $1.3 \times 10^{-3}\%$, $\epsilon\alpha$ $8.6 \times 10^{-4}\%$
		29	1/2+	-16.952	4.142 s	15 ϵ
		30	1+	-20.200	2.498 m	4 ϵ
		31	1/2+	-24.441	100%	
		32	1+	-24.304	14.262 d	14 β^-
		33	1/2+	-26.337	25.35 d	11 β^-
		34	1+	-24.548	12.43 s	8 β^-
		35	1/2+	-24.857	47.3 s	7 β^-
		36	4-	-20.25	5.6 s	3 β^-
		37		-19.00	2.31 s	13 β^-
		38	(0-;4-)	-14.64	0.64 s	14 β^- , β^- n 12%
		39	(1/2+)	-12.80	0.28 s	4 β^- , β^- n 26%
		40	(2-,3-)	-8.1	125 ms	25 β^- , β^- n 15.8%
		41	(1/2+)	-4.98	100 ms	5 β^- , β^- n 30%
		42		1.0	48.5 ms	15 β^- , β^- n 50%
		43	(1/2+)	4.7	36.5 ms	15 β^- , β^- n
44		10.4s	18.5 ms	25 β^- , β^- n		
45		15.3s	>200 ns	β^-		
46		22.8s	>200 ns	β^-		
47		29.2s				
16	S	26	0+	27.1s	<79 ns	2p?
		27	(5/2+)	17.0s	15.5 ms	15 ϵ , ϵ p 2.3%, ϵ 2p 1.1%
		28	0+	4.1	125 ms	10 ϵ , ϵ p 20.7%
		29	5/2+	-3.16	187 ms	4 ϵ , ϵ p 47%
		30	0+	-14.062	1.178 s	5 ϵ
		31	1/2+	-19.043	2.572 s	13 ϵ
		32	0+	-26.015	94.99%	26
		33	3/2+	-26.586	0.75%	2
		34	0+	-29.931	4.25%	24
		35	3/2+	-28.846	87.37 d	4 β^-
		36	0+	-30.664	0.01%	1
		37	7/2-	-26.896	5.05 m	2 β^-
		38	0+	-26.861	170.3 m	7 β^-
		39	(7/2)-	-23.16	11.5 s	5 β^-
		40	0+	-22.9	8.8 s	22 β^-
		41	(7/2-)	-19.09	1.99 s	5 β^- , β^- n
		42	0+	-17.7	1.03 s	3 β^-
		43		-12.07	0.28 s	3 β^- , β^- n 40%
44	0+	-9.1	100 ms	1 β^- , β^- n 18%		
45		-4.0	68 ms	2 β^- , β^- n 54%		
46	0+	0.0s	50 ms	8 β^-		
47		7.4s				
48	0+	12.8s	\geq 200 ns	β^-		
49		21.2s	<200 ns	n		
17	Cl	28	(1+)	27.5s	p?	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode		
Z	El	A	(MeV)	Abundance			
17	Cl	29	(3/2+)	13.8s	<20 ns	p	
		30	(3+)	4.4s	<30 ns	p	
		31		-7.07	150 ms	25	ϵ , ϵp 0.7%
		32	1+	-13.335	298 ms	1	ϵ , $\epsilon\alpha$ 0.05%, ϵp 0.03%
		33	3/2+	-21.003	2.511 s	4	ϵ
		34	0+	-24.440	1.5264 s	14	ϵ
		34m	3+	-24.294	32.00 m	4	ϵ 55.4%, IT 44.6%
		35	3/2+	-29.013	75.76%	10	
		36	2+	-29.521	3.01×10^5 y	2	β^- 98.1%, ϵ 1.9%
		37	3/2+	-31.761	24.24%	10	
		38	2-	-29.798	37.24 m	5	β^-
		38m	5-	-29.127	715 ms	3	IT
		39	3/2+	-29.800	56.2 m	6	β^-
		40	2-	-27.56	1.35 m	2	β^-
		41	(1/2+)	-27.31	38.4 s	8	β^-
		42		-24.9	6.8 s	3	β^-
		43	(1/2+)	-24.4	3.13 s	9	β^-
		44	(2-)	-20.6	0.56 s	11	β^- , $\beta^- n$ <8%
		45	(1/2+)	-18.36	413 ms	25	β^- , $\beta^- n$ 24%
		46		-13.8	232 ms	2	β^- , $\beta^- n$ 60%
		47		-10.1s	101 ms	6	β^- , $\beta^- n$ >0%
48		-4.1s	≥ 200 ns		β^-		
49		1.1s	≥ 170 ns		β^-		
50		8.4s	>620 ns		β^- , $\beta^- n$		
51	(3/2+)	14.5s	>200 ns		β^-		
18	Ar	30	0+	21.5s	<20 ns	p?	
		31	5/2(+)	11.3s	14.4 ms	6	ϵ , ϵp 62%, $\epsilon 2p$ 8.5%
		32	0+	-2.200	100.5 ms	3	ϵ , ϵp 35.6%
		33	1/2+	-9.384	173.0 ms	20	ϵ , ϵp 38.7%
		34	0+	-18.377	844.5 ms	34	ϵ
		35	3/2+	-23.047	1.7756 s	10	ϵ
		36	0+	-30.231	0.3336%	21	
		37	3/2+	-30.947	35.04 d	4	ϵ
		38	0+	-34.714	0.0629%	7	
		39	7/2-	-33.242	269 y	3	β^-
		40	0+	-35.040	99.6035%	25	
		41	7/2-	-33.067	109.61 m	4	β^-
		42	0+	-34.422	32.9 y	11	β^-
		43	(5/2-)	-32.009	5.37 m	6	β^-
		44	0+	-32.673	11.87 m	5	β^-
		45	5/2-, 7/2-	-29.770	21.48 s	15	β^-
		46	0+	-29.73	8.4 s	6	β^-
47	(3/2)-	-25.21	1.23 s	3	β^- , $\beta^- n$ <0.2%		
48	0+	-22.6s	475 ms	40	β^-		
49		-16.8s	170 ms	50	β^- , $\beta^- n$ 65%		
50	0+	-12.8s	85 ms	30	β^- , $\beta^- n$ 35%		
51		-5.9s	>200 ns		β^-		
52	0+	-1.0s	>620 ns		β^- ?		
53		7.1s	>620 ns		β^- ?, $\beta^- n$?, $\beta^- 2n$?		
19	K	32		21.1s		p?	
		33		7.0s	<25 ns	p	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
19	K	34	(1+)	-1.2s	<25 ns	p
		35	3/2+	-11.172	178 ms	8 ϵ , ϵp 0.37%
		36	2+	-17.417	342 ms	2 ϵ , ϵp 0.05%, $\epsilon\alpha$ $3.4 \times 10^{-3}\%$
		37	3/2+	-24.800	1.226 s	7 ϵ
		38	3+	-28.800	7.636 m	18 ϵ
		38m	0+	-28.670	924.3 ms	3 ϵ 99.97%, IT 0.03%
		39	3/2+	-33.807	93.2581%	44
		40	4-	-33.535	1.248×10^9 y	3 β - 89.28%, ϵ 10.72%
		41	3/2+	-35.560	6.7302%	44
		42	2-	-35.022	12.321 h	25 β -
		43	3/2+	-36.575	22.3 h	1 β -
		44	2-	-35.781	22.13 m	19 β -
		45	3/2+	-36.615	17.81 m	61 β -
		46	(2-)	-35.413	105 s	10 β -
		47	1/2+	-35.708	17.50 s	24 β -
		48	(2-)	-32.285	6.8 s	2 β -, β -n 1.14%
		49	(1/2+,3/2+)	-29.611	1.26 s	5 β -, β -n 86%
		50	(0-,1-,2-)	-25.74	472 ms	4 β -, β -n 29%
		51	(1/2+,3/2+)	-21.6s	365 ms	5 β -, β -n 47%
		52	(2-)	-16.0s	118 ms	6 β -, β -n \approx 73%
53	(3/2+)	-11.1s	30 ms	5 β -, β -n \approx 75%, β -2n < 1%		
54		-4.3s	10 ms	5 β -, β -n > 0%		
55		2s	>360 ns	β -, β -n		
56		8.7s	>620 ns	β -, β -n?, β -2n?		
20	Ca	34	0+	13.9s	<35 ns	p
		35		4.8s	25.7 ms	2 ϵ , ϵp 95.9%, $\epsilon 2p$ 4.1%
		36	0+	-6.45	102 ms	2 ϵ , ϵp 54.3%
		37	3/2+	-13.135	181.1 ms	10 ϵ , ϵp 82.1%
		38	0+	-22.058	440 ms	12 ϵ
		39	3/2+	-27.282	859.6 ms	14 ϵ
		40	0+	-34.846	$>3.0 \times 10^{21}$ y	2 ϵ
		41	7/2-	-35.137	1.02×10^5 y	7 ϵ
		42	0+	-38.547	0.647%	23
		43	7/2-	-38.408	0.135%	10
		44	0+	-41.468	2.09%	11
		45	7/2-	-40.812	162.61 d	9 β -
		46	0+	-43.139	$>0.28 \times 10^{16}$ y	2 β -
		47	7/2-	-42.345	4.536 d	3 β -
		48	0+	-44.223	$>5.8 \times 10^{22}$ y	2 β - 75%
		49	3/2-	-41.298	8.718 m	6 β -
		50	0+	-39.588	13.9 s	6 β -
		51	(3/2-)	-35.87	10.0 s	8 β -, β -n
		52	0+	-32.5	4.6 s	3 β -, β -n \leq 2%
		53	(3/2-,5/2-)	-27.5s	90 ms	15 β -, β -n > 30%
54	0+	-23.0s	86 ms	7 β -		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$			
Z	El	A	J π	(MeV)	Abundance	Decay Mode	
20	Ca	55	(5/2-)	-17.0s	22 ms 2	β^- , β^-n	
		56	0+	-12.4s	11 ms 2	β^- , $\beta^-n?$	
		57		-5s	>620 ns	β^- , β^-n , β^-2n	
		58	0+	-0.3s	>620 ns	β^- , β^-n	
21	Sc	36		15.5s		p?	
		37		3.6s		p?	
		38		-4.4s		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%
		45	7/2-	-41.070	100%		
		45m	3/2+	-41.058	318 ms 7		IT
		46	4+	-41.759	83.79 d 4		β^-
		46m	1-	-41.617	18.75 s 4		IT
		47	7/2-	-44.336	3.3492 d 6		β^-
		48	6+	-44.502	43.67 h 9		β^-
		49	7/2-	-46.560	57.18 m 13		β^-
		50	5+	-44.55	102.5 s 5		β^-
		50m	2+,3+	-44.29	0.35 s 4		IT>97.5%, β^- <2.5%
		51	(7/2)-	-43.23	12.4 s 1		β^-
		52	3(+)	-40.4	8.2 s 2		β^-
		53	(7/2)-	-37.5s	2.4 s 6		β^- , $\beta^-n?$
		54	(3)+	-33.7s	526 ms 15		β^-
		55	(7/2)-	-29.6	96 ms 2		β^- , β^-n 17%
		56	(1+)	-24.5s	26 ms 6		β^- , $\beta^-n?$
		56m	(5,6)+	-24.5s	75 ms 6		β^- , β^-n >14%
		57	(7/2)-	-20.1s	22 ms 2		β^- , β^-n
		58		-14.4s	12 ms 5		β^- , β^-n
		59		-9.6s	>360 ns		β^- , β^-n
		60		-3.4s	>360 ns		β^- , β^-n
61		1.6s	>360 ns		β^- , β^-n		
22	Ti	38	0+	10.6s			
		39	(3/2+)	2.2s	31 ms +6-4		ϵ , ϵp
		40	0+	-8.9	52.4 ms 3		ϵ , ϵp 97.5%
		41	3/2+	-15.1	80.4 ms 9		ϵ , ϵp
		42	0+	-25.104	199 ms 6		ϵ
		43	7/2-	-29.321	509 ms 5		ϵ
		44	0+	-37.548	60.0 y 11		ϵ
		45	7/2-	-39.008	184.8 m 5		ϵ
		46	0+	-44.127	8.25% 3		
		47	5/2-	-44.936	7.44% 2		
		48	0+	-48.491	73.72% 3		
		49	7/2-	-48.562	5.41% 2		
		50	0+	-51.430	5.18% 2		
		51	3/2-	-49.731	5.76 m 1		β^-
52	0+	-49.468	1.7 m 1		β^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	J^π	(MeV)	Abundance	Decay Mode		
22	Ti	53	(3/2)-	-46.8	32.7 s 9	β^-		
		54	0+	-45.6	1.5 s 4	β^-		
		55	(1/2)-	-41.7	1.3 s 1	β^-		
		56	0+	-38.9	0.200 s 5	β^- , β^-n		
		57	(5/2-)	-33.5	98 ms 5	β^- , β^-n		
		58	0+	-30.7s	57 ms 10	β^- , β^-n		
		59	(5/2-)	-25.0s	27.5 ms 25	β^-		
		60	0+	-21.5s	22.4 ms 25	β^-		
		61	(1/2-)	-15.5s	15 ms 4	β^- , β^-n		
		62	0+	-11.8s	>620 ns	β^- , β^-n		
		63		-5.2s	>360 ns	β^- , β^-n		
		23	V	40		11.6s		p?
				41		0.0s		p?
42				-7.6s	<55 ns		p	
43				-18.0s	79.3 ms 24		ϵ	
44	(2+)			-24.1	111 ms 7		ϵ , $\epsilon\alpha$	
44m	(6+)			-24.1	150 ms 3		ϵ	
45	7/2-			-31.88	547 ms 6		ϵ	
46	0+			-37.074	422.50 ms 11		ϵ	
46m	3+			-36.272	1.02 ms 7		IT	
47	3/2-			-42.005	32.6 m 3		ϵ	
48	4+			-44.476	15.9735 d 25		ϵ	
49	7/2-			-47.960	330 d 15		ϵ	
50	6+			-49.224	>2.1 $\times 10^{17}$ y		$\epsilon > 92.9\%$, $\beta^- < 7.1\%$	
					0.250% 2			
51	7/2-			-52.203	99.750% 2			
52	3+			-51.443	3.743 m 5		β^-	
53	7/2-			-51.849	1.543 m 14		β^-	
54	3+			-49.89	49.8 s 5		β^-	
55	(7/2-)			-49.2	6.54 s 15		β^-	
56	1+			-46.1	0.216 s 4		β^- , β^-n	
57	(7/2-)			-44.2	0.32 s 3		β^- , β^-n	
58	(1+)	-40.2	191 ms 10		β^- , β^-n			
59	(5/2-)	-37.1	97 ms 2		β^- , $\beta^-n < 3\%$			
60		-32.6	68 ms 5		β^-			
60m		-32.6	40 ms 15		β^- , β^-n			
60m		-32.6	122 ms 18		β^- , β^-n			
61	(3/2-)	-29.5s	52.6 ms 42		β^- , $\beta^-n \geq 6\%$			
62		-24.6s	33.5 ms 20		β^- , β^-n			
63	7/2-	-21.1s	19.2 ms 24		β^- , $\beta^-n \approx 35\%$			
64		-15.6s	19 ms 8		β^-			
65		-11.3s	>360 ns		β^- , β^-n			
66		-5.3s	>360 ns		β^- , β^-n			
24	Cr	42	0+	6.5s	13.3 ms 10	ϵ , ϵp 94.4%		
		43	(3/2+)	-1.9s	20.6 ms 9	ϵ , ϵp 81%, $\epsilon 2p$ 7.1%, $\epsilon 3p$ 0.08%		
		44	0+	-13.1s	42.8 ms 6	ϵ , ϵp 14%		
		45	(7/2-)	-19.4s	60.9 ms 4	ϵ , ϵp 34.4%		
		46	0+	-29.47	0.26 s 6	ϵ		
		47	3/2-	-34.56	500 ms 15	ϵ		
		48	0+	-42.821	21.56 h 3	ϵ		
		49	5/2-	-45.332	42.3 m 1	ϵ		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
24	Cr	50	0+	-50.261	$>1.3 \times 10^{18}$ y 4.345% 13	2 ϵ
		51	7/2-	-51.451	27.7025 d 24	ϵ
		52	0+	-55.418	83.789% 18	
		53	3/2-	-55.285	9.501% 17	
		54	0+	-56.933	2.365% 7	
		55	3/2-	-55.108	3.497 m 3	β^-
		56	0+	-55.281	5.94 m 10	β^-
		57	(3/2)-	-52.524	21.1 s 10	β^-
		58	0+	-51.8	7.0 s 3	β^-
		59	(1/2-)	-47.9	1.05 s 9	β^-
		60	0+	-46.5	0.49 s 1	β^-
		61	(5/2-)	-42.2	243 ms 11	β^- , β^-n
		62	0+	-40.4	206 ms 12	β^- , β^-n
		63	1/2-	-35.6s	129 ms 2	β^- , β^-n
		64	0+	-33.3s	42 ms 2	β^-
		65	(1/2-)	-27.8s	28 ms 3	β^-
		66	0+	-24.3s	23 ms 4	β^-
		67		-18.5s		$\beta^-?$
68	0+	-14.9s	>360 ns	β^- , β^-n		
25	Mn	44	(2-)	6.7s	<105 ns	ϵ , p
		45		-5.1s		
		46	(4+)	-12.0s	36.2 ms 4	ϵ , ϵp 57%
		47	(5/2-)	-22.3s	88.0 ms 13	ϵ , ϵp $<1.7\%$
		48	4+	-29.3	158.1 ms 22	ϵ , ϵp 0.28%, $\epsilon \alpha < 6.0 \times 10^{-4}\%$
		49	5/2-	-37.61	382 ms 7	ϵ
		50	0+	-42.627	283.19 ms 10	ϵ
		50m	5+	-42.402	1.75 m 3	ϵ
		51	5/2-	-48.243	46.2 m 1	ϵ
		52	6+	-50.706	5.591 d 3	ϵ
		52m	2+	-50.328	21.1 m 2	ϵ 98.25%, IT 1.75%
		53	7/2-	-54.689	3.74×10^6 y 4	ϵ
		54	3+	-55.556	312.12 d 6	ϵ , $\beta^- < 2.9 \times 10^{-4}\%$
		55	5/2-	-57.711	100%	
		56	3+	-56.910	2.5789 h 1	β^-
		57	5/2-	-57.486	85.4 s 18	β^-
		58	1+	-55.827	3.0 s 1	β^-
		58m	4+	-55.755	65.4 s 5	$\beta^- \approx 90\%$, IT $\approx 10\%$
59	(5/2)-	-55.525	4.59 s 5	β^-		
60	1+	-52.967	0.28 s 2	β^-		
60m	4+	-52.695	1.77 s 2	β^- 88.5%, IT 11.5%		
61	(5/2)-	-51.742	0.67 s 4	β^-		
62m	(3+)	-48.180	671 ms 5	β^- , β^-n		
62m	(1+)	-48.180	92 ms 13	β^- , β^-n		
63	5/2-	-46.886	0.275 s 4	β^- , β^-n		
64	(1+)	-42.989	90 ms 4	β^- , β^-n 33%		
64m	(4+)	-42.814	0.50 ms 5	IT		
65	(5/2-)	-40.967	84 ms 8	β^-		
66		-36.75	65 ms 2	β^-		
67	(5/2+)	-32.8s	51 ms 4	β^- , $\beta^-n > 10\%$		
68	(>3)	-28.0s	28 ms 3	β^- , β^-n		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	J π	(MeV)	Abundance	Decay Mode
25	Mn	69	5/2-	-24.4s	18 ms 4	β^-
		70		-19.2s	>360 ns	β^- , β^-n
		71			>637 ns	β^- , β^-n , β^-2n
26	Fe	45	(3/2+)	13.8s	1.89 ms +49-21	2p 70%, $\epsilon \leq 30\%$, ϵp 19%, $\epsilon 2p$ 7.8%, $\epsilon 3p$ 3.3%
		46	0+	0.8s	13.0 ms 20	ϵ , ϵp 78.7%
		47	(7/2-)	-6.6s	21.9 ms 2	ϵ , ϵp 88.4%, $\epsilon 2p$
		48	0+	-18.16s	45.3 ms 6	ϵ , ϵp 15.9%
		49	(7/2-)	-24.8s	64.7 ms 3	ϵ , ϵp 56.7%
		50	0+	-34.49	155 ms 11	ϵ , ϵp ?
		51	5/2-	-40.22	305 ms 5	ϵ
		52	0+	-48.332	8.275 h 8	ϵ
		52m	12+	-41.374	45.9 s 6	ϵ , IT < 4.0 $\times 10^{-3}\%$
		53	7/2-	-50.946	8.51 m 2	ϵ
		53m	19/2-	-47.906	2.54 m 2	IT
		54	0+	-56.253	5.845% 35	
		55	3/2-	-57.480	2.744 y 9	ϵ
		56	0+	-60.606	91.754% 36	
		57	1/2-	-60.181	2.119% 10	
		58	0+	-62.154	0.282% 4	
		59	3/2-	-60.664	44.495 d 9	β^-
		60	0+	-61.412	2.62 $\times 10^6$ y 4	β^-
		61	3/2-, 5/2-	-58.920	5.98 m 6	β^-
		62	0+	-58.877	68 s 2	β^-
		63	(5/2-)	-55.635	6.1 s 6	β^-
		64	0+	-54.969	2.0 s 2	β^-
		65	(1/2-)	-51.221	0.81 s 5	β^-
		65m	(9/2+)	-50.819	1.12 s 15	β^-
		66	0+	-50.067	440 ms 60	β^-
		67	(1/2-)	-45.7	0.40 s 4	β^-
		68	0+	-43.1	180 ms 19	β^-
69	1/2-	-38.4s	110 ms 6	β^-		
70	0+	-36.3s	71 ms 10	β^-		
71		-31.0s	28 ms 5	β^- , β^-n		
72	0+	-28.3s	≥ 150 ns	β^- , β^-n 27.6%		
73			>633 ns	β^- , β^-n , β^-2n		
74	0+		>638 ns	β^- , β^-n , β^-2n		
27	Co	47		10.3s		
		48		1.9s		
		49		-9.6s		
		50	(6+)	-17.2s	38.8 ms 2	ϵ , ϵp 70.5%, $\epsilon 2p$
		51	(7/2-)	-27.3s	>200 ns	ϵ
		52	(6+)	-33.92s	115 ms 23	ϵ
		53	(7/2-)	-42.658	240 ms 9	ϵ
		53m	(19/2-)	-39.461	247 ms 12	$\epsilon \approx 98.5\%$, $p = 1.5\%$
		54	0+	-48.009	193.28 ms 7	ϵ
		54m	7+	-47.812	1.48 m 2	ϵ
		55	7/2-	-54.029	17.53 h 3	ϵ
		56	4+	-56.039	77.236 d 26	ϵ
		57	7/2-	-59.344	271.74 d 6	ϵ
		58	2+	-59.846	70.86 d 6	ϵ

Nuclear Wallet Cards

Nuclide			Δ	T½, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
27	Co	58m	5+	-59.821	9.10 h 9	IT
		59	7/2-	-62.229	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-	-62.897	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)-	-59.185	1.16 s 3	β^-
		66	(3+)	-56.41	0.20 s 2	β^-
		67	(7/2-)	-55.321	0.425 s 20	β^-
		68	(7-)	-51.9	0.199 s 21	β^-
		68m	(3+)	-51.9	1.6 s 3	β^-
		69	7/2-	-50.0	229 ms 24	β^-
		70	(6-)	-45.6	108 ms 7	β^-
		70m	(3+)	-45.6	0.50 s 18	β^-
		71	(7/2-)	-43.9	80 ms 3	β^- , $\beta^-n \leq 6\%$
		72	(6-,7-)	-39.7s	59.9 ms 17	β^- , $\beta^-n \geq 6\%$
		73		-37.2s	41 ms 4	β^-
74	0+	-32.7s	25 ms 5	β^- , $\beta^-n \approx 18\%$		
75	(7/2-)	-29.4s	>150 ns	β^-		
76			>634 ns	β^- , β^-2n , β^-n		
28	Ni	48	0+	18.0s	2.1 ms +14-6	2p = 70%, ϵ
		49		8.7s	7.5 ms 10	ϵ , ϵp 83%
		50	0+	-3.6s	18.5 ms 12	ϵ , ϵp 86.7%, $\epsilon 2p$
		51	(7/2-)	-11.5s	23.8 ms 2	ϵ , ϵp 87.2%
		52	0+	-22.9s	40.8 ms 2	ϵ , ϵp 31.4%
		53	(7/2-)	-29.7s	55.2 ms 7	ϵ , ϵp 23.4%
		54	0+	-39.22	104 ms 7	ϵ
		55	7/2-	-45.335	204.7 ms 37	ϵ
		56	0+	-53.906	6.075 d 10	ϵ
		57	3/2-	-56.083	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	1.1399% 13	
		62	0+	-66.745	3.6346% 40	
		63	1/2-	-65.512	101.2 y 15	β^-
		64	0+	-67.098	0.9255% 19	
		65	5/2-	-65.125	2.5175 h 5	β^-
		66	0+	-66.006	54.6 h 3	β^-
		67	(1/2)-	-63.742	21 s 1	β^-
		68	0+	-63.463	29 s 2	β^-
		68m	5-	-60.614	0.86 ms 5	IT
		69	9/2+	-59.978	11.2 s 9	β^-
69m	1/2-	-59.657	3.5 s 9	β^-		
70	0+	-59.213	6.0 s 3	β^-		
71	(9/2+)	-55.405	2.56 s 3	β^-		
71m	(1/2-)	-54.906	2.3 s 3	β^-		
72	0+	-54.225	1.57 s 5	β^-		
73	(9/2+)	-50.107	0.84 s 3	β^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	J π	(MeV)	Abundance	Decay Mode
28 Ni	74		0+	-48.7s	0.68 s 18	β^- , β^-n
	75	(7/2+)		-44.1s	344 ms 25	β^- , β^-n 10%
	76		0+	-41.6s	0.238 s +15-18	β^- , β^-n
	77			-36.7s	128 ms +36-32	β^- , β^-n 30%
	78		0+	-34.1s	0.11 s +10-6	β^- , β^-n
	79				>635 ns	β^- , β^-n , β^-2n
29 Cu	52	(3+)		-1.9s		p
	53	(3/2-)		-13.5s	<300 ns	ϵ , p
	54	(3+)		-21.4s	<75 ns	p
	55	(3/2-)		-31.6s	27 ms 8	ϵ , ϵp 15%
	56	(4+)		-38.2s	93 ms 3	ϵ , ϵp 0.4%
	57	3/2-		-47.308	196.3 ms 7	ϵ
	58	1+		-51.667	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-		-61.983	3.333 h 5	ϵ
	62	1+		-62.786	9.673 m 8	ϵ
	63	3/2-		-65.579	69.15% 15	
	64	1+		-65.424	12.701 h 2	ϵ 61.5%, β^- 38.5%
	65	3/2-		-67.263	30.85% 15	
	66	1+		-66.257	5.120 m 14	β^-
	67	3/2-		-67.318	61.83 h 12	β^-
	68	1+		-65.567	30.9 s 6	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+		-62.733	6.6 s 2	β^- 93.2%, IT 6.8%
	71	3/2(-)		-62.711	19.4 s 16	β^-
	72	(2)		-59.782	6.63 s 3	β^-
	73	(3/2-)		-58.987	4.2 s 3	β^-
	74	(1+,3+)		-56.006	1.594 s 10	β^-
	75	(5/2-)		-54.471	1.222 s 8	β^- , β^-n 3.5%
	76	(3,4)		-50.975	637 ms 7	β^- , β^-n 7.2%
	76m			-50.975	1.27 s 30	β^-
	77	(5/2-)		-48.3	468.1 ms 20	β^- , β^-n 30.3%
	78	(4-,5-,6-)		-44.5	335 ms 11	β^- , β^-n >65%
	79			-41.9s	188 ms 25	β^- , β^-n 55%
80			-36.4s	0.17 s +11-5	β^-	
81				>632 ns	β^- , β^-2n , β^-n	
82				>636 ns	β^- , β^-n , β^-2n	
30 Zn	54	0+		-6.0s	1.59 ms +60-35	2p 92%
	55	(5/2-)		-14.4s	19.8 ms 13	ϵ , ϵp 91%
	56	0+		-25.2s	30.0 ms 17	ϵ , ϵp 86%
	57	(7/2-)		-32.5s	38 ms 4	ϵ , ϵp \geq 65%
	58	0+		-42.30	86 ms 8	ϵ , ϵp < 3%
	59	3/2-		-47.214	182.0 ms 18	ϵ , ϵp 0.1%
	60	0+		-54.173	2.38 m 5	ϵ
	61	3/2-		-56.34	89.1 s 2	ϵ
	61m	1/2-		-56.25	<430 ms	IT
	61m	3/2-		-55.92	0.14 s 7	IT
	61m	5/2-		-55.59	<0.13 s	IT

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
30 Zn	62	0+	-61.167	9.186 h 13	ϵ
	63	3/2-	-62.213	38.47 m 5	ϵ
	64	0+	-66.003	$\geq 7.0 \times 10^{20}$ y	2 ϵ
				49.17% 75	
	65	5/2-	-65.911	243.93 d 9	ϵ
	66	0+	-68.899	27.73% 98	
	67	5/2-	-67.880	4.04% 16	
	68	0+	-70.006	18.45% 63	
	69	1/2-	-68.417	56.4 m 9	β^-
	69m	9/2+	-67.978	13.76 h 2	IT 99.97%, β^- 0.03%
	70	0+	-69.564	$\geq 2.3 \times 10^{17}$ y	2 β^-
				0.61% 10	
	71	1/2-	-67.328	2.45 m 10	β^-
	71m	9/2+	-67.170	3.96 h 5	β^- , IT $\leq 0.05\%$
	72	0+	-68.145	46.5 h 1	β^-
	73	(1/2)-	-65.593	23.5 s 10	β^-
	73m		-65.593	5.8 s 8	β^- , IT
	73m	(5/2+)	-65.397	13.0 ms 2	IT
	74	0+	-65.756	95.6 s 12	β^-
	75	(7/2+)	-62.558	10.2 s 2	β^-
	76	0+	-62.303	5.7 s 3	β^-
	77	(7/2+)	-58.789	2.08 s 5	β^-
	77m	(1/2-)	-58.017	1.05 s 10	IT > 50%, β^- < 50%
	78	0+	-57.483	1.47 s 15	β^-
	79	(9/2+)	-53.432	0.995 s 19	β^- , β^-n 1.3%
	80	0+	-51.648	0.54 s 2	β^- , β^-n 1%
	81	(5/2+)	-46.199	304 ms 13	β^- , β^-n 7.5%
	82	0+	-42.6s	>150 ns	β^-
	83		-36.7s	>300 ns	β^- , β^-n
	84	0+		>633 ns	β^- , β^-2n , β^-n
85			>637 ns	$\beta^-?$, $\beta^-n?$, $\beta^-2n?$	
31 Ga	56		-4.2s		p?
	57		-15.6s		p?
	58		-23.8s		p?
	59		-34.0s		p?
	60	(2+)	-39.8s	70 ms 13	ϵ 98.4%, ϵp 1.6%, $\epsilon \alpha < 0.02\%$
	61	3/2-	-47.09	167 ms 3	ϵ , $\epsilon p < 0.25\%$
	62	0+	-51.986	116.121 ms 21	ϵ , ϵp
	63	3/2-	-56.547	32.4 s 5	ϵ
	64	0+	-58.833	2.627 m 12	ϵ
	65	3/2-	-62.657	15.2 m 2	ϵ
	66	0+	-63.724	9.49 h 3	ϵ
	67	3/2-	-66.878	3.2617 d 5	ϵ
	68	1+	-67.085	67.71 m 9	ϵ
	69	3/2-	-69.327	60.108% 9	
	70	1+	-68.910	21.14 m 3	β^- 99.59%, ϵ 0.41%
	71	3/2-	-70.139	39.892% 9	
	72	3-	-68.588	14.10 h 2	β^-
	73	3/2-	-69.699	4.86 h 3	β^-
	74	(3-)	-68.049	8.12 m 12	β^-
	74m	(0)	-67.989	9.5 s 10	IT 75%, β^- < 50%

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
31 Ga	75	3/2-	-68.464	126 s 2	β^-
	76	2+	-66.296	32.6 s 6	β^-
	77	3/2-	-65.992	13.2 s 2	β^-
	78	2+	-63.705	5.09 s 5	β^-
	79	3/2-	-62.547	2.847 s 3	β^- , β^-n 0.09%
	80	3	-59.223	1.676 s 14	β^- , β^-n 0.86%
	81	5/2-	-57.627	1.217 s 5	β^- , β^-n 11.9%
	82	(1,2,3)	-52.930	0.599 s 2	β^- , β^-n 19.8%
	83		-49.257	308.1 ms 10	β^- , β^-n 62.8%
	84	(0-)	-44.3s	0.085 s 10	β^- , β^-n 74%
	84m	(3-,4-)	-44.3s	<0.085 s	β^- , β^-n ?
	85	(1/2-,3/2-)	-40.2s	<100 ms	β^- , β^-n >35%
	86		-34.5s	>150 ns	β^- , β^-n
	87			>634 ns	β^- , β^-n , β^-2n
32 Ge	58	0+	-7.7s		2p?
	59		-16.5s		2p?
	60	0+	-27.6s	>110 ns	ϵp , ϵ
	61	(3/2-)	-33.7s	44 ms 6	ϵ , ϵp >58%
	62	0+	-42.2s	129 ms 35	ϵ , ϵp
	63	3/2-	-46.92	150 ms 9	ϵ
	64	0+	-54.315	63.7 s 25	ϵ
	65	3/2-	-56.480	30.9 s 5	ϵ , ϵp 0.01%
	66	0+	-61.606	2.26 h 5	ϵ
	67	1/2-	-62.657	18.9 m 3	ϵ
	68	0+	-66.978	270.95 d 16	ϵ
	69	5/2-	-67.100	39.05 h 10	ϵ
	70	0+	-70.561	20.57% 27	
	71	1/2-	-69.906	11.43 d 3	ϵ
	71m	9/2+	-69.708	20.41 ms 18	IT
	72	0+	-72.585	27.45% 32	
	73	9/2+	-71.297	7.75% 12	
	73m	1/2-	-71.230	0.499 s 11	IT
	74	0+	-73.422	36.50% 20	
	75	1/2-	-71.856	82.78 m 4	β^-
	75m	7/2+	-71.716	47.7 s 5	IT 99.97%, β^- 0.03%
	76	0+	-73.212	7.73% 12	
	77	7/2+	-71.213	11.30 h 1	β^-
	77m	1/2-	-71.053	52.9 s 6	β^- 81%, IT 19%
	78	0+	-71.862	88.0 m 10	β^-
	79	(1/2)-	-69.53	18.98 s 3	β^-
	79m	(7/2+)	-69.34	39.0 s 10	β^- 96%, IT 4%
80	0+	-69.535	29.5 s 4	β^-	
81	(9/2+)	-66.291	7.6 s 6	β^-	
81m	(1/2+)	-65.612	7.6 s 6	β^-	
82	0+	-65.415	4.56 s 26	β^-	
83	(5/2)+	-60.976	1.85 s 6	β^-	
84	0+	-58.148	0.954 s 14	β^- , β^-n 10.2%	
85	(1/2+,5/2+)	-53.123	0.56 s 5	β^- , β^-n 14%	
86	0+	-49.8s	>150 ns	β^- , β^-n	
87	(5/2+)	-44.2s	\approx 0.14 s	β^- , β^-n	
88	0+	-40.2s	\geq 300 ns	β^-	
89		-33.8s	\geq 300 ns	β^- ?	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
32	Ge	90	0+	>635 ns	β^- , β^-n , β^-2n
33	As	60		-6.1s	p?
		61		-17.8s	p?
		62		-24.8s	p?
		63	3/2-	-33.5s	<43 ns p
		64		-39.4s	18 ms +43-7 ϵ
		65		-46.94	128 ms 16 ϵ
		66	(0+)	-52.03	95.77 ms 23 ϵ
		67	(5/2-)	-56.585	42.5 s 12 ϵ
		68	3+	-58.894	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-	-67.893	65.30 h 7 ϵ
		72	2-	-68.229	26.0 h 1 ϵ
		73	3/2-	-70.952	80.30 d 6 ϵ
		74	2-	-70.859	17.77 d 2 ϵ 66%, β^- 34%
		75	3/2-	-73.033	100%
	75m	9/2+	-72.729	17.62 ms 23	IT
		76	2-	-72.290	1.0942 d 7 β^-
		77	3/2-	-73.916	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+	-72.17	15.2 s 2 β^-
		81	3/2-	-72.533	33.3 s 8 β^-
		82	(2-)	-70.103	19.1 s 5 β^-
	82m	(5-)	-69.956	13.6 s 4 β^-	
		83	(5/2-, 3/2-)	-69.669	13.4 s 3 β^-
		84	(3-)	-65.853	4.2 s 5 β^- , β^-n 0.18%
		85	(3/2-)	-63.189	2.021 s 10 β^- , β^-n 59.4%
		86		-58.962	0.945 s 8 β^- , β^-n 26%
		87	(3/2-)	-55.617	0.56 s 8 β^- , β^-n 15.4%
		88		-50.9s	>300 ns β^-
		89		-46.9s	>300 ns $\beta^-?$, $\beta^-n?$
		90		-41.3s	>300 ns β^- , β^-n
		91		-36.9s	>150 ns β^-
		92		-31.0s	β^-
34	Se	64	0+	-26.9s	>180 ns ϵ
		65	(3/2-)	-32.9s	33 ms 4 ϵ , ϵp
		66	0+	-41.7s	
		67		-46.58	136 ms 12 ϵ , ϵp 0.5%
		68	0+	-54.189	35.5 s 7 ϵ
		69	(1/2-, 3/2-)	-56.30	27.4 s 2 ϵ , ϵp 0.05%
		70	0+	-61.929	41.1 m 3 ϵ
		71	(5/2-)	-63.146	4.74 m 5 ϵ
		72	0+	-67.868	8.40 d 8 ϵ
		73	9/2+	-68.227	7.15 h 8 ϵ
	73m	3/2-	-68.201	39.8 m 13	IT 72.6%, ϵ 27.4%
		74	0+	-72.212	0.89% 4
		75	5/2+	-72.169	119.79 d 4 ϵ
		76	0+	-75.251	9.37% 29
		77	1/2-	-74.599	7.63% 16
	77m	7/2+	-74.437	17.4 s 8	IT

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
34	Se	78	0+	-77.025	23.77% 28	
		79	7/2+	-75.917	2.95×10^5 y 38	β^-
		79m	1/2-	-75.821	3.92 m 1	IT 99.94%, β^- 0.06%
		80	0+	-77.759	49.61% 41	
		81	1/2-	-76.389	18.45 m 12	β^-
		81m	7/2+	-76.286	57.28 m 2	IT 99.95%, β^- 0.05%
		82	0+	-77.594	8.73% 22	
		83	9/2+	-75.340	22.3 m 3	β^-
		83m	1/2-	-75.112	70.1 s 4	β^-
		84	0+	-75.947	3.26 m 10	β^-
		85	(5/2+)	-72.413	32.9 s 3	β^-
		86	0+	-70.503	14.3 s 3	β^-
		87	(5/2+)	-66.426	5.50 s 12	β^- , β^- -n 0.2%
		88	0+	-63.884	1.53 s 6	β^- , β^- -n 0.67%
		89	(5/2+)	-58.992	0.41 s 4	β^- , β^- -n 7.8%
		90	0+	-55.9s	>300 ns	β^- , β^- -n
		91		-50.3s	0.27 s 5	β^- , β^- -n 21%
		92	0+	-46.7s		β^-
		93	(1/2+)	-40.7s		β^-
		94	0+	-36.8s	>150 ns	β^-
95			>300 ns	$\beta^-?$, β^- -n?, β^- -2n?		
35	Br	67		-32.8s		p?
		68		-38.7s	<1.2 μ s	p?
		69		-46.5s	<24 ns	p?
		70	0+	-51.42	79.1 ms 8	ϵ
		70m	9+	-49.13	2.2 s 2	ϵ
		71	(5/2)-	-56.502	21.4 s 6	ϵ
		72	1+	-59.067	78.6 s 24	ϵ
		72m	(3-)	-58.966	10.6 s 3	IT, ϵ
		73	1/2-	-63.647	3.4 m 2	ϵ
		74	(0-)	-65.285	25.4 m 3	ϵ
		74m	4(+)	-65.271	46 m 2	ϵ
		75	3/2-	-69.107	96.7 m 13	ϵ
		76	1-	-70.288	16.2 h 2	ϵ
		76m	(4)+	-70.185	1.31 s 2	IT > 99.4%, ϵ < 0.6%
		77	3/2-	-73.234	57.036 h 6	ϵ
		77m	9/2+	-73.128	4.28 m 10	IT
		78	1+	-73.452	6.45 m 4	$\epsilon \geq 99.99\%$, $\beta^- \leq 0.01\%$
		79	3/2-	-76.068	50.69% 7	
		79m	9/2+	-75.860	5.1 s 4	IT
		80	1+	-75.889	17.68 m 2	β^- 91.7%, ϵ 8.3%
80m	5-	-75.803	4.4205 h 8	IT		
81	3/2-	-77.975	49.31% 7			
82	5-	-77.497	35.282 h 7	β^-		
82m	2-	-77.451	6.13 m 5	IT 97.6%, β^- 2.4%		
83	3/2-	-79.006	2.40 h 2	β^-		
84	2-	-77.79	31.76 m 8	β^-		
84m	(6)-	-77.47	6.0 m 2	β^-		
85	3/2-	-78.575	2.90 m 6	β^-		
86	(1-)	-75.632	55.1 s 4	β^-		
87	3/2-	-73.891	55.65 s 13	β^- , β^- -n 2.6%		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode			
Z	El	A	(MeV)	Abundance				
35	Br	88	(2-)	-70.715	16.29 s 6	β^- , β^-n 6.58%		
		89	(3/2-, 5/2-)	-68.274	4.40 s 3	β^- , β^-n 13.8%		
		90		-64.000	1.91 s 1	β^- , β^-n 25.2%		
		91		-61.107	0.541 s 5	β^- , β^-n 20%		
		92	(2-)	-56.232	0.343 s 15	β^- , β^-n 33.1%		
		93	(5/2-)	-52.9s	102 ms 10	β^- , β^-n 68%		
		94		-47.6s	70 ms 20	β^- , β^-n 68%		
		95		-43.9s	≥ 150 ns	β^- , β^-n 34%		
		96		-38.3s	≥ 150 ns	β^- , β^-n 27.6%		
		97		-34.5s	> 300 ns	β^-		
		98			> 634 ns	β^- , β^-n , β^-2n		
		36	Kr	69		-32.4s	32 ms 10	ϵ
				70	0+	-41.6s	52 ms 17	ϵ , $\epsilon p \leq 1.3\%$
71	(5/2-)			-46.3	100 ms 3	ϵ , ϵp 2.1%		
72	0+			-53.940	17.1 s 2	ϵ , $\epsilon p < 1.0 \times 10^{-6}\%$		
73	3/2-			-56.551	27.3 s 10	ϵ , ϵp 0.25%		
74	0+			-62.331	11.50 m 11	ϵ		
75	5/2+			-64.323	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+			-74.179	$\geq 1.5 \times 10^{21}$ y	2 ϵ		
79	1/2-			-74.442	35.04 h 10	ϵ		
79m	7/2+			-74.312	50 s 3	IT		
80	0+			-77.892	2.286% 10			
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	11.593% 31			
83	9/2+			-79.990	11.500% 19			
83m	1/2-			-79.948	1.85 h 3	IT		
84	0+			-82.439	56.987% 15			
85	9/2+			-81.480	10.752 y 25	β^-		
85m	1/2-			-81.175	4.480 h 8	β^- 78.6%, IT 21.4%		
86	0+			-83.266	17.279% 41			
87	5/2+			-80.709	76.3 m 5	β^-		
88	0+			-79.691	2.84 h 3	β^-		
89	3/2(+)			-76.535	3.15 m 4	β^-		
90	0+			-74.959	32.32 s 9	β^-		
91	5/2(+)			-70.973	8.57 s 4	β^-		
92	0+			-68.769	1.840 s 8	β^- , β^-n 0.03%		
93	1/2+			-64.135	1.286 s 10	β^- , β^-n 1.95%		
94	0+			-61.35	212 ms 5	β^- , β^-n 1.11%		
95	1/2(+)			-56.16	0.114 s 3	β^- , β^-n 2.87%		
96	0+	-53.08	80 ms 6	β^- , β^-n 3.7%				
97	(3/2+)	-47.4	63 ms 4	β^- , β^-n 6.7%				
98	0+	-44.5s	46 ms 8	β^- , β^-n 7%				
99		-38.8s	13 ms +34-6	β^- , β^-n 11%				
100	0+	-35.2s	7 ms +11-3	β^- , β^-n				
101			> 635 ns	β^- , β^-n , β^-2n				
37	Rb	71		-32.3s	p?			
		72	(3+)	-38.1s	p?			
		73		-46.1s	< 30 ns	$\epsilon?$, p $> 0\%$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
37 Rb	74	(0+)	-51.916	64.9 ms 5	ϵ
	75	(3/2-)	-57.218	19.0 s 12	ϵ
	76	1(-)	-60.478	36.5 s 6	$\epsilon, \epsilon\alpha 3.8 \times 10^{-7}\%$
	77	3/2-	-64.830	3.77 m 4	ϵ
	78	0(+)	-66.936	17.66 m 3	ϵ
	78m	4(-)	-66.825	5.74 m 3	$\epsilon 91\%, \text{ IT } 9\%$
	79	5/2+	-70.802	22.9 m 5	ϵ
	80	1+	-72.175	33.4 s 7	ϵ
	81	3/2-	-75.456	4.572 h 4	ϵ
	81m	9/2+	-75.370	30.5 m 3	$\text{IT } 97.6\%, \epsilon 2.4\%$
	82	1+	-76.187	1.2575 m 2	ϵ
	82m	5-	-76.118	6.472 h 6	$\epsilon, \text{ IT } < 0.33\%$
	83	5/2-	-79.070	86.2 d 1	ϵ
	84	2-	-79.756	32.82 d 7	$\epsilon 96.1\%, \beta- 3.9\%$
	84m	6-	-79.292	20.26 m 4	IT
	85	5/2-	-82.167	72.17% 2	
	86	2-	-82.747	18.642 d 18	$\beta- 99.99\%, \epsilon 5.2 \times 10^{-3}\%$
	86m	6-	-82.191	1.017 m 3	IT, $\beta- < 0.3\%$
	87	3/2-	-84.597	4.81×10^{10} y 9	$\beta-$
				27.83% 2	
	88	2-	-82.608	17.773 m 11	$\beta-$
	89	3/2-	-81.712	15.15 m 12	$\beta-$
	90	0-	-79.364	158 s 5	$\beta-$
	90m	3-	-79.257	258 s 4	$\beta- 97.4\%, \text{ IT } 2.6\%$
	91	3/2(-)	-77.746	58.4 s 4	$\beta-$
	92	0-	-74.772	4.492 s 20	$\beta-, \beta-n 0.01\%$
	93	5/2-	-72.620	5.84 s 2	$\beta-, \beta-n 1.39\%$
94	3(-)	-68.561	2.702 s 5	$\beta-, \beta-n 10.5\%$	
95	5/2-	-65.89	377.7 ms 8	$\beta-, \beta-n 8.7\%$	
96	2(-)	-61.354	203 ms 3	$\beta-, \beta-n 13.3\%$	
97	3/2+	-58.518	169.1 ms 6	$\beta-, \beta-n 25.5\%$	
98	(0,1)	-54.03	102 ms 4	$\beta-, \beta-n 13.8\%, \beta-2n 0.05\%$	
98m	(3,4)	-53.76	96 ms 3	$\beta-$	
99	(5/2+)	-51.2	54 ms 4	$\beta-, \beta-n 15.8\%$	
100	(3+,4-)	-46.5s	51 ms 8	$\beta-, \beta-n 6\%, \beta-2n 0.16\%$	
101	(3/2+)	-43.0s	32 ms 5	$\beta-, \beta-n 28\%$	
102		-37.9s	37 ms 3	$\beta-, \beta-n 18\%$	
103			>633 ns	$\beta-, \beta-n$	
38 Sr	73		-32.0s	>25 ms	$\epsilon, \epsilon p > 0\%$
	74	0+	-40.8s	>1.2 μ s	ϵ
	75	(3/2-)	-46.6	88 ms 3	$\epsilon, \epsilon p 5.2\%$
	76	0+	-54.25	7.89 s 7	$\epsilon, \epsilon p 3.4 \times 10^{-5}\%$
	77	5/2+	-57.803	9.0 s 2	$\epsilon, \epsilon p < 0.25\%$
	78	0+	-63.173	160 s 8	ϵ
	79	3/2(-)	-65.476	2.25 m 10	ϵ
	80	0+	-70.311	106.3 m 15	ϵ
	81	1/2-	-71.528	22.3 m 4	ϵ
	82	0+	-76.009	25.34 d 2	ϵ
	83	7/2+	-76.797	32.41 h 3	ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
38	Sr	83m	1/2-	-76.538	4.95 s 12	IT
		84	0+	-80.649	0.56% I	
		85	9/2+	-81.103	64.850 d 7	ϵ
		85m	1/2-	-80.864	67.63 m 4	IT 86.6%, ϵ 13.4%
		86	0+	-84.523	9.86% I	
		87	9/2+	-84.880	7.00% I	
		87m	1/2-	-84.492	2.815 h 12	IT 99.7%, ϵ 0.3%
		88	0+	-87.921	82.58% I	
		89	5/2+	-86.208	50.53 d 7	β^-
		90	0+	-85.949	28.90 y 3	β^-
		91	5/2+	-83.652	9.63 h 5	β^-
		92	0+	-82.867	2.66 h 4	β^-
		93	5/2+	-80.086	7.43 m 3	β^-
		94	0+	-78.843	75.3 s 2	β^-
		95	1/2+	-75.123	23.90 s 14	β^-
		96	0+	-72.932	1.07 s 1	β^-
		97	1/2+	-68.591	429 ms 5	β^- , $\beta^-n \leq 0.05\%$
		98	0+	-66.436	0.653 s 2	β^- , $\beta^-n 0.25\%$
		99	3/2+	-62.529	0.269 s 1	β^- , $\beta^-n 0.1\%$
		100	0+	-59.833	202 ms 3	β^- , $\beta^-n 0.78\%$
		101	(5/2-)	-55.56	118 ms 3	β^- , $\beta^-n 2.37\%$
102	0+	-52.4s	69 ms 6	β^- , $\beta^-n 5.5\%$		
103		-47.5s	68 ms +48-20	β^-		
104	0+	-43.9s	43 ms +9-7	β^-		
105		-38.6s	40 ms +36-13	β^-		
106	0+		>392 ns	β^- , β^-n , β^-2n		
107			>395 ns	β^- , β^-n , β^-2n		
39	Y	76		-38.6s	>200 ns	ϵ , p
		77	(5/2+)	-46.78s	57 ms +22-12	ϵ , ϵp , p
		78	(0+)	-52.5s	53 ms 8	ϵ , ϵp
		78m	(5+)	-52.5s	5.8 s 6	ϵ , ϵp
		79	(5/2+)	-58.4	14.8 s 6	ϵ , ϵp
		80	(4-)	-61.148	30.1 s 5	ϵ , ϵp
		80m	(1-)	-60.919	4.8 s 3	IT 81%, ϵ 19%
		81	(5/2+)	-65.713	70.4 s 10	ϵ
		82	1+	-68.064	8.30 s 20	ϵ
		83	9/2+	-72.21	7.08 m 6	ϵ
		83m	3/2-	-72.14	2.85 m 2	ϵ 60%, IT 40%
		84	(6+)	-73.894	39.5 m 8	ϵ
		84m	1+	-73.827	4.6 s 2	ϵ
		85	(1/2)-	-77.84	2.68 h 5	ϵ
		85m	9/2+	-77.82	4.86 h 20	ϵ , IT < 2.0 × 10 ⁻³ %
		86	4-	-79.28	14.74 h 2	ϵ
		86m	(8+)	-79.06	48 m 1	IT 99.31%, ϵ 0.69%
		87	1/2-	-83.018	79.8 h 3	ϵ
		87m	9/2+	-82.637	13.37 h 3	IT 98.43%, ϵ 1.57%
		88	4-	-84.298	106.626 d 21	ϵ
89	1/2-	-87.709	100%			
89m	9/2+	-86.800	15.663 s 5	IT		
90	2-	-86.495	64.053 h 20	β^-		
90m	7+	-85.813	3.19 h 6	IT, $\beta^- 1.8 \times 10^{-3}\%$		
91	1/2-	-86.352	58.51 d 6	β^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
39	Y	91m	9/2+	-85.796	49.71 m 4	IT, $\beta^- < 1.5\%$
		92	2-	-84.817	3.54 h 1	β^-
		93	1/2-	-84.23	10.18 h 8	β^-
		93m	(9/2)+	-83.47	0.82 s 4	IT
		94	2-	-82.352	18.7 m 1	β^-
		95	1/2-	-81.213	10.3 m 1	β^-
		96	0-	-78.344	5.34 s 5	β^-
		96m	8+	-77.204	9.6 s 2	β^-
		97	(1/2-)	-76.130	3.75 s 3	β^- , $\beta^- n$ 0.06%
		97m	(9/2)+	-75.463	1.17 s 3	$\beta^- > 99.3\%$, IT < 0.7%, $\beta^- n < 0.08\%$
		97m	(27/2-)	-72.607	142 ms 8	IT 98.4%, β^- 1.6%
		98	(0)-	-72.303	0.548 s 2	β^- , $\beta^- n$ 0.33%
		98m	(4,5)	-71.893	2.0 s 2	$\beta^- > 80\%$, IT < 20%, $\beta^- n$ 3.4%
		99	(5/2+)	-70.658	1.484 s 7	β^- , $\beta^- n$ 1.7%
		100	1-, 2-	-67.34	735 ms 7	β^- , $\beta^- n$ 0.92%
		100m	(3,4,5)	-67.19	0.94 s 3	β^-
		101	(5/2+)	-65.070	0.45 s 2	β^- , $\beta^- n$ 1.94%
		102m	HighJ	-61.2s	0.36 s 4	β^- , $\beta^- n$ 4.9%
		102m	LowJ	-61.2s	0.298 s 9	β^- , $\beta^- n$ 4.9%
		103	(5/2+)	-58.50	0.23 s 2	β^- , $\beta^- n$ 8%
104		-54.1s	197 ms 4	β^- , $\beta^- n$		
105		-50.8s	85 ms +5-4	β^- , $\beta^- n < 82\%$		
106		-46.1s	62 ms +25-14	β^-		
107	(5/2+)	-42.4s	41 ms +15-9	β^-		
108		-37.3s	25 ms +66-10	β^- , $\beta^- n$		
109			>393 ns	β^- , $\beta^- n$, $\beta^- 2n$		
40	Zr	78	0+	-41.3s	>170 ns	ϵ
		79		-47.1s	56 ms 30	ϵ , ϵp
		80	0+	-56	4.6 s 6	ϵ , ϵp
		81	(3/2-)	-58.4	5.5 s 4	ϵ , ϵp 0.12%
		82	0+	-63.9s	32 s 5	ϵ
		83	(1/2-)	-65.911	41.6 s 24	ϵ , ϵp
		84	0+	-71.421	25.8 m 5	ϵ
		85	(7/2+)	-73.175	7.86 m 4	ϵ
		85m	(1/2-)	-72.883	10.9 s 3	IT $\leq 92\%$, $\epsilon > 8\%$
		86	0+	-77.969	16.5 h 1	ϵ
		87	(9/2)+	-79.347	1.68 h 1	ϵ
		87m	(1/2-)	-79.011	14.0 s 2	IT
		88	0+	-83.629	83.4 d 3	ϵ
		89	9/2+	-84.876	78.41 h 12	ϵ
		89m	1/2-	-84.288	4.161 m 17	IT 93.77%, ϵ 6.23%
		90	0+	-88.774	51.45% 40	
		90m	5-	-86.455	809.2 ms 20	IT
		91	5/2+	-87.897	11.22% 5	
92	0+	-88.460	17.15% 8			
93	5/2+	-87.123	1.61×10^6 y 5	β^-		
94	0+	-87.272	17.38% 28			
95	5/2+	-85.663	64.032 d 6	β^-		
96	0+	-85.447	2.35×10^{19} y 21	2 β^-		
			2.80% 9			

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
40	Zr	97	1/2+	-82.951	16.749 h 8	β^-
		98	0+	-81.295	30.7 s 4	β^-
		99	(1/2+)	-77.63	2.1 s 1	β^-
		100	0+	-76.384	7.1 s 4	β^-
		101	(3/2+)	-73.173	2.3 s 1	β^-
		102	0+	-71.595	2.9 s 2	β^-
		103	(5/2-)	-67.824	1.32 s 11	β^- , $\beta^-n \leq 1\%$
		104	0+	-65.733	0.87 s 6	β^- , $\beta^-n \leq 1\%$
		105		-61.47	0.66 s 7	β^- , $\beta^-n \leq 2\%$
		106	0+	-59.0s	191 ms 19	β^- , $\beta^-n \leq 7\%$
		107		-54.3s	138 ms 4	β^- , $\beta^-n \leq 23\%$
		108	0+	-51.4s	73 ms 4	β^- , β^-n
		109		-46.2s	63 ms +38-17	β^- , β^-n
		110	0+	-42.9s	37 ms +17-9	β^-
111			>392 ns	β^- , β^-n , β^-2n		
112	0+		>394 ns	β^- , β^-n , β^-2n		
41	Nb	81		-47.2s	<200 ns	ϵ
		82	(0+)	-52.2s	50 ms 5	ϵ , ϵp
		83	(5/2+)	-58.4	3.8 s 2	ϵ
		84	(1+,2+,3+)	-61.0s	9.8 s 9	ϵ , ϵp
		85	(9/2+)	-66.279	20.5 s 12	ϵ
		85m		-66.279	12 s 5	ϵ , IT
		85m	(1/2-,3/2-)	-66.279	3.3 s 9	ϵ , IT
		86	(6+)	-69.134	88 s 1	ϵ
		87	(1/2-)	-73.874	3.75 m 9	ϵ
		87m	(9/2+)	-73.870	2.6 m 1	ϵ
		88	(8+)	-76.18	14.55 m 6	ϵ
		88m	(4-)	-76.18	7.78 m 5	ϵ
		89	(9/2+)	-80.65	2.03 h 7	ϵ
		89m	(1/2)-	-80.61	66 m 2	ϵ
		90	8+	-82.663	14.60 h 5	ϵ
		90m	4-	-82.538	18.81 s 6	IT
		91	9/2+	-86.639	6.8×10^2 y 13	ϵ
		91m	1/2-	-86.534	60.86 d 22	IT 96.6%, ϵ 3.4%
		92	(7)+	-86.454	3.47×10^7 y 24	ϵ , $\beta^- < 0.05\%$
		92m	(2)+	-86.318	10.15 d 2	ϵ
		93	9/2+	-87.214	100%	
93m	1/2-	-87.183	16.12 y 12	IT		
94	6+	-86.370	2.03×10^4 y 16	β^-		
94m	3+	-86.329	6.263 m 4	IT 99.5%, β^- 0.5%		
95	9/2+	-86.786	34.991 d 6	β^-		
95m	1/2-	-86.550	3.61 d 3	IT 94.4%, β^- 5.6%		
96	6+	-85.608	23.35 h 5	β^-		
97	9/2+	-85.610	72.1 m 7	β^-		
97m	1/2-	-84.867	58.7 s 18	IT		
98	1+	-83.533	2.86 s 6	β^-		
98m	(5+)	-83.449	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	2.5 m 2	$\beta^- > 96.2\%$, IT < 3.8%		
100	1+	-79.806	1.5 s 2	β^-		
100m	(5+)	-79.492	2.99 s 11	β^-		
101	(5/2+)	-78.886	7.1 s 3	β^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
41 Nb	102	(4+)	-76.313	4.3 s 4	β^-
	102m	1+	-76.313	1.3 s 2	β^-
	103	(5/2+)	-75.023	1.5 s 2	β^-
	104	(1+)	-71.828	4.9 s 3	β^- , β^-n 0.06%
	104m		-71.613	0.94 s 4	β^- , β^-n 0.05%
	105	(5/2+)	-69.910	2.95 s 6	β^- , β^-n 1.7%
	106		-66.197	0.93 s 4	β^- , β^-n 4.5%
	107		-63.718	300 ms 9	β^- , β^-n 8%
	108	(2+)	-59.6	220 ms 18	β^- , β^-n 8%
	109	(5/2)	-56.8s	106 ms 9	β^- , β^-n <15%
	110		-52.3s	86 ms 6	β^- , β^-n 40%
	111	(5/2+)	-49.0s	51 ms +6-5	β^-
	112	(2+)	-44.4s	33 ms +9-6	β^-
	113		-40.6s	>300 ns	β^-
	114			>392 ns	β^- , β^-n , β^-2n
115			>394 ns	β^- , β^-n , β^-2n	
42 Mo	83		-46.7s	6 ms +30-3	ϵ
	84	0+	-54.5s	2.3 s 3	ϵ , ϵp
	85	(1/2-)	-57.51	3.2 s 2	ϵ , ϵp = 0.14%
	86	0+	-64.110	19.1 s 3	ϵ
	87	7/2+	-66.882	14.02 s 26	ϵ , ϵp 15%
	88	0+	-72.686	8.0 m 2	ϵ
	89	(9/2+)	-75.014	2.11 m 10	ϵ
	89m	(1/2-)	-74.627	190 ms 15	IT
	90	0+	-80.174	5.56 h 9	ϵ
	91	9/2+	-82.21	15.49 m 1	ϵ
	91m	1/2-	-81.56	64.6 s 6	ϵ 50%, IT 50%
	92	0+	-86.809	14.53% 30	
	93	5/2+	-86.807	4.0×10^3 y 8	ϵ
	93m	21/2+	-84.382	6.85 h 7	IT 99.88%, ϵ 0.12%
	94	0+	-88.414	9.15% 9	
	95	5/2+	-87.711	15.84% 11	
	96	0+	-88.794	16.67% 15	
	97	5/2+	-87.544	9.60% 14	
	98	0+	-88.116	24.39% 37	
	99	1/2+	-85.970	65.976 h 24	β^-
	100	0+	-86.187	7.3×10^{18} y 4	2 β^-
				9.82% 31	
	101	1/2+	-83.514	14.61 m 3	β^-
	102	0+	-83.572	11.3 m 2	β^-
	103	(3/2+)	-80.970	67.5 s 15	β^-
	104	0+	-80.359	60 s 2	β^-
	105	(5/2-)	-77.346	35.6 s 16	β^-
	106	0+	-76.144	8.73 s 12	β^-
	107	(5/2+)	-72.561	3.5 s 5	β^-
	108	0+	-70.765	1.09 s 2	β^- , β^-n <0.5%
109	(7/2-)	-66.68	660 ms 45	β^- , β^-n 1.3%	
110	0+	-64.55	0.27 s 1	β^- , β^-n 2%	
111		-60.1s	220 ms +41-36	β^- , β^-n \leq 12%	
112	0+	-57.6s	120 ms +13-11	β^-	
113		-52.9s	78 ms +6-5	β^-	
114	0+	-50.0s	60 ms +13-9	β^-	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
42	Mo	115	-44.7s	51 ms +79-19	β^- , β^-n	
		116	0+	>391 ns	β^- , β^-n	
		117		>393 ns	$\beta^-?$, $\beta^-n?$, $\beta^-2n?$	
43	Tc	85	-46.0s	≈ 0.5 s	p?	
		86	(0+)	-51.3s	54 ms 7	ϵ , ϵp
		87	(9/2+)	-57.690	2.2 s 2	ϵ
		88m	(3+)	-61.679	5.8 s 2	ϵ
		88m	(6+)	-61.679	6.4 s 8	ϵ
		89	(9/2+)	-67.394	12.8 s 9	ϵ
		89m	(1/2-)	-67.331	12.9 s 8	ϵ , IT<0.01%
		90m	1+	-70.723	8.7 s 2	ϵ
		90m	(6+)	-70.223	49.2 s 4	ϵ
		91	(9/2+)	-75.987	3.14 m 2	ϵ
		91m	(1/2-)	-75.848	3.3 m 1	ϵ , IT<1%
		92	(8+)	-78.924	4.25 m 15	ϵ
		93	9/2+	-83.606	2.75 h 5	ϵ
		93m	1/2-	-83.214	43.5 m 10	IT 77.4%, ϵ 22.6%
		94	7+	-84.158	293 m 1	ϵ
		94m	(2+)	-84.082	52.0 m 10	ϵ , IT<0.1%
		95	9/2+	-86.021	20.0 h 1	ϵ
		95m	1/2-	-85.982	61 d 2	ϵ 96.12%, IT 3.88%
		96	7+	-85.821	4.28 d 7	ϵ
		96m	4+	-85.787	51.5 m 10	IT 98%, ϵ 2%
		97	9/2+	-87.224	4.21×10^6 y 16	ϵ
		97m	1/2-	-87.127	91.0 d 6	IT 96.06%, ϵ 3.94%
		98	(6+)	-86.431	4.2×10^6 y 3	β^-
		99	9/2+	-87.327	2.111×10^5 y 12	β^-
		99m	1/2-	-87.184	6.0067 h 5	IT, β^- $3.7 \times 10^{-3}\%$
		100	1+	-86.020	15.46 s 19	β^- , ϵ $2.6 \times 10^{-3}\%$
		101	9/2+	-86.34	14.02 m 1	β^-
		102	1+	-84.569	5.28 s 15	β^-
		102m	(4,5)	-84.569	4.35 m 7	β^- 98%, IT 2%
		103	5/2+	-84.600	54.2 s 8	β^-
		104	(3+)	-82.51	18.3 m 3	β^-
		105	(3/2-)	-82.29	7.6 m 1	β^-
106	(2+)	-79.77	35.6 s 6	β^-		
107	(3/2-)	-78.746	21.2 s 2	β^-		
108	(2+)	-75.919	5.17 s 7	β^-		
109	(5/2+)	-74.279	0.86 s 4	β^- , β^-n 0.08%		
110	(2+)	-71.030	0.92 s 3	β^- , β^-n 0.04%		
111	(5/2+)	-69.02	350 ms 21	β^- , β^-n 0.85%		
112		-65.253	0.29 s 2	β^- , β^-n 4%		
113	>5/2	-62.88	160 ms +50-40	β^- , β^-n 2.1%		
114m	>3	-58.9s	100 ms 20	β^- , $\beta^-n?$		
114m	(1+)	-58.9s	90 ms 20	β^- , $\beta^-n?$		
115		-56.1s	83 ms +20-13	β^- , β^-n		
116		-51.5s	56 ms +15-10	β^-		
117	(5/2+)	-48.4s	85 ms +95-30	β^-		
118		-43.8s		β^-		
119			>392 ns	β^- , $\beta^-n?$, $\beta^-2n?$		
120			>394 ns	β^- , $\beta^-n?$, $\beta^-2n?$		
44	Ru	87	-45.9s	>1.5 μ s	$\epsilon?$	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
44	Ru	88	0+	-54.4s	1.2 s +3-2	ϵ
		89	(9/2+)	-58.1s	1.5 s 2	$\epsilon, \epsilon_p < 0.15\%$
		90	0+	-64.883	11.7 s 9	ϵ
		91	(9/2+)	-68.238	7.9 s 4	ϵ
		91m	(1/2-)	-68.238	7.6 s 8	IT, $\epsilon > 0\%, \epsilon_p > 0\%$
		92	0+	-74.301	3.65 m 5	ϵ
		93	(9/2+)	-77.213	59.7 s 6	ϵ
		93m	(1/2-)	-76.479	10.8 s 3	ϵ 78%, IT 22%, ϵ_p 0.03%
		94	0+	-82.579	51.8 m 6	ϵ
		95	5/2+	-83.457	1.643 h 13	ϵ
		96	0+	-86.080	5.54% 14	
		97	5/2+	-86.120	2.83 d 23	ϵ
		98	0+	-88.224	1.87% 3	
		99	5/2+	-87.620	12.76% 14	
		100	0+	-89.222	12.60% 7	
		101	5/2+	-87.952	17.06% 2	
		102	0+	-89.101	31.55% 14	
		103	3/2+	-87.262	39.247 d 13	β^-
		104	0+	-88.092	18.62% 27	
		105	3/2+	-85.931	4.44 h 2	β^-
		106	0+	-86.320	371.8 d 18	β^-
		107	(5/2+)	-83.859	3.75 m 5	β^-
		108	0+	-83.657	4.55 m 5	β^-
		109	(5/2+)	-80.734	34.5 s 10	β^-
		110	0+	-80.069	11.6 s 6	β^-
		111	5/2+	-76.781	2.12 s 7	β^-
		112	0+	-75.627	1.75 s 7	β^-
		113	(1/2+)	-71.87	0.80 s 5	β^-
		113m	(7/2-)	-71.87	510 ms 30	β^-
		114	0+	-70.21	0.52 s 5	β^-
		115	(3/2+)	-66.19	318 ms 19	β^-
		115m		-66.19	740 ms 80	β^-, β^-n
115m		-66.19	270 ms 38	β^-, β^-n		
115m		-66.19	76 ms 6	β^-, β^-n		
116	0+	-64.2s	204 ms +32-29	β^-		
117		-59.6s	142 ms +18-17	β^-		
118	0+	-57.3s	123 ms +48-35	β^-, β^-n		
119		-52.6s	>300 ns	β^-		
120	0+	-50.0s	>150 ns	β^-		
121			>390 ns	β^-, β^-n		
122	0+		>392 ns	β^-, β^-n		
123			>394 ns	$\beta^-, \beta^-n, \beta^-2n$		
124	0+		>396 ns	β^-, β^-n		
45	Rh	89		-46.0s	>1.5 μ s	$\epsilon?, p?$
		90		-52.0s	12 ms +9-4	$\epsilon?$
		90m		-52.0s	1.0 s +3-2	$\epsilon?$
		91	(9/2+)	-58.8s	1.47 s 22	ϵ
		91m	(1/2-)	-58.8s	1.46 s 11	ϵ
		92?	(6+)	-62.999	4.66 s 25	ϵ
		92m	(2+)	-62.999	0.53 s 37	ϵ
		93	(9/2+)	-69.017	12.2 s 7	ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode		
Z	El	A	(MeV)	Abundance			
45	Rh	94	(4+)	-72.907	66 s 6	ϵ , ϵ p 1.8%	
		94m	(8+)	-72.607	25.8 s 2	ϵ	
		95	9/2+	-78.342	5.02 m 10	ϵ	
		95m	(1/2)-	-77.799	1.96 m 4	IT 88%, ϵ 12%	
		96	$\geq 6+$	-79.69	9.90 m 10	ϵ	
		96m	3+	-79.64	1.51 m 2	IT 60%, ϵ 40%	
		97	9/2+	-82.60	30.7 m 6	ϵ	
		97m	1/2-	-82.34	46.2 m 16	ϵ 94.4%, IT 5.6%	
		98	(2)+	-83.18	8.72 m 12	ϵ	
		98m	(5+)	-83.18	3.6 m 2	IT 89%, ϵ 11%	
		99	1/2-	-85.576	16.1 d 2	ϵ	
		99m	9/2+	-85.511	4.7 h 1	ϵ >99.84%, IT <0.16%	
			100	1-	-85.59	20.8 h 1	ϵ
			100m	(5+)	-85.48	4.6 m 2	IT=98.3%, ϵ = 1.7%
			101	1/2-	-87.411	3.3 y 3	ϵ
			101m	9/2+	-87.254	4.34 d 1	ϵ 92.8%, IT 7.2%
			102	(1-,2-)	-86.778	207.3 d 17	ϵ 78%, β - 22%
			102m	6(+)	-86.637	3.742 y 10	ϵ 99.77%, IT 0.23%
			103	1/2-	-88.025	100%	
			103m	7/2+	-87.985	56.114 m 9	IT
			104	1+	-86.953	42.3 s 4	β - 99.55%, ϵ 0.45%
			104m	5+	-86.824	4.34 m 3	IT 99.87%, β - 0.13%
			105	7/2+	-87.848	35.36 h 6	β -
			105m	1/2-	-87.718	42.9 s 3	IT
			106	1+	-86.360	30.07 s 35	β -
			106m	(6)+	-86.223	131 m 2	β -
			107	7/2+	-86.86	21.7 m 4	β -
			108	1+	-85.03	16.8 s 5	β -
			108m	(5+)	-85.03	6.0 m 3	β -, IT
			109	7/2+	-85.010	80 s 2	β -
			110m	(≥ 4)	-82.84	28.5 s 15	β -
			110m	1+	-82.84	3.2 s 2	β -
		111	(7/2+)	-82.304	11 s 1	β -	
		112m	1+	-79.73	3.45 s 37	β -	
		112m	(4,5,6)	-79.73	6.73 s 15	β -	
		113	(7/2+)	-78.767	2.80 s 12	β -	
		114	1+	-75.71	1.85 s 5	β -	
		114m	(7-)	-75.51	1.86 s 6	β -	
		115	(7/2+)	-74.229	0.99 s 5	β -	
		116	1+	-70.74	0.68 s 6	β -	
		116m	(6-)	-70.59	0.57 s 5	β -	
		117	(7/2+)	-68.897	0.44 s 4	β -	
		118		-64.89	266 ms +22-21	β -, β -n 3.1%	
		119	(7/2+)	-62.8s	171 ms 18	β -, β -n 6.4%	
		120		-58.8s	136 ms +14-13	β -, β -n <5.4%	
		121		-56.4s	151 ms +67-58	β -, β -n	
		122		-52.4s	>300 ns	β -, β -n	
		123			>403 ns	β -, β -n	
		124			>391 ns	β -, β -n, β -2n	
		125			>393 ns	β -, β -n	
		126			>395 ns	β -, β -2n, β -n	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
46 Pd	91		-46.3s	>1 μ s	ϵ ?
	92	0+	-55.1s	0.7 s +4-2	ϵ
	93	(9/2+)	-59.1s	1.00 s 9	$\epsilon, \epsilon p$
	94	0+	-66.102	9.6 s 2	ϵ
	95	(9/2+)	-69.966	5 s 3	ϵ
	95m	(21/2+)	-68.091	13.3 s 3	ϵ 89%, IT 11%, ϵp 0.93%
	96	0+	-76.183	122 s 2	ϵ
	97	(5/2+)	-77.805	3.10 m 9	ϵ
	98	0+	-81.320	17.7 m 3	ϵ
	99	(5/2+)	-82.184	21.4 m 2	ϵ
	100	0+	-85.23	3.63 d 9	ϵ
	101	5/2+	-85.431	8.47 h 6	ϵ
	102	0+	-87.928	1.02% 1	
	103	5/2+	-87.482	16.991 d 19	ϵ
	104	0+	-89.393	11.14% 8	
	105	5/2+	-88.416	22.33% 8	
	106	0+	-89.905	27.33% 3	
	107	5/2+	-88.370	6.5 \times 10 ⁶ y 3	β^-
	107m	11/2-	-88.155	21.3 s 5	IT
	108	0+	-89.521	26.46% 9	
	109	5/2+	-87.603	13.7012 h 24	β^-
	109m	11/2-	-87.414	4.696 m 3	IT
	110	0+	-88.348	11.72% 9	
	111	5/2+	-86.003	23.4 m 2	β^-
	111m	11/2-	-85.831	5.5 h 1	IT 73%, β^- 27%
	112	0+	-86.323	21.03 h 5	β^-
	113	(5/2+)	-83.590	93 s 5	β^-
	113m	(9/2-)	-83.509	0.3 s 1	IT
	114	0+	-83.490	2.42 m 6	β^-
	115	(5/2+)	-80.43	25 s 2	β^-
	115m	(11/2-)	-80.34	50 s 3	β^- 92%, IT 8%
	116	0+	-79.831	11.8 s 4	β^-
117	(5/2+)	-76.424	4.3 s 3	β^-	
118	0+	-75.391	1.9 s 1	β^-	
119		-71.407	0.92 s 1	β^-	
120	0+	-70.309	0.5 s 1	β^-	
121	(3/2+)	-66.3s	285 ms 24	β^- , $\beta^- n \leq 0.8\%$	
122	0+	-64.7s	175 ms 16	$\beta^- \geq 97.5\%$, $\beta^- n \leq 2.5\%$	
123		-60.6s	174 ms +38-34	β^-	
124	0+	-58.8s	38 ms +38-19	β^-	
125			>230 ns	β^- , $\beta^- n$	
126	0+		>230 ns	β^- , $\beta^- n$	
128	0+		>394 ns	β^- , $\beta^- n$	
47 Ag	93		-46.3s		p, ϵ , ϵp
	94	(0+)	-52.4s	26 ms +26-9	ϵ , ϵp
	94m	(7+)	-52.4s	0.60 s 2	ϵ , ϵp 20%
	94m	(21+)	-45.7s	0.40 s 4	ϵ 95.4%, ϵp 27%, p 4.1%, 2p 0.5%
	95	(9/2+)	-59.6s	1.75 s 12	ϵ , ϵp
	95m	(1/2-)	-59.3s	<500 ms	IT

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
47	Ag	96m	(8)+	-64.62	4.40 s 6	ϵ , ϵ p 8.5%
		96m	(2+)	-64.62	6.9 s 6	ϵ , ϵ p 18%
		97	(9/2+)	-70.8	25.5 s 3	ϵ
		98	(6+)	-73.05	47.5 s 3	ϵ , ϵ p $1.1 \times 10^{-3}\%$
		99	(9/2+)	-76.712	124 s 3	ϵ
		99m	(1/2-)	-76.206	10.5 s 5	IT
		100	(5+)	-78.137	2.01 m 9	ϵ
		100m	(2+)	-78.121	2.24 m 13	ϵ , IT
		101	9/2+	-81.334	11.1 m 3	ϵ
		101m	(1/2-)	-81.060	3.10 s 10	IT
		102	5(+)	-82.246	12.9 m 3	ϵ
		102m	2+	-82.237	7.7 m 5	ϵ 51%, IT 49%
		103	7/2+	-84.800	65.7 m 7	ϵ
		103m	1/2-	-84.665	5.7 s 3	IT
		104	5+	-85.114	69.2 m 10	ϵ
		104m	2+	-85.107	33.5 m 20	ϵ 99.93%, IT < 0.07%
		105	1/2-	-87.070	41.29 d 7	ϵ
		105m	7/2+	-87.045	7.23 m 16	IT 99.66%, ϵ 0.34%
		106	1+	-86.940	23.96 m 4	ϵ 99.5%, β - < 1%
		106m	6+	-86.850	8.28 d 2	ϵ
		107	1/2-	-88.405	51.839% 8	
		107m	7/2+	-88.312	44.3 s 2	IT
		108	1+	-87.605	2.382 m 11	β - 97.15%, ϵ 2.85%
		108m	6+	-87.495	438 y 9	ϵ 91.3%, IT 8.7%
		109	1/2-	-88.719	48.161% 8	
		109m	7/2+	-88.631	39.6 s 2	IT
		110	1+	-87.457	24.6 s 2	β - 99.7%, ϵ 0.3%
		110m	6+	-87.339	249.76 d 4	β - 98.64%, IT 1.36%
		111	1/2-	-88.217	7.45 d 1	β -
		111m	7/2+	-88.157	64.8 s 8	IT 99.3%, β - 0.7%
		112	2(-)	-86.583	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+	-84.930	4.6 s 1	β -		
115	1/2-	-84.98	20.0 m 5	β -		
115m	7/2+	-84.94	18.0 s 7	β - 79%, IT 21%		
116	(0-)	-82.542	237 s 5	β -		
116m	(3+)	-82.494	20 s 1	β - 93%, IT 7%		
116m	(6-)	-82.412	9.3 s 3	β - 92%, IT 8%		
117	(1/2-)	-82.18	72.8 s +20-7	β -		
117m	(7/2+)	-82.15	5.34 s 5	β - 94%, IT 6%		
118	1(-)	-79.553	3.76 s 15	β -		
118m	4(+)	-79.425	2.0 s 2	β - 59%, IT 41%		
119m	(1/2-)	-78.64	6.0 s 5	β -		
119m	(7/2+)	-78.64	2.1 s 1	β -		
120	3(+)	-75.651	1.23 s 4	β -, β -n < $3.0 \times 10^{-3}\%$		
120m	6(-)	-75.448	0.40 s 3	β - = 63%, IT = 37%		
121	(7/2+)	-74.40	0.78 s 2	β -, β -n 0.08%		
122	(3+)	-71.11	0.529 s 13	β - 99.8%, β -n 0.2%		
122m	(1-)	-71.11	0.55 s 5	β -, IT, β -n		
122m	(9-)	-71.03	0.20 s 5	β -, β -n		
123	(7/2+)	-69.55	0.300 s 5	β -, β -n 0.55%		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode			
Z	El	A	(MeV)	Abundance				
47	Ag	124	≥ 2	-66.2	0.172 s 5	β^- , β^-n 1.3%		
		125	(9/2+)	-64.4s	166 ms 7	β^- , β^-n		
		126		-60.9s	107 ms 12	β^- , β^-n		
		127		-58.8s	109 ms 25	β^-		
		128		-54.9s	58 ms 5	β^- , β^-n		
		129	(9/2+)	-52.6s	46 ms +5-9	β^- , β^-n		
		129m	(1/2-)	-52.6s	\approx 160 ms	β^- , β^-n		
		130		-46.3s	\approx 50 ms	β^- , β^-n		
		48	Cd	95		-46.6s		$\epsilon p?$, $\epsilon?$
				96	0+	-55.6s	1.03 s +24-21	ϵ
97	(9/2+)			-60.5s	1.10 s 7	ϵ , ϵp 12%		
97m	(25/2+)			-60.5s	3.70 s 8	ϵ , ϵp 25%		
98	0+			-67.62	9.2 s 3	ϵ , $\epsilon p < 0.03\%$		
99	(5/2+)			-69.931	16 s 3	ϵ , $\epsilon \alpha < 1.0 \times 10^{-4}\%$, ϵp 0.17%		
100	0+			-74.194	49.1 s 5	ϵ		
101	(5/2+)			-75.836	1.36 m 5	ϵ		
102	0+			-79.659	5.5 m 5	ϵ		
103	(5/2+)			-80.652	7.3 m 1	ϵ		
104	0+			-83.968	57.7 m 10	ϵ		
105	5/2+			-84.333	55.5 m 4	ϵ		
106	0+			-87.130	$> 3.6 \times 10^{20}$ y	2 ϵ		
					1.25% 6			
107	5/2+			-86.990	6.50 h 2	ϵ		
108	0+			-89.252	$> 1.9 \times 10^{18}$ y	2 ϵ		
					0.89% 3			
109	5/2+			-88.504	461.4 d 12	ϵ		
110	0+			-90.350	12.49% 18			
111	1/2+			-89.254	12.80% 12			
111m	11/2-			-88.858	48.50 m 9	IT		
112	0+			-90.577	24.13% 21			
113	1/2+			-89.046	8.00×10^{15} y 26	β^-		
					12.22% 12			
113m	11/2-			-88.783	14.1 y 5	β^- 99.86%, IT 0.14%		
114	0+			-90.018	$> 2.1 \times 10^{18}$ y	2 β^-		
					28.73% 42			
115	1/2+			-88.087	53.46 h 5	β^-		
115m	(11/2)-			-87.906	44.56 d 24	β^-		
116	0+			-88.716	3.3×10^{19} y 4	2 β^-		
			7.49% 18					
117	1/2+	-86.422	2.49 h 4	β^-				
117m	(11/2)-	-86.286	3.36 h 5	β^-				
118	0+	-86.71	50.3 m 2	β^-				
119	3/2+	-83.98	2.69 m 2	β^-				
119m	(11/2-)	-83.83	2.20 m 2	β^-				
120	0+	-83.957	50.80 s 21	β^-				
121	(3/2+)	-81.06	13.5 s 3	β^-				
121m	(11/2-)	-80.84	8.3 s 8	β^-				
122	0+	-80.616	5.24 s 3	β^-				
123	(3/2+)	-77.32	2.10 s 2	β^-				
123m	(11/2-)	-77.00	1.82 s 3	$\beta^- \leq 100\%$, IT				
124	0+	-76.697	1.25 s 2	β^-				

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	(MeV)	Abundance	Decay Mode			
48	Cd	125	(3/2+)	-73.35	0.68 s 4	β^-		
		125m	(11/2-)	-73.35	0.48 s 3	β^-		
		126	0+	-72.256	0.515 s 17	β^-		
		127	(3/2+)	-68.43	0.37 s 7	β^-		
		128	0+	-67.25	0.28 s 4	β^-		
		129	(3/2+)	-63.3s	0.27 s 4			
		130	0+	-61.5	162 ms 7	β^- , β^-n 3.5%		
		131	(7/2-)	-55.4s	68 ms 3	β^- , β^-n 3.5%		
		132	0+	-50.9s	97 ms 10	β^- , β^-n 60%		
		133	(7/2-)		57 ms 10	β^- , β^-n , β^-2n		
		49	In	97		-47.2s		$\epsilon?$, p?
				98		-53.9s	32 ms +32-11	ϵ
				98m		-53.9s	1.2 s +12-4	ϵ
99				-61.4s	3.0 s 8	ϵ		
100	(6+,7+)			-64.3	5.9 s 2	ϵ , ϵp 1.6%		
101	(9/2+)			-68.6s	15.1 s 3	ϵ , ϵp		
102	(6+)			-70.694	23.3 s 1	ϵ , ϵp $9.3 \times 10^{-3}\%$		
103	(9/2)+			-74.629	65 s 7	ϵ		
103m	(1/2-)			-73.997	34 s 2	ϵ 67%, IT 33%		
104	(6+)			-76.182	1.80 m 3	ϵ		
104m	(3+)			-76.089	15.7 s 5	IT 80%, ϵ 20%		
105	9/2+			-79.64	5.07 m 7	ϵ		
105m	(1/2-)			-78.97	48 s 6	IT		
106	7+			-80.60	6.2 m 1	ϵ		
106m	(2)+			-80.57	5.2 m 1	ϵ		
107	9/2+			-83.56	32.4 m 3	ϵ		
107m	1/2-			-82.89	50.4 s 6	IT		
108	7+			-84.116	58.0 m 12	ϵ		
108m	2+			-84.086	39.6 m 7	ϵ		
109	9/2+			-86.488	4.167 h 18	ϵ		
109m	1/2-			-85.838	1.34 m 7	IT		
109m	(19/2+)			-84.386	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+			-88.393	2.8047 d 4	ϵ		
111m	1/2-			-87.856	7.7 m 2	IT		
112	1+			-87.992	14.97 m 10	ϵ 56%, β^- 44%		
112m	4+			-87.835	20.56 m 6	IT		
113	9/2+			-89.368	4.29% 5			
113m	1/2-			-88.976	99.476 m 23	IT		
114	1+	-88.570	71.9 s 1	β^- 99.5%, ϵ 0.5%				
114m	5+	-88.380	49.51 d 1	IT 96.75%, ϵ 3.25%				
115	9/2+	-89.536	4.41×10^{14} y 25	β^-				
			95.71% 5					
115m	1/2-	-89.200	4.486 h 4	IT 95%, β^- 5%				
116	1+	-88.249	14.10 s 3	β^- 99.98%, ϵ 0.02%				
116m	5+	-88.122	54.29 m 17	β^-				
116m	8-	-87.959	2.18 s 4	IT				
117	9/2+	-88.943	43.2 m 3	β^-				
117m	1/2-	-88.628	116.2 m 3	β^- 52.9%, IT 47.1%				
118	1+	-87.228	5.0 s 5	β^-				
118m	5+	-87.168	4.45 m 5	β^-				

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
49	In	118m	8-	-87.028	8.5 s 3	IT 98.6%, β^- 1.4%
		119	9/2+	-87.699	2.4 m 1	β^-
		119m	1/2-	-87.388	18.0 m 3	β^- 95.6%, IT 4.4%
		120	1+	-85.73	3.08 s 8	β^-
		120m	(8-)	-85.73	47.3 s 5	β^-
		120m	(5+)	-85.66	46.2 s 8	β^-
		121	9/2+	-85.84	23.1 s 6	β^-
		121m	1/2-	-85.52	3.88 m 10	β^- 98.8%, IT 1.2%
		122	1+	-83.57	1.5 s 3	β^-
		122m	5+	-83.53	10.3 s 6	β^-
		122m	(8-)	-83.28	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	(1)+	-80.87	3.12 s 9	β^-
		124m	(8-)	-80.82	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+)	-76.89	1.09 s 1	β^- , $\beta^-n \leq 0.03\%$
		127m	(1/2)-	-76.43	3.67 s 4	β^- , $\beta^-n 0.69\%$
		127m	(21/2-)	-75.03	1.04 s 10	β^-
		128	(3)+	-74.36	0.84 s 6	β^- , $\beta^-n < 0.05\%$
		128m	(8-)	-74.02	0.72 s 10	β^- , $\beta^-n < 0.05\%$
		129	(9/2+)	-72.81	0.61 s 1	β^- , $\beta^-n 0.25\%$
		129m	(1/2-)	-72.44	1.23 s 3	$\beta^- > 99.7\%$, $\beta^-n 2.5\%$, IT < 0.3%
		129m	(23/2-)	-71.18	0.67 s 10	β^-
		130	1(-)	-69.89	0.29 s 2	β^- , $\beta^-n 0.93\%$
		130m	(10-)	-69.84	0.54 s 1	β^- , $\beta^-n 1.65\%$
		130m	(5+)	-69.49	0.54 s 1	β^- , $\beta^-n 1.65\%$
131	(9/2+)	-68.05	0.28 s 3	β^- , $\beta^-n \leq 2\%$		
131m	(1/2-)	-67.75	0.35 s 5	$\beta^- \geq 99.98\%$, $\beta^-n \leq 2\%$, IT < 0.02%		
131m	(21/2+)	-64.29	0.32 s 6	$\beta^- > 99\%$, IT < 1%, $\beta^-n \approx 0.03\%$		
132	(7-)	-62.41	0.207 s 6	β^- , $\beta^-n 6.3\%$		
133	(9/2+)	-57.8s	165 ms 3	β^- , $\beta^-n 85\%$		
133m	(1/2-)	-57.4s	180 ms 15	β^- , IT, β^-n		
134	(4- to 7-)	-52.0s	140 ms 4	β^- , $\beta^-n 65\%$		
135		-47.2s	92 ms 10	β^- , β^-n		
50	Sn	99		-47.7s		$\epsilon?$, $\epsilon p?$
		100	0+	-56.9	0.86 s +37-20	ϵ , $\epsilon p < 17\%$
		101	(5/2+)	-59.9s	1.7 s 3	ϵ , $\epsilon p 26\%$
		102	0+	-64.9	3.8 s 2	ϵ
		103	(5/2+)	-66.97	7.0 s 2	ϵ , $\epsilon p 1.2\%$
		104	0+	-71.624	20.8 s 5	ϵ
		105	(5/2+)	-73.337	32.7 s 5	ϵ , $\epsilon p 0.01\%$
		106	0+	-77.353	115 s 5	ϵ
		107	(5/2+)	-78.512	2.90 m 5	ϵ
		108	0+	-82.071	10.30 m 8	ϵ
		109	5/2+	-82.632	18.0 m 2	ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	(MeV)	Abundance	Decay Mode			
50	Sn	110	0+	-85.84	4.11 h 10	ϵ		
		111	7/2+	-85.941	35.3 m 6	ϵ		
		112	0+	-88.657	$<1.3 \times 10^{21}$ y	2 ϵ		
					0.97% 1			
				113	1/2+	-88.330	115.09 d 3	ϵ
				113m	7/2+	-88.253	21.4 m 4	IT 91.1%, ϵ 8.9%
				114	0+	-90.559	0.66% 1	
				115	1/2+	-90.033	0.34% 1	
				116	0+	-91.525	14.54% 9	
				117	1/2+	-90.397	7.68% 7	
				117m	11/2-	-90.082	13.76 d 4	IT
				118	0+	-91.652	24.22% 9	
				119	1/2+	-90.065	8.59% 4	
				119m	11/2-	-89.976	293.1 d 7	IT
				120	0+	-91.098	32.58% 9	
				121	3/2+	-89.197	27.03 h 4	β^-
				121m	11/2-	-89.191	43.9 y 5	IT 77.6%, β^- 22.4%
				122	0+	-89.942	4.63% 3	
				123	11/2-	-87.817	129.2 d 4	β^-
				123m	3/2+	-87.792	40.06 m 1	β^-
				124	0+	-88.237	$>1.2 \times 10^{21}$ y	2 β^-
						5.79% 5		
				125	11/2-	-85.898	9.64 d 3	β^-
				125m	3/2+	-85.870	9.52 m 5	β^-
				126	0+	-86.02	2.30×10^5 y 14	β^-
				127	(11/2-)	-83.47	2.10 h 4	β^-
				127m	(3/2+)	-83.46	4.13 m 3	β^-
				128	0+	-83.34	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+	-80.137	3.72 m 7	β^-		
		130m	(7-)	-78.190	1.7 m 1	β^-		
		131	(3/2+)	-77.271	56.0 s 5	β^-		
		131m	(11/2-)	-77.271	58.4 s 5	β^- , IT		
		132	0+	-76.548	39.7 s 8	β^-		
		133	7/2-	-70.85	1.46 s 3	β^- , β^- -n 0.03%		
		134	0+	-66.3	1.050 s 11	β^- , β^- -n 17%		
		135	(7/2-)	-60.6s	530 ms 20	β^- , β^- -n 21%		
		136	0+	-56.3s	0.25 s 3	β^- , β^- -n 30%		
		137		-50.3s	190 ms 60	β^- , β^- -n 58%		
		138	0+		>408 ns	β^- , β^- -n		
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+)	-63.85	1.22 s 11	ϵ 99%, p 1%		
		106	(2+)	-66.473	0.6 s 2	ϵ		
		107	(5/2+)	-70.653	4.0 s 2	ϵ		
		108	(4+)	-72.445	7.4 s 3	ϵ		
		109	(5/2+)	-76.251	17.0 s 7	ϵ		
		110	(3+,4+)	-77.449	23.0 s 4	ϵ		
		111	(5/2+)	-80.836	75 s 1	ϵ		
		112	3+	-81.60	51.4 s 10	ϵ		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
51 Sb	113	5/2+	-84.42	6.67 m 7	ϵ
	114	3+	-84.50	3.49 m 3	ϵ
	115	5/2+	-87.00	32.1 m 3	ϵ
	116	3+	-86.822	15.8 m 8	ϵ
	116m	8-	-86.439	60.3 m 6	ϵ
	117	5/2+	-88.642	2.80 h 1	ϵ
	118	1+	-87.996	3.6 m 1	ϵ
	118m	8-	-87.746	5.00 h 2	ϵ
	119	5/2+	-89.474	38.19 h 22	ϵ
	119m (27/2+)		-86.632	0.85 s 9	IT
	120	1+	-88.417	15.89 m 4	ϵ
	120m	8-	-88.417	5.76 d 2	ϵ
	121	5/2+	-89.599	57.21% 5	
	122	2-	-88.334	2.7238 d 2	β^- 97.59%, ϵ 2.41%
	122m (8)-		-88.170	4.191 m 3	IT
	123	7/2+	-89.226	42.79% 5	
	124	3-	-87.622	60.20 d 3	β^-
	124m	5+	-87.611	93 s 5	IT 75%, β^- 25%
	124m (8)-		-87.585	20.2 m 2	IT
	125	7/2+	-88.257	2.75856 y 25	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	\approx 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+)	-81.98	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	2.34 m 5	β^-
134	(0-)	-74.17	0.78 s 6	β^-	
134m (7-)		-73.89	10.07 s 5	β^- , β^-n 0.09%	
135	(7/2+)	-69.79	1.679 s 15	β^- , β^-n 22%	
136	1-	-64.5s	0.923 s 14	β^- , β^-n 16.3%	
137	(7/2+)	-60.4s	492 ms 25	β^- , β^-n 49%	
138		-54.8s	350 ms 15	β^- , β^-n 72%	
139		-50.3s	93 ms +14-3	β^- , β^-n 90%	
140			>407 ns	β^- , β^-n , β^-2n	
52 Te	105	(5/2+)	-52.6s	0.62 μ s 7	α
	106	0+	-58.2	70 μ s 17	α
	107		-60.54	3.1 ms 1	α 70%, ϵ 30%
	108	0+	-65.783	2.1 s 1	ϵ 51%, α 49%, ϵp 2.4%
	109	(5/2+)	-67.715	4.6 s 3	ϵ 96.1%, ϵp 9.4%, α 3.9%, $\epsilon\alpha < 5.0 \times 10^{-3}\%$
	110	0+	-72.229	18.6 s 8	ϵ , $\alpha \approx 3.0 \times 10^{-3}\%$
	111	(5/2+)	-73.587	19.3 s 4	ϵ , ϵp

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
52	Te	112	0+	-77.567	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
		117m	(11/2-)	-84.80	103 ms 3	IT
		118	0+	-87.68	6.00 d 2	ϵ
		119	1/2+	-87.181	16.05 h 5	ϵ
		119m	11/2-	-86.920	4.70 d 4	ϵ , IT < 8.0 × 10 ⁻³ %
		120	0+	-89.369	0.09% 1	
		121	1/2+	-88.54	19.17 d 4	ϵ
		121m	11/2-	-88.25	164.2 d 8	IT 88.6%, ϵ 11.4%
		122	0+	-90.315	2.55% 12	
		123	1/2+	-89.173	>9.2 × 10 ¹⁶ y	ϵ
					0.89% 3	
		123m	11/2-	-88.925	119.2 d 1	IT
		124	0+	-90.526	4.74% 14	
		125	1/2+	-89.024	7.07% 15	
		125m	11/2-	-88.879	57.40 d 15	IT
		126	0+	-90.066	18.84% 25	
		127	3/2+	-88.283	9.35 h 7	β^-
		127m	11/2-	-88.195	106.1 d 7	IT 97.6%, β^- 2.4%
		128	0+	-88.993	2.41 × 10 ²⁴ y 39	2 β^-
					31.74% 8	
		129	3/2+	-87.004	69.6 m 3	β^-
		129m	11/2-	-86.898	33.6 d 1	IT 63%, β^- 37%
		130	0+	-87.352	$\geq 3.0 \times 10^{24}$ y	2 β^-
					34.08% 62	
		131	3/2+	-85.211	25.0 m 1	β^-
		131m	11/2-	-85.029	33.25 h 25	β^- 74.1%, IT 25.9%
		131m	(23/2+)	-83.271	93 ms 12	IT
132	0+	-85.180	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^- 83.5%, IT 16.5%		
134	0+	-82.56	41.8 m 8	β^-		
135	(7/2-)	-77.90	19.0 s 2	β^-		
136	0+	-74.48	17.63 s 8	β^- , β^-n 1.31%		
137	(7/2-)	-69.3	2.49 s 5	β^- , β^-n 2.99%		
138	0+	-65.8	1.4 s 4	β^- , β^-n 6.3%		
139	(7/2-)	-60.4s	>150 ns	β^- , β^-n		
140	0+	-56.6s	>300 ns	β^- , β^-n		
141		-51.0s	>150 ns	$\beta^-?$, $\beta^-n?$		
142	0+	-46.9s				
143			>408 ns	β^- , β^-n , β^-2n		
53	I	107		-49.6s		
		108	(1)	-52.6s	36 ms 6	α 91%, ϵ 9%, p < 1%
		109	1/2+	-57.675	93.5 μ s 3	p 99.99%, α 0.01%
		110		-60.46	0.65 s 2	ϵ 83%, α 17%, ϵ p 11%, ϵ α 1.1%
		111	(5/2+)	-64.953	2.5 s 2	ϵ 99.9%, $\alpha \approx 0.1\%$

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
53	I	112	-67.06	3.42 s 11	$\epsilon, \alpha \approx 1.2 \times 10^{-3}\%$	
		113	5/2+	-71.119	6.6 s 2	$\epsilon, \alpha 3.3 \times 10^{-7}\%$
		114	1+	-72.8s	2.1 s 2	$\epsilon, \epsilon p$
		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	$\epsilon < 100\%$, IT
		119	5/2+	-83.76	19.1 m 4	ϵ
		120	2-	-83.75	81.6 m 2	ϵ
		120m	(7-)	-83.43	53 m 4	ϵ
		121	5/2+	-86.253	2.12 h 1	ϵ
		122	1+	-86.081	3.63 m 6	ϵ
		123	5/2+	-87.945	13.2235 h 19	ϵ
		124	2-	-87.367	4.1760 d 3	ϵ
		125	5/2+	-88.838	59.407 d 10	ϵ
		126	2-	-87.912	12.93 d 5	ϵ 52.7%, β - 47.3%
		127	5/2+	-88.984	100%	
		128	1+	-87.739	24.99 m 2	β - 93.1%, ϵ 6.9%
		129	7/2+	-88.507	1.57×10^7 y 4	β -
		130	5+	-86.936	12.36 h 1	β -
		130m	2+	-86.896	8.84 m 6	IT 84%, β - 16%
		131	7/2+	-87.442	8.0252 d 6	β -
		132	4+	-85.698	2.295 h 13	β -
		132m	(8-)	-85.578	1.387 h 15	IT 86%, β - 14%
		133	7/2+	-85.886	20.83 h 8	β -
		133m	(19/2-)	-84.252	9 s 2	IT
		134	(4)+	-84.072	52.5 m 2	β -
		134m	(8)-	-83.756	3.52 m 4	IT 97.7%, β - 2.3%
135	7/2+	-83.791	6.58 h 3	β -		
136	(1-)	-79.57	83.4 s 10	β -		
136m	(6-)	-78.93	46.9 s 10	β -		
137	(7/2+)	-76.51	24.5 s 2	β -, β -n 7.14%		
138	(2-)	-71.9s	6.23 s 3	β -, β -n 5.56%		
139	(7/2+)	-68.5	2.280 s 11	β -, β -n 10%		
140	(4-)	-63.6	0.86 s 4	β -, β -n 9.3%		
141		-60.3	0.43 s 2	β -, β -n 21.2%		
142		-55.0s	222 ms 12	β -, β -n?		
143		-51.1s	130 ms 45	β -?		
144		-45.8s	>300 ns	β -?		
145			>407 ns	β -, β -n		
54	Xe	108	0+	-42.7s		
		109	(7/2+)	-45.9s	13 ms 2	α
		110	0+	-51.9	93 ms 3	α 64%, $\epsilon, \epsilon p$
		111	(7/2+)	-54.39	0.81 s 20	ϵ 90%, α 10%
		112	0+	-60.028	2.7 s 8	ϵ 99.16%, α 0.84%
		113	(5/2+)	-62.203	2.74 s 8	$\epsilon, \epsilon p$ 7%, $\alpha \approx 0.01\%$, $\epsilon \alpha \approx 7.0 \times 10^{-3}\%$
		114	0+	-67.08	10.0 s 4	ϵ
		115	(5/2+)	-68.66	18 s 4	$\epsilon, \epsilon p$ 0.34%, $\alpha 3.0 \times 10^{-4}\%$

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode			
Z	El	A	(MeV)	Abundance				
54	Xe	116	0+	-73.05	59 s 2	ϵ		
		117	5/2(+)	-74.18	61 s 2	ϵ , ϵp 2.9×10 ^{-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+	-85.35	20.1 h 1	ϵ		
		123	(1/2)+	-85.249	2.08 h 2	ϵ		
		124	0+	-87.661	≥1.6×10 ¹⁴ y	2 ϵ		
					0.0952% 3			
				125	1/2(+)	-87.193	16.9 h 2	ϵ
				125m	9/2(-)	-86.940	57 s 1	IT
				126	0+	-89.146	0.0890% 2	
				127	1/2+	-88.322	36.346 d 3	ϵ
				127m	9/2-	-88.025	69.2 s 9	IT
				128	0+	-89.860	1.9102% 8	
				129	1/2+	-88.696	26.4006% 82	
				129m	11/2-	-88.460	8.88 d 2	IT
				130	0+	-89.880	4.0710% 13	
				131	3/2+	-88.413	21.232% 30	
				131m	11/2-	-88.249	11.84 d 4	IT
				132	0+	-89.279	26.9086% 33	
				132m	(10+)	-86.527	8.39 ms 11	IT
				133	3/2+	-87.643	5.2475 d 5	β^-
				133m	11/2-	-87.410	2.198 d 13	IT
				134	0+	-88.124	>5.8×10 ²² y	2 β^-
						10.4357% 21		
				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%, β^- <0.6%
				136	0+	-86.429	>2.4×10 ²¹ y	2 β^-
						8.8573% 44		
				137	7/2-	-82.383	3.818 m 13	β^-
				138	0+	-79.975	14.08 m 8	β^-
				139	3/2-	-75.644	39.68 s 14	β^-
				140	0+	-72.986	13.60 s 10	β^-
		141	5/2(-)	-68.197	1.73 s 1	β^- , β^-n 0.04%		
		142	0+	-65.229	1.23 s 2	β^- , β^-n 0.21%		
		143	5/2-	-60.202	0.511 s 6	β^- , β^-n 1%		
		144	0+	-56.872	0.388 s 7	β^- , β^-n 3%		
		145		-51.49	188 ms 4	β^- , β^-n 5%		
		146	0+	-47.95	146 ms 6	β^- , β^-n 6.9%		
		147	(3/2-)	-42.5s	0.10 s +10 ⁻⁵	β^- , β^-n <8%		
		148	0+		>408 ns	β^- , β^-n		
55	Cs	112	(0+,3+)	-46.29	0.5 ms 1	p		
		113	(3/2+)	-51.765	16.7 μ s 7	p, α		
		114	(1+)	-54.68	0.57 s 2	ϵ 99.98%, 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 2.8%, $\epsilon\alpha$ 0.05%		
		116m	4+,5,6	-62.0s	3.85 s 13	ϵ , ϵp 0.51%, $\epsilon\alpha$ 8.0×10 ^{-3%}		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
55	Cs	117m (9/2+)	-66.49	8.4 s 6	ϵ
		117m (3/2+)	-66.49	6.5 s 4	ϵ
		118 2	-68.41	14 s 2	$\epsilon, \epsilon p < 0.04\%, \epsilon \alpha < 2.4 \times 10^{-3}\%$
		118m 6,7,8	-68.41	17 s 3	$\epsilon, \epsilon p < 0.04\%, \epsilon \alpha < 2.4 \times 10^{-3}\%$
		119 9/2+	-72.31	43.0 s 2	ϵ
		119m 3/2(+)	-72.31	30.4 s 1	ϵ
		120 2(+)	-73.888	61.3 s 11	$\epsilon, \epsilon \alpha 2.0 \times 10^{-5}\%, \epsilon p 7.0 \times 10^{-6}\%$
		120m (7-)	-73.888	57 s 6	ϵ
		121 3/2(+)	-77.10	155 s 4	ϵ
		121m 9/2(+)	-77.03	122 s 3	$\epsilon 83\%, \text{ IT } 17\%$
		122 1+	-78.14	21.18 s 19	ϵ
		122m (5)-	-78.01	0.36 s 2	IT
		122m 8(-)	-78.00	3.70 m 11	ϵ
		123 1/2+	-81.04	5.88 m 3	ϵ
		123m (11/2)-	-80.89	1.64 s 12	IT
		124 1+	-81.731	30.9 s 4	ϵ
		124m (7)+	-81.268	6.3 s 2	IT
		125 1/2(+)	-84.087	46.7 m 1	ϵ
		125m (11/2-)	-83.821	0.90 ms 3	IT
		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+	-87.499	32.06 h 6	ϵ
		130 1+	-86.899	29.21 m 4	$\epsilon 98.4\%, \beta- 1.6\%$
		130m 5-	-86.736	3.46 m 6	IT 99.84%, $\epsilon 0.16\%$
		131 5/2+	-88.058	9.689 d 16	ϵ
		132 2+	-87.155	6.480 d 6	$\epsilon 98.13\%, \beta- 1.87\%$
		133 7/2+	-88.070	100%	
		134 4+	-86.891	2.0652 y 4	$\beta-, \epsilon 3.0 \times 10^{-4}\%$
		134m 8-	-86.752	2.912 h 2	IT
		135 7/2+	-87.581	2.3×10^6 y 3	$\beta-$
		135m 19/2-	-85.948	53 m 2	IT
136 5+	-86.339	13.04 d 3	$\beta-$		
136m 8-	-85.821	17.5 s 2	$\beta-, \text{ IT} > 0\%$		
137 7/2+	-86.545	30.08 y 9	$\beta-$		
138 3-	-82.887	33.41 m 18	$\beta-$		
138m 6-	-82.807	2.91 m 8	IT 81%, $\beta- 19\%$		
139 7/2+	-80.701	9.27 m 5	$\beta-$		
140 1-	-77.050	63.7 s 3	$\beta-$		
141 7/2+	-74.48	24.84 s 16	$\beta-, \beta-n 0.04\%$		
142 0-	-70.53	1.684 s 14	$\beta-, \beta-n 0.09\%$		
143 3/2+	-67.67	1.791 s 7	$\beta-, \beta-n 1.64\%$		
144 1(-)	-63.27	0.994 s 6	$\beta-, \beta-n 3.03\%$		
144m (≥ 4)	-63.27	<1 s	$\beta-$		
145 3/2+	-60.06	0.587 s 5	$\beta-, \beta-n 14.7\%$		
146 1-	-55.57	0.321 s 2	$\beta-, \beta-n 14.2\%$		
147 (3/2+)	-52.02	0.230 s 1	$\beta-, \beta-n 28.5\%$		
148	-47.3	146 ms 6	$\beta-, \beta-n 25.1\%$		
149	-43.8s	>50 ms	$\beta-, \beta-n$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
55	Cs	150	-39.0s	>50 ms	β^- , β^-n	
		151	-35.1s	>50 ms	β^- , β^-n	
56	Ba	112	0+	-36.1s		
		113		-39.8s		
		114	0+	-46.0	0.43 s +30-15	ϵ 99.1%, ϵp 20%, α 0.9%, $^{12}C < 0.0034\%$
		115	(5/2+)	-49.0s	0.45 s 5	ϵ , $\epsilon p > 15\%$
		116	0+	-54.6s	1.3 s 2	ϵ , ϵp 3%
		117	(3/2)	-57.5	1.75 s 7	ϵ , $\epsilon\alpha > 0\%$, $\epsilon p > 0\%$
		118	0+	-62.4s	5.5 s 2	ϵ , ϵp
		119	(5/2+)	-64.6	5.4 s 3	ϵ , $\epsilon p < 25\%$
		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	3.3 m 3	ϵ
		126	0+	-82.67	100 m 2	ϵ
		127	1/2+	-82.82	12.7 m 4	ϵ
		127m	7/2-	-82.73	1.9 s 2	IT
		128	0+	-85.379	2.43 d 5	ϵ
		129	1/2+	-85.06	2.23 h 11	ϵ
		129m	7/2+	-85.06	2.16 h 2	$\epsilon \leq 100\%$, IT
		130	0+	-87.261	0.106% 1	
		130m	8-	-84.786	9.4 ms 4	IT
		131	1/2+	-86.684	11.50 d 6	ϵ
		131m	9/2-	-86.496	14.6 m 2	IT
		132	0+	-88.434	$> 3.0 \times 10^{21}$ y 0.101% 1	
		133	1/2+	-87.553	10.551 y 11	ϵ
		133m	11/2-	-87.265	38.93 h 10	IT 99.99%, ϵ 0.01%
134	0+	-88.950	2.417% 18			
135	3/2+	-87.850	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-	-87.059	2.552 m 1	IT		
138	0+	-88.261	71.698% 42			
139	7/2-	-84.914	83.06 m 28	β^-		
140	0+	-83.270	12.7527 d 23	β^-		
141	3/2-	-79.733	18.27 m 7	β^-		
142	0+	-77.845	10.6 m 2	β^-		
143	5/2-	-73.937	14.5 s 3	β^-		
144	0+	-71.767	11.5 s 2	β^- , β^-n 3.6%		
145	5/2-	-67.516	4.31 s 16	β^-		
146	0+	-64.94	2.22 s 7	β^-		
147	(3/2-)	-60.26	0.894 s 10	β^- , β^-n 0.06%		
148	0+	-57.59	0.612 s 17	β^- , β^-n 0.4%		
149		-53.2s	0.344 s 7	β^- , β^-n 0.43%		
150	0+	-50.3s	0.3 s	β^- , β^-n		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
56	Ba	151	-45.6s	>300 ns	β^- , β^-n	
		152	0+	-42.4s	>406 ns	β^- , β^-n
		153		-37.2s		$\beta^-?$
57	La	117	(3/2+, 3/2-)	-46.5s	23.5 ms 26	p 93.9%, ϵ 6.1%
		117m	(9/2+)	-46.3s	10 ms 5	p 97.4%, ϵ 2.6%
		118		-49.6s		$\epsilon?$
		119		-55.0s		$\epsilon?$
		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	(8-)	-70.26	29.21 s 17	ϵ
		124m		-70.26	21 s 4	ϵ
		125	(3/2+)	-73.76	64.8 s 12	ϵ
		125m		-73.65	0.39 s 4	
		126m	(5+)	-74.97	54 s 2	$\epsilon > 0\%$
		126m	(0-, 1, 2-)	-74.97	<50 s	ϵ , IT
		127	(11/2-)	-77.89	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-	-83.72	4.8 h 2	ϵ
		132m	6-	-83.53	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+	-87.11	6×10^4 y 2	ϵ
		138	5+	-86.521	1.02×10^{11} y 1	ϵ 65.6%, β^- 34.4%
					0.08881% 71	
					99.9119% 71	
139	7/2+	-87.228	1.67855 d 12	β^-		
140	3-	-84.317	3.92 h 3	β^-		
141	(7/2+)	-82.934	91.1 m 5	β^-		
142	2-	-80.022	14.2 m 1	β^-		
143	(7/2+)	-78.171	40.8 s 4	β^-		
144	(3-)	-74.83	24.8 s 20	β^-		
145	(5/2+)	-72.83	6.27 s 10	β^-		
146	2-	-69.05	10.0 s 1	β^-		
146m	(6-)	-69.05	4.06 s 4	β^- , β^-n 0.04%		
147	(3/2+)	-66.68	1.26 s 8	β^- , β^-n 0.15%		
148	(2-)	-62.71	1.05 s 3	β^- , β^-n 1.43%		
149	(3/2-)	-60.2	0.86 s 5	β^- , β^-n 2.7%		
150	(3+)	-56.6s	>300 ns	β^- , β^-n		
151		-53.9s	>150 ns	β^-		
152		-49.7s	>100 ns	$\beta^-?$		
153		-46.6s		$\beta^-?$		
154		-42.0s		$\beta^-?$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
57	La	155	-38.5s		β^- ?
58	Ce	119	-43.9s		ϵ ?
		120	-49.5s		ϵ ?
		121	(5/2) -52.5s	1.1 s 1	$\epsilon, \epsilon p \approx 1\%$
		122	0+ -57.7s		$\epsilon, \epsilon p$
		123	(5/2) -60.1s	3.8 s 2	$\epsilon, \epsilon p > 0\%$
		124	0+ -64.6s	6 s 2	ϵ
		125	(7/2-) -66.7s	9.7 s 3	$\epsilon, \epsilon p$
		126	0+ -70.82	51.0 s 3	ϵ
		127	(1/2+) -71.97	34 s 2	ϵ
		127m	(5/2+) -71.97	28.6 s 7	ϵ
		128	0+ -75.53	3.93 m 2	ϵ
		129	5/2+ -76.29	3.5 m 5	$\epsilon > 0\%$
		130	0+ -79.42	22.9 m 5	ϵ
		131	7/2+ -79.71	10.3 m 3	ϵ
		131m	(1/2+) -79.64	5.4 m 4	ϵ, IT
		132	0+ -82.47	3.51 h 11	ϵ
		132m	(8-) -80.13	9.4 ms 3	IT
		133	1/2+ -82.42	97 m 4	ϵ
		133m	9/2- -82.39	5.1 h 3	ϵ, IT
		134	0+ -84.83	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	$> 0.7 \times 10^{14}$ y	2ϵ
				0.185% 2	
		137	3/2+ -85.88	9.0 h 3	ϵ
		137m	11/2- -85.63	34.4 h 3	IT 99.21%, ϵ 0.79%
		138	0+ -87.56	$\geq 0.9 \times 10^{14}$ y	2ϵ
				0.251% 2	
		138m	7- -85.43	8.65 ms 20	IT
		139	3/2+ -86.949	137.641 d 20	ϵ
		139m	11/2- -86.195	54.8 s 10	IT
		140	0+ -88.078	88.450% 51	
		141	7/2- -85.435	32.508 d 13	β^-
		142	0+ -84.532	$> 5 \times 10^{16}$ y	$2\beta^-$
				11.114% 51	
		143	3/2- -81.605	33.039 h 6	β^-
		144	0+ -80.431	284.91 d 5	β^-
		145	(5/2-) -77.09	3.01 m 6	β^-
		146	0+ -75.64	13.52 m 13	β^-
		147	(5/2-) -72.013	56.4 s 10	β^-
		148	0+ -70.40	56 s 1	β^-
		149	(3/2-) -66.67	5.3 s 2	β^-
		150	0+ -64.85	4.0 s 6	β^-
		151	(5/2+) -61.22	1.76 s 6	β^-
		151m	-61.22	1.02 s 6	β^-
		152	0+ -59.3s	1.4 s 2	β^-
		153	-55.2s	> 100 ns	β^- ?
		154	0+ -52.7s	> 100 ns	β^-
		155	-48.3s	> 300 ns	β^- ?
		156	0+ -45.3s		β^- ?
		157	-40.4s		β^- ?

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
59	Pr	121	(3/2)	-41.4s	10 ms +6-3	p
		122		-44.7s	≈ 0.5 s	ϵ ?
		123		-50.1s	≈ 0.8 s	ϵ ?
		124		-53.0s	1.2 s 2	$\epsilon, \epsilon p > 0\%$
		125		-57.7s	3.3 s 7	$\epsilon, \epsilon p$
		126	>3	-60.1s	3.14 s 22	$\epsilon, \epsilon p$
		127		-64.3s	4.2 s 3	ϵ
		128	4,5,6	-66.33	2.84 s 9	ϵ
		129	(11/2-)	-69.77	30 s 4	$\epsilon > 0\%$
		130?	(7,8)	-71.18	40 s 4	ϵ
		130?	(4+,5+)	-71.18	40 s 4	ϵ
		130?	(2+)	-71.18	40 s 4	ϵ
		131	(3/2+)	-74.30	1.51 m 2	ϵ
		131m	(11/2-)	-74.15	5.73 s 20	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
		133m	(11/2-)	-77.74	1.1 s 2	IT
		134m	(6-)	-78.51	≈ 11 m	ϵ
		134m	2-	-78.51	17 m 2	ϵ
		135	3/2(+)	-80.93	24 m 1	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-	-82.76	2.12 h 4	ϵ
		139	5/2+	-84.820	4.41 h 4	ϵ
		140	1+	-84.690	3.39 m 1	ϵ
		141	5/2+	-86.015	100%	
		142	2-	-83.787	19.12 h 4	β^- 99.98%, ϵ 0.02%
		142m	5-	-83.783	14.6 m 5	IT
		143	7/2+	-83.067	13.57 d 2	β^-
		144	0-	-80.749	17.28 m 5	β^-
		144m	3-	-80.690	7.2 m 3	IT 99.93%, β^- 0.07%
		145	7/2+	-79.626	5.984 h 10	β^-
146	(2)-	-76.68	24.15 m 18	β^-		
147	(5/2+)	-75.44	13.4 m 3	β^-		
148	1-	-72.54	2.29 m 2	β^-		
148m	(4)	-72.44	2.01 m 7	β^-		
149	(5/2+)	-71.039	2.26 m 7	β^-		
150	(1)-	-68.299	6.19 s 16	β^-		
151	(3/2-)	-66.78	18.90 s 7	β^-		
152	(4+)	-63.76	3.57 s 18	β^-		
153		-61.58	4.28 s 11	β^-		
154	(3+)	-58.2	2.3 s 1	β^-		
155		-55.8s	>300 ns	β^- ?		
156		-51.9s	>300 ns	β^- ?		
157		-49.0s		β^- ?		
158		-44.7s		β^- ?		
159		-41.5s		β^- ?		
60	Nd	124	0+	-44.3s		ϵ ?
		125	(5/2)	-47.4s	0.65 s 15	$\epsilon, \epsilon p > 0\%$
		126	0+	-52.6s	>200 ns	$\epsilon, \epsilon p$
		127		-55.3s	1.8 s 4	$\epsilon, \epsilon p$

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
60 Nd	128	0+	-60.1s	5 s	ϵ , ϵp
	129	(5/2+)	-62.2s	4.9 s 2	$\epsilon > 0\%$, $\epsilon p > 0\%$
	130	0+	-66.60	21 s 3	ϵ
	131	(5/2+)	-67.77	25.4 s 9	ϵ , $\epsilon p > 0\%$
	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+	-82.01	29.7 m 5	ϵ
	139m	11/2-	-81.78	5.50 h 20	ϵ 88.2%, IT 11.8%
	140	0+	-84.25	3.37 d 2	ϵ
	140m	7-	-82.03	0.60 ms 5	IT
	141	3/2+	-84.192	2.49 h 3	ϵ
	141m	11/2-	-83.436	62.0 s 8	IT, $\epsilon < 0.05\%$
	142	0+	-85.949	27.152% 40	
	143	7/2-	-84.001	12.174% 26	
	144	0+	-83.747	2.29 $\times 10^{15}$ y 16	α
				23.798% 19	
	145	7/2-	-81.431	8.293% 12	
	146	0+	-80.925	17.189% 32	
	147	5/2-	-78.146	10.98 d 1	β^-
	148	0+	-77.406	5.756% 21	
	149	5/2-	-74.374	1.728 h 1	β^-
	150	0+	-73.683	0.79 $\times 10^{19}$ y 7	
			5.638% 28		
151	3/2+	-70.946	12.44 m 7	β^-	
152	0+	-70.15	11.4 m 2	β^-	
153	(3/2)-	-67.34	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	5.06 s 13	β^-	
157		-56.8s	>100 ns	$\beta^-?$	
158	0+	-54.4s	>50 ns	β^-	
159		-50.2s		$\beta^-?$	
160	0+	-47.4s		$\beta^-?$	
161		-43.0s		$\beta^-?$	
61 Pm	126		-38.8s		$\epsilon?$
	127		-44.4s		$p?, \epsilon?$
	128		-47.6s	1.0 s 3	ϵ , α , ϵp
	129	(5/2-)	-52.5s	2.4 s 9	ϵ
	130	(4,5,6)	-55.2s	2.6 s 2	ϵ , ϵp
	131	(11/2-)	-59.6s	6.3 s 8	ϵ
	132	(3+)	-61.6s	6.2 s 6	ϵ , $\epsilon p = 5.0 \times 10^{-5}\%$
	133	(3/2+)	-65.41	13.5 s 21	ϵ
	133m	(11/2-)	-65.28	<8.8 s	IT, ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
61 Pm	134	(2+)	-66.74	≈ 5 s	ϵ
	134m	(5+)	-66.74	22 s 1	ϵ
	135m(3/2+, 5/2+)		-69.98	49 s 3	ϵ
	135m	(11/2-)	-69.91	45 s 4	ϵ
	136m	(5-)	-71.20	107 s 6	ϵ
	136m	(2+)	-71.20	47 s 2	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
	142m	(8)-	-80.27	2.0 ms 2	IT
	143	5/2+	-82.960	265 d 7	ϵ
	144	5-	-81.415	363 d 14	ϵ
	145	5/2+	-81.267	17.7 y 4	ϵ , α 2.8 \times 10 ⁻⁷ %
	146	3-	-79.453	5.53 y 5	ϵ 66%, β - 34%
	147	7/2+	-79.041	2.6234 y 2	β -
	148	1-	-76.865	5.368 d 2	β -
	148m	5-, 6-	-76.727	41.29 d 11	β - 95.8%, IT 4.2%
	149	7/2+	-76.063	53.08 h 5	β -
	150	(1-)	-73.60	2.68 h 2	β -
	151	5/2+	-73.388	28.40 h 4	β -
	152	1+	-71.25	4.12 m 8	β -
	152m	(8)	-71.11	13.8 m 2	β -, IT \geq 0%
	152m	4-	-71.11	7.52 m 8	β -
	153	5/2-	-70.68	5.25 m 2	β -
	154	(3, 4)	-68.49	2.68 m 7	β -
	154m	(0-, 1-)	-68.49	1.73 m 10	β -
	155	5/2-	-66.97	41.5 s 2	β -
156m	4-	-64.21	26.70 s 10	β -	
157	(5/2-)	-62.4	10.56 s 10	β -	
158		-59.1	4.8 s 5	β -	
159		-56.8	1.5 s 2	β -	
160		-53.1s		β -?	
161		-50.4s		β -?	
162		-46.3s		β -?	
163		-43.1s		β -?	
62 Sm	128	0+	-38.0s		ϵ ?, p?
	129	(1/2+, 3/2+)	-41.3s	0.55 s 10	ϵ , ϵ p > 0%
	130	0+	-46.9s		ϵ
	131		-49.6s	1.2 s 2	ϵ , ϵ p > 0%
	132	0+	-54.7s	4.0 s 3	ϵ , ϵ p
	133	(5/2+)	-56.8s	2.89 s 16	ϵ , ϵ p > 0%
	133m	(1/2-)	-56.8s	3.5 s 4	ϵ , IT, ϵ p
	134	0+	-61.2s	9.5 s 8	ϵ
	135	(3/2+, 5/2+)	-62.9	10.3 s 5	ϵ , ϵ p 0.02%
	136	0+	-66.81	47 s 2	ϵ
	137	(9/2-)	-68.03	45 s 1	ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
62 Sm	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+	-75.934	10.2 m 2	ϵ
	141m	11/2-	-75.758	22.6 m 2	ϵ 99.69%, IT 0.31%
	142	0+	-78.987	72.49 m 5	ϵ
	143	3/2+	-79.516	8.75 m 6	ϵ
	143m	11/2-	-78.762	66 s 2	IT 99.76%, ϵ 0.24%
	143m	23/2(-)	-76.722	30 ms 3	IT
	144	0+	-81.965	3.07% 7	
	145	7/2-	-80.651	340 d 3	ϵ
	146	0+	-80.995	10.3×10 ⁷ y 5	α
	147	7/2-	-79.265	1.060×10 ¹¹ y 11	α
				14.99% 18	
	148	0+	-79.335	7×10 ¹⁵ y 3	α
				11.24% 10	
	149	7/2-	-77.135	13.82% 7	
	150	0+	-77.050	7.38% 1	
	151	5/2-	-74.575	90 y 8	β^-
	152	0+	-74.762	26.75% 16	
	153	3/2+	-72.559	46.284 h 4	β^-
	153m	11/2-	-72.461	10.6 ms 3	IT
	154	0+	-72.454	22.75% 29	
	155	3/2-	-70.190	22.3 m 2	β^-
	156	0+	-69.362	9.4 h 2	β^-
	157	(3/2-)	-66.72	8.03 m 7	β^-
158	0+	-65.21	5.30 m 3	β^-	
159	5/2-	-62.24	11.37 s 15	β^-	
160	0+	-60.4s	9.6 s 3	β^-	
161		-56.8	4.8 s 4	β^-	
162	0+	-54.8s	2.4 s 5	β^-	
163		-50.9s		$\beta^-?$	
164	0+	-48.2s		$\beta^-?$	
165		-43.8s		$\beta^-?$	
63 Eu	130	(1+)	-33.0s	0.90 ms +49-29	p
	131	3/2+	-38.7s	17.8 ms 19	p 89%, ϵ 11%
	132		-41.9s		p, ϵ
	133		-47.1s		$\epsilon?$
	134		-49.7s	0.5 s 2	ϵ , $\epsilon p > 0%$
	135		-54.1s	1.5 s 2	ϵ , ϵp
	136m	(7+)	-56.1s	3.3 s 3	ϵ , ϵp 0.09%
	136m	(3+)	-56.1s	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-)	-66.99	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+	-71.31	2.34 s 12	ϵ
	142m	8-	-71.31	1.223 m 8	ϵ

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
63 Eu	143	5/2+	-74.24	2.59 m 2	ϵ
	144	1+	-75.62	10.2 s 1	ϵ
	145	5/2+	-77.991	5.93 d 4	ϵ
	146	4-	-77.117	4.61 d 3	ϵ
	147	5/2+	-77.544	24.1 d 6	$\epsilon, \alpha 2.2 \times 10^{-3}\%$
	148	5-	-76.30	54.5 d 5	$\epsilon, \alpha 9.4 \times 10^{-7}\%$
	149	5/2+	-76.440	93.1 d 4	ϵ
	150	5-	-74.791	36.9 y 9	ϵ
	150m	0-	-74.749	12.8 h 1	$\beta- 89\%, \epsilon 11\%,$ $IT \leq 5.0 \times 10^{-8}\%$
	151	5/2+	-74.651	$\geq 1.7 \times 10^{18}$ y 47.81% 3	α
	152	3-	-72.887	13.528 y 14	$\epsilon 72.1\%, \beta- 27.9\%$
	152m	0-	-72.841	9.3116 h 13	$\beta- 72\%, \epsilon 28\%$
	152m	8-	-72.739	96 m 1	IT
	153	5/2+	-73.366	52.19% 6	
	154	3-	-71.736	8.601 y 10	$\beta- 99.98\%, \epsilon 0.02\%$
	154m	8-	-71.591	46.3 m 4	IT
	155	5/2+	-71.816	4.753 y 14	$\beta-$
	156	0+	-70.085	15.19 d 8	$\beta-$
	157	5/2+	-69.459	15.18 h 3	$\beta-$
	158	(1-)	-67.20	45.9 m 2	$\beta-$
	159	5/2+	-66.045	18.1 m 1	$\beta-$
	160	1	-63.24	38 s 4	$\beta-$
	161		-61.80	26 s 3	$\beta-$
	162		-58.69	10.6 s 10	$\beta-$
	163		-56.80	7.7 s 4	$\beta-$
	164		-53.4s	4.2 s 2	$\beta-$
	165		-50.8s	2.3 s 2	$\beta-$
166		-46.8s		$\beta-?$	
167		-43.8s		$\beta-?$	
64 Gd	133		-35.6s		
	134	0+	-41.1s		$\epsilon?$
	135	(5/2+)	-44.0s	1.1 s 2	$\epsilon, \epsilon p 18\%$
	136	0+	-48.9s	≥ 200 ns	
	137	(7/2)	-51.2s	2.2 s 2	$\epsilon, \epsilon p$
	138	0+	-55.7s	4.7 s 9	ϵ
	139	(9/2-)	-57.6s	5.8 s 9	$\epsilon p > 0\%, \epsilon > 0\%$
	139m		-57.6s	4.8 s 9	$\epsilon p > 0\%, \epsilon > 0\%$
	140	0+	-61.78	15.8 s 4	ϵ
	141	1/2+	-63.22	14 s 4	$\epsilon, \epsilon p 0.03\%$
	141m	11/2-	-62.85	24.5 s 5	$\epsilon 89\%, IT 11\%$
	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%, $\epsilon 5.7\%$
146	0+	-76.087	48.27 d 10	ϵ	
147	7/2-	-75.356	38.06 h 12	ϵ	
148	0+	-76.269	70.9 y 10	α	
149	7/2-	-75.126	9.28 d 10	$\epsilon, \alpha 4.3 \times 10^{-4}\%$	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
64 Gd	150	0+	-75.763	1.79×10^6 y 8	α
	151	7/2-	-74.187	123.9 d 10	$\epsilon, \alpha \approx 8.0 \times 10^{-7}\%$
	152	0+	-74.706	1.08×10^{14} y 8	α
				0.20% 1	
	153	3/2-	-72.882	240.4 d 10	ϵ
	154	0+	-73.705	2.18% 3	
	155	3/2-	-72.069	14.80% 12	
	155m	11/2-	-71.948	31.97 ms 27	IT
	156	0+	-72.534	20.47% 9	
	157	3/2-	-70.823	15.65% 2	
	158	0+	-70.689	24.84% 7	
	159	3/2-	-68.560	18.479 h 4	β^-
	160	0+	-67.940	$>3.1 \times 10^{19}$ y	$2\beta^-$
				21.86% 19	
	161	5/2-	-65.505	3.66 m 5	β^-
	162	0+	-64.279	8.4 m 2	β^-
	163	(5/2-, 7/2+)	-61.47	68 s 3	β^-
	164	0+	-59.9s	45 s 3	β^-
	165		-56.6s	10.3 s 16	β^-
	166	0+	-54.5s	4.8 s 10	β^-
	167		-50.8s		$\beta^-?$
168	0+	-48.3s		$\beta^-?$	
169		-44.2s		$\beta^-?$	
65 Tb	135	(7/2-)	-32.6s	0.94 ms +33-22	p
	136		-35.9s		$\epsilon?$
	137		-40.7s		p?, $\epsilon?$
	138m		-43.5s	≥ 200 ns	ϵ, p
	139		-48.0s	1.6 s 2	$\epsilon, \epsilon p?$
	140	(7+)	-50.5	2.0 s 5	$\epsilon, \epsilon p 0.26\%$
	141	(5/2-)	-54.5	3.5 s 2	ϵ
	141m		-54.5	7.9 s 6	ϵ
	142	1+	-56.6	597 ms 17	$\epsilon, \epsilon p 2.2 \times 10^{-3}\%$
	142m	5-	-56.3	303 ms 17	IT
	143	(11/2-)	-60.42	12 s 1	ϵ
	143m		-60.42	<21 s	ϵ
	144	1+	-62.37	≈ 1 s	ϵ
	144m	(6-)	-61.97	4.25 s 15	IT 66%, $\epsilon 34\%$
	145		-65.88		$\epsilon?$
	145m	(11/2-)	-65.88	30.9 s 6	ϵ
	146	1+	-67.76	8 s 4	ϵ
	146m	5-	-67.76	23 s 2	ϵ
	146m	(10+)	-66.98	1.18 ms 2	IT
	147	(1/2+)	-70.742	1.64 h 3	ϵ
	147m	(11/2-)	-70.691	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+	-71.489	4.118 h 25	$\epsilon 83.3\%, \alpha 16.7\%$	
149m	11/2-	-71.453	4.16 m 4	$\epsilon 99.98\%, \alpha 0.02\%$	
150	(2-)	-71.105	3.48 h 16	$\epsilon, \alpha < 0.05\%$	
150m	9+	-70.631	5.8 m 2	ϵ	
151	1/2(+)	-71.622	17.609 h 14	$\epsilon 99.99\%, \alpha 9.5 \times 10^{-3}\%$	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
65 Tb	151m	(11/2-)	-71.522	25 s 3	IT 93.4%, ϵ 6.6%	
	152	2-	-70.72	17.5 h 1	ϵ , $\alpha < 7.0 \times 10^{-7}\%$	
	152m	8+	-70.21	4.2 m 1	IT 78.8%, ϵ 21.2%	
	153	5/2+	-71.313	2.34 d 1	ϵ	
	154	0	-70.15	21.5 h 4	ϵ , $\beta- < 0.1\%$	
	154m	7-	-70.15	22.7 h 5	ϵ 98.2%, IT 1.8%	
	154m	3-	-70.15	9.4 h 4	ϵ 78.2%, IT 21.8%, $\beta- < 0.1\%$	
	155	3/2+	-71.25	5.32 d 6	ϵ	
	156	3-	-70.090	5.35 d 10	ϵ	
	156m	(7-)	-70.040	24.4 h 10	IT	
	156m	(0+)	-70.002	5.3 h 2	IT < 100%, $\epsilon > 0\%$	
	157	3/2+	-70.762	71 y 7	ϵ	
	158	3-	-69.469	180 y 11	ϵ 83.4%, $\beta-$ 16.6%	
	158m	0-	-69.359	10.70 s 17	IT, $\beta- < 0.6\%$, $\epsilon < 0.01\%$	
	158m	7-	-69.081	0.40 ms 4	IT	
	159	3/2+	-69.531	100%		
	160	3-	-67.835	72.3 d 2	$\beta-$	
	161	3/2+	-67.460	6.89 d 2	$\beta-$	
	162	1-	-65.67	7.60 m 15	$\beta-$	
	163	3/2+	-64.594	19.5 m 3	$\beta-$	
	164	(5+)	-62.1	3.0 m 1	$\beta-$	
	165	(3/2+)	-60.7s	2.11 m 10	$\beta-$	
	166	(2-)	-57.88	25.1 s 21	$\beta-$	
	167	(3/2+)	-55.9s	19.4 s 27	$\beta-$	
	168	(4-)	-52.6s	8.2 s 13	$\beta-$	
	169		-50.2s		$\beta-?$	
	170		-46.5s		$\beta-?$	
	171		-43.8s		$\beta-?$	
	66 Dy	138	0+	-34.8s		$\epsilon?$
		139	(7/2+)	-37.6s	0.6 s 2	ϵ , ϵp
		140	0+	-42.7s		ϵ
		141	(9/2-)	-45.2s	0.9 s 2	ϵ , ϵp
		142	0+	-49.9s	2.3 s 3	ϵ , ϵp 0.06%
143		(1/2+)	-52.17	5.6 s 10	ϵ , ϵp	
143m		(11/2-)	-51.86	3.0 s 3	ϵ , ϵp	
144		0+	-56.570	9.1 s 4	ϵ , ϵp	
145		(1/2+)	-58.242	6 s 2	ϵ , $\epsilon p \approx 50\%$	
145m		(11/2-)	-58.124	14.1 s 7	ϵ , $\epsilon p \approx 50\%$	
146		0+	-62.554	29 s 3	ϵ	
146m		(10+)	-59.618	150 ms 20	IT	
147		(1/2+)	-64.194	67 s 7	ϵ , ϵp 0.05%	
147m		(11/2-)	-63.444	55.2 s 5	ϵ 68.9%, IT 31.1%	
148		0+	-67.859	3.3 m 2	ϵ	
149		(7/2-)	-67.702	4.20 m 14	ϵ	
149m		(27/2-)	-65.041	0.490 s 15	IT 99.3%, ϵ 0.7%	
150	0+	-69.310	7.17 m 5	ϵ 64%, α 36%		
151	7/2(-)	-68.752	17.9 m 3	ϵ 94.4%, α 5.6%		
152	0+	-70.118	2.38 h 2	ϵ 99.9%, α 0.1%		
153	7/2(-)	-69.142	6.4 h 1	ϵ 99.99%, α $9.4 \times 10^{-3}\%$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode
Z	El	A	(MeV)	Abundance	
66 Dy	154	0+	-70.392	$3.0 \times 10^6 \text{ y } 15$	α
	155	3/2-	-69.15	9.9 h 2	ϵ
	156	0+	-70.522	0.056% 3	
	157	3/2-	-69.420	8.14 h 4	ϵ
	157m	11/2-	-69.221	21.6 ms 16	IT
	158	0+	-70.404	0.095% 3	
	159	3/2-	-69.166	144.4 d 2	ϵ
	160	0+	-69.671	2.329% 18	
	161	5/2+	-68.054	18.889% 42	
	162	0+	-68.179	25.475% 36	
	163	5/2-	-66.379	24.896% 42	
	164	0+	-65.966	28.260% 54	
	165	7/2+	-63.610	2.334 h 1	β^-
	165m	1/2-	-63.502	1.257 m 6	IT 97.76%, β^- 2.24%
	166	0+	-62.583	81.6 h 1	β^-
	167	(1/2-)	-59.93	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		β^-
	171		-50.1s		$\beta^-?$
172	0+	-47.8s		$\beta^-?$	
173		-43.7s		$\beta^-?$	
67 Ho	140	(6-,0-,8+)	-29.2s	6 ms 3	p
	141	7/2-	-34.3s	4.1 ms 3	p
	142	(7-,8+)	-37.2s	0.4 s 1	$\epsilon, \epsilon p > 0\%$
	143	(11/2-)	-42.0s		$\epsilon?, \epsilon p?$
	144	(5-)	-44.609	0.7 s 1	$\epsilon, \epsilon p$
	145	(11/2-)	-49.120	2.4 s 1	ϵ
	146	(10+)	-51.238	3.6 s 3	ϵ
	147	(11/2-)	-55.757	5.8 s 4	ϵ
	148	(1+)	-57.99	2.2 s 11	ϵ
	148m	(6-)	-57.99	9.59 s 15	$\epsilon, \epsilon p 0.08\%$
	148m	(10+)	-57.30	2.35 ms 4	IT
	149	(11/2-)	-61.66	21.1 s 2	ϵ
	149m	(1/2+)	-61.62	56 s 3	ϵ
	150	2-	-61.95	72 s 4	ϵ
	150m	(9+)	-61.45	24.1 s 5	$\epsilon,$
	151	(11/2-)	-63.622	35.2 s 1	$\epsilon 78\%, \alpha 22\%$
	151m	(1/2+)	-63.581	47.2 s 13	$\alpha 80\%, \epsilon 20\%$
	152	2-	-63.61	161.8 s 3	$\epsilon 88\%, \alpha 12\%$
	152m	9+	-63.45	50.0 s 4	$\epsilon 89.2\%, \alpha 10.8\%$
	153	11/2-	-65.012	2.01 m 3	$\epsilon 99.95\%, \alpha 0.05\%$
	153m	1/2+	-64.943	9.3 m 5	$\epsilon 99.82\%, \alpha 0.18\%$
	154	2-	-64.639	11.76 m 19	$\epsilon 99.98\%, \alpha 0.02\%$
	154m	8+	-64.639	3.10 m 14	$\epsilon, \alpha < 1.0 \times 10^{-3}\%$
	155	5/2+	-66.04	48 m 1	ϵ
	155m	11/2-	-65.90	0.88 ms 8	IT
	156	4-	-65.47	56 m 1	ϵ
	156m	1-	-65.42	9.5 s 15	IT
	156m	9+	-65.42	7.8 m 3	$\epsilon 75\%, \text{ IT } 25\%$
157	7/2-	-66.83	12.6 m 2	ϵ	
158	5+	-66.18	11.3 m 4	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
67 Ho	158m	2-	-66.12	28 m 2	IT>81%, ϵ <19%
	158m	(9+)	-66.00	21.3 m 23	$\epsilon \geq 93\%$, IT $\leq 7\%$
	159	7/2-	-67.328	33.05 m 11	ϵ
	159m	1/2+	-67.122	8.30 s 8	IT
	160	5+	-66.38	25.6 m 3	ϵ
	160m	2-	-66.32	5.02 h 5	IT 73%, ϵ 27%
	160m	(9+)	-66.21	3 s	IT
	161	7/2-	-67.195	2.48 h 5	ϵ
	161m	1/2+	-66.984	6.76 s 7	IT
	162	1+	-66.040	15.0 m 10	ϵ
	162m	6-	-65.934	67.0 m 7	IT 62%, ϵ 38%
	163	7/2-	-66.376	4570 y 25	ϵ
	163m	1/2+	-66.078	1.09 s 3	IT
	164	1+	-64.980	29 m 1	ϵ 60%, β^- 40%
	164m	6-	-64.840	37.5 m +15-5	IT
	165	7/2-	-64.897	100%	
	166	0-	-63.070	26.824 h 12	β^-
	166m	7-	-63.064	1.20 $\times 10^3$ y 18	β^-
	167	7/2-	-62.279	3.003 h 18	β^-
	168	3+	-60.06	2.99 m 7	β^-
	168m	(6+)	-60.00	132 s 4	IT $\geq 99.5\%$, $\beta^- \leq 0.5\%$
	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		-51.5s	25 s 3	β^-
173		-49.2s		β^- ?	
174		-45.7s		β^- ?	
175		-43.1s		β^- ?	
68 Er	142	0+	-28.1s		
	143		-31.2s		ϵ ?
	144	0+	-36.7s	≥ 200 ns	ϵ
	145	(1/2+)	-39.4s		ϵ ?
	145m	(11/2-)	-39.2s	1.0 s 3	$\epsilon, \epsilon p$
	146	0+	-44.322	1.7 s 6	$\epsilon, \epsilon p$
	147	(1/2+)	-46.61	2.5 s 2	$\epsilon, \epsilon p > 0\%$
	147m	(11/2-)	-46.61	1.6 s 2	$\epsilon, \epsilon p > 0\%$
	148	0+	-51.48	4.6 s 2	ϵ
	149	(1/2+)	-53.74	4 s 2	$\epsilon, \epsilon p 7\%$
	149m	(11/2-)	-53.00	8.9 s 2	$\epsilon 96.5\%$, IT 3.5%, $\epsilon p 0.18\%$
	150	0+	-57.83	18.5 s 7	ϵ
	151	(7/2-)	-58.26	23.5 s 20	ϵ
	151m	(27/2-)	-55.68	0.58 s 2	IT 95.3%, $\epsilon 4.7\%$
	152	0+	-60.500	10.3 s 1	$\alpha 90\%$, $\epsilon 10\%$
	153	(7/2-)	-60.475	37.1 s 2	$\alpha 53\%$, $\epsilon 47\%$
	154	0+	-62.606	3.73 m 9	$\epsilon 99.53\%$, $\alpha 0.47\%$
	155	7/2-	-62.209	5.3 m 3	$\epsilon 99.98\%$, $\alpha 0.02\%$
	156	0+	-64.21	19.5 m 10	$\epsilon, \alpha 1.7 \times 10^{-5}\%$
	157	3/2-	-63.41	18.65 m 10	ϵ
157m	(9/2+)	-63.26	76 ms 6	IT	
158	0+	-65.30	2.29 h 6	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
68 Er	159	3/2-	-64.560	36 m 1	ϵ
	160	0+	-66.06	28.58 h 9	ϵ
	161	3/2-	-65.199	3.21 h 3	ϵ
	162	0+	-66.332	0.139% 5	
	163	5/2-	-65.166	75.0 m 4	ϵ
	164	0+	-65.941	1.601% 3	
	165	5/2-	-64.520	10.36 h 4	ϵ
	166	0+	-64.924	33.503% 36	
	167	7/2+	-63.289	22.869% 9	
	167m	1/2-	-63.081	2.269 s 6	IT
	168	0+	-62.989	26.978% 18	
	169	1/2-	-60.921	9.392 d 18	β^-
	170	0+	-60.108	14.910% 36	
	171	5/2-	-57.718	7.516 h 2	β^-
	172	0+	-56.482	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+	-46.6s		$\beta^-?$	
177		-42.9s		$\beta^-?$	
69 Tm	144	(10+)	-22.2s	1.9 μ s +12-5	p>0%
	145	(11/2-)	-27.7s	3.17 μ s 20	p
	146	(5-)	-31.2s	80 ms 10	p, ϵ
	146m	(8+)	-31.1s	200 ms 10	p, ϵ
	147	11/2-	-35.974	0.58 s 3	ϵ 85%, p 15%
	147m	3/2+	-35.906	0.36 ms 4	p
	148m	(10+)	-38.76	0.7 s 2	ϵ
	149	(11/2-)	-43.9s	0.9 s 2	ϵ , ϵ p 0.2%
	150	(6-)	-46.5s	2.20 s 6	ϵ
	150m	(10+)	-45.8s	5.2 ms 3	IT
	151	(11/2-)	-50.78	4.17 s 11	ϵ
	151m	(1/2+)	-50.78	6.6 s 20	ϵ
	152	(2-)	-51.77	8.0 s 10	ϵ
	152m	(9+)	-51.77	5.2 s 6	ϵ
	153	(11/2-)	-53.99	1.48 s 1	α 91%, ϵ 9%
	153m	(1/2+)	-53.95	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-	-56.626	21.6 s 2	ϵ 99.11%, α 0.89%
	155m	1/2+	-56.585	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	\approx 20 s	$\epsilon?$
	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-	-61.47	21.70 m 19	ϵ	
162m	5+	-61.47	24.3 s 17	IT 81%, ϵ 19%	
163	1/2+	-62.727	1.810 h 5	ϵ	
164	1+	-61.90	2.0 m 1	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
69 Tm	164m	6-	-61.90	5.1 m 1	IT=80%, $\epsilon \approx 20\%$
	165	1/2+	-62.928	30.06 h 3	ϵ
	166	2+	-61.89	7.70 h 3	ϵ
	166m	(6-)	-61.78	340 ms 25	IT
	167	1/2+	-62.542	9.25 d 2	ϵ
	168	3+	-61.312	93.1 d 2	ϵ 99.99%, β - 0.01%
	169	1/2+	-61.274	100%	
	170	1-	-59.795	128.6 d 3	β - 99.87%, ϵ 0.13%
	171	1/2+	-59.210	1.92 y 1	β -
	172	2-	-57.373	63.6 h 2	β -
	173	(1/2+)	-56.253	8.24 h 8	β -
	174	(4)-	-53.86	5.4 m 1	β -
	174m	0+	-53.61	2.29 s 1	IT 99%, β - < 1%
	175	(1/2+)	-52.31	15.2 m 5	β -
	176	(4+)	-49.4	1.9 m 1	β -
	177m	(7/2-)	-47.5s	90 s 6	β -
	178		-44.1s	>300 ns	β -
	179		-41.6s		β -?
	70 Yb	148	0+	-30.2s	
149		(1/2+,3/2+)	-33.2s	0.7 s 2	ϵ , ϵp
150		0+	-38.6s	≥ 200 ns	ϵ ?
151		(1/2+)	-41.5	1.6 s 1	ϵ , $\epsilon p > 0\%$
151m		(11/2-)	-41.5	1.6 s 1	ϵ , IT=0.4%, ϵp
152		0+	-46.3	3.03 s 6	ϵ , ϵp
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+	-53.265	26.1 s 7	ϵ 90%, α 10%
157		7/2-	-53.43	38.6 s 10	ϵ 99.5%, α 0.5%
158		0+	-56.008	1.49 m 13	$\alpha \approx 2.1 \times 10^{-3}\%$, ϵ
159		5/2(-)	-55.84	1.67 m 9	ϵ
160		0+	-58.16	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+	-61.594	56.7 h 1	ϵ
167		5/2-	-60.588	17.5 m 2	ϵ
168		0+	-61.580	0.123% 3	
169		7/2+	-60.376	32.018 d 5	ϵ
169m		1/2-	-60.352	46 s 2	IT
170		0+	-60.763	2.982% 39	
171		1/2-	-59.306	14.09% 14	
171m		7/2+	-59.211	5.25 ms 24	IT
172	0+	-59.255	21.68% 13		
173	5/2-	-57.551	16.103% 63		
174	0+	-56.944	32.026% 80		
175	(7/2-)	-54.695	4.185 d 1	β -	
175m	1/2-	-54.180	68.2 ms 3	IT	
176	0+	-53.488	12.996% 83		
176m	8-	-52.438	11.4 s 3	IT	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
70 Yb	177	(9/2+)	-50.983	1.911 h 3	β^-
	177m	(1/2-)	-50.652	6.41 s 2	IT
	178	0+	-49.69	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		$\beta^- ?$
71 Lu	150	(2+)	-24.6s	45 ms 3	p 70.9%, ϵ 29.1%
	151	11/2-	-30.1s	80.6 ms 20	p 63.4%, ϵ 36.6%
	152	(4-,5-,6-)	-33.4s	0.7 s 1	ϵ , ϵp 15%
	153	11/2-	-38.4	0.9 s 2	$\alpha \approx 70\%$, $\epsilon \approx 30\%$
	154	(2-)	-39.6s		
	154m	(9+)	-39.6s	1.12 s 8	ϵ
	155	11/2-	-42.55	68 ms 1	α 90%, ϵ 10%
	155m	1/2+	-42.53	138 ms 8	α 76%, ϵ 24%
	155m	(25/2-)	-40.77	2.69 ms 3	α
	156	(2)-	-43.75	494 ms 12	$\alpha \approx 95\%$, $\epsilon \approx 5\%$
	156m	9+	-43.75	198 ms 2	α
	157	(1/2+,3/2+)	-46.46	6.8 s 18	$\alpha > 0\%$
	157m	(11/2-)	-46.43	4.79 s 12	ϵ 94%, α 6%
	158		-47.21	10.6 s 3	ϵ 99.09%, α 0.91%
	159		-49.71	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-)	-52.40	7.3 ms 4	IT
	162	1-	-52.84	1.37 m 2	$\epsilon \leq 100\%$
	162m		-52.84	1.9 m	$\epsilon \leq 100\%$
	162m	(4-)	-52.84	1.5 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(-)	-57.07	5.5 m 1	ϵ
	168m	3+	-56.87	6.7 m 4	$\epsilon > 99.6\%$, IT < 0.8%
169	7/2+	-58.083	34.06 h 5	ϵ	
169m	1/2-	-58.054	160 s 10	IT	
170	0+	-57.30	2.012 d 20	ϵ	
170m	(4)-	-57.21	0.67 s 10	IT	
171	7/2+	-57.828	8.24 d 3	ϵ	
171m	1/2-	-57.757	79 s 2	IT	
172	4-	-56.736	6.70 d 3	ϵ	
172m	1-	-56.694	3.7 m 5	IT	
173	7/2+	-56.881	1.37 y 1	ϵ	
174	(1)-	-55.570	3.31 y 5	ϵ	
174m	(6)-	-55.399	142 d 2	IT 99.38%, ϵ 0.62%	
175	7/2+	-55.166	97.401% 13		
176	7-	-53.382	3.76×10^{10} y 7	β^-	
			2.599% 13		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
71 Lu	176m	1-	-53.259	3.664 h 19	β^- 99.9%, ϵ 0.09%	
	177	7/2+	-52.384	6.647 d 4	β^-	
	177m	23/2-	-51.414	160.44 d 6	β^- 78.6%, IT 21.4%	
	177m	(39/2-)	-49.644	6 m +3-2	β^- , IT?	
	178	1(+)	-50.338	28.4 m 2	β^-	
	178m	(9-)	-50.214	23.1 m 3	β^-	
	179	7/2+	-49.059	4.59 h 6	β^-	
	179m	1/2+	-48.467	3.1 ms 9	IT	
	180	5+	-46.68	5.7 m 1	β^-	
	181	(7/2+)	-44.7s	3.5 m 3	β^-	
	182		-41.9s	2.0 m 2	β^-	
	183	(7/2+)	-39.5s	58 s 4	β^-	
	184	(3+)	-36.4s	19 s 2	β^-	
	72 Hf	153		-27.3s	>60 ns	ϵ ?
		154	0+	-32.7s	2 s 1	ϵ , α ?
155			-34.1s	0.84 s 3	ϵ	
156		0+	-37.9	23 ms 1	α	
156m		8+	-35.9	0.52 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%	
159		7/2-	-42.85	5.6 s 4	ϵ 65%, α 35%	
160		0+	-45.938	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+	-49.166	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+	-51.83	111 s 8	ϵ	
165		(5/2-)	-51.63	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+	-55.845	2.0×10^{15} y 4	α	
				0.16% 1		
175		5/2(-)	-54.482	70 d 2	ϵ	
176		0+	-54.576	5.26% 7		
177		7/2-	-52.885	18.60% 9		
177m		23/2+	-51.569	1.09 s 5	IT	
177m		37/2-	-50.145	51.4 m 5	IT	
178	0+	-52.439	27.28% 7			
178m	8-	-51.292	4.0 s 2	IT		
178m	16+	-49.993	31 y 1	IT		
179	9/2+	-50.467	13.62% 2			
179m	1/2-	-50.092	18.67 s 4	IT		
179m	25/2-	-49.361	25.05 d 25	IT		
180	0+	-49.783	35.08% 16			
180m	8-	-48.641	5.47 h 4	IT 99.7%, β^- 0.3%		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
72 Hf	181	1/2-	-47.407	42.39 d 6	β^-
	181m	(25/2-)	-45.665	1.5 ms 5	IT
	182	0+	-46.053	8.90×10^6 y 9	β^-
	182m	(8-)	-44.880	61.5 m 15	β^- 54%, IT 46%
	183	(3/2-)	-43.29	1.018 h 2	β^-
	184	0+	-41.50	4.12 h 5	β^-
	184m	(8-)	-40.23	48 s 10	IT
	185		-38.4s	3.5 m 6	β^-
	186	0+	-36.4s	2.6 m 12	β^-
	187m		-32.8s	0.27 μ s 8	β^-
	188	0+	-30.9s		β^-
	189				
	73 Ta	155m	11/2-	-24.0s	2.9 ms +15-11
156		(2-)	-25.8s	144 ms 24	p, ϵ
156m		9+	-25.7s	0.36 s 4	ϵ 95.8%, p 4.2%
157		1/2+	-29.6	10.1 ms 4	α 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	$\alpha \approx 91\%$, $\epsilon \approx 9\%$
158m		(9+)	-30.9s	36.7 ms 15	α 95%, ϵ 5%
159		1/2+	-34.44	0.83 s 18	ϵ 66%, α 34%
159m		11/2-	-34.38	0.56 s 6	α 55%, ϵ 45%
160			-35.87	1.55 s 4	ϵ 66%, α 34%
160m			-35.87	1.7 s 2	
161		(1/2+)	-38.71		ϵ, α
161m		(11/2-)	-38.71	3.08 s 11	ϵ, α
162			-39.78	3.57 s 12	ϵ 99.93%, α 0.07%
163			-42.54	10.6 s 18	$\epsilon \approx 99.8\%$, $\alpha = 0.2\%$
164		(3+)	-43.28	14.2 s 3	ϵ
165			-45.85	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+	-51.719	56.56 h 6	ϵ
178m		(1+)	-50.50	9.31 m 3	ϵ
178m		7-	-50.50	2.36 h 8	ϵ
178m	15-	-49.03	58 ms 4	IT	
178m	(21-)	-47.60	290 ms 12	IT	
179	7/2+	-50.361	1.82 y 3	ϵ	
179m	(25/2+)	-49.044	9.0 ms 2	IT	
179m	(37/2+)	-47.722	54.1 ms 17	IT	
180	1+	-48.936	8.154 h 6	ϵ 86%, β^- 14%	
180m	9-	-48.859	$>1.2 \times 10^{15}$ y	ϵ ?	

0.01201% 32

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
73	Ta	180m	9-	-48.859	$>1.2 \times 10^{15}$ y 0.01201% 32	$\beta^-?$
		181	7/2+	-48.441	99.98799% 32	
		182	3-	-46.433	114.74 d 12	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^-
		185m	(21/2)	-40.14	>1 ms	
		186	(2-,3-)	-38.61	10.5 m 3	β^-
		186m		-38.61	1.54 m 5	β^-
		187	(7/2+)	-36.8s	2.3 m 6	β^-
		187m	(27/2-)	-35.0s	22 s 9	$\beta^-?$, IT?
		187m	(41/2+)	-33.8s	>5 m	$\beta^-?$, IT?
		188		-33.7s	19.6 s 20	β^-
		189?		-31.8s	1.6 μ s 2	$\beta^-?$
		190		-28.7s	5.3 s 7	β^-
		191		-26.5s	>300 ns	$\beta^-?$
		192	(1,2)	-23.1s	2.2 s 7	β^-
74	W	157	(7/2-)	-19.3s	275 ms 40	ϵ
		158	0+	-23.7s	1.25 ms 21	α
		158m	(8+)	-21.8s	0.143 ms 19	IT, α
		159		-25.2s	7.3 ms 27	$\alpha \approx 99.9\%$, $\epsilon = 0.1\%$
		160	0+	-29.4	91 ms 5	$\alpha 87\%$
		161		-30.4s	409 ms 18	$\alpha 73\%$, $\epsilon 27\%$
		162	0+	-34.00	1.36 s 7	$\epsilon 54.8\%$, $\alpha 45.2\%$
		163	7/2-	-34.91	2.67 s 10	$\epsilon 86\%$, $\alpha 14\%$
		164	0+	-38.235	6.3 s 2	$\epsilon 96.2\%$, $\alpha 3.8\%$
		165	(5/2-)	-38.86	5.1 s 5	ϵ , $\alpha < 0.2\%$
		166	0+	-41.88	19.2 s 6	$\epsilon 99.96\%$, $\alpha 0.04\%$
		167	(+)	-42.09	19.9 s 5	$\epsilon 99.96\%$, $\alpha 0.04\%$
		168	0+	-44.90	50.9 s 19	ϵ , $\alpha 3.2 \times 10^{-3}\%$
		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
		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+	-50.41	21.6 d 3	ϵ
		179	7/2-	-49.29	37.05 m 16	ϵ
		179m	1/2-	-49.07	6.40 m 7	IT 99.71%, $\epsilon 0.29\%$
		180	0+	-49.636	$\geq 6.6 \times 10^{17}$ y 0.12% 1	2 ϵ
		181	9/2+	-48.253	121.2 d 2	ϵ
		182	0+	-48.247	26.50% 16	
		183	1/2-	-46.367	$>1.3 \times 10^{19}$ y 14.31% 4	α
		183m	11/2+	-46.057	5.2 s 3	IT

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
74 W	184	0+	-45.707	30.64% 2	
	185	3/2-	-43.389	75.1 d 3	β^-
	185m	11/2+	-43.192	1.67 m 3	IT
	186	0+	-42.510	$>2.3 \times 10^{19}$ y	2 β^-
				28.43% 19	
	186m	(16+)	-38.967	>3 ms	IT
	187	3/2-	-39.906	24.000 h 4	β^-
	188	0+	-38.669	69.78 d 5	β^-
	189	(3/2-)	-35.5	10.7 m 5	β^-
	190	0+	-34.3	30.0 m 15	β^-
	190m	(10-)	-31.9	≤ 3.1 ms	IT
	191		-31.1s	>300 ns	$\beta^-?$
	192	0+	-29.6s		$\beta^-?$
	193		-26.2s	>300 ns	$\beta^-?$
	194	0+	-24.4s	>300 ns	$\beta^-?$
	75 Re	159	(1/2+)	-14.8s	
160		(2-)	-16.7s	0.82 ms +15-9	p 91%, α 9%
161		1/2+	-20.9	0.44 ms 1	p, $\alpha \leq 1.4\%$
161m		11/2-	-20.8	14.7 ms 3	α 93%, p 7%
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			-27.52	0.85 s +14-11	$\alpha \approx 58\%$, $\epsilon \approx 42\%$
164m			-27.45	0.86 s +15-11	IT, $\alpha \approx 3\%$
165		(1/2+)	-30.65	≈ 1 s	α , ϵ
165m		(11/2-)	-30.60	2.1 s 3	ϵ 87%, α 13%
166			-31.89	2.25 s 21	$\epsilon > 76\%$, $\alpha < 24\%$
167		(9/2-)	-34.84s	5.9 s 3	$\epsilon \approx 99\%$, $\alpha \approx 1\%$
167m			-34.84s	3.4 s 4	α
168		(7+)	-35.79	4.4 s 1	ϵ , $\alpha \approx 5.0 \times 10^{-3}\%$
169		(9/2-)	-38.41	8.1 s 5	ϵ , $\alpha < 0.01\%$
169m		(5/2+, 3/2+)	-38.41	15.1 s 15	ϵ , IT, $\alpha \approx 0.2\%$
170		(5+)	-38.92	9.2 s 2	ϵ
171		(9/2-)	-41.25	15.2 s 4	ϵ
172m		(2)	-41.52	55 s 5	ϵ
172m		(5)	-41.52	15 s 3	ϵ
173		(5/2-)	-43.55	1.98 m 26	ϵ
174		(≤ 4)	-43.67	2.40 m 4	ϵ
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+	-46.58	19.5 m 1	ϵ
179m		7/2, 49/2+	-41.18	0.466 ms 15	IT
180		(1-)	-45.84	2.44 m 6	ϵ
181		5/2+	-46.52	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	
183m	(25/2)+	-43.903	1.04 ms 4	IT	
184	3(-)	-44.224	35.4 d 7	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	
Z	El	A	(MeV)	Abundance	Decay Mode
75 Re	184m	8(+)	-44.036	169 d 8	IT 74.5%, ϵ 25.5%
	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+	-41.218	4.33×10^{10} y 7	β^- , 62.60% 2 $\alpha < 1.0 \times 10^{-4}\%$
	188	1-	-39.018	17.003 h 3	β^-
	188m	(6)-	-38.846	18.59 m 4	IT
	189	5/2+	-37.980	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		-31.8s	16 s 1	β^-
	193?		-30.2s		
	194m		-27.4s	5 s 1	β^-
	194m		-27.4s	25 s 8	β^-
	194m		-27.4s	100 s 10	β^-
	195		-25.6s	6 s 1	β^-
	196		-22.5s	3 s + 1-2	β^-
	198				
76 Os	161	(7/2-)	-9.9s	0.64 ms 6	α
	162	0+	-14.5s	2.1 ms 1	$\alpha \approx 99\%$
	163	(7/2-)	-16.1s	5.5 ms 6	α, ϵ
	164	0+	-20.5	21 ms 1	α 98%, ϵ 2%
	165	(7/2-)	-21.6s	71 ms 3	$\alpha > 60\%$, $\epsilon < 40\%$
	166	0+	-25.44	199 ms 3	α 72%, ϵ 18%
	167	(7/2-)	-26.50	0.81 s 6	α 57%, ϵ 43%
	168	0+	-29.992	2.1 s 1	ϵ 57%, α 43%
	169	(5/2-)	-30.72	3.43 s 14	ϵ 86.3%, α 13.7%
	170	0+	-33.92	7.37 s 18	ϵ 90.5%, α 9.5%
	171	(5/2-)	-34.29	8.3 s 2	ϵ 98.2%, α 1.8%
	172	0+	-37.24	19.2 s 9	ϵ 99.8%, α 0.2%
	173	(5/2-)	-37.44	22.4 s 9	ϵ, α 0.4%
	174	0+	-40.00	44 s 4	ϵ 99.98%, α 0.02%
	175	(5/2-)	-40.11	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, α
	179	1/2-	-43.02	6.5 m 3	ϵ
	180	0+	-44.35	21.5 m 4	ϵ
	181	1/2-	-43.55	105 m 3	ϵ
	181m	7/2-	-43.50	2.7 m 1	$\epsilon, IT \leq 3\%$
	182	0+	-44.61	21.84 h 20	ϵ
	182m	(8)-	-42.78	0.78 ms 7	IT
	183	9/2+	-43.66	13.0 h 5	ϵ
	183m	1/2-	-43.49	9.9 h 3	ϵ 85%, IT 15%
184	0+	-44.256	$> 5.6 \times 10^{13}$ y	α	
			0.02% 1		
185	1/2-	-42.809	93.6 d 5	ϵ	
186	0+	-43.002	2.0×10^{15} y 11	α	
			1.59% 3		
187	1/2-	-41.220	1.96% 2		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
76 Os	188	0+	-41.139	13.24% 8	
	189	3/2-	-38.988	16.15% 5	
	189m	9/2-	-38.957	5.81 h 6	IT
	190	0+	-38.709	26.26% 2	
	190m	(10)-	-37.004	9.9 m 1	IT
	191	9/2-	-36.396	15.4 d 1	β^-
	191m	3/2-	-36.322	13.10 h 5	IT
	192	0+	-35.883	40.78% 19	
	192m	(10-)	-33.868	5.9 s 1	IT>87%, β^- <13%
	193	3/2-	-33.395	30.11 h 1	β^-
	194	0+	-32.437	6.0 y 2	β^-
	195		-29.7	\approx 9 m	β^-
	196	0+	-28.28	34.9 m 2	β^-
	197		-25.3s	2.8 m 6	β^-
	198	0+	-23.8s		β^-
	199		-20.5s	5 s +4-2	β^-
	200	0+	-18.9s	6 s +4-3	β^-
	201			>300 ns	$\beta^-?$
	202	0+		>300 ns	$\beta^-?$
	77 Ir	164m	(9+)	-7.3s	94 μ s 27
165		(1/2+)	-11.6s	<1 μ s	p?, $\alpha?$
165m		11/2-	-11.4s	0.30 ms 6	p 87%, α 13%
166		(2-)	-13.2s	10.5 ms 22	α 93%, p 7%
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			-18.72	222 ms +60-40	$\alpha \leq 100%$, ϵ , p
168m			-18.72	159 ms +16-13	α 77%, $\epsilon \leq 23%$, p
169		(1/2+)	-22.08	0.353 s 4	α 45%, ϵ , p
169m		(11/2-)	-21.93	0.281 s 4	α 72%, ϵ , p
170		(3-)	-23.36s	0.87 s +18-12	ϵ 94.8%, α 5.2%
170m		(8+)	-23.36s	811 ms 18	IT \leq 62%, $\epsilon \leq 62%$, α 38%
171		(1/2+)	-26.43	3.2 s +13-7	$\alpha > 0%$, p, ϵ
171m		(11/2-)	-26.43	1.40 s 10	α 58%, p \leq 42%, $\epsilon \leq 42%$
172		(3+)	-27.38	4.4 s 3	ϵ 98%, $\alpha \approx 2%$
172m		(7+)	-27.24	2.0 s 1	ϵ 77%, α 23%
173		(3/2+,5/2+)	-30.27	9.0 s 8	$\epsilon > 93%$, $\alpha < 7%$
173m		(11/2-)	-30.04	2.4 s 9	ϵ , α 7%
174		(3+)	-30.87	7.9 s 6	ϵ 99.5%, α 0.5%
174m		(7+)	-30.67	4.9 s 3	ϵ 97.5%, α 2.5%
175		(5/2-)	-33.39	9 s 2	ϵ 99.15%, α 0.85%
176			-33.86	8.7 s 5	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	3+	-39.05	15 m 1	ϵ	
183	5/2-	-40.20	57 m 4	ϵ	
184	5-	-39.61	3.09 h 3	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
77	Ir	185	5/2-	-40.33	14.4 h 1	ϵ
		186	5+	-39.17	16.64 h 3	ϵ
		186m	2-	-39.17	1.90 h 5	$\epsilon \approx 75\%$, IT $\approx 25\%$
		187	3/2+	-39.532	10.5 h 3	ϵ
		187m	9/2-	-39.346	30.3 ms 6	IT
		188	1-	-38.351	41.5 h 5	ϵ
		188m		-37.428	4.2 ms 2	$\epsilon ?$, IT
		189	3/2+	-38.46	13.2 d 1	ϵ
		189m	11/2-	-38.08	13.3 ms 3	IT
		189m (25/2)+		-36.12	3.7 ms 2	IT
		190	4-	-36.755	11.78 d 10	ϵ
		190m	(1-)	-36.729	1.120 h 3	IT
		190m	(11-)	-36.379	3.087 h 12	ϵ 91.4%, IT 8.6%
		191	3/2+	-36.710	37.3% 2	
		191m	11/2-	-36.539	4.899 s 23	IT
		191m		-34.663	5.5 s 7	IT
		192	4+	-34.837	73.829 d 11	β^- 95.24%, ϵ 4.76%
		192m	1-	-34.780	1.45 m 5	IT 99.98%, β^- 0.02%
		192m	(11-)	-34.669	241 y 9	IT
		193	3/2+	-34.538	62.7% 2	
		193m	11/2-	-34.458	10.53 d 4	IT
		194	1-	-32.533	19.28 h 13	β^-
		194m	4+	-32.386	31.85 ms 24	IT
		194m	(10,11)	-32.343	171 d 11	β^-
		195	3/2+	-31.694	2.5 h 2	β^-
		195m	11/2-	-31.594	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^- , IT < 0.3%
		197	3/2+	-28.26	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	6 s +5-4	β^-		
200		-21.6s	>300 ns	β^-		
201		-19.9s	>300 ns	β^-		
202	(1-,2-)	-17.0s	11 s 3	β^-		
203			>300 ns	$\beta^- ?$		
204						
78	Pt	166	0+	-4.8s	300 μ s 100	α
		167		-6.5s	0.9 ms 3	α
		168	0+	-11.0	2.02 ms 10	α
		169	(7/2-)	-12.4s	7.0 ms 2	α
		170	0+	-16.30	13.8 ms 5	α 98%, ϵ
		171	(7/2-)	-17.47	45.5 ms 25	α 90%, ϵ 10%
		172	0+	-21.10	97.6 ms 13	α 94%, ϵ 6%
		173	(5/2-)	-21.94	382 ms 2	α , $\epsilon ?$
		174	0+	-25.31	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 60%, α 40%
		177	5/2-	-29.37	10.6 s 4	ϵ 94.3%, α 5.7%
		178	0+	-32.00	20.7 s 7	ϵ 92.3%, α 7.7%
		179	1/2-	-32.270	21.2 s 4	ϵ 99.76%, α 0.24%
		180	0+	-34.44	56 s 2	ϵ , $\alpha = 0.3\%$

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
78 Pt	181	1/2-	-34.37	52.0 s 22	ϵ , $\alpha \approx 0.08\%$	
	182	0+	-36.17	2.67 m 12	ϵ 99.96%, α 0.04%	
	183	1/2-	-35.77	6.5 m 10	ϵ , $\alpha \approx 1.3 \times 10^{-3}\%$	
	183m	(7/2)-	-35.74	43 s 5	ϵ , $\alpha < 4.0 \times 10^{-4}\%$, IT	
	184	0+	-37.33	17.3 m 2	ϵ , $\alpha \approx 1.0 \times 10^{-3}\%$	
	184m	8-	-35.49	1.01 ms 5	IT	
	185	9/2+	-36.68	70.9 m 24	$\epsilon < 100\%$	
	185m	1/2-	-36.58	33.0 m 8	ϵ 99%, IT < 2%	
	186	0+	-37.86	2.08 h 5	ϵ , $\alpha \approx 1.4 \times 10^{-4}\%$	
	187	3/2-	-36.71	2.35 h 3	ϵ	
	188	0+	-37.828	10.2 d 3	ϵ , $\alpha 2.6 \times 10^{-5}\%$	
	189	3/2-	-36.49	10.87 h 12	ϵ	
	190	0+	-37.325	6.5×10^{11} y 3	α	
				0.012% 2		
		191	3/2-	-35.701	2.83 d 2	ϵ
		192	0+	-36.292	0.782% 24	
		193	1/2-	-34.481	50 y 6	ϵ
		193m	13/2+	-34.331	4.33 d 3	IT
		194	0+	-34.762	32.86% 40	
		195	1/2-	-32.796	33.78% 24	
		195m	13/2+	-32.537	4.010 d 5	IT
		196	0+	-32.646	25.21% 34	
		197	1/2-	-30.421	19.8915 h 19	β^-
		197m	13/2+	-30.021	95.41 m 18	IT 96.7%, β^- 3.3%
		198	0+	-29.905	7.36% 13	
		199	5/2-	-27.390	30.80 m 21	β^-
		199m	(13/2)+	-26.966	13.6 s 4	IT
		200	0+	-26.60	12.6 h 3	β^-
		201	(5/2-)	-23.74	2.5 m 1	β^-
		202	0+	-22.6s	44 h 15	β^-
	202m	(7-)	-20.8s	0.28 ms +42-19	IT	
	203	(1/2-)	-19.7s	10 s 3	β^-	
	204	0+	-18.1s	10.3 s 14	β^-	
	205		-12.8s	>300 ns	β^-	
79 Au	169		-1.8s		$p?$, $\alpha?$	
	170	(2-)	-3.6s	286 μ s +50-40	p 89%, α 11%	
	170m	(9+)	-3.6s	617 μ s +50-40	p 58%, α 42%	
	171	(1/2+)	-7.57	17 μ s +9-5	p , α	
	171m	(11/2-)	-7.32	1.02 ms 10	α 54%, p 46%	
	172		-9.37	22 ms +6-4	α , ϵ , p	
	172m		-9.37	7.7 ms 14	α , $p < 0.02\%$, ϵ	
	173	(1/2+)	-12.82	25 ms 1	α 94%, ϵ , p	
	173m	(11/2-)	-12.61	14.0 ms 9	α 92%, p , ϵ	
	174		-14.24s	139 ms 3	$\alpha > 0\%$	
	175	(1/2+)	-17.44		$\epsilon?$, $\alpha?$	
	175m	(11/2-)	-17.44	156 ms 5	α 94%, ϵ 6%	
	176		-18.40			
	176m	(3-)	-18.40	1.05 s 1	ϵ , α	
	176m	(9+)	-18.40	1.36 s 2		
177	(1/2+, 3/2+)	-21.55	1.53 s 7	α 40%, ϵ		
177m	11/2-	-21.39	1.00 s 20	α 66%, ϵ		
178		-22.33	2.6 s 5	$\epsilon \leq 60\%$, $\alpha \geq 40\%$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
79 Au	179	(1/2+, 3/2+)	-24.98	7.1 s 3	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	(2+)	-28.30	15.5 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	ϵ , $\alpha \leq 0.02\%$
	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 $8.0 \times 10^{-4}\%$
	187	1/2(+)	-33.01	8.3 m 2	ϵ , α $3.0 \times 10^{-3}\%$
	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
	191	3/2+	-33.81	3.18 h 8	ϵ
	191m	(11/2-)	-33.54	0.92 s 11	IT
	192	1-	-32.78	4.94 h 9	ϵ
	192m	(5+)	-32.64	29 ms	IT
	192m	(11-)	-32.34	160 ms 20	IT
	193	3/2+	-33.405	17.65 h 15	ϵ
	193m	11/2-	-33.115	3.9 s 3	IT 99.97%, $\epsilon \approx 0.03\%$
	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+	-32.569	186.098 d 47	ϵ
	195m	11/2-	-32.250	30.5 s 2	IT
	196	2-	-31.139	6.1669 d 6	ϵ 93%, β^- 7%
	196m	5+	-31.054	8.1 s 2	IT
	196m	12-	-30.543	9.6 h 1	IT
	197	3/2+	-31.140	100%	
	197m	11/2-	-30.731	7.73 s 6	IT
	198	2-	-29.581	2.6948 d 12	β^-
	198m	(12-)	-28.769	2.272 d 16	IT
	199	3/2+	-29.094	3.139 d 7	β^-
	199m	(11/2)-	-28.545	0.44 ms 3	IT
	200	(1-)	-27.27	48.4 m 3	β^-
	200m	12-	-26.31	18.7 h 5	β^- 84%, IT 16%
	201	3/2+	-26.401	26.0 m 8	β^-
	202	(1-)	-24.4	28.4 s 12	β^-
	203	3/2+	-23.143	60 s 6	β^-
	204	(2-)	-20.8s	39.8 s 9	β^-
	205	(3/2+)	-18.9s	32.5 s 14	β^-
	205m	(11/2-)	-18.0s	6 s 2	β^- , IT
	206		-14.3s	>300 ns	β^-
	207		-10.8s	>300 ns	β^- , β^-n
	208		-6.1s	>300 ns	β^- , β^-n
	209		-2.5s	>300 ns	β^- , β^-n
	210		2.3s	>300 ns	β^- , β^-n

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
80	Hg	171	3.5s	59 μ s +36-16	α	
		172	0+	-1.1	231 μ s 9	α
		173		-2.6s	0.6 ms +5-2	α
		174	0+	-6.65	2.1 ms +18-7	α 99.6%
		175	(7/2-)	-7.97	10.6 ms 4	α
		176	0+	-11.78	20.3 ms 14	α 94%
		177	(7/2-)	-12.78	118 ms 8	α
		178	0+	-16.31	266.5 ms 24	$\alpha \approx 70\%$, $\epsilon \approx 30\%$
		179	(7/2-)	-16.92	1.05 s 3	α 55%, ϵ 45%, $\epsilon p = 0.15\%$
		180	0+	-20.25	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-	-23.806	9.4 s 7	ϵ 88.3%, α 11.7%, ϵp $2.6 \times 10^{-4}\%$
		184	0+	-26.35	30.87 s 26	ϵ 98.89%, α 1.11%
		185	1/2-	-26.17	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	3/2(-)	-28.12	2.4 m 3	ϵ , $\alpha < 3.7 \times 10^{-4}\%$
		187m	13/2(+)	-28.12	1.9 m 3	ϵ , $\alpha < 3.7 \times 10^{-4}\%$
		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 , $\alpha < 3.4 \times 10^{-7}\%$
		191	3/2(-)	-30.59	49 m 10	ϵ , α $5.0 \times 10^{-6}\%$
		191m	13/2(+)	-30.59	50.8 m 15	ϵ
		192	0+	-32.01	4.85 h 20	ϵ
		193	3/2(-)	-31.06	3.80 h 15	ϵ
		193m	13/2(+)	-30.92	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+	-31.826	0.15% 1			
197	1/2-	-30.540	64.14 h 5	ϵ		
197m	13/2+	-30.241	23.8 h 1	IT 91.4%, ϵ 8.6%		
198	0+	-30.954	9.97% 20			
199	1/2-	-29.546	16.87% 22			
199m	13/2+	-29.014	42.67 m 9	IT		
200	0+	-29.503	23.10% 19			
201	3/2-	-27.662	13.18% 9			
202	0+	-27.345	29.86% 26			
203	5/2-	-25.269	46.594 d 12	β^-		
204	0+	-24.690	6.87% 15			
205	1/2-	-22.287	5.14 m 9	β^-		
205m	13/2+	-20.731	1.09 ms 4	IT		
206	0+	-20.95	8.32 m 7	β^-		
207	(9/2+)	-16.2	2.9 m 2	β^-		
208	0+	-13.27	41 m +5-4	β^-		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
80	Hg	209	-8.5s	35 s +9-6	β^-	
		210	0+	-5.4s	>300 ns	β^- ?
		211		-0.5s	>300 ns	β^- , β^-n
		212	0+	2.8s	>300 ns	β^- , β^-n
		213		7.8s	>300 ns	β^- , β^-n
		214	0+	11.2s	>300 ns	β^- , β^-n
		215		16.3s	>300 ns	β^- , β^-n
216	0+	19.9s	>300 ns	β^- , β^-n		
81	Tl	176 (3-,4-,5-)	0.58	5.2 ms +30-14	p	
		177 (1/2+)	-3.33	18 ms 5	α 73%, p 27%	
		178	-4.8s	254 ms +11-9	α \approx 53%, ϵ \approx 47%	
		179 (1/2+)	-8.30	0.23 s 4	α < 100%, ϵ , p	
		179m (11/2-)	-8.30	1.5 ms 3	α \leq 100%, p, ϵ , IT	
		180 (4-,5-)	-9.26	1.09 s 1	ϵ 94%, α 6%, ϵ SF \approx $1.0 \times 10^{-4}\%$	
		181 (1/2+)	-12.799	3.2 s 3	ϵ , α \leq 10%	
		181m (9/2-)	-11.963	1.40 ms 3	IT 99.6%, α 0.4%	
		182 (7+)	-13.35	3.1 s 10	ϵ 97.5%, α < 5%	
		183 (1/2+)	-16.589	6.9 s 7	α , ϵ > 0%	
		183m (9/2-)	-15.959	53.3 ms 3	IT, ϵ , α 2%	
		184	-16.89	10.1 s 5	ϵ 97.9%, α 2.1%	
		185 (1/2+)	-19.75	19.5 s 5	ϵ	
		185m (9/2-)	-19.30	1.93 s 8	α , IT	
		186m (7+)	-19.87	27.5 s 10	ϵ , α \approx $6.0 \times 10^{-3}\%$	
		186m (10-)	-19.50	2.9 s 2	IT	
		187 (1/2+)	-22.443	\approx 51 s	ϵ , α \approx 0.03%	
		187m (9/2-)	-22.109	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	
		188m (9-)	-22.08	41 ms 4	IT, 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(-)	-24.31	2.6 m 3	ϵ	
		190m 7(+)	-24.31	3.7 m 3	ϵ	
		190m (8-)	-24.15	0.75 ms 4	IT	
		191 (1/2+)	-26.282			
		191m 9/2(-)	-26.282	5.22 m 16		
		192 (2-)	-25.87	9.6 m 4	ϵ	
		192m (7+)	-25.72	10.8 m 2	ϵ	
		193 1/2(+)	-27.30	21.6 m 8	ϵ	
		193m (9/2-)	-26.93	2.11 m 15	IT \leq 75%, ϵ \geq 25%	
		194 2-	-26.8	33.0 m 5	ϵ , α < $1.0 \times 10^{-4}\%$	
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 96.2%, IT 3.8%			
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 55.9%, IT 44.1%			

Nuclear Wallet Cards

Nuclide		Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El A	J π	(MeV)	Abundance	Decay Mode
81	Tl	198m (10-)	-26.75	32.1 ms 10	IT
		199 1/2+	-28.06	7.42 h 8	ϵ
		199m 9/2-	-27.31	28.4 ms 2	IT
		200 2-	-27.047	26.1 h 1	ϵ
		200m 7+	-26.293	34.0 ms 9	IT
		201 1/2+	-27.18	3.0421 d 17	ϵ
		201m (9/2-)	-26.26	2.01 ms 7	IT
		202 2-	-25.99	12.31 d 8	ϵ
		203 1/2+	-25.762	29.524% 1	
		204 2-	-24.346	3.783 y 12	β^- 97.08%, ϵ 2.92%
		205 1/2+	-23.821	70.48% 1	
		206 0-	-22.254	4.202 m 11	β^-
		206m (12-)	-19.611	3.74 m 3	IT
		207 1/2+	-21.034	4.77 m 3	β^-
		207m 11/2-	-19.686	1.33 s 11	IT
		208 5+	-16.752	3.053 m 4	β^-
		209 (1/2+)	-13.637	2.161 m 7	β^-
		210 (5+)	-9.25	1.30 m 3	β^- , β^-n $7.0 \times 10^{-3}\%$
		211	-5.9s	>300 ns	β^- ?
		212	-1.5s	>300 ns	β^- ?
		213	1.76	101 s +486-46	β^-
	214	6.5s	>300 ns	β^- , β^-n	
	215	10.1s	>300 ns	β^- , β^-n	
	216	14.7s	>300 ns	β^- , β^-n	
	217	18.4s	>300 ns	β^- , β^-n	
82	Pb	178 0+	3.57	0.12 ms +22-5	α
		179 (9/2-)	2.05	3.5 ms +14-8	α
		180 0+	-1.93	4.2 ms 5	α
		181 (9/2-)	-3.10	36 ms 2	α
		181m (13/2+)	-3.10	45 ms 20	$\alpha < 100\%$
		182 0+	-6.82	55 ms 5	$\alpha \approx 98\%$, $\epsilon \approx 2\%$
		183 (3/2-)	-7.57	535 ms 30	$\alpha \approx 90\%$
		183m (13/2+)	-7.47	415 ms 20	α
		184 0+	-11.05	490 ms 25	α 80%, ϵ 20%
		185 3/2-	-11.54	6.3 s 4	ϵ , α 34%
		185m 13/2+	-11.54	4.3 s 2	α 50%, ϵ
		186 0+	-14.68	4.82 s 3	ϵ 60%, α 40%
		187 (13/2+)	-14.990	18.3 s 3	ϵ 88%, α 12%
		187m (3/2-)	-14.957	15.2 s 3	ϵ 90.5%, α 9.5%
		188 0+	-17.82	25.1 s 1	ϵ 90.7%, α 9.3%
		189 (3/2-)	-17.88	39 s 8	ϵ , $\alpha < 1\%$
		189m (13/2+)	-17.84	50 s 3	ϵ , $\alpha < 1\%$
		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+)	-20.25	2.18 m 8	ϵ , $\alpha \approx 0.02\%$
		192 0+	-22.56	3.5 m 1	ϵ 99.99%, α $5.9 \times 10^{-3}\%$
		193 (3/2-)	-22.19		ϵ
		193m (13/2+)	-22.19	5.8 m 2	ϵ
	194 0+	-24.21	10.7 m 6	ϵ , α $7.3 \times 10^{-6}\%$	
	195 3/2-	-23.71	≈ 15 m	ϵ	
	195m 13/2+	-23.51	15.0 m 12	ϵ	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
82 Pb	196	0+	-25.36	37 m 3	$\epsilon, \alpha \leq 3.0 \times 10^{-5}\%$
	197	3/2-	-24.748	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-	-25.231	90 m 10	ϵ
	199m (13/2+)		-24.806	12.2 m 3	IT=93%, $\epsilon \approx 7\%$
	200	0+	-26.25	21.5 h 4	ϵ
	201	5/2-	-25.26	9.33 h 3	ϵ
	201m	13/2+	-24.63	60.8 s 18	IT
	202	0+	-25.937	52.5×10^3 y 28	ϵ
	202m	9-	-23.767	3.54 h 2	IT 90.5%, ϵ 9.5%
	203	5/2-	-24.787	51.92 h 3	ϵ
	203m	13/2+	-23.962	6.21 s 11	IT
	203m	29/2-	-21.838	480 ms 7	IT
	204	0+	-25.110	$\geq 1.4 \times 10^{17}$ y	α
				1.4% I	
	204m	9-	-22.924	66.93 m 10	IT
	205	5/2-	-23.770	1.73×10^7 y 7	ϵ
	205m	13/2+	-22.756	5.55 ms 2	IT
	206	0+	-23.786	24.1% I	
	207	1/2-	-22.452	22.1% I	
	207m	13/2+	-20.819	0.806 s 5	IT
208	0+	-21.749	52.4% I		
209	9/2+	-17.615	3.253 h 14	β^-	
210	0+	-14.729	22.20 y 22	β^- , α $1.9 \times 10^{-6}\%$	
211	9/2+	-10.491	36.1 m 2	β^-	
212	0+	-7.553	10.64 h 1	β^-	
213 (9/2+)		-3.200	10.2 m 3	β^-	
214	0+	-0.181	26.8 m 9	β^-	
215		4.5s	147 s 12	β^-	
216	0+	7.7s	>300 ns	β^-	
217		12.4s	>300 ns	β^-	
218	0+	15.6s	>300 ns	β^-	
219		20.5s	>300 ns	β^-	
220	0+	23.9s	>300 ns	β^-	
83 Bi	184m		1.19	13 ms 2	α
	184m		1.19	6.6 ms 15	α
	185	1/2+	-2.3s	58 μ s 4	p 90%, α 10%
	186	(3+)	-3.17	15.0 ms 17	α
	186m	(10-)	-3.17	9.8 ms 13	α
	187	(9/2-)	-6.39	37 ms 2	α
	187m	(1/2+)	-6.27	0.370 ms 20	α
	188m	(10-)	-7.20	265 ms 15	$\alpha, \epsilon?$
	188m	(3+)	-7.20	60 ms 3	$\alpha, \epsilon?$
	189	(9/2-)	-10.06	674 ms 11	$\alpha > 50\%, \epsilon < 50\%$
	189m	(1/2+)	-9.88	5.0 ms 1	$\alpha > 50\%, \epsilon < 50\%$
	190m	(3+)	-10.59	6.3 s 1	α 90%, ϵ 10%
	190m	(10-)	-10.59	6.2 s 1	α 70%, ϵ 30%
	191	(9/2-)	-13.240	12.4 s 3	α 51%, ϵ 49%
	191m	(1/2+)	-12.999	125 ms 13	α 68%, IT 32%, ϵ
	192	(3+)	-13.55	34.6 s 9	ϵ 88%, α 12%
192m	(10-)	-13.40	39.6 s 4	ϵ 90%, α 10%	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode	
Z	El	A	(MeV)	Abundance		
83	Bi	193	(9/2-)	-15.872	63.6 s 30	ϵ 96.5%, α 3.5%
		193m	(1/2+)	-15.564	3.2 s 5	α 84%, ϵ 16%
		194	(3+)	-15.97	95 s 3	ϵ 99.54%, α 0.46%
		194m	(6+,7+)	-15.97	125 s 2	ϵ
		194m	(10-)	-15.97	115 s 4	ϵ 99.8%, α 0.2%
		195	(9/2-)	-18.025	183 s 4	ϵ 99.97%, α 0.03%
		195m	(1/2+)	-17.624	87 s 1	ϵ 67%, α 33%
		196	(3+)	-18.01	308 s 12	ϵ , α $1.2 \times 10^{-3}\%$
		196m	(7+)	-17.84	0.6 s 5	ϵ , IT
		196m	(10-)	-17.74	240 s 3	ϵ 74.2%, IT 25.8%, α $3.8 \times 10^{-4}\%$
		197	(9/2-)	-19.686	9.33 m 50	ϵ , α $1.0 \times 10^{-4}\%$
		197m	(1/2+)	-19.186	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+)	-20.13	24.70 m 15	ϵ 99%, IT \leq 2%, $\alpha \approx 0.01\%$
		200	7+	-20.37	36.4 m 5	ϵ
		200m	(2+)	-20.37	31 m 2	$\epsilon \leq 100\%$
		200m	(10-)	-19.94	0.40 s 5	IT
		201	9/2-	-21.42	103 m 3	ϵ
		201m	1/2+	-20.57	57.5 m 21	$\epsilon > 91.1\%$, IT $\leq 8.6\%$, $\alpha \approx 0.3\%$
		202	5+	-20.74	1.71 h 4	ϵ
		203	9/2-	-21.52	11.76 h 5	ϵ
		203m	1/2+	-20.43	305 ms 5	IT
		204	6+	-20.645	11.22 h 10	ϵ
		204m	10-	-19.840	13.0 ms 1	IT
		204m	17+	-17.812	1.07 ms 3	IT
		205	9/2-	-21.064	15.31 d 4	ϵ
		206	6+	-20.028	6.243 d 3	ϵ
		206m	10-	-18.983	0.89 ms 1	IT
		207	9/2-	-20.055	31.55 y 4	ϵ
208	5+	-18.870	3.68×10^5 y 4	ϵ		
208m	10-	-17.299	2.58 ms 4	IT		
209	9/2-	-18.259	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(-)	-8.120	60.55 m 6	β^- 64.06%, α 35.94%		
212m	(8-,9-)	-7.870	25.0 m 2	α 67%, β^- 33%, β^- α 30%		
212m	≥ 16	-6.210	7.0 m 3	β^-		
213	9/2-	-5.230	45.59 m 6	β^- 97.8%, α 2.2%		
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	>23/2-	3.00	36.9 s 6	IT 76.2%, β^- 23.8%		
216	(6-,7-)	5.87	2.25 m 5	$\beta^- \leq 100\%$		
216m	(3)	5.87	6.6 m 21	$\beta^- \leq 100\%$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
83	Bi	217	(9/2-)	8.9s	98.5 s 8	β^-
		218		13.2s	33 s 1	β^-
		219		16.3s	>300 ns	β^-
		220		20.7s	>300 ns	β^-
		221		24.0s	>300 ns	β^- , β^-n
		222		28.4s	>300 ns	β^-
		223		31.9s	>300 ns	β^- , β^-n
		224		36.4s	>300 ns	β^- , β^-n
84	Po	186	0+	4.10		
		187	(1/2-, 5/2-)	2.83	1.40 ms 25	α
		188	0+	-0.54	0.275 ms 30	ϵ , α
		189	(7/2-)	-1.42	3.5 ms 5	α
		190	0+	-4.56	2.46 ms 5	α
		191	(3/2-)	-5.05	22 ms 1	α 99%
		191m	(13/2+)	-5.01	93 ms 3	α 96%
		192	0+	-8.07	32.2 ms 3	$\alpha \approx 99.5\%$, $\epsilon \approx 0.5\%$
		193m	(13/2+)	-8.36	245 ms 22	$\alpha \leq 100\%$
		193m	(3/2-)	-8.36	370 ms +46-40	$\alpha \leq 100\%$
		194	0+	-11.01	0.392 s 4	α , ϵ
		195	(3/2-)	-11.07	4.64 s 9	α 75%, ϵ 25%
		195m	(13/2+)	-10.84	1.92 s 2	$\alpha \approx 90\%$, $\epsilon \approx 10\%$, IT < 0.01%
		196	0+	-13.47	5.8 s 2	$\alpha \approx 98\%$, $\epsilon \approx 2\%$
		197	(3/2-)	-13.36	84 s 16	ϵ 56%, α 44%
		197m	(13/2+)	-13.15	32 s 2	α 84%, ϵ 16%, IT 0.01%
		198	0+	-15.47	1.77 m 3	α 57%, ϵ 43%
		199	(3/2-)	-15.21	5.47 m 15	ϵ 92.5%, α 7.5%
		199m	(13/2+)	-14.90	4.17 m 5	ϵ 73.5%, α 24%, IT 2.5%
		200	0+	-16.95	11.51 m 8	ϵ 88.9%, α 11.1%
		201	3/2-	-16.524	15.6 m 1	ϵ 98.87%, α 1.13%
		201m	13/2+	-16.100	8.96 m 12	IT 56.2%, ϵ 41.4%, α 2.4%
		202	0+	-17.92	44.6 m 4	ϵ 98.08%, α 1.92%
		203	5/2-	-17.310	36.7 m 5	ϵ 99.89%, α 0.11%
		203m	13/2+	-16.668	45 s 2	IT, ϵ
		204	0+	-18.34	3.519 h 12	ϵ 99.33%, α 0.67%
		205	5/2-	-17.51	1.74 h 8	ϵ 99.96%, α 0.04%
		205m	13/2+	-16.63	0.645 ms 20	IT
205m	19/2-	-16.05	57.4 ms 9	IT		
206	0+	-18.185	8.8 d 1	ϵ 94.55%, α 5.45%		
207	5/2-	-17.146	5.80 h 2	ϵ 99.98%, α 0.02%		
207m	19/2-	-15.763	2.79 s 8	IT		
208	0+	-17.470	2.898 y 2	α , ϵ $4.0 \times 10^{-3}\%$		
209	1/2-	-16.366	102 y 5	α 99.52%, ϵ 0.48%		
210	0+	-15.953	138.376 d 2	α		
211	9/2+	-12.433	0.516 s 3	α		
211m	(25/2+)	-10.971	25.2 s 6	α 99.98%, IT 0.02%		
212	0+	-10.370	0.299 μ s 2	α		
212m	(18+)	-7.448	45.1 s 6	α 99.93%, IT 0.07%		
213	9/2+	-6.654	3.72 μ s 2	α		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
84	Po	214	0+	-4.470	164.3 μ s 20	α
		215	9/2+	-0.540	1.781 ms 4	α , β - 2.3 $\times 10^{-4}\%$
		216	0+	1.778	0.145 s 2	α
		217	(9/2+)	5.886	1.53 s 5	α
		218	0+	8.357	3.098 m 12	α 99.98%, β - 0.02%
		219		12.6s	>300 ns	β -
		220	0+	15.3s	>300 ns	β -
		221		19.78	112 s +58-28	β - ?
		222	0+	22.48	550 s 430	β - ?
		223		26.8s	>300 ns	β -
		224	0+	29.7s	>300 ns	β -
		225		34.3s	>300 ns	β -
		226	0+	37.3s	>300 ns	β -
		227		42.0s	>300 ns	β -
85	At	191	(1/2+)	3.86	1.7 ms +11-5	α
		191m	(7/2-)	3.92	2.1 ms +4-3	α
		192m		2.92	11.5 ms 6	α
		192m	(9-,10-)	2.92	88 ms 6	α
		193	(1/2+)	-0.06	28 ms +5-4	α
		193m	(7/2-)	-0.06	21 ms 5	α
		193m	(13/2+)	-0.03	27 ms +4-3	IT 76%, α 24%
		194m	(9-10-)	-0.70	310 ms 8	α
		194m		-0.70	253 ms 10	α
		195	1/2+	-3.476	328 ms 20	α
		195m	7/2-	-3.476	147 ms 5	α
		196	(3+)	-3.92	0.388 s 7	α 95.1%, ϵ 4.9%
		197	(9/2-)	-6.34	0.388 s 6	α 96.1%, ϵ 3.9%
		197m	(1/2+)	-6.29	2.0 s 2	α \leq 100%, ϵ , IT \leq 4.0 $\times 10^{-3}\%$
		198	(3+)	-6.65	3.8 s 4	α 90%, ϵ 10%
		198m	(10-)	-6.55	1.04 s 15	α 84%, ϵ 16%
		199	(9/2-)	-8.822	7.03 s 15	α 90%, ϵ 10%
		200	(3+)	-8.99	43 s 1	α 52%, ϵ 48%
		200m	(7+)	-8.88	47 s 1	ϵ \leq 57%, α 43%
		200m	(10-)	-8.64	7.3 s +26-15	ϵ < 89.5%, IT < 89.5%, α = 10.5%
		201	(9/2-)	-10.789	85.2 s 16	α 71%, ϵ 29%
		202	(2+,3+)	-10.59	184 s 1	ϵ 63%, α 37%
		202m	(7+)	-10.59	182 s 2	ϵ 91.3%, α 8.7%
		202m	(10-)	-10.20	0.46 s 5	IT 99.9%, α 0.1%
		203	9/2-	-12.16	7.4 m 2	ϵ 69%, α 31%
		204	7+	-11.88	9.12 m 11	ϵ 96.09%, α 3.91%
		204m	10-	-11.29	108 ms 10	IT
		205	9/2-	-12.97	26.9 m 8	ϵ 90%, α 10%
206	(5+)	-12.43	30.6 m 8	ϵ 99.1%, α 0.9%		
207	9/2-	-13.23	1.81 h 3	ϵ 91.4%, α 8.6%		
208	6+	-12.469	1.63 h 3	ϵ 99.45%, α 0.55%		
209	9/2-	-12.882	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-	-11.648	7.214 h 7	ϵ 58.2%, α 41.8%		
212	(1-)	-8.628	0.314 s 2	α , ϵ < 0.03%, β - < 2.0 $\times 10^{-6}\%$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	(MeV)	Abundance	Decay Mode			
85	At	212m	(9-)	-8.405	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-	2.254	0.30 ms 3	α , $\beta^- < 6.0 \times 10^{-3}\%$, $\epsilon < 3.0 \times 10^{-7}\%$		
		217	9/2-	4.395	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	$\alpha \approx 97\%$, $\beta^- \approx 3\%$		
		220	3	14.35	3.71 m 4	$\beta^- 92\%$, $\alpha 8\%$		
		221		16.8s	2.3 m 2	β^-		
		222		20.6s	54 s 10	β^-		
		223		23.4s	50 s 7	β^-		
		224		27.71	76 s + 138-23	$\beta^- ?$		
		225		30.2s	>300 ns	β^-		
		226		34.2s	>300 ns	β^-		
		227		37.2s	>300 ns	β^-		
		228		41.4s	>300 ns	β^-		
		229		44.6s	>300 ns	β^- , β^-n		
		86	Rn	193	(3/2-)	9.05	1.15 ms 27	α
				194	0+	5.72	0.78 ms 16	α
				195	3/2-	5.06	6 ms +3-2	α
				195m	13/2+	5.12	5 ms +3-2	α
196	0+			1.97	4.4 ms +13-9	α 99.9%, $\epsilon \approx 0.1\%$		
197	(3/2-)			1.48	53 ms +7-5	α		
197m	(13/2+)			1.48	25 ms +3-2	α		
198	0+			-1.23	65 ms 3	α , ϵ		
199	(3/2-)			-1.51	0.59 s 3	α 94%, ϵ 6%		
199m	(13/2+)			-1.33	0.31 s 2	α 97%, ϵ 3%		
200	0+			-4.01	1.03 s +20-11	α 86%, ϵ 14%		
201	(3/2-)			-4.07	7.0 s 4	α , ϵ		
201m	(13/2+)			-4.07	3.8 s 1	ϵ , α		
202	0+			-6.28	9.7 s 1	α 78%, ϵ 22%		
203	(3/2-)			-6.16	44 s 2	α 66%, ϵ 34%		
203m	(13/2+)			-5.80	26.9 s 5	α 75%, ϵ 25%		
204	0+			-7.98	74.5 s 14	α 72.4%, ϵ 27.6%		
205	5/2-			-7.71	170 s 4	ϵ 75.4%, α 24.6%		
206	0+			-9.12	5.67 m 17	α 62%, ϵ 38%		
207	5/2-			-8.634	9.25 m 17	ϵ 79%, α 21%		
208	0+			-9.66	24.35 m 14	α 62%, ϵ 38%		
209	5/2-			-8.93	28.5 m 10	ϵ 83%, α 17%		
210	0+	-9.601	2.4 h 1	α 96%, ϵ 4%				
211	1/2-	-8.756	14.6 h 2	ϵ 72.6%, α 27.4%				
212	0+	-8.660	23.9 m 12	α				
213	(9/2+)	-5.699	19.5 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+	0.254	45 μ s 5	α				
217	9/2+	3.657	0.54 ms 5	α				
218	0+	5.216	35 ms 5	α				
219	5/2+	8.831	3.96 s 1	α				

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
86	Rn	220	0+	10.607	55.6 s 1	α
		221	7/2+	14.473	25 m 2	β^- 78%, α 22%
		222	0+	16.373	3.8235 d 3	α
		223	7/2	20.40	24.3 m 4	β^-
		224	0+	22.43	107 m 3	β^-
		225	7/2-	26.56	4.66 m 4	β^-
		226	0+	28.74	7.4 m 1	β^-
		227		32.87	20.8 s 7	β^-
		228	0+	35.25	65 s 2	β^-
		229		39.36	12.0 s +12-13	β^-
		230	0+	42.1s	>300 ns	β^-
		231		46.5s	>300 ns	β^-
	87	Fr	199		6.76	12 ms +10-4
		200	(3+)	6.12	49 ms 4	α
		201	(9/2-)	3.60	62 ms 5	α
		201m	(1/2+)	3.60	19 ms +19-6	α
		202	(3+)	3.16	0.30 s 5	α
		202m	(10-)	3.16	0.29 s 5	α
		203	(9/2-)	0.877	0.55 s 1	α \leq 100%
		204	(3+)	0.61	1.8 s 3	α 92%, ϵ 8%
		204m	(7+)	0.65	1.6 s +5-3	α 90%, ϵ 10%
		204m	(10-)	0.92	0.8 s 2	α 74%, ϵ 26%
		205	(9/2-)	-1.309	3.97 s 4	α 98.5%, ϵ 1.5%
		206	(2+,3+)	-1.24	\approx 16 s	α \approx 84%, ϵ \approx 16%
		206m	(7+)	-1.24	\approx 16 s	α \approx 84%, ϵ \approx 16%
		206m	(10-)	-0.71	0.7 s 1	IT 95%, α 5%
		207	9/2-	-2.84	14.8 s 1	α 95%, ϵ 5%
		208	7+	-2.67	59.1 s 3	α 89%, ϵ 11%
		209	9/2-	-3.77	50.5 s 7	α 89%, ϵ 11%
		210	6+	-3.33	3.18 m 6	α 71%, ϵ 29%
		211	9/2-	-4.14	3.10 m 2	α 87%, ϵ 13%
		212	5+	-3.515	20.0 m 6	ϵ 57%, α 43%
		213	9/2-	-3.553	34.82 s 14	α 99.44%, ϵ 0.56%
		214	(1-)	-0.959	5.0 ms 2	α
		214m	(8-)	-0.837	3.35 ms 5	α
		215	9/2-	0.317	86 ns 5	α
		216	(1-)	2.970	700 ns 20	α
		217	9/2-	4.313	19 μ s 3	α
		218	1-	7.058	1.0 ms 6	α
		218m		7.144	22.0 ms 5	α \leq 100%, IT
		219	9/2-	8.617	20 ms 2	α
	220	1+	11.480	27.4 s 3	α 99.65%, β^- 0.35%	
	221	5/2-	13.278	286.1 s 10	α , β^- < 0.1%	
	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-	21.65	3.33 m 10	β^-	
	225	3/2-	23.82	3.95 m 14	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 20	β^-	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
87	Fr	230	39.50	19.1 s 5	β^-	
		231	(1/2+)	42.3s	17.6 s 6	β^-
		232	(5)	46.1s	5.5 s 6	β^-
		233		49.2s	>300 ns	β^-
88	Ra	201m	(13/2+)	11.8s	1.6 ms +77-7	α, ϵ
		202	0+	9.09	16 ms +30-7	α
		203	(3/2-)	8.66	31 ms +17-9	α
		203m	(13/2+)	8.66	24 ms +6-4	α
		204	0+	6.06	57 ms +11-5	α
		205	(3/2-)	5.84	210 ms +60-40	$\alpha \leq 100\%, \epsilon$
		205m	(13/2+)	5.84	170 ms +60-40	$\alpha \leq 100\%, \epsilon$
		206	0+	3.56	0.24 s 2	α
		207	(3/2-, 5/2-)	3.54	1.35 s -13+22	$\alpha \approx 86\%, \epsilon \approx 14\%$
		207m	(13/2+)	4.09	59 ms 4	IT $\geq 85\%, \alpha \leq 15\%$
		208	0+	1.71	1.3 s 2	$\alpha 95\%, \epsilon 5\%$
		209	5/2-	1.85	4.6 s 2	$\alpha \approx 90\%, \epsilon \approx 10\%$
		210	0+	0.46	3.7 s 2	$\alpha \approx 96\%, \epsilon \approx 4\%$
		211	5/2(-)	0.832	13 s 2	$\alpha > 93\%, \epsilon < 7\%$
		212	0+	-0.20	13.0 s 2	$\alpha \approx 85\%, \epsilon \approx 15\%$
		213	1/2-	0.36	2.73 m 5	$\alpha 80\%, \epsilon 20\%$
		213m	(17/2-)	2.13	2.20 ms 5	IT = 99.4%, $\alpha = 0.6\%$
		214	0+	0.095	2.46 s 3	$\alpha 99.94\%, \epsilon 0.06\%$
		215	(9/2+)	2.532	1.55 ms 7	α
		216	0+	3.290	182 ns 10	$\alpha, \epsilon < 1.0 \times 10^{-8}\%$
		217	(9/2+)	5.886	1.6 μ s 2	α
		218	0+	6.65	25.2 μ s 3	α
		219	(7/2+)	9.393	10 ms 3	α
		220	0+	10.272	18 ms 2	α
		221	5/2+	12.963	28 s 2	$\alpha, {}^{14}\text{C} 1 \times 10^{-12}\%$
		222	0+	14.320	38.0 s 5	$\alpha, {}^{14}\text{C} 3.0 \times 10^{-8}\%$
		223	3/2+	17.234	11.43 d 5	$\alpha, {}^{14}\text{C} 8.9 \times 10^{-8}\%$
		224	0+	18.821	3.6319 d 23	$\alpha, {}^{14}\text{C} 4.0 \times 10^{-9}\%$
		225	1/2+	21.995	14.9 d 2	β^-
		226	0+	23.668	1600 y 7	$\alpha, {}^{14}\text{C} 3.2 \times 10^{-9}\%$
		227	3/2+	27.178	42.2 m 5	β^-
		228	0+	28.946	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+)	38.22	104.1 s 8	β^-		
232	0+	40.50	4.2 m 8	β^-		
233		44.6s	30 s 5	β^-		
234	0+	47.2s	30 s 10	β^-		
235		51.4s				
89	Ac	206	(3+)	13.53	22 ms +9-5	α
		206m	(10-)	13.53	33 ms +22-9	α
		207	(9/2-)	11.15	27 ms +11-6	α
		208	(3+)	10.76	95 ms +24-16	$\alpha \approx 99\%, \epsilon \approx 1\%$
		208m	(10-)	11.27	25 ms +9-5	$\alpha \approx 90\%, \epsilon \approx 10\%$
		209	(9/2-)	8.84	0.10 s 5	$\alpha \approx 99\%, \epsilon \approx 1\%$
		210		8.79	0.35 s 5	$\alpha 91\%, \epsilon \approx 9\%$
		211		7.20	0.21 s 3	α
		212		7.27	0.93 s 5	$\alpha \approx 57\%, \epsilon \approx 43\%$

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
89	Ac	213	6.16	738 ms 16	$\alpha \leq 100\%$	
		214	(5+)	6.44	8.2 s 2	$\alpha \geq 89\%, \epsilon \leq 11\%$
		215	9/2-	6.03	0.17 s 1	$\alpha 99.91\%, \epsilon 0.09\%$
		216	(1-)	8.14	440 μ s 16	α
		216m	(9-)	8.19	441 μ s 7	α
		217	9/2-	8.70	69 ns 4	$\alpha, \epsilon \leq 2\%$
		218	(1-)	10.84	1.08 μ s 9	α
		219	9/2-	11.57	11.8 μ s 15	α
		220	(3-)	13.742	26.4 ms 2	$\alpha, \epsilon 5.0 \times 10^{-4}\%$
		221	(3/2-)	14.52	52 ms 2	α
		222	1-	16.620	5.0 s 5	$\alpha 99\%, \epsilon 1\%$
		222m		16.620	63 s 3	$\alpha \geq 88\%, IT \leq 10\%, \epsilon \geq 0.7\%$
		223	(5/2-)	17.826	2.10 m 5	$\alpha 99\%, \epsilon 1\%$
		224	0-	20.231	2.78 h 17	$\epsilon 90.9\%, \alpha 9.1\%, \beta < 1.6\%$
		225	(3/2-)	21.638	10.0 d 1	$\alpha, {}^{14}\text{C} 4 \times 10^{-12}\%$
		226	(1)	24.309	29.37 h 12	$\beta - 83\%, \epsilon 17\%, \alpha 6.0 \times 10^{-3}\%$
		227	3/2-	25.851	21.772 y 3	$\beta - 98.62\%, \alpha 1.38\%$
		228	3+	28.900	6.15 h 2	$\beta -$
		229	(3/2+)	30.75	62.7 m 5	$\beta -$
		230	(1+)	33.8	122 s 3	$\beta -, \beta - \text{F} 1.2 \times 10^{-6}\%$
		231	(1/2+)	35.9	7.5 m 1	$\beta -$
		232	(1+)	39.2	119 s 5	$\beta -$
		233	(1/2+)	41.5s	145 s 10	$\beta -$
234		45.0s	44 s 7	$\beta -$		
235		47.6s	60 s 4	$\beta -$		
236		51.27		$\beta - ?$		
237		54.3s				
90	Th	208	0+	16.68	1.7 ms +17-6	α
		209	(5/2-)	16.54	2.5 ms +17-7	α
		210	0+	14.06	16 ms 4	$\alpha 99\%, \epsilon \approx 1\%$
		211		13.90	0.04 s +3-1	α
		212	0+	12.10	31.7 ms 13	$\alpha, \epsilon = 0.3\%$
		213		12.12	144 ms 21	$\alpha \leq 100\%$
		214	0+	10.71	87 ms 10	α
		215	(1/2-)	10.921	1.2 s 2	α
		216	0+	10.29	26.0 ms 2	$\alpha, \epsilon = 0.01\%$
		216m	8+	12.33	134 μ s 4	$\alpha 2.8\%, IT$
		217	(9/2+)	12.22	0.241 ms 5	α
		218	0+	12.37	117 ns 9	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+)	16.937	1.68 ms 6	α
		222	0+	17.20	2.8 ms 3	α
		223	(5/2+)	19.384	0.60 s 2	α
224	0+	20.00	0.81 s 10	α		
225	(3/2+)	22.309	8.75 m 4	$\alpha \approx 90\%, \epsilon \approx 10\%$		
226	0+	23.196	30.57 m 10	α		
227	1/2+	25.806	18.68 d 9	α		
228	0+	26.766	1.9116 y 16	$\alpha, {}^{20}\text{O} 1 \times 10^{-11}\%$		

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Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$				
Z	El	A	(MeV)	Abundance	Decay Mode			
90	Th	229	5/2+	29.587	7932 y 28	α		
		229m	(3/2+)	29.587	2 m 1	IT?		
		230	0+	30.863	7.54×10^4 y 3	α , ^{24}Ne $6 \times 10^{-11}\%$, SF $\leq 4 \times 10^{-12}\%$		
		231	5/2+	33.816	25.52 h 1	β^- , $\alpha = 4 \times 10^{-11}\%$		
		232	0+	35.452	1.40×10^{10} y 1	α , SF $1.1 \times 10^{-9}\%$		
		233	1/2+	38.737	21.83 m 4	β^-		
		234	0+	40.615	24.10 d 3	β^-		
		235	(1/2+)	44.26	7.2 m 1	β^-		
		236	0+	46.5s	37.3 m 15	β^-		
		237	(5/2+)	50.2s	4.7 m 6	β^-		
		238	0+	52.6s	9.4 m 20	β^-		
		239		56.6s				
		91	Pa	212		21.61	5.1 ms +61-19	α
				213		19.66	5.3 ms +40-16	α
214				19.49	17 ms 3	$\alpha \leq 100\%$		
215				17.87	14 ms 2	α		
216				17.80	0.15 s +6-4	$\alpha \approx 98\%$, $\epsilon \approx 2\%$		
217				17.07	3.6 ms 8	α		
217m				18.92	1.2 ms 2	α 73%, IT 27%		
218				18.68	113 μ s 10	α		
219m	9/2-			18.54	53 ns 10	α		
220m				20.40	0.78 μ s 16	α , ϵ $3.0 \times 10^{-7}\%$		
221	9/2-			20.38	5.9 μ s 17	α		
222				22.11s	2.9 ms +6-4	α		
223				22.32	5.1 ms 6	α		
224				23.861	0.85 s 2	α		
225				24.34	1.7 s 2	α		
226				26.03	1.8 m 2	α 74%, ϵ 26%		
227	(5/2-)			26.831	38.3 m 3	α 85%, ϵ 15%		
228	3+			28.921	22.4 h 10	ϵ 98.15%, α 1.85%		
229	(5/2+)			29.898	1.50 d 5	ϵ 99.52%, α 0.48%		
230	(2-)			32.173	17.4 d 5	ϵ 92.2%, β^- 7.8%, α $3.2 \times 10^{-3}\%$		
231	3/2-	33.425	3.276×10^4 y 11	α , SF $\leq 2 \times 10^{-11}\%$				
232	(2-)	35.941	1.32 d 2	β^- , ϵ				
233	3/2-	37.491	26.975 d 13	β^-				
234	4+	40.342	6.70 h 5	β^-				
234m	(0-)	40.416	1.159 m 11	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^-				
239	(3/2)	53.3s	1.8 h 5	β^-				
240		56.8s		β^- ?				
241		59.7s						
92	U	217		22.71	16 ms +21-6	$\alpha \leq 100\%$		
		218	0+	21.91	0.51 ms +17-10	α		
		218m	(8+)	24.02	0.56 ms +26-14	α		
		219		23.30	42 μ s +34-13	α		
		220	0+	23.0s		$\alpha?$, $\epsilon?$		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$		
Z	El	A	(MeV)	Abundance	Decay Mode	
92	U	221	(9/2+)	24.6s	700 ns	
		222	0+	24.3s	1.0 μ s +12-4	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	95 ms 15	α
		226	0+	27.33	0.35 s 15	α
		227	(3/2+)	29.02	1.1 m 1	α
		228	0+	29.22	9.1 m 2	$\alpha > 95\%, \epsilon < 5\%$
		229	(3/2+)	31.209	58 m 3	$\epsilon \approx 80\%, \alpha \approx 20\%$
		230	0+	31.613	20.8 d	$\alpha, \text{ SF} < 1 \times 10^{-10}\%$, $^{22}\text{Ne } 5 \times 10^{-12}\%$
		231	(5/2-)	33.807	4.2 d 1	$\epsilon, \alpha \approx 4.0 \times 10^{-3}\%$
		232	0+	34.604	68.9 y 4	$\alpha, \text{ SF } 3 \times 10^{-12}\%$
		233	5/2+	36.921	1.592×10^5 y 2	$\alpha, ^{24}\text{Ne } 9 \times 10^{-10}\%$, $\text{SF} < 6 \times 10^{-11}\%$, $^{28}\text{Mg} < 1. \times 10^{-13}\%$
		234	0+	38.148	2.455×10^5 y 6 0.0054% 5	$\alpha,$ $\text{SF } 1.6 \times 10^{-9}\%$, $\text{Mg } 1 \times 10^{-11}\%$, $\text{Ne } 9 \times 10^{-12}\%$
		235	7/2-	40.921	7.04×10^8 y 1 0.7204% 6	$\alpha,$ $\text{SF } 7.0 \times 10^{-9}\%$, $^{28}\text{Mg } 8. \times 10^{-10}\%$, $\text{Ne} \approx 8. \times 10^{-10}\%$
		235m	1/2+	40.921	≈ 26 m	IT
		236	0+	42.447	2.342×10^7 y 4	$\alpha, \text{ SF } 9.4 \times 10^{-8}\%$
		237	1/2+	45.393	6.75 d 1	$\beta-$
		238	0+	47.310	4.468×10^9 y 3 99.2742% 10	$\alpha,$ $\text{SF } 5.5 \times 10^{-5}\%$
		239	5/2+	50.575	23.45 m 2	$\beta-$
		240	0+	52.716	14.1 h 1	$\beta-$
		241		56.2s		$\beta-?$
		242	0+	58.6s	16.8 m 5	$\beta-$
243		62.4s				
93	Np	225	(9/2-)	31.59		α
		226		32.74s	35 ms 10	α
		227		32.56	0.51 s 6	α
		228		33.59	61.4 s 14	ϵ 60%, α 40%
		229		33.78	4.0 m 2	α 68%, ϵ 32%
		230		35.24	4.6 m 3	$\epsilon \leq 97\%, \alpha \geq 3\%$
		231	(5/2)	35.62	48.8 m 2	ϵ 98%, α 2%
		232	(4+)	37.4s	14.7 m 3	$\epsilon, \alpha 2.0 \times 10^{-4}\%$
		233	(5/2+)	37.95	36.2 m 1	$\epsilon, \alpha \leq 1.0 \times 10^{-3}\%$
		234	(0+)	39.957	4.4 d 1	ϵ
		235	5/2+	41.045	396.1 d 12	$\epsilon, \alpha 2.6 \times 10^{-3}\%$
		236	(6-)	43.37	153×10^3 y 5	ϵ 86.3%, $\beta-$ 13.5%, α 0.16%
		236m	1	43.37	22.5 h 4	$\beta-$ 50%, ϵ 50%
		237	5/2+	44.874	2.144×10^6 y 7	$\alpha, \text{ SF} \leq 2 \times 10^{-10}\%$
238	2+	47.457	2.117 d 2	$\beta-$		
239	5/2+	49.313	2.356 d 3	$\beta-$		
240	(5+)	52.32	61.9 m 2	$\beta-$		

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Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or }$	
Z	El	A	(MeV)	Abundance	Decay Mode
93 Np	240m	(1+)	52.32	7.22 m 2	β^- 99.88%, IT 0.12%
	241	5/2+	54.26	13.9 m 2	β^-
	242	(1+)	57.4	2.2 m 2	β^-
	242m	(6+)	57.4	5.5 m 1	β^-
	243	(5/2-)	59.88s	1.85 m 15	β^-
	244	(7-)	63.2s	2.29 m 16	β^-
	245		65.9s		
94 Pu	228	0+	36.08	1.1 s +20-5	α
	229	(3/2+)	37.39	67 s +41-19	ϵ 50%, α 50%, SF < 7%
	230	0+	36.93	102 s 10	$\alpha \leq 100\%$
	231	(3/2+)	38.28	8.6 m 5	$\epsilon \leq 99.8\%$, $\alpha > 0.2\%$
	232	0+	38.36	33.8 m 7	ϵ 90%, α 10%
	233		40.05	20.9 m 4	ϵ 99.88%, α 0.12%
	234	0+	40.348	8.8 h 1	$\epsilon \approx 94\%$, $\alpha \approx 6\%$
	235	(5/2+)	42.18	25.3 m 5	ϵ , α $2.8 \times 10^{-3}\%$
	236	0+	42.896	2.858 y 8	α , SF $1.9 \times 10^{-7}\%$
	237	7/2-	45.094	45.64 d 4	ϵ , α $4.2 \times 10^{-3}\%$
	237m	1/2+	45.240	0.18 s 2	IT
	238	0+	46.166	87.7 y 1	α , SF $1.9 \times 10^{-7}\%$
	239	1/2+	48.591	24110 y 30	α , SF $3. \times 10^{-10}\%$
	240	0+	50.128	6561 y 7	α , SF $5.7 \times 10^{-6}\%$
	241	5/2+	52.958	14.325 y 6	β^- , α $2.5 \times 10^{-3}\%$, SF < $2 \times 10^{-14}\%$
	242	0+	54.719	3.75×10^5 y 2	α , SF $5.5 \times 10^{-4}\%$
	243	7/2+	57.756	4.956 h 3	β^-
244	0+	59.806	8.00×10^7 y 9	α 99.88%, SF 0.12%	
245	(9/2-)	63.18	10.5 h 1	β^-	
246	0+	65.40	10.84 d 2	β^-	
247		69.1s	2.27 d 23	β^-	
95 Am	230			≈ 17 s	ϵ
	231		42.4s		$\alpha?$, $\epsilon?$
	232		43.4s	79 s 2	$\epsilon \approx 97\%$, $\alpha \approx 3\%$
	233		43.2s	3.2 m 8	$\alpha > 3\%$, ϵ
	234		44.5s	2.32 m 8	ϵ , α
	235	5/2-	44.62	10.3 m 6	ϵ 99.6%, α 0.4%
	236	5-	46.0s	3.6 m 2	α , ϵ
	236m	(1-)	46.0s	2.9 m 2	α , ϵ
	237	5/2(-)	46.57s	73.6 m 8	ϵ 99.97%, α 0.03%
	238	1+	48.42	98 m 2	ϵ , α $1.0 \times 10^{-4}\%$
	239	(5/2)-	49.393	11.9 h 1	ϵ 99.99%, α 0.01%
	240	(3-)	51.51	50.8 h 3	ϵ , α $1.9 \times 10^{-4}\%$
	240m		54.51	0.94 ms 4	SF $\leq 100\%$
	241	5/2-	52.937	432.6 y 6	α , SF $4 \times 10^{-10}\%$
	242	1-	55.471	16.02 h 2	β^- 82.7%, ϵ 17.3%
	242m	5-	55.520	141 y 2	IT 99.55%, α 0.45%, SF < $4.7 \times 10^{-9}\%$
	242m	(2+,3-)	57.671	14.0 ms 10	SF, IT, $\alpha < 5.0 \times 10^{-3}\%$
243	5/2-	57.177	7370 y 40	α , SF $3.7 \times 10^{-9}\%$	
244	(6-)	59.882	10.1 h 1	β^-	
244m		59.882	0.90 ms 15	SF $\leq 100\%$	
244m	1+	59.968	26 m 1	β^- 99.96%, ϵ 0.04%	

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Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	
Z	El	A	(MeV)	Abundance	Decay Mode
95 Am	245	(5/2)+	61.901	2.05 h 1	β^-
	246	(7-)	65.00	39 m 3	β^-
	246m	2(-)	65.00	25.0 m 2	β^- , IT<0.02%
	247	(5/2)	67.2s	23.0 m 13	β^-
	248		70.6s	\approx 10 m	β^-
	249		73.1s		β^- ?
96 Cm	233	(3/2+)	47.29	23 s +13-6	ϵ 80%, α 20%
	234	0+	46.72	51 s 12	$\alpha \approx$ 40%, SF=40%, $\epsilon \approx$ 20%
	235		47.9s		$\alpha?$, $\epsilon?$
	236	0+	47.86		ϵ , α
	237		49.25		ϵ , $\alpha < 1\%$
	238	0+	49.44	2.4 h 1	$\epsilon \geq 90\%$, $\alpha \leq 10\%$
	239	(7/2-)	51.15	\approx 2.9 h	ϵ , $\alpha < 0.1\%$
	240	0+	51.719	27 d 1	SF $3.9 \times 10^{-6}\%$, $\alpha > 99.5\%$, $\epsilon < 0.5\%$
	241	1/2+	53.704	32.8 d 2	ϵ 99%, α 1%
	242	0+	54.806	162.8 d 2	α , SF $6.2 \times 10^{-6}\%$, ^{34}Si $1. \times 10^{-14}\%$
	243	5/2+	57.184	29.1 y 1	α 99.71%, ϵ 0.29%, SF $5.3 \times 10^{-9}\%$
	244	0+	58.455	18.1 y 1	α , SF $1.4 \times 10^{-4}\%$
	244m	6+	59.495	34 ms 2	IT
	245	7/2+	61.006	8423 y 74	α , SF $6.1 \times 10^{-7}\%$
	246	0+	62.619	4706 y 40	α 99.97%, SF 0.03%
	247	9/2-	65.535	1.56×10^7 y 5	α
	248	0+	67.393	3.48×10^5 y 6	α 91.61%, SF 8.39%
	249	1/2+	70.751	64.15 m 3	β^-
	250	0+	72.99	$\approx 8.3 \times 10^3$ y	SF = 74%, $\alpha \approx 18\%$, $\beta^- \approx 8\%$
	251	(1/2+)	76.65	16.8 m 2	β^-
	252	0+	79.1s	<2 d	
	97 Bk	234			1.4×10^2 s +14-5
235			52.7s		$\epsilon?$, $\alpha?$
236			53.4s		
237			53.1s	\approx 1 m	$\epsilon?$, $\alpha?$
238			54.3s	144 s 5	ϵ , ϵ SF 0.048%
239m(7/2+,3/2-)			54.3s		$\epsilon > 99\%$, $\alpha < 1\%$, SF < 1%
240			55.7s	4.8 m 8	ϵ , ϵ SF $2.0 \times 10^{-3}\%$
241		(7/2+)	56.1s	4.6 m 4	α , ϵ
242			57.7s	7.0 m 13	$\epsilon \leq 100\%$
243		(3/2-)	58.692	4.5 h 2	$\epsilon \approx 99.85\%$, $\alpha \approx 0.15\%$
244		(4-)	60.72	4.35 h 15	ϵ 99.99%, α $6.0 \times 10^{-3}\%$
245		3/2-	61.816	4.95 d 3	ϵ 99.88%, α 0.12%
246m		2(-)	63.97	1.80 d 2	ϵ
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 $4.7 \times 10^{-8}\%$	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode			
Z	El	A	(MeV)	Abundance				
97	Bk	250	2-	72.952	3.212 h 5	β^-		
		251	(3/2-)	75.23	55.6 m 11	β^-		
		252		78.5s				
		253		80.9s		$\beta^-?$		
		254		84.4s				
98	Cf	237	(3/2+)	57.94	0.8 s 2	SF 70%, α 30%		
		238	0+	57.2s	21 ms 2	SF		
		239		58.1s	39 s +37-12	ϵ, α		
		240	0+	58.01	64 s 9	α 98.5%, SF 1.5%		
		241	(7/2-)	59.3s	3.78 m 70	$\epsilon \approx 75\%, \alpha \approx 25\%$		
		242	0+	59.38	3.7 m 5	α 80%, ϵ 20%, SF $\leq 0.01\%$		
		243	(1/2+)	60.9s	10.7 m 5	$\epsilon \approx 86\%, \alpha \approx 14\%$		
		244	0+	61.473	19.4 m 6	$\alpha \leq 100\%$		
		245	1/2+	63.388	45.0 m 15	ϵ 64.7%, α 35.3%		
		246	0+	64.093	35.7 h 5	$\alpha, \epsilon < 4.0 \times 10^{-3}\%$, SF $2.4 \times 10^{-4}\%$		
		246m		66.593	45 ns 10	SF $\leq 100\%$		
		247	(7/2+)	66.10	3.11 h 3	ϵ 99.97%, α 0.04%		
		248	0+	67.241	333.5 d 28	$\alpha, \text{ SF } 2.9 \times 10^{-3}\%$		
		249	9/2-	69.726	351 y 2	$\alpha, \text{ SF } 5.0 \times 10^{-7}\%$		
		250	0+	71.173	13.08 y 9	α 99.92%, SF 0.08%		
		251	1/2+	74.137	898 y 44	$\alpha, \text{ SF}$		
		252	0+	76.035	2.645 y 8	α 96.91%, SF 3.09%		
		253	(7/2+)	79.302	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, $\beta^- < 1\%$, $\alpha \approx 1.0 \times 10^{-6}\%$		
		99	Es	240		64.2s		$\alpha?, \epsilon?$
				241		63.8s	8 s +6-5	ϵ, α
242				64.9s	17.8 s 16	α 57%, ϵ 43%		
243	(7/2+)			64.7s	23 s 3	α 61%, ϵ 39%, SF < 1%		
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	7.5 m 5	ϵ 90.1%, α 9.9%		
247	(7/2+)			68.58	4.55 m 26	$\epsilon \approx 93\%, \alpha \approx 7\%$		
247m				68.58	625 d 84	α		
248	(2-, 0+)			70.30s	27 m 5	ϵ 99.7%, $\alpha \approx 0.25\%$		
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-)			74.513	33 h 1	ϵ 99.5%, α 0.5%		
252	(5-)			77.29	471.7 d 19	α 78%, ϵ 22%		
253	7/2+			79.015	20.47 d 3	SF $8.7 \times 10^{-6}\%$, α		
254	(7+)	81.993	275.7 d 5	$\alpha, \beta^- 1.7 \times 10^{-4}\%$, SF $< 3.0 \times 10^{-6}\%$				
254m	2+	82.077	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 $4.1 \times 10^{-3}\%$				

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
99	Es	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		$\alpha?$, $\epsilon?$
100	Fm	241			0.73 ms 6	SF > 78%, α < 14%, ϵ < 12%
		242	0+	68.4s	< 4 μ s	SF \leq 100%
		243	(7/2+)	69.3s	231 ms 9	α 91%, SF 9%, ϵ < 10%
		244	0+	69.0s	3.12 ms 8	SF > 97%, ϵ < 2%, α < 1%
		245		70.2s	4.2 s 13	α \leq 100%
		246	0+	70.19	1.54 s 4	α 93.2%, SF 6.8%, ϵ \leq 1.3%
		247	(7/2+)	71.6s	31 s 1	α \geq 84%, ϵ \leq 16%
		247m	(1/2+)	71.6s	5.1 s 2	α 84%
		248	0+	71.894	36 s 2	α 93%, ϵ 7%, SF 0.1%
		249	(7/2+)	73.521	2.6 m 7	ϵ 67%, α 33%
		250	0+	74.074	30 m 3	α > 90%, ϵ < 10%, SF 6.9 $\times 10^{-3}\%$
		250m		74.074	1.93 s 15	IT
		251	(9/2-)	75.95	5.30 h 8	ϵ 98.2%, α 1.8%
		252	0+	76.818	25.39 h 4	SF 2.3 $\times 10^{-3}\%$, α
		253	(1/2+)	79.349	3.00 d 12	ϵ 88%, α 12%
		254	0+	80.905	3.240 h 2	α 99.94%, SF 0.06%
		255	7/2+	83.801	20.07 h 7	α , SF 2.4 $\times 10^{-5}\%$
		256	0+	85.487	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+	95.8s	\approx 4 ms	SF
		101	Md	245	(1/2-)	75.3s
245m	(7/2)			75.6s	0.35 s +23-16	ϵ , α
246m				76.2s	0.9 s 2	α
246m				76.2s	4.4 s 8	ϵ > 77%, α < 23%
246m				76.2s	0.9 s 2	SF?, $\epsilon?$
247	(7/2-)			75.9s	1.2 s 1	α 99.9%, SF < 0.1%
247m	(1/2-)			75.9s	0.25 s 4	α 79%, SF 21%
248				77.1s	13 s +15-4	α 58%, ϵ 42%
249	(7/2-)			77.3s	21.7 s 20	α > 60%, ϵ \leq 40%
249m	(1/2-)			77.3s	1.9 s 9	$\alpha?$
250				78.6s	25 s +10-5	ϵ 93%, α 7%
251	(7/2-)			78.97	4.3 m 6	ϵ 90%, α 10%
252				80.5s	2.3 m 8	ϵ \leq 100%
253	(7/2-)			81.18s	6 m +12-3	ϵ \leq 100%, α
254m				83.5s	28 m 8	ϵ \leq 100%
254m				83.5s	10 m 3	ϵ \leq 100%
255	(7/2-)			84.844	27 m 2	ϵ 92%, α 8%, SF < 0.15%
256	(1-)			87.61	77 m 2	ϵ 90.8%, α 9.2%, SF < 3%
257	(7/2-)	88.997	5.52 h 5	ϵ 85%, α 15%, SF < 1%		
258		91.689	51.5 d 3	α , SF		

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode			
Z	El	A	(MeV)	Abundance				
101	Md	258m	91.689	57.0 m 9	$\epsilon \geq 70\%$, SF			
		259	93.6s	96 m 3	SF, $\alpha < 1.3\%$			
		260	96.6s	31.8 d 5	SF $\geq 42\%$, $\alpha \leq 25\%$, $\epsilon \leq 23\%$, $\beta^- \leq 10\%$			
		261	98.6s		$\alpha?$			
		262	101.6s		SF?, $\alpha?$			
		102	No	248	80.6s	<2 μ s	SF?	
				249	81.8s			
				250	81.6s	4.2 μ s +12-9	SF, $\alpha < 2\%$	
				251	(7/2+)	82.8s	0.80 s 1	$\alpha 84\%$, SF < 0.3%, ϵ
				251m	(1/2+)	82.9s	1.02 s 3	α
252	0+			82.867	2.47 s 2	$\alpha 70.7\%$, SF 29.3%, $\epsilon < 1.1\%$		
252m	(8-)			82.867	110 ms 10	IT		
253	(9/2-)			84.360	1.62 m 15	$\alpha \approx 80\%$, 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+	86.81	3.52 m 21	$\epsilon 70\%$, $\alpha 30\%$				
256	0+	87.825	2.91 s 5	$\alpha 99.47\%$, SF 0.53%				
257	(7/2+)	90.251	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	(3/2+)	98.5s		$\alpha?$				
262	0+	100.1s	≈ 5 ms	SF				
263		103.1s		$\alpha?$, SF?				
264	0+	105.2s		$\alpha?$				
103	Lr	251	87.9s		$\epsilon?$, $\alpha?$			
		252	88.7s	0.27 s +18-8	α , ϵ			
		253	(7/2-)	88.7s	0.57 s +7-6	$\alpha \approx 98.7\%$, SF $\approx 1.3\%$		
		253m	(1/2-)	88.7s	1.49 s +30-21	$\alpha 92\%$, SF 8%		
		254		89.9s	18.4 s 18	$\alpha 71.7\%$, $\epsilon 28.3\%$		
		255	1/2-	89.95	31.1 s 13	$\alpha 85\%$, $\epsilon 15\%$		
		255m	7/2-	89.98	2.53 s 13	IT 60%, $\alpha 40\%$		
		256		91.75	27 s 3	$\alpha 85\%$, $\epsilon 15\%$, SF < 0.03%		
		257		92.61s	≈ 4 s	$\alpha \leq 100\%$		
		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		102.0s	≈ 4 h	SF < 10%, ϵ , α				
263		103.7s		$\alpha?$				
264		106.4s		SF?, $\alpha?$				
265		108.3s		SF?, $\alpha?$				
266		111.4s		$\alpha?$, SF?				
104	Rf	253m	93.8s	48 μ s +17-10	SF $\leq 100\%$, α			
		253m	93.8s	≈ 1.8 s	$\alpha \approx 50\%$, SF $\approx 50\%$			

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	Decay Mode
Z	El	A	(MeV)	Abundance	
104 Rf	254	0+	93.2s	23 μ s 3	SF \leq 100%
	255	(9/2-)	94.2s	2.3 s +8-5	α 52%, SF 48%, ϵ ? 1%
	256	0+	94.22	6.4 ms 2	SF 99.68%, α 0.32%
	257	(1/2+)	95.87	4.7 s 3	α < 100%, SF \leq 1.4%, ϵ > 0%
	257m	(11/2-)	95.87	4.1 s 7	α < 100%, SF \leq 1.4%, ϵ > 0%
	258	0+	96.34	14.7 ms +12-10	SF 69%, α 31%
	259		98.36s	3.2 s 6	α 92%, SF 8%
	259m		98.36s	2.5 s +4-3	ϵ 15%
	260	0+	99.2s	21 ms 1	SF \leq 100%, α ?
	261m		101.32	1.9 s 4	SF 73%, α 27%
	261m		101.32	78 s +11-6	α > 74%, ϵ < 15%, SF < 11%
	262	0+	102.4s	2.3 s 4	SF \leq 100%, α < 3%
	263		104.8s	10 m 2	SF, α
	264	0+	106.2s		α ?
	265m		108.8s		SF
	266	0+	110.2s		SF ?, α ?
	267		113.4s		
	268	0+	115.4s		α ?, SF ?
105 Db	255		99.7s	1.6 s +6-4	α 80%, SF \approx 20%
	256		100.5s	1.9 s 4	α \approx 70%, ϵ \approx 30%, SF = 0.02%
	257	(9/2+)	100.3s	1.82 s +27-21	α 94%, SF \approx 6%
	257m		100.3s	0.58 s +13-9	α , SF
	258		101.8s	4.2 s +4-3	α 65%, ϵ 35%, SF < 1%
	258m		101.8s	20 s 10	ϵ
	259		101.99	0.51 s 16	α
	260		103.36	1.52 s 13	α \geq 90.4%, SF \leq 9.6%, ϵ < 2.5%
	261		104.2s	1.8 s 4	α \geq 82%, SF \leq 18%
	262		106.3s	35 s 5	α \approx 67%, SF
	263		107.1s	27 s +10-7	SF 55%, α 41%, ϵ 3%
	264		109.4s		α ?
	265		110.5s		α ?
	266		112.7s		α ?, SF ?
	267m		114.2s	73 m +350-33	SF
268m		117.0s	32 h +11-7	SF	
269		119.1s		α ?, SF ?	
270m		122.0s	23 h	SF, α	
106 Sg	258	0+	105.3s	2.9 ms +13-7	SF \leq 100%, α ?
	259	(1/2+)	106.5s	0.32 s +8-6	α 96%, SF 4%
	259m		106.5s	0.28 s 5	
	260	0+	106.54	3.6 ms 9	SF 50%, α 50%
	260m		106.54	4.95 ms 33	SF 71%, α 29%
	261		108.01	0.23 s 6	α , SF < 1%
	262	0+	108.4s	6.9 ms +38-18	SF \geq 78%, α \leq 22%
	263		110.19s	1.0 s 2	α > 70%, SF < 30%
	263m		110.19s	0.12 s	IT, α
	264	0+	110.8s	37 ms +27-11	SF, α < 36%
	265m		112.8s	16.2 s +47-35	α \geq 65%, SF \leq 35%

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}$, Γ , or	
Z	El	A	(MeV)	Abundance	Decay Mode
106 Sg	265m		113.0s	8.9 s +27-19	
	266	0+	113.7s	21 s +20-12	SF > 50%, α > 18%
	267		115.9s		
	268	0+	116.9s		SF?, α ?
	269		120.0s		
	270	0+	121.3s		α ?, SF?
	271m		124.4s	2.4 m +43-10	α = 50%, SF = 50%
	272	0+	126.4s		α ?, SF?
	273		129.8s		SF?
	107 Bh	260		113.3s	35 ms +19-9
261			113.2s	11.8 ms +39-24	α
262m			114.5s	22 ms 4	α < 100%
262m			114.5s	83 ms 14	α < 100%
263			114.5s		α ?
264			115.7s	0.44 s +60-16	α \leq 100%
265			116.4s	0.9 s +7-3	α
266m			118.2s	1.7 s +82-8	α
267m			118.9s	17 s +14-6	α
268			120.9s		
269			121.7s		
270?			124.2s	6×10^1 s +29-3	α
271?			125.8s		α ?
272m			128.6s	10 s +12-4	α
273			130.5s		α ?, SF?
274			133.3s	0.9 m +42-4	α , SF
275			135.4s		SF?
108 Hs	263		120.0s	0.74 ms +48-21	α \leq 100%, SF < 8.4%
	264	0+	119.56	\approx 0.8 ms	SF = 50%, α = 50%
	265		121.17	1.9 ms 2	α < 100%, SF \leq 1%
	265m		121.47	0.3 ms +2-1	α < 100%
	266	0+	121.1s	2.3 ms +13-6	α , SF < 1.4%
	267 (3/2+)		122.65s	52 ms +13-8	α \geq 80%, SF < 20%
	267m		122.65s	0.8 s +38-4	α
	268	0+	122.8s	0.4 s +18-2	α
	269		124.6s	3.6 s +8-14	α
	269m		124.6s	9.7 s +97-33	α
	270	0+	125.1s	22 s	α
	271		127.8s		α ?, SF?
	272	0+	129.1s		SF?, α ?
	273		132.1s		α
	274	0+	133.3s		SF?, α ?
	275m		136.3s	0.15 s +27-6	α
	276	0+	138.0s		α ?, SF?
277		141.1s			
109 Mt	265		126.6s		α ?
	266m		128.0s	1.7 ms +18-16	α \leq 100%
	267		127.8s		α ?
	268m		128.9s	21 ms +8-5	α
	269		129.3s		
	270m		130.8s	5.0 ms +24-3	α
271		131.5s		α ?	

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
109 Mt	272		133.7s		$\alpha?$, SF?	
	273		134.8s		$\alpha?$, SF?	
	274m		137.1s	0.44 s +81-17	α , SF	
	275?		138.4s	9.7 ms +460-44	α	
	276m		140.9s	0.72 s +87-25	α	
	277		142.5s			
	278m		145.1s	8 s +37-4	α , SF	
	279		146.8s		$\alpha?$, SF?	
	110 Ds	267m		134.3s	2.8 μ s +133-12	α
268?		0+	133.6s	1	α	
269m			135.03	179 μ s +245-66	α	
270		0+	134.7s	0.10 ms +14-4	α , SF < 0.2%	
270m			135.9s	6.0 ms +82-22	α > 70%, IT \leq 30%	
271			135.95s	1.63 ms +44-29	α	
271m			135.95s	69 ms +56-21	α > 0%, IT?	
272		0+	136.0s		SF	
273			138.4s	0.17 ms +17-6	α	
274?		0+	138.9s		SF?, $\alpha?$	
275?			141.2s		$\alpha?$	
276?		0+	142.2s		SF?, $\alpha?$	
277?			145.3s		$\alpha?$	
278?		0+	145.8s		SF?, $\alpha?$	
279m			148.6s	0.18 s +5-3	SF = 90%, α = 10%	
280		0+	149.6s			
281			152.4s	20 s +20-7	SF 85%, α 15%	
281m			152.4s	9.6 s +50-25	SF	
111 Rg	272m		142.8s	3.8 ms +14-8	α	
	273		143.1s		$\alpha?$	
	274m		144.7s	6.4 ms +307-29	α	
	275?		145.4s		$\alpha?$	
	276?		147.4s		$\alpha?$, SF?	
	277?		148.4s		SF?, $\alpha?$	
	278m		150.4s	4.2 ms +76-17	α , SF	
	279m		151.3s	0.17 s +81-8	α	
	280m		153.4s	3.6 s +43-13	α	
	281m		154.6s	26 s +25-8	SF, α	
	282m		156.7s	0.5 s +25-2	α , SF	
	283?		158.1s		SF?, $\alpha?$	
	112 Cn	276	0+	150.6s		
		277		152.4s		
278?		0+	152.7s		$\alpha?$, SF?	
279?			154.7s		SF?, $\alpha?$	
280?		0+	155.4s		$\alpha?$, SF?	
281m			158.1s		α	
282m			158.2s	0.50 ms +33-14	SF	
283m			160.7s	4.0 s +13-7	α \geq 90%, SF \leq 10%	
283m			160.7s	6.9 s +69-23	SF 50%, α 50%	
284m			161.5s	101 ms +41-22	SF	
285			164.1s	30 s +30-10	α	
113		278m		159.0s	0.24 ms +114-11	α
	279		159.5s			

Nuclear Wallet Cards

Nuclide			Δ	$T_{1/2}, \Gamma, \text{ or}$	Decay Mode	
Z	El	A	(MeV)	Abundance		
113		280	161.2s			
		281	161.9s			
		282m	163.6s	0.07 s +13-3	α	
		283m	164.0s	100 ms +490-45	α	
		284m	166.0s	0.48 s +58-17	α	
		285m	166.9s	5.5 s +50-18	$\alpha, \text{ SF}$	
		286m	168.9s	20 s +94-9	$\alpha, \text{ SF}$	
		287?	170.1s		$\alpha?, \text{ SF?}$	
114		285m	171.2s		α	
		286m	0+	171.0s	0.16 s +7-3	SF = 60%, α = 40%
		287		173.2s	0.51 s +18-10	α
		288	0+	174.0s	0.52 s +22-13	α
		289		176.5s	0.97 s +97-32	α
		289m		176.5s	2.7 s +14-7	α
115		287?	177.2s	32 ms +155-14	α	
		288m	179.0s	87 ms +105-30	α	
		289	179.8s	0.22 s +26-8	$\alpha, \text{ SF}$	
		290	181.6s	16 ms +76-7	$\alpha, \text{ SF}$	
		291?	182.8s		$\alpha?, \text{ SF?}$	
116		289	184.8s			
		290	0+	184.4s	15 ms +26-6	α
		291		186.6s	6.3 ms +116-25	α
		292	0+	187.2s	18 ms +16-6	α
		293		189.6s	53 ms +62-19	α
117		291?	191.0s		SF?, $\alpha?$	
		292?	192.7s		SF?, $\alpha?$	
		293	193.4s	14 ms +11-4	$\alpha, \text{ SF}$	
		294	195.1s	0.08 s +37-4	α	
118		294	198.7s	0.9 ms +11-3	$\alpha, \text{ SF} \leq 50\%$	
		295	200.7s			

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	1.008	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	6.94	0.534 ^c	180.5	1342	1
4	Be	9.012182 3	1.848 ^c	1287	2471 (5 mm)	2
5	B	10.81	2.34 ^h	2075	4000 (subl.)	3
6	C	12.011	1.8 to 2.1 ⁱ	≈3550	4827	2,3,4
7	N	14.007	0.0012506 ^j	-210.00	-195.798	3,5
8	O	15.999	0.001308 ^k	-218.79	-182.953	2
9	F	18.9984032 5	0.001696	-219.67 ^g	-188.12 ^g	1
10	Ne	20.1797 6	8.9990×10 ⁻⁴	-248.609	-246.053 ^g	0
11	Na	22.98976928 2	0.971 ^c	97.80	883	1
12	Mg	24.3050 6	1.738 ^c	650	1090	2
13	Al	26.9815386 8	2.6989 ^c	660.32	2519	3
14	Si	28.085	2.33 ^e	1414	3265	4
15	P	30.973762 2	1.82 ^l	44.15 ^l	280.5 ^l	3,5
16	S	32.06	2.07 ^{cm}	115.21 ^m	444.61	2,4,6
17	Cl	35.45	0.003214	-101.5	-34.04	1,3,5,7
18	Ar	39.948	0.0017837	-189.36	-185.85	0
19	K	39.0983	0.89	63.5	759	1
20	Ca	40.078 4	1.54 ^c	842	1484	2
21	Sc	44.955912 6	2.989 ^e	1541	2836	3
22	Ti	47.867	4.51	1668	3287	2 to 4
23	V	50.9415	6.0 (18.7°C)	1910	3407	2 to 5
24	Cr	51.9961 6	7.15 ^c	1907	2671	2,3,6
25	Mn	54.938045 5	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	58.933195 5	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	65.38 2	7.134 ^e	419.53	907	2
31	Ga	69.723	5.904 (29.6°C)	29.76	2204	2,3
32	Ge	72.63	5.323 ^e	938.25	2833	2,4
33	As	74.92160 2	5.75 ^o	817 ^o (28 atm)	616 ^o (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	83.798 2	0.003733	-157.36	-153.34	0
37	Rb	85.4678 3	1.532 ^c	39.30	688	1
38	Sr	87.62	2.64	777	1382	2
39	Y	88.90585 2	4.469 ^e	1522	3345	3
40	Zr	91.224 2	6.52 ^c	1855	4409	2 to 4
41	Nb	92.90638 2	8.57 ^c	2477	4744	2,3,4?,5
42	Mo	95.96 2	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	12.1 ^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	8.69 ^c	321.07	767	2
49	In	114.818 3	7.31 ^c	156.60	2072	1 to 3
50	Sn	118.710 7	5.77 ^q	231.93	2602	2,4
51	Sb	121.760	6.68 ^c	630.63	1587	0,±3,5
52	Te	127.60 3	6.23 ^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 ^w	-111.74	-108.09	0
55	Cs	132.9054519 2	1.873 ^c	28.44	671	1
56	Ba	137.327 7	3.62 ^c	727	1897	2
57	La	138.90547 7	6.145 ^e	920	3464	3
58	Ce	140.116	6.770 ^e	799	3443	3,4
59	Pr	140.90765 2	6.773 ^r	931	3520	3
			6.64 ^s			
60	Nd	144.242 3	7.008	1016	3074	3
61	Pm	(145)	7.264 ^e	1042	3000	3
62	Sm	150.36 2	7.520 ^r	1072	1794	2,3
			7.40 ^s			
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	162.500	8.551 ^e	1412	2567	3
67	Ho	164.93032 2	8.795 ^e	1472	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	173.054 5	6.903 ^r	824	1196	2,3
			6.966 ^s			
71	Lu	174.9668	9.841 ^e	1663	3402	3
72	Hf	178.49 2	13.31 ^c	2233	4603	4
73	Ta	180.94788 2	16.4	3017	5458	2?,3,4?,5
74	W	183.84	19.3 ^c	3422	5555	2 to 6
75	Re	186.207	20.8 ^c	3185	5596	4,6,7
76	Os	190.23 3	22.587	3033	5012	0 to 8
77	Ir	192.217 3	22.562 ^c	2446	4428	3,4
78	Pt	195.084 9	21.45 ^c	1768.2	3825	1?,2,3
79	Au	196.966569 4	≈19.3 ^c	1064.18	2856	1,3
80	Hg	200.59 2	13.546 ^c	-38.83	356.62	1,2
81	Tl	204.38	11.85 ^c	304	1473	1,3
82	Pb	207.2	11.35 ^c	327.46	1749	2,4
83	Bi	208.98040	9.747 ^c	271.4	1564	3,5
84	Po	(209)	9.20	254	962	0,±2,3?,4,6
85	At	(210)		302		1,3,5,7
86	Rn	(222)	0.00973 ^x	-71	-61.7	0
87	Fr	(223)		27		1
88	Ra	(226)	5	696		2
89	Ac	(227)	10.07 ^t	1050	3198	3
90	Th	232.03806 2	11.72	1750	4788	2?,3?,4
91	Pa	231.03588 2	15.37 ^t	1572		4,5
92	U	238.02891 3	19.1	1135	4131	2 to 6
93	Np	(237)	20.25 ^c	644	3902	3 to 6

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
94	Pu	(244)	19.84 ^e	640	3228	3, to 6
95	Am	(243)	12 ^c	1176	2011	2 to 6
96	Cm	(247)	13.51 ^t	1345		3, 4
97	Bk	(247)	14 ^t	996		3, 4
98	Cf	(251)	15.1	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
103	Lr	(262)		1627		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 M. E. Wieser, T.B. Coplen *Pure Appl. Chem.* 83, 359 (2011). 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, 92nd edition, 2011*. 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.

e) At 25°C.

f) For gas; density (liquid)=0.125 g/cc at b.p.

g) At 1 atm.

h) For crystal form; density (amorphous)=2.37 g/cc.

Appendix-I Table of Elemental Properties

- 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.
For Ozone: density=0.001962; m.p.=-193, b.p.=-111.35
- 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)=2.00 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)=7.29 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.
- w) For gas; density (liquid)=2.95 g/cc at -109°C.
- x) For gas; density (liquid)=4.4 g/cc at -62°C.

Appendix-II Frequently-Used Constants

The frequently used constants are given below in familiar units. Only approximate values are given; see App-IIa 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: 2006*.^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	5.2917721092 17	10^{-11} m	10^{-9} cm
$\alpha=e^2/\hbar c[4\pi\epsilon_0]$ $1/\alpha$	Fine structure constant	0.0072973525698 24 137.035999679 94		
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	3.74177153 17	10^{-16} W m ²	10^{-5} erg cm ² s ⁻¹
$c_2=\hbar c/k$	Second radiation constant	1.4387770 13	10^{-2} m K	cm K
e	Elementary charge	1.602176565 35	10^{-19} C	10^{-20} emu
$2e/h$	Josephson frequency-voltage ratio	4.83597870 11	10^{14} Hz V ⁻¹	
$-e/m_e$	Electron specific charge	-1.758820088 39	10^{11} C kg ⁻¹	10^7 emu g ⁻¹
$F=N_A e$	Faraday constant	9.64853365 21	10^4 C mol ⁻¹	10^3 emu mol ⁻¹
γ_p	Gyromagnetic ratio of proton	2.675222005 63	10^8 s ⁻¹ T ⁻¹	10^4 s ⁻¹ G ⁻¹
	Proton magnetic shielding correction	0.000025694 14		
G	Gravitational constant	6.67384 80	10^{-11} m ³ kg ⁻¹ s ⁻²	10^{-8} cm ³ g ⁻¹ s ⁻²

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Appendix-IIa Fundamental Constants

Symbol	Constant	Value	Units (SI) ^b	Units (cgs) ^b
h	Planck constant	6.62606957 29	10^{-34} J s	10^{-27} erg s
$\hbar=h/2\pi$		1.054571726 47	10^{-34} J s	10^{-27} erg s
$h/2e$	Quantum of magnetic flux	2.067833758 46	10^{-15} Wb	10^{-7} G cm ²
$k=R/N_A$	Boltzmann constant	1.3806488 13	10^{-23} J K ⁻¹	10^{-16} erg K ⁻¹
$\lambda_{C,e}=h/m_e c$	Compton wavelength of electron	2.4263102389 16	10^{-12} m	10^{-10} cm
$\lambda_{C,p}=h/m_p c$	Compton wavelength of proton	1.32140985623 94	10^{-15} m	10^{-13} cm
$\lambda_{C,n}=h/m_n c$	Compton wavelength of neutron	1.3195909068 11	10^{-15} m	10^{-13} cm
m_e	Electron mass	5.4857990946 22	10^{-4} u	10^{-4} u
m_H	Mass of hydrogen atom	1.00782503207 10 ^(c)	u	u
m_μ	Muon mass	0.1134289267 29	u	u
m_n	Neutron mass	1.00866491600 55	u	u
m_p	Proton mass	1.007276466812 90	u	u
m_{π^\pm}	π^\pm mass	139.57018 35 ^(d)	MeV	
m_{π^0}	π^0 mass	134.9766 6 ^(d)	MeV	

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Appendix-IIa Fundamental Constants

Symbol	Constant	Value	Units (SI) ^b	Units (cgs) ^b
$\mu_B = [c]e\hbar/2m_e c$	Bohr magneton	9.27400968 20	$10^{-24} \text{ J T}^{-1}$	$10^{-21} \text{ erg G}^{-1}$
μ_e/μ_B	Magnetic moment of electron in units of μ_B	-1.00115965218076 27		
μ_μ	Muon magnetic moment	-4.49044807 15	$10^{-26} \text{ J T}^{-1}$	$10^{-23} \text{ erg G s}^{-1}$
$\mu_N = [c]e\hbar/2m_p c$	Nuclear magneton	5.05078353 11	$10^{-27} \text{ J T}^{-1}$	$10^{-24} \text{ erg G}^{-1}$
N_A	Avogadro constant	6.02214129 27	10^{23} mol^{-1}	10^{23} mol^{-1}
R	Molar gas constant	8.3144621 75	$\text{J mol}^{-1} \text{ K}^{-1}$	$10^7 \text{ erg mol}^{-1} \text{ K}^{-1}$
$R_\infty = m_e c \alpha^2 / 2\hbar$	Rydberg constant for infinite mass	1.0973731568539 55	10^7 m^{-1}	10^5 cm^{-1}
$r_e = \hbar \alpha / m_e c$	Classical e^- radius	2.8179403267 27	10^{-15} m	10^{-13} cm
$\sigma = (\pi^2/60)k^4/\hbar^3 c^2$	Stefan-Boltzmann constant	5.670373 21	$10^{-8} \text{ W m}^{-2} \text{ K}^{-4}$ $\text{erg cm}^{-2} \text{ s}^{-1} \text{ K}^{-4}$	10^{-5}
$u = 1/N_A$	Atomic mass unit	1.66053873 13 ^(c) 931.494013 37 ^(c)	10^{-27} kg MeV	10^{-24} g
1 year (sidereal) = 365.25636 days = $3.1558150 \times 10^7 \text{ s}$, 1 year (tropical) = 365.242 days = $3.15569 \times 10^7 \text{ s}$				

Appendix-IIa Fundamental Constants

- a) P.J. Mohr, B.N. Taylor, and D.B. Newell *Jl. of Phys. and Chem. Ref. Data* 37, 1187 (2008); *Rev. Mod. Phys.* 80, 633 (2008). Data taken from <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, C. Amsler, *et al.*, *Physics Letters B*667, 1 (2008); <http://pdg.lbl.gov/>
- e) Speed of light in vacuum is an exact constant as a result of redefinition of the 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	1.602176565 35×10 ⁻¹²	6.62606957 29×10 ⁻²⁷	1.986445684 88×10 ⁻¹⁶
eV	6.24150934 14×10 ¹¹	1.0	4.135667516 91×10 ⁻¹⁵	1.239841930 27×10 ⁻⁴
s ⁻¹	1.509190311 67×10 ²⁶	2.417989348 53×10 ¹⁴	1.0	2.99792458 ×10 ¹⁰
cm ⁻¹	5.03411701 22×10 ¹⁵	8.06554429 18×10 ³	3.335640951×10 ⁻¹¹	1.0
K	7.2429716 22×10 ¹⁵	1.1604519 11×10 ⁴	4.7992434 44×10 ⁻¹¹	1.4387770 13
g	1.112650056×10 ⁻²¹	1.782661845 39×10 ⁻³³	7.37249668 33×10 ⁻⁴⁸	2.210218902 98×10 ⁻³⁷
u	6.70053662 53×10 ²	1.073544150 24×10 ⁻⁹	4.4398216689 31×10 ⁻²⁴	1.33102505120 94×10 ⁻¹³
	(1 cal = 4.1840 J, 1 J = 10 ⁷ erg)			

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

$$1 \text{ erg} = 1/c^2 \text{ g} = 1/(mc^2) \text{ u} = 1/(hc) \text{ cm}^{-1} = 1/h \text{ s}^{-1} = 1/k \text{ }^0\text{K} = 1/e \text{ eV}$$

Examples: 1 eV = 1.602..×10⁻¹² erg = 1.073..×10⁻⁹ u = 3.829..×10⁻²⁰ cal

$$e/h = 2.417..×10¹⁴ \text{ s}^{-1}, e/(hc) = 8.0654..×10^3 \text{ cm}^{-1}$$

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

$$e/k = 1.160..×10^4 \text{ K}$$

Appendix-III Energy-Equivalent Factors†

units	deg K	g	u
erg	1.3806488 13×10^{-16}	8.987551787 $\times 10^{20}$	1.492417954 66×10^{-3}
eV	8.6173324 78×10^{-5}	5.60958885 12×10^{32}	9.31494061 21×10^8
s ⁻¹	2.0836618 19×10^{10}	1.356392608 60×10^{47}	2.2523427168 16×10^{23}
cm ⁻¹	6.9503476 63×10^{-1}	4.52443873 20×10^{36}	7.5130066042 53×10^{12}
K	1.0	6.5096582 59×10^{36}	1.08095408 98×10^{13}
g	1.5361790 14×10^{-37}	1.0	1.660538921 73×10^{-24}
u	9.2510868 84×10^{-14}	6.02214129 27×10^{23}	1.0

App-III-i

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

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

† From CODATA Values of Fundamental Physical Constants: 2006, P.J. Mohr, B.N. Taylor, and D.B. Newell, *Jour. of Phys. and Chem. Ref. Data* 37, 1187 (2008), *Rev. Mod. Phys.* 80, 633 (2008). Data taken from <http://physics.nist.gov/constants> (Aug, 2011)

Appendix-IV Observed Λ Hypernuclides†

El	A	J(g.s.)	B_{Λ} (g.s.)	Excited states (MeV)
H	3	1/2+	0.13 5	
	4	0+	2.04 4	1.05 4 1+
He	4	0+	2.39 3	1.15 4 1+
	5	1/2+	3.12 2	
	6		4.18 10	
	8		7.16 70	
Li	6			
	7	1/2+ ^a	5.58 3	0.692 2 3/2+, 2.050 1 5/2+, 2.521 2 7/2+, 3.878 5 1/2+
	8	1-	6.80 3	
Be	9		8.50 12	
	7	1/2+	5.16 8	
	8		6.84 5	
	9	1/2+	6.71 4	3.024 4 5/2+, 3.067 4 3/2+
B	10		9.11 22	
	9		8.29 18	
	10		8.89 12	
C	11		10.24 5	0.263 1 7/2+, 1.483 1 1/2+, 1.987 1 3/2+
	12	1-	11.37 6	
	12	1-	10.80 18 ^b	0.161 1 2-, 2.832 3 1-
	13	1/2+	11.69 12	4.88 2 3/2+, 10.83 6 3/2-, 10.98 6 1/2-
N	14		12.17 33	
	14			
	15	3/2+ ^c		2.268 1 1/2+, 4.229 1 1/2+, 4.710 1 3/2+
O	16		13.76 16 ^d	
	16	0-	12.42 5	0.026 2 1-, 6.562 2 1-, 6.786 6 2-
	18			
Al	27			
	28	e		
Si	28		16.6 2	$B_{\Lambda}=7.0$ 2 (p)
S	32			
Ca	40			
V	51		20.0 2	$B_{\Lambda}=11.2$ 3 (p), 2.6 3 (d)
Fe	56			
Y	89		23.1 5	$B_{\Lambda}=16.5$ 14 (p), 9.1 13 (d), 2.3 12 (f)
La	139		24.5 12	$B_{\Lambda}=20.4$ 6 (p), 14.3 6 (d), 8.0 6 (f), 1.6 6 (g)
Pb	208		26.3 8	$B_{\Lambda}=21.9$ 6 (p), 16.8 7 (d), 11.7 6 (f), 6.6 6 (g)
Bi	209			

Appendix-IV Observed Λ Hypernuclides†

† This table has been prepared by **D.J. Millener** (BNL). The Λ binding energies (s_{Λ} single-particle energies), B_{Λ} , for $A \leq 14$ come from emulsion data compiled by D.H. Davis and J. Pniewski, *Contemp. Phys.* 27, 91 (1986). Most of the rest of the data comes from a review by O. Hashimoto and H Tamura, *Prog. Part. Nucl. Phys.* 57, 564 (2006), which lists all counter experiments for hypernuclei up to 2004. The B_{Λ} values for $A > 16$ from (π^+, K^+) reactions, as do the Λ single-particle binding energies for higher orbits (listed by their orbital angular momentum p, d, f, or g).

The precise excitation energies given for bound excited states of hypernuclei from $A=7$ to $A=16$ come from γ -rays measured in coincidence with the outgoing meson in (π^+, K^+) or (K^-, π^-) reactions by a Ge detector array (NaI for $A=13$); for the latest results, see H. Tamura *et al.*, *Nucl. Phys.* A835, 3 (2010). Many particle unbound states of these nuclei are seen in (π^+, K^+) , (K^-, π^-) , and $(e, e'K^+)$ reactions.

In addition to these single- Λ hypernuclides, several instances of double- Λ species have been reported, including the important case of ${}_{\Lambda\Lambda}^6\text{He}$, as reviewed by K. Nakazawa *Nucl. Phys.* A835, 207 (2010).

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Half-lives of fully-ionized (bare) and highly-charged atoms†

El	A	T1/2(bare)	T1/2(neutral)	Decay mode	Ref
Ne	19	18.5(6) s #	17.22(2) s	ϵ	[1]
Mn	52m	22.7(30) m	21.1(2) m	ϵ, IT	[2]
Fe	52	12.5(+15-12) h	8.275(8) h	ϵ	[2]
	53	8.5(3) m	8.51(2) m	ϵ	[2]
	53m	2.48(5) m	2.54(2) m	IT	[2]
Sb	133m	>60 μ s	16.54(19) μ s	IT?	[15]
Ce	125m	2.2(+11-1) m	4.4 s (est.)	IT	[3]
Pr	140	7.3(4) m	3.39(1) m	ϵ	[5]
		3.04(9) m &			[5]
		3.84(17) m \$			[5]
Pm	142	56.4(32) s	40.5(5) s	ϵ	[6]
		39.2(7) s &			[6]
		39.6(14) s \$			[6]
Tb	144m	12(2) s	4.25(15) s	ϵ, IT	[7]
Dy	149m	11(1) s	0.490(15) s	IT, ϵ	[7]
	163	47(+5-4) d	stable	β^-	[8]
Ho	163	beta-stable	4570(25) y	ϵ	[8]
Er	151m	19(3) s	0.58(2) s	IT, ϵ	[7]
Hf	183m	10(+48-5) s &		IT, $\beta^-?$	[16]
	184m1	1.9(+12-7) m	48(10) s	IT	[16]
	184m2	12(+10-4) m		IT, $\beta^-?$	[16]
	186m	>20 s		IT, $\beta^-?$	[16]
Ta	168	5.2(7) m	2.0(1) m	ϵ	[4]
	186m	3.4(+24-14) m &	1.54(5) m	IT, $\beta^-?$	[16]
	187	2.3(6) m		β^-	[16]
	187m1	22(9) s		IT, $\beta^-?$	[16]
	187m2	>5 m		IT, $\beta^-?$	[16]
Re	187	32.9(20) y	4.33(7) $\times 10^{10}$ y	β^-	[9]
	192m	61(+40-20) s		IT	[18]
Hg	205	5.61(9) m	5.14(9) m	β^-	[11]
Tl	207	4.25(19) m	4.77(3) m	β^-	[10]
	207	4.72(19) m	4.77(3) m	β^-	[11]
	207m	1.47(32) s	1.33(11) s	IT	[12]
	213	1.7(+81-8) m		β^-	[14]
Po	221	1.9(+10-5) m @		β^-	[14]
	222	2.4(+116-11) m		β^-	[14]
At	224	1.3(+23-4) m @		β^-	[14]
Ac	234	45(2) s \$	44(7) s	β^-	[13]
	235	62(4) s &	6% longer (est.)	β^-	[13]
	236	1.2(+58-6) m		β^-	[14]

& H-like

\$ He-like

11% contamination by beta-decay of O-15 is suggested [1].

@ Can be a mixture of bare, H-like and He-like states [14].

† Table prepared by **Yuri A. Litvinov** (GSI, Darmstadt and MPI, Heidelberg) and **Balraj Singh** (McMaster Univ.) September 12, 2011, on the basis of review article [17] and other papers cited here for fully-ionized (bare) or highly-charged (H-like, He-like) atoms.

**Half-lives of fully-ionized (bare) and
highly-charged atoms†**

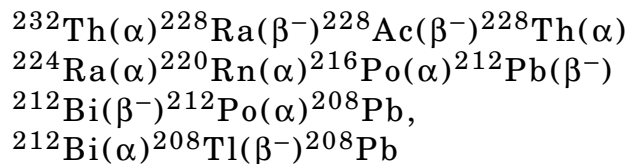
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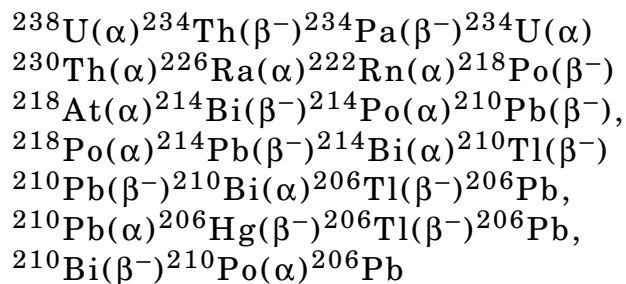
Radioactive Decay Chains in Nature

The following three radioactive decay chains occur in nature:

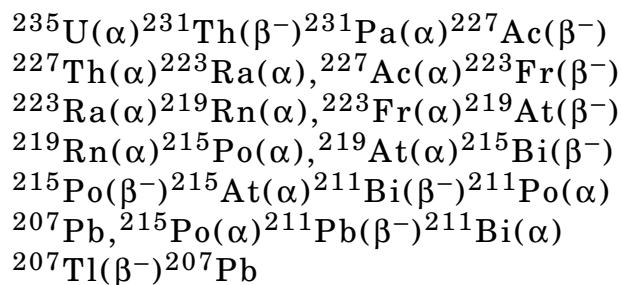
The Thorium Series:



The Uranium Series:



The Actinium Series



Radioactive Nuclides in Nature

Nuclide	Half-life	Decay Modes
1 H 3	12.32 y	β^-
4 Be 7	53.24 d	ϵ
6 C 14	5700 y	β^-
19 K 40	1.248×10^9 y	β^-
23 V 50	$>2.1 \times 10^{17}$ y	ϵ, β^-
37 Rb 87	4.81×10^{10} y	β^-
48 Cd 113	8.00×10^{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, β^-
60 Nd 144	2.29×10^{15} y	α
62 Sm 147	1.060×10^{11} y	α
148	7×10^{15} y	α
64 Gd 152	1.08×10^{14} y	α
71 Lu 176	3.76×10^{10} y	β^-
72 Hf 174	2.0×10^{15} y	α
73 Ta 180m	$>1.2 \times 10^{15}$ y	ϵ, β^-
75 Re 187	4.33×10^{10} y	β^-, α
76 Os 186	2.0×10^{15} y	α
78 Pt 190	6.5×10^{11} y	α
81 Tl 206	4.202 m	β^-
207	4.77 m	β^-
208	3.053 m	β^-
210	1.3 m	β^-, β^-n
82 Pb 210	22.2 y	β^-, α
211	36.1 m	β^-
212	10.64 h	β^-
214	26.8 m	β^-
83 Bi 210	5.012 d	β^-, α
211	2.14 m	α, β^-
212	1.009 h	β^-, α
214	19.9 m	β^-, α
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, β^-
216	0.145 s	α
218	3.098 m	α, β^-
85 At 215	0.1 ms	α
218	1.5 s	α, β^-
219	56 s	α, β^-
86 Rn 219	3.96 s	α
220	55.6 s	α

Radioactive Nuclides in Nature

Nuclide	Half-life	Decay Modes
86 Rn 222	3.823 d	α
87 Fr 223	22 m	β^- , α
88 Ra 223	11.43 d	α , ^{14}C
224	3.632 d	α , ^{14}C
226	1600 y	α , ^{14}C
228	5.75 y	β^-
89 Ac 227	21.77 y	β^- , α
228	6.15 h	β^-
90 Th 227	18.68 d	α
228	1.912 y	α , ^{20}O
230	7.54×10^4 y	α , Ne, SF
231	1.063 d	β^- , α
232	1.40×10^{10} y	α , SF
234	24.1 d	β^-
91 Pa 231	3.276×10^4 y	α , SF
234	6.7 h	β^-
92 U 234	2.455×10^5 y	α , SF, Mg, Ne
235	7.04×10^8 y	α , SF, Mg, Ne
238	4.468×10^9 y	α , SF

Appendix-VIa Periodic Table of Elements

Appendix-VIa

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

Appendix-VIb List of Elements - Alphabetical

Name	Symbol	Z	Name	Symbol	Z
Actinium	Ac	89	Meitnerium	Mt	109
Aluminum	Al	13	Mendelevium	Md	101
Americium	Am	95	Mercury	Hg	80
Antimony	Sb	51	Molybdenum	Mo	42
Argon	Ar	18	Neodymium	Nd	60
Arsenic	As	33	Neon	Ne	10
Astatine	At	85	Neptunium	Np	93
Barium	Ba	56	Nickel	Ni	28
Berkelium	Bk	97	Niobium	Nb	41
Beryllium	Be	4	Nitrogen	N	7
Bismuth	Bi	83	Nobelium	No	102
Bohrium	Bh	107	Osmium	Os	76
Boron	B	5	Oxygen	O	8
Bromine	Br	35	Palladium	Pd	46
Cadmium	Cd	48	Phosphorus	P	15
Calcium	Ca	20	Platinum	Pt	78
Californium	Cf	98	Plutonium	Pu	94
Carbon	C	6	Polonium	Po	84
Cerium	Ce	58	Potassium	K	19
Cesium	Cs	55	Praseodymium	Pr	59
Chlorine	Cl	17	Promethium	Pm	61
Chromium	Cr	24	Protactinium	Pa	91
Cobalt	Co	27	Radium	Ra	88
Copernicium	Cn	112	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

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	112	Cn	Copernicium

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