

TABLE OF THE ISOTOPES  
(Revised 2002)

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This table presents an evaluated set of values for the experimental quantities which characterize the decay of radioactive nuclides. A list of the major references used in this evaluation is given below. When uncertainties are not listed, they are assumed to be five or less in the last digit quoted. If they exceed five in the last digit, the value is prefaced by an approximate sign. For quasi-stable nuclides, the measured width,  $\Gamma$ , of the resonance is given. To estimate the approximate half-life, the Heisenberg relationship may be used, the half-life =  $4.56 \text{ E-}22 \text{ seconds} / \Gamma$  (MeV). The effective literature cutoff date for data in this edition of the Table is December, 2002.

TABLE LAYOUT

Column No.	Column Title	Description
1	Isotope or Element	For elements, the atomic number and chemical symbol are listed. For nuclides, the mass number and chemical symbol are listed. Isomers are indicated by the addition of m, ml, or m2.
2	Isotopic Abundance	in atom percent.
3	Atomic Mass or Atomic Weight	Atomic mass relative to $^{12}\text{C} = 12$ . Atomic weight is given on the same scale.
4	Half-life/Resonance Width	Half-life in decimal notation. $\mu$ = microseconds; ms = milliseconds; s = seconds; m = minutes; h = hours; d = days; and y = years. For quasi-stable nuclides, the measured width at half maximum of the energy resonance is given
5	Decay Mode/Energy	Decay modes are $\alpha$ = alpha particle emission; $\beta^-$ = negative beta emission; $\beta^+$ = positron emission; EC = orbital electron capture; IT = isomeric transition from upper to lower isomeric state; n = neutron emission; SF = spontaneous fission. Total disintegration energy in MeV units.
6	Particle Energy/Intensity	End point energies of beta transitions and discrete energies of alpha particles in MeV and their intensities in percent.
7	Spin and Parity	Nuclear spin or angular momentum of the nuclides in units of $h/2B$ ; parity is positive or negative.
8	Magnetic Dipole Moment	Magnetic dipole moments in nuclear magneton units.
9	Electric Quadrupole Moment	Electric quadrupole moments in barn units $(10)^{24} \text{ cm}^2$ .
10	Gamma Ray Energy/Intensity	Gamma ray energies in MeV and intensities in percent. Ann. rad. refers to the 511.006 keV photons emitted in the annihilation of positrons in matter.

GENERAL NUCLEAR DATA REFERENCES

The following references represent the major sources of the nuclear data presented, along with subsequent published journals and reports:

1. G. Audi, O. Bersillon, J. Blachot, A.H. Wapstra, *The Nubase Evaluation of Nuclear and Decay Properties*, Nuclear Physics **A624**, 1 (1997).
2. International Commission on Atomic Weights, *Atomic Weights of the Elements - 1999*, Pure & Applied Chemistry **75**, to be published (2003).
3. J.R. Parrington, H.D. Knox, S. Breneman, E.M. Baum, F. Feiner, *Chart of the Nuclides, 15th Edition*, Knolls Atomic Power Lab. (1996)
4. N.E. Holden, *Total and Spontaneous Fission Half-lives for Uranium, Plutonium, Americium and Curium Nuclides*, Pure & Applied Chemistry **61**, 1483 (1989).
5. N.E. Holden, *Half-lives of Selected Nuclides*, Pure & Applied Chemistry **62**, 941 (1990).
6. N.E. Holden, *Review of Thermal Neutron Cross Sections and Isotopic Composition of the Elements*, BNL-NCS-42224 (March 1989).
7. P. Raghavan, *Table of Nuclear Moments*, Atomic Data Nuclear Data Tables **42**, 189 (1989).
8. E. Brown, R. Firestone, *Radioactivity Handbook*, Wiley Interscience Press (1986).
9. J.K. Tuli, *Nuclear Wallet Cards*, Brookhaven National Laboratory (January 2000).
10. N.E. Holden, D.C. Hoffman, *Spontaneous Fission Half-lives for Ground State Nuclides*, Pure & Applied Chemistry **72** 1525 (2000).
11. N. Stone, *Table of New Nuclear Moments*, private communication, www.nndc.bnl.gov/nndc/stone\_moments/moments.html (Dec 2000)

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T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<b>1</b> <sub>0</sub> n		<b>1.008664924</b>	<b>614. s</b>	<b>β<sup>-</sup>/0.78235</b> β <sup>+</sup> , fl	<b>0.782/100.</b> /< 0.069	<b>1/2+</b>	<b>-1.913043</b>		
<b>1</b> <sub>1</sub> H		<b>1.00794(7)</b>							
<sup>1</sup> H	99.9885(70)	1.007825032	> 2.8x10 <sup>23</sup> y			1/2+	+2.79285		
<sup>2</sup> H	0.0115(70)	2.014101778				1+	+0.85744	+2.86 mb	
<sup>3</sup> H		3.016049268	12.33 y	β <sup>-</sup> /0.01859	0.01860/100.	1/2+	+2.97896		
<sup>4</sup> H		4.0278	3	n/	/100	2-			
<sup>5</sup> H		5.040	=1.9(4)	n/	/100	(1/2+)			
<sup>6</sup> H		6.0449	=1.6(4)	n/		(2-)			
<b>2</b> <sub>0</sub> He		<b>4.002602(2)</b>							
<sup>3</sup> He	1.34x10 <sup>-4</sup>	3.016029309				1/2+	-2.12762		
<sup>4</sup> He	.100.	4.002603250				0+			
<sup>5</sup> He		5.01222	' = 0.60(2)	n, "		3/2-			
<sup>6</sup> He		6.018888	0.807 s	β <sup>-</sup> /3.508	3.510/100.	0+			
<sup>7</sup> He		7.02803	' = 0.15(2)	n		(3/2)-			
<sup>8</sup> He		8.03392	0.119 s	β <sup>-</sup> /10.65	/84.	0+			0.9807/84. 0.4776/5.
<sup>9</sup> He		9.0438	' = 0.10(6)	n	/100	(1/2-)			
<sup>10</sup> He		10.0524	' = 0.3(2)	2n	/100	0+			
<b>3</b> <sub>0</sub> Li		<b>6.941(2)</b>							
<sup>4</sup> Li		4.0272	' = 6.0	p/	/100	2-			
<sup>5</sup> Li		5.01254	' = 1.2	p/		3/2-			
<sup>6</sup> Li	7.59(4)	6.0151223				1+	+0.82205	-0.8 mb	
<sup>7</sup> Li	92.41(4)	7.0160041				3/2-	+3.25644	-0.041	
<sup>8</sup> Li		8.022486	0.84 s	β <sup>-</sup> /16.004	12.5/100. "(1.6)	2+	+1.6536	+0.032	
<sup>9</sup> Li		9.026789	0.178 s	β <sup>-</sup> /13.606	13.5/75. 11/25.	3/2-	3.439	-0.027	
<sup>10</sup> Li		10.03590	' =0.11(5)	n	/7.	1+			
<sup>11</sup> Li		11.04380	8.8 ms	β <sup>-</sup> /20.6	/8.3 /85.7 /4.1 /1.9 /β <sup>-</sup> , 2n /β <sup>-</sup> , 3n /β <sup>-</sup> , d /β <sup>-</sup> , t	3/2(-)	3.668	-0.031	3.368/33. 0.320/7.8 2.590/6. 2.811/2.8 0.219/0.78
<sup>12</sup> Li		12.054	<0.01 μs		/0.02				
<b>4</b> <sub>0</sub> Be		<b>9.012182(3)</b>							
<sup>5</sup> Be		5.041		p, <sup>3</sup> He		(1/2+)			
<sup>6</sup> Be		6.01973	' =0.092(6)	2p, "		0+			
<sup>7</sup> Be		7.0169293	53.28 d	EC/0.8618		3/2-			0.4776/10.4
<sup>8</sup> Be		8.00530509	' =6.8(17)eV	2"/0.046		0+			
<sup>9</sup> Be		9.0121822				3/2-	-1.1776	+0.0529	
<sup>10</sup> Be	100.	10.0135338	1.52x10 <sup>6</sup> y	β <sup>-</sup> /0.5559	0.555/100.	0+			
<sup>11</sup> Be		11.02166	13.8 s	β <sup>-</sup> , β <sup>+</sup> /11.51	11.48/61.	1/2+			2.125/35.5 (0.478-7.97)
<sup>12</sup> Be		12.02692	22.0 ms	β <sup>-</sup> , (n)/11.71	n/0.5	0+			(0.95 - 4.4)
<sup>13</sup> Be		13.0361	1.						
<sup>14</sup> Be		14.0428	4.6 ms	β <sup>-</sup> /16.2	0.288/94. /6. /<0.012 /<0.04	0+			3.5346/0.9 3.6845/7.
<b>5</b> <sub>0</sub> B		<b>10.811(7)</b>							
<sup>7</sup> B		7.0299	' = 1.4(2)	p, "		(3/2-)			
<sup>8</sup> B		8.024607	0.770 s	β <sup>+</sup> , 2"/17.979	13.7(\$)/93.	2+	1.0355	0.068	ann.rad.
<sup>9</sup> B		9.013329	' =0.5(2)keV	p, 2"/		3/2-			
<sup>10</sup> B	19.9(7)	10.0129371				3+	+1.8006	+0.085	
<sup>11</sup> B	80.1(7)	11.0093055				3/2-	+2.6886	+0.0406	
<sup>12</sup> B		12.014352	0.0202 s	β <sup>-</sup> /13.369		1+	+1.0027	0.0132	4.438/1.3 3.215/0.00065 3.68/7.6
<sup>13</sup> B		13.017780	0.0174 s	β <sup>-</sup> /13.437	13.4 2.43(n)/0.09 3.55(n)/0.16	3/2-	+3.17778	0.037	
<sup>14</sup> B		14.02540	14. ms	β <sup>-</sup> /20.64		2-	1.185	0.0298	6.094/90.
<sup>15</sup> B		15.03110	10.4 ms	β <sup>-</sup> , (n)/19.09		(3/2-)	2.66	0.038	
<sup>16</sup> B		16.0398	' < 0.1	n					
<sup>17</sup> B		17.0469	5.1 ms	β <sup>-</sup> , (n)/22.7			2.54	0.039	
<sup>18</sup> B		18.056	<0.026 μs			0-			
<sup>19</sup> B		19.0637	3.3 ms	β <sup>-</sup> , (n)/26.5	n/125.	(3/2-)			
<b>6</b> <sub>0</sub> C		<b>12.0107(8)</b>							
<sup>8</sup> C		8.03768	' = 0.25(4)	p		0+			
<sup>9</sup> C		9.031040	127. ms	β <sup>+</sup> , p, 2"/16.498		(3/2-)	-1.391		ann.rad.
<sup>10</sup> C		10.0168532	19.3 s	β <sup>+</sup> /3.648	1.865	0+			ann.rad. 0.71829/100. ann.rad.
<sup>11</sup> C		11.011433	20.3 m	β <sup>+</sup> , EC/1.982	0.9608/99.	3/2-	-0.964	0.0333	ann.rad.
<sup>12</sup> C	98.93(8)	12.000000000				0+			
<sup>13</sup> C	1.07(8)	13.003354838				1/2-	+0.70241		
<sup>14</sup> C		14.003241991	5715. y	β <sup>-</sup> /0.15648	0.1565/100.	0+			
<sup>15</sup> C		15.010599	2.45 s	β <sup>-</sup> /9.772	4.51/68. 9.82/32.	1/2+	1.32		5.298/68. (7.30-9.05)
<sup>16</sup> C		16.014701	0.750 s	β <sup>-</sup> /8.012	β/3.3, 4.3/84, 16 n/0.8, 1.7/84, 16	0+			
<sup>17</sup> C		17.02258	0.19 s	β <sup>-</sup> /13.17	n/1.6-3.7/11.	3/2+			1.375 1.849 1.906
<sup>18</sup> C		18.02676	0.092 s	β <sup>-</sup> /11.81		0+			

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<sup>19</sup> C		19.0353	0.05 s	\$^-,n	n/0.88-4.59/21.	1/2+			
<sup>20</sup> C		20.0403	0.01 s			0+			
<sup>21</sup> C		21.0493	<0.03 μs						
<sup>22</sup> C		22.056	9 ms	\$^-,n	n//99.	0+			
<b>7N</b>		<b>14.0067(2)</b>							
<sup>10</sup> N		10.0426	' =2.3(16)			1/2+			
<sup>11</sup> N		11.0268	' =0.52(9)			1+			
<sup>12</sup> N		12.018613	11.00 ms	\$^-,n	17.338	16.38/95.	+0.457	+10. mb	ann.rad. 4.438/2.
<sup>13</sup> N		13.0057386	9.97 m	\$^+ /2.2204	1.190/100.	1/2-	0.3222		
<sup>14</sup> N	99.636(20)	14.003074007				1+	+0.40376	+0.0200	
<sup>15</sup> N	0.364(20)	15.00010897				1/2-	-0.28319		
<sup>16</sup> N		16.006100	7.13 s	\$) /10.419	4.27/68.	2-	1.986	18 mb	6.129/68.8
<sup>17</sup> N		17.00845	4.17 s	\$) , \$) n/8.68	10.44/26. 1.85/.0012 3.7/100.	1/2-	0.352		7.115/4.7 (0.99-8.87) 0.871/3. 2.1842/0.3
<sup>18</sup> N		18.01408	0.62 s	\$) /13.90	8.0, 8.2 9.4/100. /12.	1-	0.328	0.012	0.822/61. 1.65/60.5 1.982/98. (0.535-7.13) (0.096-3.14)
<sup>19</sup> N		19.01703	0.32 s	\$) /12.53					
<sup>20</sup> N		20.02337	0.14 s	\$) /17.97					
<sup>21</sup> N		21.0271	0.08 s						
<sup>22</sup> N		22.0344	0.02 s						
<sup>23</sup> N		23.0405	15 ms	\$^-,n	n//80.				
<b>8O</b>		<b>15.9994(3)</b>							
<sup>12</sup> O		12.03440	' =0.51(16)	2p		0+			
<sup>13</sup> O		13.02481	8.9 ms	\$^-,p/17.77	1.56 (p)/	(3/2-)	1.389	0.011	ann.rad. 4.438/0.56
<sup>14</sup> O		14.0085953	70.60 s	\$^+ /5.1430	1.81/99.	0+			ann.rad. 2.312/99.4
<sup>15</sup> O		15.0030655	122.2 s	\$^+ /2.754	1.723/100.	1/2-	0.7195		ann.rad.
<sup>16</sup> O	99.757(16)	15.994914622				0+			
<sup>17</sup> O	0.038(1)	16.9991315				5/2+	-1.8938	-0.026	
<sup>18</sup> O	0.205(14)	17.999160				0+			
<sup>19</sup> O		19.003579	26.9 s	\$) /4.820	3.25/60. 4.60/40.	5/2+	1.5320	3.7 mb	0.197/95.9 1.3569/50.4 (0.11-4.18) 1.057/100. (0.28-4.6) (0.64-1.86)
<sup>20</sup> O		20.004076	13.5 s	\$) /3.814		0+			1.83/28. 0.52/14. 1.31/12.
<sup>21</sup> O		21.00866	3.4 s	\$) /8.11					
<sup>22</sup> O		22.00997	2.2 s	\$) /6.5		0+			
<sup>23</sup> O		23.0157	0.08 s						
<sup>24</sup> O		24.0204	.65 ms	\$^-,n	n//18.	0+			
<sup>25</sup> O		25.029	<0.05 μs						
<sup>26</sup> O		26.038	<0.04 μs			0+			
<b>9F</b>		<b>18.9984032(5)</b>							
<sup>14</sup> F		14.036							
<sup>15</sup> F		15.0180	' = 0.9(3)	p		(1/2+)			
<sup>16</sup> F		16.01147	' =0.037(14)	p		0-			
<sup>17</sup> F		17.0020952	64.5 s	\$^+ /2.761	1.75/	5/2+	+4.721	0.058	ann.rad.
<sup>18</sup> F		18.000938	1.830 h	\$^+ ,EC/1.656	0.635/97.	1+			ann.rad.
<sup>19</sup> F	100.	18.9984032				1/2+	+2.62887	0.072	
<sup>20</sup> F		19.9999813	11.00 s	\$) /7.0245	5.398/100.	2+	+2.0934	0.042	1.634/100. 3.33/0.009 0.3507/90. 1.395/15. (1.746-4.684)
<sup>21</sup> F		20.999949	4.16 s	\$) /5.684	3.7/8. 5.0/63. 5.4/29.	5/2+	3.9		1.2746/100. 2.0826/82. (0.82-4.37) 1.701/48. 2.129/34. (0.493-3.83)
<sup>22</sup> F		22.00300	4.23 s	\$) /10.82	3.48/15. 4.67/7. 5.50/62.	4+			
<sup>23</sup> F		23.00357	2.2 s	\$) /8.5		5/2+			
<sup>24</sup> F		24.0081	0.3 s	\$) /13.5					1.9816/ 1.70/39. (0.57-2.19)
<sup>25</sup> F		25.0121	.50 ms	\$^-, (n)	n//14.				2.02/67. 1.67/19. 2.02/18.
<sup>26</sup> F		26.0196	10 ms	\$^-, (n)	n//11.				
<sup>27</sup> F		27.0269	5.0 ms	\$^-, (n)	n//90.				
<sup>28</sup> F		29.043	2.5 ms	\$^-, (n)	n//100.				
<sup>29</sup> F									
<sup>31</sup> F									
<b>10Ne</b>		<b>20.1797(6)</b>							
<sup>16</sup> Ne		16.02575	' = 0.12(4)	2p		0+			
<sup>17</sup> Ne		17.01770	109. ms	\$^-,p/14.53	1.4-10.6/6.9 /0.014	1/2-			ann.rad. / 0.495
<sup>18</sup> Ne		18.005697	1.67 s	\$^+ /4.446	3.416/92.	0+			ann.rad. / 1.0413/7.8 (0.658-1.70) ann.rad. / (0.11-1.55)
<sup>19</sup> Ne		19.001880	17.22 s	\$^+ /3.238	2.24/99.	1/2+	-1.885		
<sup>20</sup> Ne	90.48(3)	19.992440176				0+			
<sup>21</sup> Ne	0.27(1)	20.99384674				3/2+	-0.66180	+0.103	
<sup>22</sup> Ne	9.25(3)	21.9913855				0+		-0.19	
<sup>23</sup> Ne		22.9944673	37.2 s	\$) /4.376	3.95/32. 4.39/67.	5/2+	-1.08		0.440/33. (1.64-2.98) 0.4723/100.
<sup>24</sup> Ne		23.99362	3.38 m	\$) /2.47	1.10/8.	0+			

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<sup>25</sup> Ne		24.99779	0.61 s	\$) /7.30	1.98/92. 6.3/ 7.3/	1/2+			0.874/7.9 0.0895/96. (0.98-3.69)
<sup>26</sup> Ne		26.00046	197 ms	\$) ,n/7.3	n//0.13	0+			0.233/
<sup>27</sup> Ne		27.00076	31. ms	\$) ,n/12.7	n//2.	(3/2+)			
<sup>28</sup> Ne		28.0121	19. ms	\$) ,n/12.3	n//11.	0+			2.06/19. 0.86/3. 2.92/55. (0.22-1.18)
<sup>29</sup> Ne		29.0194	15. ms	\$) ,(n)/15.4 \$, 2n	n//17. /<2.2	(3/2+)			0.151/9.
<sup>30</sup> Ne		30.024	7. ms	\$) ,(n)	n//9.	0+			
<sup>31</sup> Ne		31.033	>0.26 μs						
<sup>32</sup> Ne		32.040	>0.20 μs						
<sup>34</sup> Ne									
<b><sup>11</sup>Na</b>		<b>22.989770(2)</b>							
<sup>16</sup> Na		18.0272							
<sup>15</sup> Na		19.01388	0.03 s	\$* ,p/11.18					
<sup>20</sup> Na		20.00735	0.446 s	\$* /13.89		2+	+0.3694		ann.rad./ 1.634/79.
<sup>21</sup> Na		20.997655	22.48 s	\$* /3.547	2.15/ 2.50/95.	3/2+	+2.3863	+0.05	ann.rad./ 0.351/5.
<sup>22</sup> Na		21.9944366	2.605 y	\$* /90/2.842 EC/10/	0.545/90.	3+	+1.746	+0.19	ann.rad./ 1.2745/99.9
<sup>23</sup> Na	100.	22.9897697				3/2+	+2.21752	+0.106	
<sup>24a</sup> Na		24.002	20.2 ms	I.T., \$)		1+			0.4723/100.
<sup>24</sup> Na		23.9909633	14.96 h	\$) /5.5158	1.389/>99.	4+	+1.690		1.3686/100. 2.754/100. (0.997-4.238)
<sup>25</sup> Na		24.989954	59.3 s	\$) /3.835	2.6/7. 3.15/25. 4.0/65.	5/2+	+3.683	-0.06	0.3897/12.7 0.5850/13. 0.9747/14.9 (0.836-2.80)
<sup>26</sup> Na		25.99259	1.07 s	\$) /9.31		3+	+2.851	-5.3 mb	1.809/98.9
<sup>27</sup> Na		26.99401	0.290 s	\$) /9.01	7.95/	5/2+	+3.90	-7.2 mb	0.9847/87.4
<sup>28</sup> Na		27.9989	31. ms	\$) ,n/ /14.0	12.3/	1+	+2.42	+0.04	1.698/11.9 1.473/37.
<sup>29</sup> Na		29.0028	44. ms	\$) ,n/ /13.3	11.5/	3/2+	+2.46	+86. mb	2.389/18.6 2.560/36. (1.04-3.99)
<sup>30</sup> Na		30.0092	50. ms	\$) ,n/17.5	n//30.	2	+2.07		1.483/46.
<sup>31</sup> Na		31.0136	17.2 ms	\$) ,n/15.9	n//37.	3/2-	+2.30		1.483/14. (0.05-3.54)
<sup>32</sup> Na		32.0197	13.5 ms	\$) /19.1					0.240-3.935
<sup>33</sup> Na		33.027	8.0 ms	\$) /20. \$, n \$, 2n	. 38 0.8,1.02/47(6) /13(3)				0.886/16 0.546/6.4 0.050-2.55
<sup>34</sup> Na		34.035	5. ms	\$) /24.					
<sup>35</sup> Na		35.044	1.5 ms	\$) /24					
<sup>37</sup> Na									
<b><sup>12</sup>Mg</b>		<b>24.3050(6)</b>							
<sup>20</sup> Mg		20.01886	96. ms	\$* /10.73 \$, p	/70 /30	0+			
<sup>21</sup> Mg		21.01171	122. ms	\$* ,p/13.10		5/2+			0.332/51.
<sup>22</sup> Mg		21.999574	3.86 s	\$* /4.786	3.05/	0+			0.0729/60. 0.5820/100. (1.28-1.93)
<sup>23</sup> Mg		22.994125	11.32 s	\$* /4.057	3.09/92.	3/2+	0.536	1.25	0.440/8.2
<sup>24</sup> Mg	78.99(4)	23.9850419				0+			
<sup>25</sup> Mg	10.00(1)	24.9858370				5/2+	-0.85545	+0.200	
<sup>26</sup> Mg	11.01(3)	25.9825930				0+			
<sup>27</sup> Mg		26.9843407	9.45 m	\$) /2.6103	1.59/41. 1.75/58. 2.65/0.3	1/2+			0.17068/0.9 0.84376/72. 1.01443/28. 0.0306/95. 0.4006/36. 0.9418/36.
<sup>28</sup> Mg		27.983877	20.9 h	\$) /1.832	0.459/95.	0+			1.342/54. 0.960/15. 1.398/16. 2.224/36. 0.224/85. 1.61/26.
<sup>29</sup> Mg		28.98855	1.3 s	\$) /7.55	5.4/	3/2+			
<sup>30</sup> Mg		29.9905	0.32 s	\$) /7.0		0+			
<sup>31</sup> Mg		30.9966	0.24 s	\$) /11.7 \$, n	. 6.	(3/2+)			
<sup>32</sup> Mg		31.9992	0.12 s	\$) /10.3		0+			2.765/25.
<sup>33</sup> Mg		33.0056	91. ms	\$) /13.7 \$, n	/83. /17.				1.848/
<sup>34</sup> Mg		34.0091	0.02 s	\$) /11.3		0+			
<sup>35</sup> Mg		35.0175	0.07 s			(7/2-)			
<sup>36</sup> Mg		36.022	>0.2 μs			0+			
<sup>37</sup> Mg		37.031	>0.26 μs			(7/2-)			
<sup>38</sup> Mg						0+			
<b><sup>13</sup>Al</b>		<b>26.981538(2)</b>							
<sup>21</sup> Al		21.028	<0.035 μs						
<sup>22</sup> Al		22.0195	59. ms	\$* /18.6 \$, p, 2p, n / \$, p/0.17	p/1.3/18. n/3.3/0.3	4+			ann.rad./
<sup>23m</sup> Al			0.35 s						0.554 0.839
<sup>23</sup> Al		23.00727	0.47 s	\$* /12.24 \$, p/					ann.rad./
<sup>24m</sup> Al			0.129 s	I.T., /0.4259 \$, n					
<sup>24</sup> Al		23.999941	2.07 s	\$* /13.878, p	13.3 3.40/48. 4.42/41. 6.80/3. 8.74/8.	1+ 4+			1.3686/5.3 1.078(2)/16. 1.368(2)/96. 2.753(2)/43. 4.315(3)/15. 5.392(3)/20. 7.0662(2)/41.

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>25</sup> Al		24.990429	7.17 s	\$ <sup>+</sup> /4.277	3.27/	5/2+	3.646		ann. rad. / 1.6115(2)/100. 0.975(2)/5.
<sup>26m</sup> Al <sup>26</sup> Al		25.9868917	6.345 s 7.1x10 <sup>8</sup> y	\$ <sup>+</sup> / \$ <sup>+</sup> /82/4.0042 EC/18	3.2/ 1.16/	0+ 5+		+2.804 +0.17	ann. rad. / ann. rad. / 1.8087/99.8
<sup>27</sup> Al <sup>28</sup> Al <sup>29</sup> Al	100.	26.9815384 27.9819102 28.980445	2.25 m 6.5 m	\$) /4.6422 \$) /3.680	2.865/100. 1.4/30. 2.5/70.	5/2+ 3+ 5/2+	+3.64151 3.24	+0.140 0.18	1.7778(6)/100. 1.2732(8)/89. 2.0282(8)/4. 2.4262(8)/7. 1.26313(3)/35. 2.23525(5)/65. 0.75223(3)/18. 1.69473(3)/59. 2.31664(4)/73.
<sup>30</sup> Al <sup>31</sup> Al		29.98296 30.98395	3.68 s 0.64 s	\$) /8.56 \$) /8.00	5.05/ 6.25/	3+ 5/2+			
<sup>32</sup> Al <sup>33</sup> Al		31.9881 32.9909	33. ms 41.7 ms	\$) /13.0 \$ <sup>-</sup> /12.0		1+			1.940/2.5 (1.01-4.34)
<sup>34</sup> Al <sup>35</sup> Al <sup>36</sup> Al		33.9969 34.9999 36.0064	56. ms 39. ms 0.09 s	\$) /17.1 \$ <sup>-</sup> /14.3 \$ <sup>-</sup> /18.3	4.255/44 /26. 0.974/48 /. 41.	4 5/2+			0.929/57 (0.12-4.26) 0.064/45. (0.12-5.63)
<sup>37</sup> Al <sup>38</sup> Al <sup>39</sup> Al <sup>40</sup> Al <sup>41</sup> Al		37.010 38.0169 39.022	>1 μs >0.2 μs >0.2 μs >0.26 :s	\$ <sup>-</sup> /16.	<31.				
<b><sup>14</sup>Si</b>		<b>28.0855(3)</b>							
<sup>22</sup> Si <sup>23</sup> Si <sup>24</sup> Si		22.0345 23.0255 24.01155	29. ms 40.7 ms 0.14 s	\$ <sup>+</sup> ,p \$ <sup>+</sup> ,p/5.9 \$ <sup>+</sup> ,p/10.81	1.99/20 1.32, (0.6-11.6) 1.44, 3.92, 1.09 (1.66-4.47)	0+ 0+ 0+			ann. rad. /
<sup>25</sup> Si <sup>26</sup> Si		25.00411 25.992330	221 ms 2.23 s	\$ <sup>+</sup> ,p/12.74 \$ <sup>+</sup> /5.066		5/2+ 0+			ann. rad. / ann. rad. / 0.8294(8)/22.
<sup>27</sup> Si		26.9867048	4.14 s	\$ <sup>+</sup> /4.8118	3.85/100.	5/2+	-0.8554		ann. rad. / 2.211(5)/0.2
<sup>28</sup> Si <sup>29</sup> Si <sup>30</sup> Si <sup>31</sup> Si <sup>32</sup> Si <sup>33</sup> Si	92.223(19) 4.685(8) 3.092(11)	27.97692653 28.97649472 29.97377022 30.9753633 31.974148 32.97800	2.62 h 1.6x10 <sup>2</sup> y 6.1 s	\$) /1.4920 \$) /0.224 \$) /5.85	1.471/99.9 0.213/100. 3.92	0+ 1/2+ 0+ 3/2+ 0+ (3/2+)			1.2662(5)/0.05 1.4313(5)/13. 1.8477/100. 2.538(2)/10. 0.42907(5)/60. 1.17852(2)/64. 1.60756(5)/36.
<sup>34</sup> Si <sup>35</sup> Si <sup>36</sup> Si <sup>37</sup> Si <sup>38</sup> Si <sup>39</sup> Si <sup>40</sup> Si <sup>41</sup> Si <sup>42</sup> Si <sup>43</sup> Si		33.97858 34.98458 35.9867 36.9930 37.9960 39.0023 40.0058 41.013 42.016	2.8 s 0.9 s 0.5 s 0.09 s >1 μs >1 μs >0.2 μs >0.2 μs >0.2 μs	\$) /4.60 \$) /10.50 \$) /7.9 \$ <sup>-</sup> /12.5 \$ <sup>-</sup> /10.7 \$ <sup>-</sup> /14.8	3.09/ /. 12. /. 17.	0+ 0+ 0+ 0+			
<b><sup>15</sup>P</b>		<b>30.973761(2)</b>							
<sup>24</sup> P <sup>25</sup> P <sup>26</sup> P <sup>27</sup> P <sup>28</sup> P		24.0344 25.0203 26.0118 26.99919 27.992312	<0.03 μs .20. ms 0.3 s 270. ms	\$ <sup>+</sup> ,p/18.1 \$ <sup>+</sup> ,p/11.63 \$ <sup>+</sup> /14.332	p/0.73, 0.61/0.07 3.94/13. 5.25/13. 6.96/16. 8.8/7. 11.49/52.	3+ 1/2+ 3+			ann. rad. / 1.779(2)/98. 2.839(2)/2.8 3.040(2)/3.2 4.498(2)/12. 7.537(2)/9.
<sup>29</sup> P <sup>30</sup> P <sup>31</sup> P <sup>32</sup> P		28.981801 29.9783138 30.9737615 31.9739071	4.14 s 2.50 m 14.28 d	\$ <sup>+</sup> /4.9431 \$ <sup>+</sup> /4.2323 \$) /1.7106	3.945/98. 3.245/99.9 1.710/100.	1/2+ 1+ 1/2+ 1+	1.2349		ann. rad. / 1.273/1.32 2.426/0.39 ann. rad. / 2.230(3)/0.07
<sup>33</sup> P <sup>34</sup> P <sup>35</sup> P <sup>36</sup> P <sup>37</sup> P <sup>38</sup> P <sup>39</sup> P <sup>40</sup> P	100.	32.971725 33.973636 34.973314 35.97826 36.97961 37.9845 38.9864 39.9911	25.3 d 12.4 s 47. s 5.7 s 2.3 s 0.6 s .016 s .026 s	\$) /0.249 \$) /5.374 \$) /3.989 \$) /10.41 \$) /7.90 \$) /12.4 \$ <sup>-</sup> /10.5 \$ <sup>-</sup> /14.5 \$ <sup>-</sup> ,n	0.249/100. 3.2/15. 5.1/85. 2.34/100. /. 12. /. 12. /26 /. 30.	1/2+ 1+ 1/2+ 1/2+ 1+ 1+ 1+ 1+			1.78-4.1/ 2.127(5)/15. 1.572(1)/100. 0.902/77. 3.291/100. 0.6462/ 1.5829/ 1.2923/ 2.224/

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>41</sup> P		40.9948	0.12 s	\$^- /13.8					
<sup>42</sup> P		42.0001	0.11 s	\$^- ,n \$/17.	/ 30.				
<sup>43</sup> P		43.0033	33. ms	\$^- ,n \$/16.	/ 50.				
<sup>44</sup> P		44.010	>0.2 μs	\$^- ,n	/100.				
<sup>45</sup> P		45.015	>0.2 μs						
<sup>46</sup> P		46.024	>0.2 μs						
<b><sup>16</sup>S</b>		<b>32.065(5)</b>							
<sup>26</sup> S		26.0278	10 ms			0+			
<sup>27</sup> S		27.0188	16. ms	\$^+ ,2p/18.3	p/2.26,7.80	0+			
<sup>28</sup> S			0.13 s			0+			
<sup>29</sup> S		28.99661	0.188 s	\$^+ /13.79		5/2+			ann.rad./
<sup>30</sup> S		29.984903	1.18 s	\$^+ ,p/ \$/6.138	4.42/78. 5.08/20.	0+			ann.rad./ 0.678/79.
<sup>31</sup> S		30.979555	2.56 s	\$^+ /5.396	4.39/99.	1/2+	0.48793		ann.rad./ 1.2662(5)/1.2
<sup>32</sup> S	94.93(31)	31.9720707				0+			
<sup>33</sup> S	0.76(2)	32.9714585				3/2+	+0.64382	-0.068	
<sup>34</sup> S	4.29(28)	33.9678668				0+			
<sup>35</sup> S		34.9690321	87.2 d	\$) /0.1672	0.1674/100.	3/2+	+1.00	+0.047	
<sup>36</sup> S	0.02(1)	35.9670809				0+			
<sup>37</sup> S		36.9711257	5.05 m	\$) /4.8653	1.64/94. 4.75/5.6	7/2-			0.9083(4)/0.06 3.1033(2)/94.2
<sup>38</sup> S		37.97116	2.84 h	\$) /2.94	1.00/	0+			0.1962(4)/0.2 1.9421(3)/84.
<sup>39</sup> S		38.97514	11.5 s	\$) /6.64					1.301/52. 1.697/44.
<sup>40</sup> S		39.9755	9. s	\$) /4.7		0+			
<sup>41</sup> S		40.9800	2.6 s	\$^- /8.7					
<sup>42</sup> S		41.9815	0.056 s	\$^- ,n \$/7.8		0+			
<sup>43</sup> S		42.987	0.22 s	\$^- ,n \$/12.	<4.				
<sup>44</sup> S		43.9883	0.12 s	\$^- ,n \$/9.	/ 40	0+			
<sup>45</sup> S		44.9948	0.08 s	\$^- ,n \$/14.	/18.				
<sup>46</sup> S		45.9996	>0.2 μs	\$^- ,n	/54.	0+			
<sup>47</sup> S		47.008	>0.2 μs						
<sup>48</sup> S		48.013	>0.2 μs			0+			
<sup>49</sup> S		49.022	<0.2 μs						
<b><sup>17</sup>Cl</b>		<b>35.453(2)</b>							
<sup>28</sup> Cl		28.0285							
<sup>29</sup> Cl		29.0141	<0.02 μs						
<sup>30</sup> Cl		30.0048	<0.03 μs						
<sup>31</sup> Cl		30.99242	0.15 s	\$^+ ,p/11.98	0.986,1.52/0.7	3/2+			ann.rad./
<sup>32</sup> Cl		31.98569	297. ms	\$^+ /12.69	9.47/50. /0.05	1+	1.11		ann.rad./ 2.2305/92 (1.55-4.77)
<sup>33</sup> Cl		32.977452	2.511 s	\$^+ ,p \$/5.583	4.51/98.	3/2+	+0.752		ann.rad./ 0.8409/0.52 1.966/0.45 2.866/0.44
<sup>34m</sup> Cl			32.2 m	\$^+ /	1.35/24. 2.47/28.	3+			ann.rad./
<sup>34</sup> Cl		33.9737620	1.528 s	\$^+ /5.4922	4.50/100.	0+			0.1457(8)/42. 2.1276(5)/42.
<sup>35</sup> Cl	75.78(4)	34.96885271				3/2+	+0.82187	-0.0825	ann.rad./
<sup>36</sup> Cl		35.9683069	3.01x10 <sup>5</sup> y	\$) /0.7086	0.7093/98. \$/EC/1.1421	0+	+1.28547	-0.018	
<sup>37</sup> Cl	24.22(4)	36.96590260			0.115/0.002	3/2+	+0.68412	-0.0649	ann.rad./
<sup>38m</sup> Cl			0.715 s	I.T./		5-			0.6714/100
<sup>38</sup> Cl		37.9680106	37.2 m	\$) /4.9168	1.11/31. 2.77/11. 4.91/58.	2-	2.05		1.64216(1)/31. 2.16760(2)/42.
<sup>39</sup> Cl		38.968008	55.6 m	\$) /3.442	1.91/85. 2.18/8. 3.45/7.	3/2+			0.25026(1)/47. 1.26720(5)/54. 0.986-1.517 0.6431(3)/6.
<sup>40</sup> Cl		39.97042	1.38 m	\$) /7.48		2-			1.4608(1)/77. 2.8402(2)/17. (0.167-1.359)
<sup>41</sup> Cl		40.9707	34. s	\$) /5.7	3.8/				
<sup>42</sup> Cl		41.9732	6.8 s	\$) /9.4					
<sup>43</sup> Cl		42.9742	3.3 s	\$) /8.0					
<sup>44</sup> Cl		43.9785	0.43 s	\$) /12.3					
<sup>45</sup> Cl		44.980	0.40 s	\$^- ,n \$/11.	<8.				
<sup>46</sup> Cl		45.984	0.22 s	\$^- ,n \$/14.9	/24.				
<sup>47</sup> Cl		46.988	>0.2 μs	\$^- ,n \$/15.	/ 60				
<sup>48</sup> Cl		47.995	>0.2 μs	\$^- ,n	<3.				
<sup>49</sup> Cl		48.9999	>0.17 s						
<sup>50</sup> Cl		50.008							
<sup>51</sup> Cl		51.014	>0.2 μs						
<b><sup>18</sup>Ar</b>		<b>39.948(1)</b>							
<sup>30</sup> Ar		30.0216	<0.02 μs			0+			

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>31</sup> Ar		31.0121	14.1 ms	\$ <sup>+</sup> /18.4	p/2.08/100.	5/2			
				\$ <sup>+</sup> , p	/55.				
				\$ <sup>+</sup> , 2p	/2.5				
				\$ <sup>+</sup> , 3p	/0.11				
<sup>32</sup> Ar		31.99766	98. ms	\$ <sup>+</sup> /11.2	p/3.35,0.6-5.55	0+			ann. rad. /
				\$ <sup>+</sup> , p	/43.				
<sup>33</sup> Ar		32.98993	174. ms	\$ <sup>+</sup> /11.62	3.17,2.10	1/2+	-0.72		ann. rad. /
				\$ <sup>+</sup> , p/	(1.32-5.72)				0.810(2)/48.
<sup>34</sup> Ar		33.980270	0.844 s	\$ <sup>+</sup> /6.061	5.0/95.	0+			ann. rad. /
									0.6658(1)/2.5
									3.1290(1)/1.3
<sup>35</sup> Ar		34.975257	1.77 s	\$ <sup>+</sup> /5.965	4.94/93.	3/2+	+0.633	-0.08	ann. rad. /
									1.2185(5)/1.22
									1.763(1)/0.25
									2.964(1)/0.2
<sup>36</sup> Ar	0.3365(30)	35.9675463				0+			
<sup>37</sup> Ar		36.9667759	35.0 d	EC/ .813		3/2+	+1.15	+0.076	
<sup>38</sup> Ar	0.0632(5)	37.9627322				0+			
<sup>39</sup> Ar		38.964313	268. y	\$) /0.565	0.565/100.	7/2-	-1.59	-0.12	
<sup>40</sup> Ar	99.6003(30)	39.962383123				0+			
<sup>41</sup> Ar		40.964501	1.82 h	\$) /2.492	1.198/	7/2-			1.29364(5)/99.
									1.6770(3)/0.05
<sup>42</sup> Ar		41.96305	33. y	\$) /0.60	0.60/100.	0+			
<sup>43</sup> Ar		42.9657	5.4 m	\$) /4.6					0.4791(2)/10.
									0.7380(1)/43.
									0.9752(1)/100.
									1.4400(3)/39.
<sup>44</sup> Ar		43.96537	11.87 m	\$) /3.55		0+			0.182-1.866
<sup>45</sup> Ar		44.96809	21.5 s	\$) /6.9		7/2-			0.0610/25.
									1.020/35.
									3.707/34.
									1.944/
<sup>46</sup> Ar		45.96809	8.4 s	\$) /5.70		0+			
<sup>47</sup> Ar		46.9722	0.7 s	\$ <sup>-</sup>					
<sup>48</sup> Ar		47.9751							
<sup>49</sup> Ar		48.9822	>0.17 μs	\$ <sup>-</sup>					
<sup>50</sup> Ar		49.986	>0.17 μs	\$ <sup>-</sup>					
<sup>51</sup> Ar		50.993	>0.2 μs	\$ <sup>-</sup>					
<sup>52</sup> Ar		51.998	10 ms	\$ <sup>-</sup>					
<sup>53</sup> Ar		52.994		\$ <sup>-</sup>					
<sup>55</sup> Ar		52.994		\$ <sup>-</sup>					
<b><sup>19</sup>K</b>		<b>39.0983(1)</b>							
<sup>32</sup> K		32.0219							
<sup>33</sup> K		33.0073	<0.025 μs						
<sup>34</sup> K		33.9984	<0.04 μs						
<sup>35</sup> K		34.98801	0.19 s	\$ <sup>+</sup> /11.88		3/2+			ann. rad. /
				\$ <sup>+</sup> , p/	/0.37				1.751/14.
									2.5698/26.
									2.9827/51.
<sup>36</sup> K		35.98129	0.342 s	\$ <sup>+</sup> /12.81	5.3/42.	2+	+0.548		ann. rad. /
				\$ <sup>+</sup> , p	9.9/44.				1.97044(5)/82.
					/0.048				2.20783(5)/30.
									2.43343(2)/32.
<sup>37</sup> K		36.9733769	1.23 s	\$ <sup>+</sup> /6.149	5.13/	3/2+	+0.2032		ann. rad. /
									2.7944(8)/2.
									3.602(2)/0.05
<sup>38m</sup> K		37.969080	0.924 s	\$ <sup>+</sup> /6.742	5.02/100.	0+			ann. rad. /
<sup>38</sup> K		37.969080	7.63 m	\$ <sup>+</sup> /5.913	2.60/99.8	3+	+1.37		ann. rad. /
									2.1675(3)/99.8
									3.9356(5)/0.2
<sup>39</sup> K	93.2581(44)	38.9637069				3/2+	+0.39146	+0.049	
<sup>40</sup> K	0.0117(1)	39.9639987	1.26x10 <sup>9</sup> y	\$) /1.3111	1.312/89.	4-	-1.29810	-0.061	ann. rad. /
				\$ <sup>+</sup> , EC/1.505	1.50/10.7				1.4608/10.5
<sup>41</sup> K	6.7302(44)	40.9618260				3/2+	+0.21487	+0.060	
<sup>42</sup> K		41.9624031	12.36 h	\$) /3.525	1.97/19.	2-	-1.1425		0.31260(2)/0.3
					3.523/81.				1.5246(3)/18.1
<sup>43</sup> K		42.96072	22.3 h	\$) /1.82	0.465/8.	3/2+	+0.163		0.2211(2)/4.
					0.825/87.				0.3729(2)/88.
					1.24/3.5				0.3971(2)/11.
					1.814/1.3				0.6178(2)/81.
<sup>44</sup> K		43.96156	22.1 m	\$) /5.66	5.66/34.	2-	-0.856		0.36821/2.2
									1.15700(1)/58.
									2.15079(2)/22.
<sup>45</sup> K		44.96070	17.8 m	\$) /4.20	1.1/23.	3/2+	+0.173		0.1743(5)/80.
					2.1/69.				1.2607(8)/7.
					4.0/8.				1.7056(6)/69.
									2.3542(5)/14.
<sup>46</sup> K		45.96198	1.8 m	\$) /7.72	6.3/	2-	-1.05		1.347(1)/91.
<sup>47</sup> K		46.96168	17.5 s	\$) /6.64	4.1/99.	1/2+	+1.93		0.56474(3)/15.
					6.0/1.				0.58575(3)/85.
									2.0131/100
<sup>48</sup> K		47.96551	6.8 s	\$) /12.09	5.0/	(2-)			0.67122(1)/4.
									0.6723(5)/20.
									0.78016(1)/32.
									3.83153(7)/80.
<sup>49</sup> K		48.9675	1.26 s	\$) /11.0					2.025/
									2.252/
<sup>50</sup> K		49.9728	0.472 s	\$) /14.2					
<sup>51</sup> K		50.9764	0.365 s	\$) /					
<sup>52</sup> K		51.983	0.105 s	\$) /					
<sup>53</sup> K		52.987	30. ms	\$) /		3/2+			
<sup>54</sup> K		53.994	10. ms	\$) /					
<b><sup>20</sup>Ca</b>		<b>40.078(4)</b>							
<sup>34</sup> Ca		34.0141	<0.035 μs						
<sup>35</sup> Ca		35.0048	25.7 ms	\$ <sup>+</sup> , p/15.6	p/1.43/49				
					1.9-8.8				
<sup>36</sup> Ca		35.99309	0.10 s	\$ <sup>+</sup> , (p)/10.99	2.52				ann. rad. /

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>37</sup> Ca		36.98587	0.18 s	\$ <sup>+</sup> , n/ \$ <sup>+</sup> /11.64	3.103	3/2+			ann.rad./ 1.369
<sup>38</sup> Ca		37.976319	0.44 s	\$ <sup>+</sup> , n/ \$ <sup>+</sup> /6.74		0+			ann.rad./ 1.5677(5)/25. 3.210(2)/1.
<sup>39</sup> Ca		38.970718	0.861 s	\$ <sup>+</sup> /6.531	5.49/100.	3/2+	1.02168		ann.rad./
<sup>40</sup> Ca	96.941(156)	39.9625912				0+			
<sup>41</sup> Ca		40.9622783	1.02x10 <sup>5</sup> y	EC/0.4214		7/2-	-1.5948	-0.090	
<sup>42</sup> Ca	0.647(23)	41.9586183				0+			
<sup>43</sup> Ca	0.135(10)	42.9587668				7/2-	-1.3173	-0.055	
<sup>44</sup> Ca	2.086(110)	43.955481				0+			
<sup>45</sup> Ca		44.956186	162.7 d	\$ <sup>-</sup> /0.257	0.257/100.	7/2-	-1.327	+0.05	
<sup>46</sup> Ca	0.004(3)	45.953693	>0.4x10 <sup>16</sup> y	\$ <sup>-</sup> /		0+			
<sup>47</sup> Ca		46.954546	4.536 d	\$ <sup>-</sup> /1.992	0.684/84. 1.98/16.	7/2-	-1.38	+0.02	1.297/75 (0.041-1.88)
<sup>48</sup> Ca	0.187(21)	47.952533	4.3x10 <sup>19</sup> y	\$ <sup>-</sup> /		0+			
<sup>49</sup> Ca		48.955673	>7.1x10 <sup>19</sup> y	\$ <sup>-</sup> /5.262	0.89/7. 1.95/92. 3.12/	3/2-			3.0844(1)/92. 4.0719(1)/7. 0.2569/98. (0.0715 -1.59)
<sup>50</sup> Ca		49.95752	14. s	\$ <sup>-</sup> /4.97		0+			
<sup>51</sup> Ca		50.9615	10. s	\$ <sup>-</sup> /7.3		(3/2-)			
<sup>52</sup> Ca		51.9651	4.6 s	\$ <sup>-</sup> /8.0					
<sup>53</sup> Ca		52.9701	0.09 s	\$ <sup>-</sup> /10.9					
<sup>54</sup> Ca		53.975							
<sup>55</sup> Ca		54.981							
<sup>56</sup> Ca		55.986							
<b><sup>21</sup>Sc</b>		<b>44.955910(8)</b>							
<sup>36</sup> Sc		36.0149							
<sup>37</sup> Sc		37.0030							
<sup>38</sup> Sc		37.9947	<0.3 μs						
<sup>39</sup> Sc		38.98479	<0.3 μs	p <sup>+</sup>					
<sup>40</sup> Sc		39.977964	0.182 s	\$ <sup>+</sup> /14.320	5.73/50. 7.53/15. 8.76/15. 9.58/20.	4-			ann.rad./ 0.752/41. 3.732/99.5 (1.12-3.92)
<sup>41</sup> Sc		40.9692513	0.596 s	\$ <sup>+</sup> /6.4953	5.61/100.	7/2-	+5.431	-0.156	ann.rad./
<sup>42m</sup> Sc			61.6 s	\$ <sup>+</sup> /	2.82/	7+			ann.rad./ 0.4375(5)/100. 1.2270(5)/100. 1.5245(5)/100.
<sup>42</sup> Sc		41.9655168	0.682 s	\$ <sup>+</sup> /6.4259	5.32/100.	0+			ann.rad./
<sup>43</sup> Sc		42.961151	3.89 h	\$ <sup>+</sup> , EC/2.221	0.82/22. 1.22/78.	7/2-	+4.62	-0.26	ann.rad./ 0.3729(1)/22. 0.27124(1)/87. (1.00-1.16)
<sup>44m</sup> Sc			58.2 h	I.T./0.27 EC/3.926		6+	+3.88		ann.rad./
<sup>44</sup> Sc		43.959403	3.93 h	\$ <sup>+</sup> , EC/3.653	1.47/	2+	+2.56	+0.10	ann.rad./ 1.157/100
<sup>45</sup> Sc	100.	44.955910				7/2-	+4.75649	-0.220	
<sup>46m</sup> Sc			18.7 s	I.T./0.14253		1-			0.14253(2)/62.
<sup>46</sup> Sc		45.955170	83.81 d	\$ <sup>-</sup> /2.367	0.357/100.	4+	+3.03	+0.12	0.8893/100 1.121/100
<sup>47</sup> Sc		46.952408	3.349 d	\$ <sup>-</sup> /0.600	0.439/69. 0.601/31.	7/2-	+5.34	-0.22	0.15938(1)/68.
<sup>48</sup> Sc		47.95224	43.7 h	\$ <sup>-</sup> /3.99	0.655/	6+			0.9835/100 1.03750(1)/97. 1.3121/100
<sup>49</sup> Sc		48.950024	57.3 m	\$ <sup>-</sup> /2.006	2.00/99.9.	7/2-			1.7619(3)/0.05
<sup>50</sup> Sc		49.95219	1.71 m	\$ <sup>-</sup> /6.89	3.05/76. 3.60/24.	(5+)			0.5235(1)/88. 1.1210(1)/100. 1.5537(2)/100.
<sup>51</sup> Sc		50.95360	12.4 s	\$ <sup>-</sup> /6.51	4.4/ 5.0/	7/2-			1.4373(4)/52. 0.718-2.144
<sup>52</sup> Sc		51.9566	8.2 s	\$ <sup>-</sup> /9.0		(3+)			
<sup>53</sup> Sc		52.9592	> 3. ms	\$ <sup>-</sup> /8.1					
<sup>54m</sup> Sc			7 μs			(5+)			0.110/IT
<sup>54</sup> Sc		53.9630	0.23 s	\$ <sup>-</sup> /11.6					0.100/50 1.70/40 0.50/40
<sup>55</sup> Sc		54.967	0.12 s	\$ <sup>-</sup> /13					
<sup>56</sup> Sc		55.973							
<sup>57</sup> Sc		56.977							
<sup>58</sup> Sc		57.983							
<b><sup>22</sup>Ti</b>		<b>47.867(1)</b>							
<sup>38</sup> Ti		38.0098	<0.12 μs						
<sup>39</sup> Ti		39.0013	29. ms	\$ <sup>+</sup> /15.4	p/2.16/29				
<sup>40</sup> Ti		39.9905	53. ms	\$ <sup>+</sup> /11.7 \$ <sup>+</sup> , p	3.73/23 1.70/22 0.242-5.74				
<sup>41</sup> Ti		40.98313	80. ms	\$ <sup>+</sup> , p/12.93	p/4.73/107 3.10/67 3.75/39 0.744-6.73	3/2+			ann.rad./
<sup>42</sup> Ti		41.97303	0.20 s	\$ <sup>+</sup> /7.000	6.0/				ann.rad./ 0.6107(5)/56.
<sup>43</sup> Ti		42.96852	0.50 s	\$ <sup>+</sup> /6.87	5.80/	7/2-	0.85		ann.rad./
<sup>44</sup> Ti		43.959690	60. y	EC/0.268		0+			0.06787/91 0.07832/97
<sup>45</sup> Ti		44.958124	3.078 h	\$ <sup>+</sup> /86/2.062 EC/14/	1.04	7/2-	0.095	0.015	ann.rad./ (0.36-1.66)
<sup>46</sup> Ti	8.25(3)	45.952630				0+			
<sup>47</sup> Ti	7.44(2)	46.951764				5/2-	-0.78848	+0.30	
<sup>48</sup> Ti	73.72(3)	47.947947				0+			
<sup>49</sup> Ti	5.41(2)	48.947871				7/2-	-1.10417	+0.24	
<sup>50</sup> Ti	5.18(2)	49.944792				0+			
<sup>51</sup> Ti		50.946616	5.76 m	\$ <sup>-</sup> /2.471	1.50/92.	3/2-			0.3197(2)/93.





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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom. (nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<b><sup>25</sup>Mn</b>		<b>54.938049(9)</b>							
<sup>44</sup> Mn		44.0069	<0.105 μs						
<sup>45</sup> Mn		44.9945	<0.07 μs						
<sup>46</sup> Mn		45.9867	34. ms	\$ <sup>+</sup> /17.1					
<sup>47</sup> Mn		46.9761	.0.1 s	\$ <sup>+</sup> ,p /12.3	//. 58				
<sup>48</sup> Mn		47.9689	0.15 s	\$ <sup>+</sup> /13.5	5.79/58.	4+			
<sup>49</sup> Mn		48.95962	0.38 s	\$ <sup>+</sup> /7.72	4.43/10. 6.69/	5/2-			ann. rad. /
<sup>50m</sup> Mn			1.74 m	\$ <sup>+</sup> /7.887	3.54/	5+			ann. rad. / 1.0980/94. 0.783/91. (0.66-3.11)
<sup>50</sup> Mn		49.954244	0.283 s	\$ <sup>+</sup> /7.6330	6.61/	0+			ann. rad. /
<sup>51</sup> Mn		50.948215	46.2 m	\$ <sup>+</sup> ,EC/3.208	2.2/	5/2-	3.568	0.4	ann. rad. / 0.7491(1)/0.26 (1.148-1.164)
<sup>52m</sup> Mn			21.1 m	\$ <sup>+</sup> /98/5.09 I.T./2/0.378	2.631/	2+	0.0076		ann. rad. / 0.3778 (I.T.) 1.43406(1)/98. (0.7-4.8)
<sup>52</sup> Mn		51.945570	5.591 d	\$ <sup>+</sup> /4.712 EC/	0.575/	6+	+3.063	+0.5	ann. rad. / 0.74421(1)/90. 1.4341/100
<sup>53</sup> Mn		52.941294	3.7x10 <sup>6</sup> y	EC/0.5970		7/2-	5.024		
<sup>54</sup> Mn		53.940363	312.1 d	EC/1.377		3+	+3.282	+0.33	0.8340/100
<sup>55</sup> Mn	100.	54.938049	6.7x10 <sup>8</sup> y	\$ <sup>+</sup>	//1.3x10 <sup>-7</sup>				
<sup>56</sup> Mn		55.938909	2.579 h	\$) /3.6954	0.718/18. 1.028/34.	5/2- 3+	+3.4687 +3.2266	+0.32	0.84675/99 1.81072(4)/27. 2.113/14.5
<sup>57</sup> Mn		56.938287	1.45 m	\$) /2.691		5/2-			
<sup>58</sup> Mn		57.93999	65 s	\$) /6.25	3.8/ 5.1/	3+			0.45916(2)/20. 0.81076(1)/82. 1.32309(5)/53.
<sup>59</sup> Mn		58.94045	4.6 s	\$) /5.19	4.5/	5/2-			0.726/ 0.473/ 0.287-2.35 0.824/ 1.969/
<sup>60m</sup> Mn			1.77 s	\$) /IT	5.7/	3+			
<sup>60</sup> Mn		59.9433	50. s	\$) /8.6		0+			
<sup>61</sup> Mn		60.9446	0.67 s	\$) /7.4		(5/2)-			
<sup>62</sup> Mn		61.9480	0.67 s	\$) /10.4		(3+)			0.877/ 0.942-1.299 0.356,0.450 0.135/IT 0.746 0.366 0.471
<sup>63</sup> Mn		62.9498	0.28 s	\$) /8.8					
<sup>64m</sup> Mn			> 0.1 ms						
<sup>64</sup> Mn		63.9537	87 ms	\$) /11.8					
<sup>65</sup> Mn		64.9561	0.09 s	\$) /10.					
<sup>66</sup> Mn		65.961	66 ms						
<sup>67</sup> Mn		66.964	42 ms						
<sup>68</sup> Mn			28 ms						
<sup>69</sup> Mn			14 ms						
<b><sup>26</sup>Fe</b>		<b>55.845(2)</b>							
<sup>45</sup> Fe		45.0146	4. ms	2p	p//. 80.				
<sup>46</sup> Fe		46.0008	12. ms	\$ <sup>+</sup> /13.1	p//. 36.				
<sup>47</sup> Fe		46.9929	22. ms	\$ <sup>+</sup> /15.6	p//87.				
<sup>48</sup> Fe		47.9806	. 44. ms	\$ <sup>+</sup> /11.2					
<sup>49</sup> Fe		48.9763	70. ms	\$ <sup>+</sup> /13.0		(7/2-)			ann. rad. /
<sup>50</sup> Fe		49.9630	0.15 s	\$ <sup>+</sup> /8.2					0.651
<sup>51</sup> Fe		50.95683	0.31 s	\$ <sup>+</sup> /8.02		(5/2-)			ann. rad. /
<sup>52m</sup> Fe			46. s	\$ <sup>+</sup> /4.4		(12+)			ann. rad. / (0.622-2.286)/
<sup>52</sup> Fe		51.94812	8.28 h	\$ <sup>+</sup> /57/2.37 EC/43/ I.T./	0.804/	0+			ann. rad. / 0.16868(1)/99. 0.377 (I.T.)/ 0.7011(1)/99. 1.0115(1)/87. 1.3281(1)/87. 2.3396(1)/13.
<sup>53m</sup> Fe			2.6 m	I.T./3.0407		19/2-			ann. rad. / 0.3779(1)/42. (1.2 - 3.2)
<sup>53</sup> Fe		52.945312	8.51 m	\$ <sup>+</sup> /3.743	2.40/42. 2.80/57.	7/2-			
<sup>54</sup> Fe	5.845(35)	53.939615	>3.1x10 <sup>22</sup> y	EC-EC		0+			Mn x-ray
<sup>55</sup> Fe		54.938298	2.73 y	EC/0.2314		3/2-			
<sup>56</sup> Fe	91.754(36)	55.934942				0+			
<sup>57</sup> Fe	2.119(10)	56.935398				1/2-	+0.0906	0.16	
<sup>58</sup> Fe	0.282(4)	57.933280				0+			
<sup>59</sup> Fe		58.934880	44.51 d	\$) /1.565	0.273/48. 0.475/51.	3/2-	- 0.336		1.099/57 1.292/43. (0.14-1.48)
<sup>60</sup> Fe		59.934077	1.5x10 <sup>6</sup> y	\$) /0.237	0.184/100.	0+			0.0586/100
<sup>61m</sup> Fe			0.25 μs			(9/2+)			0.654/IT 0.207
<sup>61</sup> Fe		60.93675	6.0 m	\$) /3.98	2.5/13. 2.63/54. 2.80/31. 2.5/100.				1.205/44. 1.028/43. (0.12-3.37)
<sup>62</sup> Fe		61.93677	68. s	\$) /2.53		0+			0.5061(1)/100.
<sup>63</sup> Fe		62.9404	6. s	\$) /6.3		5/2-			0.995/ (1.365-1.427)
<sup>64</sup> Fe		63.9411	2.0 s	\$) /4.9					
<sup>65m</sup> Fe			0.4 μs			(5/2-)			0.364/IT
<sup>65</sup> Fe		64.9449	1.3 s	\$) /7.9					
<sup>66</sup> Fe		65.9460	0.44 s	\$) /5.7					0.471-1.425
<sup>67m</sup> Fe			. 0.04 ms			(5/2-)			0.367/IT
<sup>67</sup> Fe		66.9500	0.48 s	\$) /8.8					0.189
<sup>68</sup> Fe		67.953	0.15 s	\$) /7.6					
<sup>69</sup> Fe		68.958	0.17 s						
<sup>70</sup> Fe			>0.15 μs						

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>71</sup> Fe			>0.15 μs						
<sup>72</sup> Fe			>0.15 μs						
<b><sup>27</sup>Co</b>		<b>58.933200(9)</b>							
<sup>48</sup> Co		48.0018							
<sup>49</sup> Co		48.990	<0.035 μs						
<sup>50</sup> Co		49.9812	44. ms	\$ <sup>+</sup> /17.0	2.03-2.79				
<sup>51</sup> Co		50.9705	>0.2 μs	\$ <sup>+</sup> /12.8					
<sup>52</sup> Co		51.9632	0.12 s	\$ <sup>+</sup> /14.0					0.849-1.942
<sup>53m</sup> Co			0.25 s	\$ <sup>+</sup> , p/		19/2-			ann. rad. /
<sup>53</sup> Co		52.95423	0.24 s	\$ <sup>+</sup> /8.30		7/2-			ann. rad. /
<sup>54m</sup> Co			1.46 m	\$ <sup>+</sup> /8.44	4.25/100.	7+			ann. rad. /
									0.411(1)/99.
									1.130(1)/100.
									1.408(1)/100.
<sup>54</sup> Co		53.948464	0.1932 s	\$ <sup>+</sup> /8.2430	7.34/100.	0+			ann. rad. /
<sup>55</sup> Co		54.942003	17.53 h	\$ <sup>+</sup> /3.4513 EC/	0.53/ 1.03/ 1.50/	7/2-	+4.822		ann. rad. /
									0.9312/75.
									0.4772/20.
									(0.092-3.11)
<sup>56</sup> Co		55.939844	77.3 d	\$ <sup>+</sup> /4.566 EC/	1.459/18.	4+	3.85	+0.25	ann. rad. /
									0.8468/99.9
									1.2383/68.
									(0.26-3.61)
<sup>57</sup> Co		56.936296	271.8 d	EC/0.8361		7/2-	+4.72	+0.5	0.12206/86
									(0.014-0.706)
<sup>58m</sup> Co			9.1 h	I.T./		5+			0.02489/0.035
<sup>58</sup> Co		57.935757	70.88 d	\$ <sup>+</sup> /2.307 EC/		2+	+4.04	+0.22	ann. rad. /
									0.81076/99
<sup>59</sup> Co	100.	58.933200	10.47 m	I.T./99.8/0.059		7/2-	+4.63	+0.41	
<sup>60m</sup> Co				\$) /0.2/1.56		2+	+4.40	+0.3	0.0586/2.0
<sup>60</sup> Co		59.933822	5.271 y	\$) /2.824	0.315/99.7	5+	+3.799	+0.44	1.1732/100
									1.3325/100
<sup>61</sup> Co		60.932479	1.650 h	\$) /1.322	1.22/95.	7/2-			0.0674/86.
									0.842-0.909
<sup>62m</sup> Co			13.9 m	\$) /	0.88/25.	5+			1.1635(3)/70.
					2.88/75.				1.1730(3)/98.
									2.0039(3)/19.
<sup>62</sup> Co		61.93405	1.50 m	\$) /5.32	1.03/10. 1.76/5.	2+			1.1292(3)/13.
					2.9/20.				1.1730(3)/83.
					4.05/60.				1.9851(1)/3.
<sup>63</sup> Co		62.93362	27.5 s	\$) /3.67	3.6/	7/2-			2.3020(1)/19.
									0.08713(1)/49.
									0.9817(3)/2.6
									0.156-2.17
<sup>64</sup> Co		63.93581	0.30 s	\$) /7.31	7.0/	1+			
<sup>65</sup> Co		64.93648	1.14 s	\$) /5.96		(7/2)-			
<sup>66m2</sup> Co			>0.1 ms			(8-)			0.252/IT
									0.214
									0.175
									0.175/IT
									(1.245-1.425)
									0.694
<sup>66m1</sup> Co			1.2 μs			(5+)			
<sup>66</sup> Co		65.9398	0.25 s	\$) /10.0					
<sup>67</sup> Co		66.9406	0.43 s	\$) /8.4					
<sup>68</sup> Co		67.9444	0.19 s	\$) /11.7					
<sup>69</sup> Co		68.9452	0.20 s	\$) /9.3					
<sup>70</sup> Co		69.950	0.09 s	\$) 13.					
<sup>71</sup> Co		70.952	0.21 s	\$					
<sup>72</sup> Co		71.956	0.09 s	\$					
<sup>73</sup> Co			>0.15 μs						
<sup>74</sup> Co			>0.15 μs						
<sup>75</sup> Co			>0.15 μs						
<b><sup>28</sup>Ni</b>		<b>58.6934(2)</b>							
<sup>48</sup> Ni			0.5 s						
<sup>49</sup> Ni			12. ms						
<sup>50</sup> Ni		49.9959	9. ms	\$ <sup>+</sup> , p	//. 75.				
<sup>51</sup> Ni		50.9877	>0.2 μs	\$ <sup>+</sup> /16.0					
<sup>52</sup> Ni		51.9757	38. ms	\$ <sup>+</sup> /11.7					
<sup>53</sup> Ni		52.9685	0.05 s	\$ <sup>+</sup> , p/13.3		7/2-			ann. rad. /
<sup>54</sup> Ni		53.95791	0.11 s	\$ <sup>+</sup> /8.80					0.937
<sup>55</sup> Ni		54.95134	0.20 s	\$ <sup>+</sup> /8.70	7.66/	7/2-			ann. rad. /
<sup>56</sup> Ni		55.94214	6.08 d	EC/2.14 \$ <sup>+</sup> / $10^{-6}$		0+			0.15838/99
									0.8185(3)/87.
									0.2695-0.7500
<sup>57</sup> Ni		56.939800	35.6 h	\$ <sup>+</sup> /3.264 EC/	0.712/10. 0.849/76.	3/2-	- 0.798		ann. rad. /
									1.3776/78.
									(0.127-3.177)
<sup>58</sup> Ni	68.0769(89)	57.935348	> 4x10 <sup>19</sup> y	EC-EC		0+			
<sup>59</sup> Ni		58.934351	7.6x10 <sup>4</sup> y	EC/		3/2-			
<sup>60</sup> Ni	26.2231(77)	59.930790			0+				
<sup>61</sup> Ni	1.1399(6)	60.931060				3/2-	-0.75002	+0.16	
<sup>62</sup> Ni	3.6345(17)	61.928348				0+			
<sup>63</sup> Ni		62.929673	100. y	\$) /0.066945	0.065/	1/2-			
<sup>64</sup> Ni	0.9256(9)	63.927969				0+			
<sup>65</sup> Ni		64.930088	2.517 h	\$) /2.137	0.65/30. 1.020/11. 2.140/58.	5/2-	0.69		0.36627(3)/5.
									1.11553(4)/16.
									1.48184(5)/23.
<sup>66</sup> Ni		65.92912	54.6 h	\$) /0.23		0+			
<sup>67m</sup> Ni			13.3 μs			9/2+			0.313/IT
									0.694
<sup>67</sup> Ni		66.93157	21. s	\$) /3.56	3.8/	1/2-	+0.601		1.0722/100.
									1.6539/100.
									(0.10-1.98)
<sup>68m2</sup> Ni			0.34 μs			0+			0.511
<sup>68m1</sup> Ni			0.86 ms			(5-)			0.814/IT
<sup>68</sup> Ni		67.93185	29. s	\$) /2.06					2.033

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>69m2</sup> Ni			0.44 μs			(17/2)			0.148/IT 0.593 1.959
<sup>69m1</sup> Ni			3.5 s						0.6807(3)/100. (0.207-1.213)
<sup>69</sup> Ni	68.9352		11. s	β <sup>-</sup> /5.4					0.183/IT 0.448 0.970 1.259
<sup>70m</sup> Ni			0.21 μs			(8+)			
<sup>70</sup> Ni		69.9361	6.0 s	β <sup>-</sup> /3.5					
<sup>71</sup> Ni		70.9400	2.56 s	β <sup>-</sup> /6.9					
<sup>72</sup> Ni		71.9413	1.6 s	β <sup>-</sup> /5.2					
<sup>73</sup> Ni		72.946	0.84 s	β <sup>-</sup> /9.					
<sup>74</sup> Ni		73.948	1.1 s	β <sup>-</sup> /7.					
<sup>75</sup> Ni		74.953	0.47 s						
<sup>76</sup> Ni		75.955	0.24 s						
<sup>77</sup> Ni		76.961	>0.15 μs						
<sup>78</sup> Ni		77.964	>0.15 μs						
<b><sup>29</sup>Cu</b>		<b>63.546(3)</b>							
<sup>52</sup> Cu		51.9972							
<sup>53</sup> Cu		52.9856	<0.3 μs						
<sup>54</sup> Cu		53.9767	<0.075 μs						
<sup>55</sup> Cu		54.9655	>0.2 μs	β <sup>+</sup> /13.2					
<sup>56</sup> Cu		55.9586	93. ms	β <sup>+</sup> /15.3					0.511/233 2.700/100 0.9507-3.287
<sup>57</sup> Cu		56.94922	196. ms	β <sup>+</sup> /8.77		3/2-			0.77-3.01
<sup>58</sup> Cu		57.944541	3.21 s	β <sup>+</sup> /8.563 EC/	4.5/15. 7.439/83.	1+			ann. rad. / 0.0403(4)/5. 1.4483(2)/11. 1.4546(2)/16.
<sup>59</sup> Cu		58.939504	1.36 m	β <sup>+</sup> /4.800	1.9/ 3.75/	3/2-			ann. rad. / 0.3393(1)/8. 0.8780(1)/12. 1.3015(1)/15. (0.4 - 2.6)
<sup>60</sup> Cu		59.937368	23.7 m	β <sup>+</sup> /6.127 EC/	2.00/69. 3.00/18. 3.92/6.	2+	+1.219		ann. rad. / 1.3325/88. 1.7915/45. (0.12-5.048)
<sup>61</sup> Cu		60.933462	3.35 h	β <sup>+</sup> /2.237	0.56/3. 0.94/5. 1.15/2. 1.220/51. 2.93/98.	3/2-	+2.14		ann. rad. / 0.2830/13. 0.6560/11. (0.067-2.123)
<sup>62</sup> Cu		61.932587	9.67 m	β <sup>+</sup> /98/3.948 EC/		1+	-0.380		ann. rad. / 1.17302(1)/0.6 (0.87-3.37)
<sup>63</sup> Cu	69.15(15)	62.929601				3/2-	+2.2233	-0.211	
<sup>64</sup> Cu		63.929768	12.701 h	β <sup>-</sup> /38/0.579 β <sup>-</sup> /19/1.6751 EC/41/	0.578/ 0.65/	1+	-0.217		ann. rad. / 1.3459(3)/0.6
<sup>65</sup> Cu	30.85(15)	64.927794				3/2-	+2.3817	-0.195	
<sup>66</sup> Cu		65.928873	5.09 m	β <sup>-</sup> /2.642	1.65/6. 2.7/94.	1+	-0.282		0.8330(1)/0.22 1.0392(2)/9.2 0.09125(1)/7. 0.09325(1)/17. 0.18453(1)/47.
<sup>67</sup> Cu		66.92775	2.580 d	β <sup>-</sup> /0.58	0.395/56. 0.484/23. 0.577/20.	3/2-			0.0843(5)/70. 0.1112(5)/18. 0.5259(5)/74. (0.64-1.34)
<sup>68m</sup> Cu			3.79 m	I.T./86/ β <sup>-</sup> /14/1.8		6-	+1.24		1.0774(5)/58. 1.2613(5)/17. (0.15-2.34)
<sup>68</sup> Cu		67.92964	31. s	β <sup>-</sup> /4.46	3.5/40. 4.6/31.	1+	+2.48		0.075/IT 0.190/IT 0.680 1.871
<sup>69m</sup> Cu			0.36 μs			(13/2+)			
<sup>69</sup> Cu		68.92943	2.8 m	β <sup>-</sup> /2.68	2.48/80.	3/2-	+2.84		0.5307(3)/3. 0.8340(5)/6. 1.0065(8)/10. 0.8848(2)/100. 0.9017(2)/90. 1.2517(5)/60. (0.39-3.06)
<sup>70m</sup> Cu			47. s	β <sup>-</sup> /	2.52/10.	5-	+1.9		0.8848(2)/54.
<sup>70</sup> Cu		69.93241	5. s	β <sup>-</sup> /6.60	5.42/54. 6.09/46.	1+	+1.5		
<sup>71m</sup> Cu			0.28 μs			(19/2)			0.133/IT 0.494 0.939 1.189
<sup>71</sup> Cu		70.93262	20. s	β <sup>-</sup> /4.56		3/2-			0.490/
<sup>72m</sup> Cu			1.76 μs			(4-)			0.051/IT 0.082 0.138
<sup>72</sup> Cu		71.9357	6.6 s	β <sup>-</sup> /8.2		(1+)			0.652/
<sup>73</sup> Cu		72.9365	4.2 s	β <sup>-</sup> /6.3	5.8/43 6.25/42				0.450/100 0.307-1.559
<sup>74</sup> Cu		73.9401	1.6 s	β <sup>-</sup> /9.9					
<sup>75</sup> Cu		74.9414	1.2 s	β <sup>-</sup> /7.9					
<sup>76</sup> Cu		75.9455	0.64 s	β <sup>-</sup> /11.					
<sup>77</sup> Cu		76.947	0.47 s	β <sup>-</sup> /10.					
<sup>78</sup> Cu		77.952	0.34 s	β <sup>-</sup> /12.					
<sup>79</sup> Cu		78.954	0.19 s	β <sup>-</sup> /11.					
<sup>80</sup> Cu		79.962	>0.15 μs						
<b><sup>30</sup>Zn</b>		<b>65.39(2)</b>							
<sup>54</sup> Zn		53.9929							

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>55</sup> Zn		54.9840							
<sup>56</sup> Zn		55.9724	0.04 s						
<sup>57</sup> Zn		56.9649	0.04 s	\$^+,p/14.6		(7/2-)			ann.rad./
<sup>58</sup> Zn		57.9546	0.09 s	\$^+					
<sup>59</sup> Zn		58.94927	183. ms	\$^+,p/9.09	8.1/	3/2-			ann.rad./ (0.491-0.914)
<sup>60</sup> Zn		59.94183	2.40 m	\$^+ /97/4.16 EC/3/		0+			ann.rad./ 0.669/47. (0.062-0.947)
<sup>61</sup> Zn		60.93951	1.485 m	\$^+ /5.64	4.38/68.	3/2-			ann.rad./ 0.4748/17. (0.15-3.52)
<sup>62</sup> Zn		61.93433	9.22 h	\$^+ /3/1.63 EC/93/	0.66/7.	0+			ann.rad./ 0.0408/25 0.5967/26. (0.20-1.526)/
<sup>63</sup> Zn		62.933215	38.5 m	\$^+ /93/3.367 EC/7/	1.02/ 1.40/ 1.71/ 2.36/84.	3/2-	-0.28164	+0.29	ann.rad./ 0.66962(5)/8.4 0.96206(5)/6.6 (0.24-3.1)
<sup>64</sup> Zn	48.27(32)	63.929146	>2.3x10 <sup>18</sup> y	EC-EC		0+			
<sup>65</sup> Zn		64.929245	243.8 d	\$^+ /98/1.3514 EC/1.5/	0.325/	5/2-	+0.7690	-0.023	ann.rad./ 1.116/50.8
<sup>66</sup> Zn	27.977(77)	65.926036				0+			
<sup>67</sup> Zn	4.102(21)	66.927131				5/2-	+0.8755	+0.15	
<sup>68</sup> Zn	19.02(12)	67.924847				0+			
<sup>69m</sup> Zn			13.76 h	I.T./99+/0.439		9/2+			0.4390(2)/95.
<sup>69</sup> Zn		68.926553	56. m	\$) /0.906	0.905/99.9	1/2-			0.318/
<sup>70</sup> Zn	0.631(9)	69.925325				0+			
<sup>71m</sup> Zn			3.97 h	\$) /	1.45/	9/2+			0.3864/93. 0.4874/62. 0.6203/57. (0.099-2.489)
<sup>71</sup> Zn		70.92773	2.4 m	\$) /2.81		1/2-			0.5116(1)/30. 0.9103(1)/7.5 (0.12-2.29)
<sup>72</sup> Zn		71.92686	46.5 h	\$) /0.46	0.25/14. 0.30/86.	0+			0.0164(3)/8. 0.1447(1)/83. 0.1915(2)/9.4 0.042
<sup>73m</sup> Zn			6. s		I.T./0.196	(7/2+)			0.216(1)/100.
<sup>73</sup> Zn		72.92978	24. s	\$) /4.29	4.7/	(1/2-)			0.496-0.911
<sup>74</sup> Zn		73.92946	1.60 m	\$) /2.3	2.1/				0.0565/ 0.1401/ (0.05-0.35)
<sup>75</sup> Zn		74.9329	10.2 s	\$) /6.0					0.229/
<sup>76</sup> Zn		75.9334	5.7 s	\$) /4.2	3.6/				0.119/
<sup>77m</sup> Zn			1.0 s	\$) /		(1/2-)			0.772
<sup>77</sup> Zn		76.9371	2.1 s	\$) /7.3	4.8/				0.189/
<sup>78m</sup> Zn			>0.03 ms						1.070
<sup>78</sup> Zn		77.9386	1.5 s	\$) /6.4					0.225/
<sup>79</sup> Zn		78.9421	1.0 s	\$) /8.6					0.702/
<sup>80</sup> Zn		79.9444	0.54 s	\$) /7.3					0.713/ 0.2248/
<sup>81</sup> Zn		80.9505	0.29 s	\$) /11.9					
<sup>82</sup> Zn		81.9548	>0.15 μs						
<sup>83</sup> Zn			>0.15 μs						
<b><sup>31</sup>Ga</b>		<b>69.723(1)</b>							
<sup>56</sup> Ga		55.9949							1.004
<sup>57</sup> Ga		56.9829							3.848
<sup>58</sup> Ga		57.9742			//. 1.6				1.555-2.559
<sup>59</sup> Ga		58.9634			//. 0.02				0.088-1.362
<sup>60</sup> Ga		59.9571	0.07 s	\$^+					ann.rad./ 0.6271(2)/10. 0.6370(2)/11. 1.0652(4)/45. 0.0429
<sup>61</sup> Ga		60.9492	0.17 s	\$^+ /9.0		3/2-			ann.rad./ 0.80785(1)/14. 0.99152(1)/43. 1.38727(1)/12. 3.3659(1)/13.
<sup>62</sup> Ga		61.94418	0.116 s	\$^+ /9.17 EC/	8.3/	0+			0.1151(2)/55. 0.1530(2)/96. 0.2069(2)/39. (0.06-2.4)
<sup>63</sup> Ga		62.9391	32. s	\$^+ /5.5 EC/	4.5/				ann.rad./ 1.03935(8)/38. 2.7523(1)/23. (0.28-5.01)
<sup>64m</sup> Ga			0.022 ms						0.09332/37. 0.18459/20. 0.30024/17. (0.091-0.89)
<sup>64</sup> Ga		63.936838	2.63 m	\$^+ /7.165	2.79/ 6.05/	0+			ann.rad./ 1.0774(1)/3. (0.57-2.33)/
<sup>65</sup> Ga		64.9394	15.2 m	\$^+ /86/3.255 EC/	0.82/10. 1.39/19. 2.113/56. 2.237/15.	3/2-			ann.rad./ 0.1151(2)/55. 0.1530(2)/96. 0.2069(2)/39. (0.06-2.4)
<sup>66</sup> Ga		65.931592	9.5 h	\$^+ /56/5.175 EC/43/	0.74/1. 1.84/54. 4.153/51.	0+			ann.rad./ 1.03935(8)/38. 2.7523(1)/23. (0.28-5.01)
<sup>67</sup> Ga		66.928205	3.260 d	EC/1.001		3/2-	+1.8507	0.20	0.09332/37. 0.18459/20. 0.30024/17. (0.091-0.89)
<sup>68</sup> Ga		67.927983	1.130 h	\$^+ /90/2.921 EC/10/	1.83/	1+	0.01175	0.028	ann.rad./ 1.0774(1)/3. (0.57-2.33)/
<sup>69</sup> Ga	60.108(9)	68.925581		EC/0.2/0.655		3/2-	+2.01659	+0.17	0.1755(5)/0.15
<sup>70</sup> Ga		69.926027	21.1 m	\$) /99.8/1.656	1.65/99.	1+			1.042(5)/0.48
<sup>71</sup> Ga	39.892(9)	70.924707	>2.4x10 <sup>26</sup> y	\$^-		3/2-	+2.56227	+0.11	
<sup>72</sup> Ga		71.926372	14.10 h	\$) /4.001	0.64/40.	3-	-0.13224	+0.5	0.834

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<sup>73</sup> Ga		72.92517	74.87 h	\$) /1.59	1.51/9. 2.52/8. 3.15/11.	3/2-			2.202 0.630 (0.113-3.678) 0.05344(5)/10. 0.29732(5)/47. (0.01-1.00)/ 0.0565(1)/75. 0.5959/92. 2.354/45. (0.23-3.99) 0.2529/ 0.5746/ (0.12-2.10) 0.5629/66. 0.5455/26. (0.34-4.25) 0.469/ 0.459/ 0.619/77. 1.187/20. 0.465/ 0.659/ 0.217/ 1.348/
<sup>74m</sup> Ga <sup>74</sup> Ga		73.92694	10. s 8.1 m	I.T./ \$) /5.4	2.6/	1+ 3-			
<sup>75</sup> Ga		74.92650	2.10 m	\$) /3.39	3.3/	3/2-			
<sup>76</sup> Ga		75.9289	29. s	\$) /7.0		3-			
<sup>77</sup> Ga		76.9293	13.0 s	\$) /5.3	5.2/				
<sup>78</sup> Ga		77.9317	5.09 s	\$) /8.2		3+			
<sup>79</sup> Ga		78.9329	2.85 s	\$) /7.0	4.6/				
<sup>80</sup> Ga		79.9366	1.68 s	\$) /10.4	10./				
<sup>81</sup> Ga		80.9377	1.22 s	\$) /8.3	5.1/				
<sup>82</sup> Ga		81.9432	0.599 s	\$) /12.6					
<sup>83</sup> Ga		82.9469	0.308 s	\$) /11.5					
<sup>84</sup> Ga		83.952	0.085 s	\$) /14					
<sup>85</sup> Ga			>0.15 μs						
<sup>86</sup> Ga			>0.15 μs						
<b><sup>32</sup>Ge</b>		<b>72.64(1)</b>							
<sup>58</sup> Ge		57.9910							
<sup>59</sup> Ge		58.9817							
<sup>60</sup> Ge		59.9702							
<sup>61</sup> Ge		60.9638	0.04 s	\$* /13.6					
<sup>62</sup> Ge		61.9547	0.13 s						
<sup>63</sup> Ge		62.9496	0.15 s	\$) /9.8					
<sup>64</sup> Ge		63.9416	1.06 m	\$* /4.4 EC/ \$*,p	3.0/	0+			ann.rad./ 0.1282(2)/11. 0.4270(3)/37. 0.6671(3)/17. ann.rad./ 0.0620/27. 0.6497/33. 0.8091/21. (0.19-3.28) ann.rad./ 0.0438/29. 0.3819/28. (0.022-1.77) ann.rad./ 0.1670/84. (0.25-3.73) Ga k x-ray/39. ann.rad./ 0.574/13. 1.1068/36. (0.2-2.04)
<sup>65</sup> Ge		64.9394	31. s	\$* /6.2 EC/ EC,p	0.82/10. 1.39/19. 2.113/56. 2.237/15. //0.011				
<sup>66</sup> Ge		65.93385	2.26 h	\$*,p \$* /27/2.10 EC/73/		0+			
<sup>67</sup> Ge		66.932738	19.0 m	\$* /96/4.225 EC/4/	1.6/ 2.3/ 3.15/	1/2-			
<sup>68</sup> Ge		67.92810	270.8 d	EC/0.11		0+			
<sup>69</sup> Ge		68.927973	1.63 d	\$* /36/2.2273 EC/64/	0.70/ 1.2/	5/2-	0.735	0.02	
<sup>70</sup> Ge	20.370(89)	69.924250				0+			
<sup>71m</sup> Ge			20.4 ms		I.T./0.0234	9/2+			0.1749
<sup>71</sup> Ge		70.924954	11.2 d	EC/0.229		1/2-	+0.547		
<sup>72</sup> Ge	27.380(60)	71.922076				0+			
<sup>73</sup> Ge	7.759(78)	72.923460	>1.8x10 <sup>23</sup> y	\$-		9/2+	-0.879467	-0.17	
<sup>74</sup> Ge	36.656(80)	73.921178				0+			
<sup>75m</sup> Ge			48. s	I.T./		7/2+			0.13968(3)/39. 0.26461(5)/11. 0.41931(5)/0.2
<sup>75</sup> Ge		74.922860	1.380 h	\$) /1.177	1.19/	1/2-	+0.510		
<sup>76</sup> Ge	7.835(81)	75.921403	1.6x10 <sup>21</sup> y	\$-\$		0+			
<sup>77m</sup> Ge			53. s	I.T./20/ \$) /80/2.861	2.9/	1/2-			1.605/0.22 1.676/0.16 0.195-1.482 0.2110/29. 0.2155/27. 0.2644/51. (0.15-2.35) 0.2773(5)/96. 0.2939(5)/4.
<sup>77</sup> Ge		76.923549	11.25 h	\$) /2.702	0.71/23. 1.38/35. 2.19/42.	7/2+			
<sup>78</sup> Ge		77.922853	1.45 h	\$) /0.95	0.70/	0+			
<sup>79m</sup> Ge			39. s	\$) /IT		7/2+			
<sup>79</sup> Ge		78.9254	19.1 s	\$) /4.2	4.0/20. 4.3/80.	1/2-			0.1096/21. (0.10-2.59) 0.5427(4)/15. 0.1104(4)/6. 0.2656(4)/25. 0.3362(4)/ 0.7935(4)/ 0.1976(4)/21. 0.3362(4)/100. 1.093/
<sup>80</sup> Ge		79.92545	29.5 s	\$) /2.67	2.4/	0+			
<sup>81m</sup> Ge			7.6 s	\$) /	3.75/	1/2+			
<sup>81</sup> Ge		80.9288	7.6 s	\$) /6.2	3.44/	9/2+			
<sup>82</sup> Ge		81.9296	4.6 s	\$) /4.7		0+			
<sup>83</sup> Ge		82.9345	1.9 s	\$) /8.9					
<sup>84</sup> Ge		83.9373	0.98 s	\$) /7.7					
<sup>85</sup> Ge		84.943	0.54 s	\$) /10.					
<sup>86</sup> Ge		85.946	>0.15 μs						
<sup>87</sup> Ge			>0.15 μs						
<sup>88</sup> Ge			>0.15 μs						
<sup>89</sup> Ge			>0.15 μs						
<b><sup>33</sup>As</b>		<b>74.92160(2)</b>							
<sup>60</sup> As		59.993							
<sup>61</sup> As		60.981							
<sup>62</sup> As		61.9732							
<sup>63</sup> As		62.9637							

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom. (nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>64</sup> As		63.9576	0.02 s						
<sup>65</sup> As		64.9495	0.13 s	\$* /9.4					
<sup>66</sup> As			1.9 μs						
<sup>66m1</sup> As			0.018 ms						
<sup>66</sup> As		65.94410	95.8 ms	\$* /9.55					
<sup>67</sup> As		66.9392	42. s	\$* /6.0 EC/	5.0/	5/2-			0.121/ 0.123/ 0.244/ ann.rad./ 0.652/32. 0.762/33. 1.016/77. (0.61-3.55)
<sup>68</sup> As		67.9368	2.53 m	\$* /8.1		3+			ann.rad./ 0.0868(5)/1.5 0.1458(3)/2.4 1.0395(7)/82. (0.17-4.4)/
<sup>69</sup> As		68.93228	15.2 m	\$* /98/4.01 EC/2/	2.95/	5/2-	1.6		ann.rad./ 0.0868(5)/1.5 0.1458(3)/2.4 1.0395(7)/82. (0.17-4.4)/
<sup>70</sup> As		69.93093	52.6 m	\$* /84/6.22 EC/16/2.14 /2.89	1.44/	4+	+2.1061	+0.09	ann.rad./ 1.0395(7)/82. (0.17-4.4)/
<sup>71</sup> As		70.927114	2.72 d	\$* /32/2.013 EC/68/		5/2-	+1.6735	-0.02	ann.rad./ 0.1749(2)/84. 1.0957(2)/4.2
<sup>72</sup> As		71.926753	26.0 h	\$* /77/4.356	0.669/5. 1.884/12. 2.498/62. 3.339/19.	2-	-2.1566	-0.08	ann.rad./ 0.83395(5)/80. 1.0507(1)/9.6 (0.1-4.0)
<sup>73</sup> As		72.923825	80.3 d	EC/0.341		3/2-			0.0133/0.1 0.0534/10.5 Se k x-ray/90.
<sup>74</sup> As		73.923829	17.78 d	\$* /31/2.562 EC/37/ \$) /1.353	0.94/26. 1.53/3. 0.71/16. 1.35/16.	2-	-1.597		ann.rad./ 0.59588(1)/60. 0.6084(1)/0.6 0.6348(1)/15.
<sup>75m</sup> As			0.017 s						
<sup>75</sup> As	100.	74.921597				3/2-	+1.43947	+0.31	
<sup>76</sup> As		75.922394	26.3 h	\$) /2.962	0.54/3. 1.785/8. 2.410/36. 2.97/51.	2-	-0.903		0.5591(1)/45. 0.65703(5)/6.2 1.21602(1)/3.4 (0.3-2.67)
<sup>77</sup> As		76.920648	38.8 h	\$) /0.683	0.70/98.	3/2-	+1.295		0.2391(2)/1.6 0.2500(3)/0.4 0.5208/0.43
<sup>78</sup> As		77.92183	1.512 h	\$) /4.21	3.00/12. 3.70/17. 4.42/37.	2-			0.6136(3)/54. 0.6954(3)/18. 1.3088(3)/10. 0.542/IT 0.231
<sup>79m</sup> As			1.21 μs			9/2+			0.0955(5)/16. 0.3645(5)/1.9
<sup>79</sup> As		78.92095	9.0 m	\$) /2.28	1.80/95.	3/2-			0.6662(2)/42. (2.5-3.0)
<sup>80</sup> As		79.92258	16. s	\$) /5.64	3.38/	1+			0.4676(2)/20. 0.4911(2)/8.
<sup>81</sup> As		80.92213	33. s	\$) /3.856		3/2-			
<sup>82m</sup> As			13.7 s	\$) /	3.6/	5-			0.6544(1)/72. 0.8186(4)/27. 1.7313(2)/27. 1.8954(2)/38.
<sup>82</sup> As		81.9246	19. s	\$) /7.4	7.2/80.	1+			0.6544(1)/15. 0.7345/100. 1.1131/34. 2.0767/28.
<sup>83</sup> As		82.9250	13.4 s	\$) /5.5					
<sup>84m</sup> As			0.6 s	\$)					
<sup>84</sup> As		83.9291	4. s	\$), n/7.2		1-			0.6671(2)/21. 1.4439(5)/49. (0.325-5.150)
<sup>85</sup> As		84.9318	2.03 s	\$), n/8.9		3/2-			0.667(1)/42. 1.4551(2)/100.
<sup>86</sup> As		85.9362	0.95 s	\$), n/11.4					0.704/
<sup>87</sup> As		86.9396	0.49 s	\$), n/10.					0.704/
<sup>88</sup> As		87.945	>0.15 μs						
<sup>89</sup> As		88.949	>0.15 μs						
<sup>90</sup> As			>0.15 μs						
<sup>91</sup> As			>0.15 μs						
<sup>92</sup> As			>0.15 μs						
<b><sup>34</sup>Se</b>		<b>78.96(3)</b>							
<sup>65</sup> Se		64.965	0.011 s	\$* /60/14. \$, p	3.55/				
<sup>66</sup> Se		65.9552	0.03 s						
<sup>67</sup> Se		66.9501	0.13 s	\$* /10.2 \$, (p)/					ann.rad./ 0.352
<sup>68</sup> Se		67.9419	36. s	\$* /4.7					ann.rad./ (0.050-0.426)
<sup>69</sup> Se		68.93956	27.4 s	\$* /6.78 EC/	5.006/				ann.rad./ 0.0664(4)/27. 0.0982(4)/63.
<sup>70</sup> Se		69.9335	41.1 m	\$*, p \$* /2.4	//. 0.045	0+			ann.rad 0.04951(5)/35. 0.4262(2)/29.
<sup>71</sup> Se		70.9319	4.7 m	\$* /4.4 EC/	3.4/36.	5/2-			ann.rad 0.1472(3)/47. 0.8309(3)/13. 1.0960(3)/10.
<sup>72</sup> Se		71.92711	8.5 d	EC/0.34		0+			0.0460(2)/57.
<sup>73m</sup> Se			40. m	I.T./73/0.0257 \$* /27/2.77	0.85 1.45/ 1.70/	3/2-			ann.rad. 0.0257(2)/27. 0.2538(1)/2.5
<sup>73</sup> Se		72.92678	7.1 h	\$* /65/2.74 EC/35/	0.80/ 1.32/95.	9/2+	0.86		ann.rad 0.0670(1)/72.

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
					1.68/1.				0.3609(1)/97. (0.6-1.5)
<sup>74</sup> Se	0.89(4)	73.922477				0+			
<sup>75</sup> Se		74.922524	119.78 d	EC/0.864		5/2+	0.67	1.0	0.13600/55 0.26465/58 (0.024-0.821)
<sup>76</sup> Se	9.37(29)	75.919214				0+			
<sup>77a</sup> Se			17.4 s	I.T./		7/2+			0.1619(2)/52.
<sup>77</sup> Se	7.63(16)	76.919915				1/2-	+0.53506		
<sup>78</sup> Se	23.77(28)	77.917310				0+			
<sup>79a</sup> Se			3.92 m	I.T./		7/2+			0.09573(3)/9.5
<sup>79</sup> Se		78.918500	2.9x10 <sup>5</sup> y	\$/0.151		0+	-1.018	+0.8	
<sup>80</sup> Se	49.61(41)	79.916522				7/2+			
<sup>81a</sup> Se			57.3 m	I.T./99/0.1031		0+			0.1031(3)/9.7 0.2602(2)/0.06
<sup>81</sup> Se		80.917993	18.5 m	\$/1.585	1.6/98.	1/2-			0.2760/0.06 0.2759/0.85 0.2901/0.75 0.8283/0.32
<sup>82</sup> Se	8.73(22)	81.916700	.1x10 <sup>20</sup> y	\$\$		0+			
<sup>83a</sup> Se			1.17 m	\$/3.96	2.88/ 3.92/	1/2-			0.35666(6)/17. 0.9879(1)/15. 1.0305(1)/21. 2.0514(2)/11. (0.19-3.1) 0.22516(6)/33. 0.35666(6)/69. 0.51004(8)/45. (0.21-2.42) 0.4088(5)/100. 0.3450(1)/22. 0.6094(1)/41. 2.0124(1)/24. 2.4433(8)/100. 2.6619(1)/49. 0.468(1)/100. 1.4979(1)/23. 0.5346/
<sup>83</sup> Se		82.919119	22.3 m	\$/3.668	0.93/ 1.51/	9/2+			
<sup>84</sup> Se		83.91847	3.3 m	\$/1.83	1.41/100.	0+			
<sup>85</sup> Se		84.92225	32. s	\$/6.18	5.9/	5/2+			
<sup>86</sup> Se		85.92428	15. s	\$/5.10		5/2+			
<sup>87</sup> Se		86.92853	5.4 s	\$/7.28					
<sup>88</sup> Se		87.93143	1.5 s	\$/n/6.85					
<sup>89</sup> Se		88.93360	0.41 s	\$/n/9.0					
<sup>90</sup> Se		89.9394	>0.15 μs						
<sup>91</sup> Se		90.945	0.27 s	\$/n/8.					
<sup>92</sup> Se		91.949	>0.15 μs						
<sup>93</sup> Se			>0.15 μs						
<sup>94</sup> Se			>0.15 μs						
<b><sup>35</sup>Br</b>		<b>79.904(1)</b>							
<sup>67</sup> Br		66.9648							
<sup>68</sup> Br		67.958	<1.2 μs						
<sup>69</sup> Br		68.9502	<0.024 μs	\$/9.6					
<sup>70a</sup> Br			2.2 s			9+			
<sup>70</sup> Br		69.9446	79. ms	\$/10.0	/0.75				
<sup>71</sup> Br		70.9392	21. s	\$/6.9					
<sup>72</sup> Br		71.9365	1.31 m	\$/8.7		3	0.55		0.4547-1.3167 ann.rad
<sup>73</sup> Br		72.9318	3.4 m	\$/4.7	3.7/	3/2-			0.065-0.700 ann.rad 0.6348 0.7285 (0.2-4.38) ann.rad 0.6341 0.6348 (0.2-4.7) ann.rad 0.28650 (0.1-1.56) 0.104548 0.05711 ann.rad 0.55911 1.85368 (0.4-4.6) 0.1059 ann.rad. 0.23898 0.52069 (0.08-1.2) ann.rad. 0.61363 (0.7-3.0) 0.2072
<sup>74a</sup> Br			46. m	\$/	4.5/	4-	1.82		
<sup>74</sup> Br		73.92989	25.4 m	\$/6.91					
<sup>75</sup> Br		74.92578	1.62	\$/76/3.03		3/2-	+0.75		
<sup>76a</sup> Br			1.4 s	I.T./5.05		4+			
<sup>76</sup> Br		75.92454	16.0 h	\$/57/4.96	1.9/ 3.68/	1-	0.54821	0.270	
<sup>77a</sup> Br			4.3 m	I.T./0.1059		9/2+			
<sup>77</sup> Br		76.921380	2.376 d	EC/99/1.365		3/2-	0.973	+0.53	
<sup>78</sup> Br		77.921146	6.45 m	\$/92/3.574 EC/8/	1.2/ 2.5/	1+	0.13		
<sup>79a</sup> Br			4.86 s	I.T./0.207		9/2+			
<sup>79</sup> Br	50.69(7)	78.918338				3/2-	+2.106400	+0.331	
<sup>80a</sup> Br			4.42 h	I.T./0.04885		5-	+1.3177	+0.75	Br k x-ray 0.03705/39.1 0.04885/0.3 ann.rad. 0.6169/6.7 (0.64-1.45)
<sup>80</sup> Br		79.918530	17.66 m	\$/92/2.004 EC/5.7/1.8706 \$/2.6/	1.38 \$/7.6 1.99 \$/82 0.85 \$/2.8	1+	0.5140	0.196	
<sup>81</sup> Br	49.31(7)	80.916291				3/2-	+2.270562	+0.276	
<sup>82a</sup> Br			6.1 m	I.T./98/0.046 \$/2/3.139		2-			0.046/0.24 (0.62-2.66)
<sup>82</sup> Br		81.916805	1.471 d	\$/3.093	0.444/	5-	+1.6270	0.751	0.5544/71 0.61905/43 0.77649/84 (0.013-1.96) 0.52964 (0.12-0.68) 0.4240/100 0.8817/98 1.4637/101 0.8816/41
<sup>83</sup> Br		82.915181	2.40 h	\$/0.972	0.395/1 0.925/99	3/2-			
<sup>84a</sup> Br			6.0 m	\$/4.97	2.2/100	(6-)			
<sup>84</sup> Br		83.91651	31.8 m	\$/4.65	2.70/11	2-	2.		



T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>85</sup> Br		84.91561	2.87 m	\$) /2.87	3.81/20 4.63/34 2.57	3/2-			1.8976/13 (0.23-4.12) 0.80241/2.56 0.92463/1.6 (0.09-2.4)
<sup>86</sup> Br		85.91880	55.5 s	\$) /7.63	3.3 7.4	(2-)			1.56460/64 2.75106/21 (0.5-6.8)
<sup>87</sup> Br		86.92072	55.6 s	\$) /6.85 n/	6.1/	3/2-			1.41983 1.4762 (0.2-6.1)
<sup>88m</sup> Br <sup>88</sup> Br		87.92407	5.1 μs 16.3 s	\$) /8.96 n/		1-			0.7649 0.7753 0.8021 (0.1-6.99)
<sup>89</sup> Br		88.92640	4.35 s	\$) /8.16 n/		3/2-			0.7753 1.0978
<sup>90</sup> Br		89.9306	1.91 s	\$) /10.4 n/	8.3/ 9.8/	2-			0.6555 0.7071 1.3626
<sup>91</sup> Br		90.9339	0.54 s	\$) /90 /9.80 \$) n/10 /					0.263 0.803
<sup>92</sup> Br		91.9392	0.31 s	\$) /12.20 \$) n/					0.740
<sup>93</sup> Br		92.9431	0.10 s	\$) /11 \$) n	//11				0.117 (0.237-3.606)
<sup>94</sup> Br <sup>95</sup> Br <sup>96</sup> Br <sup>97</sup> Br		93.9487	0.07 s >0.15 μs >0.15 μs >0.15 μs	\$) n/ \$) n/ \$) n/ \$) n/					
<b><sup>36</sup>Kr</b>		<b>83.80(1)</b>							
<sup>69</sup> Kr <sup>70</sup> Kr <sup>71</sup> Kr <sup>72</sup> Kr		68.9653 69.9560 70.9505 71.9419	0.03 s 0.06 s 100. ms 17. s	\$*, (p) \$*, EC/10.1 \$* /5.0 EC/	4.07/				(0.198-0.207) ann.rad 0.3100/29 0.4150/36 (0.12-0.58)
<sup>73</sup> Kr		72.9389	28. s	\$* /6.7 EC/		5/2-			ann.rad. 0.1781/66 (0.06-0.86)
<sup>74</sup> Kr		73.9333	11.5 m	\$*, p/ \$* /3.1 EC/	/0.25	0+			ann.rad. 0.08970/31 0.2030/20 (0.010-1.06)
<sup>75</sup> Kr		74.93104	4.3 m	\$* /4.90 EC/	3.2/	5/2+	- 0.531	+ 1.1	ann.rad. 0.1325/68 0.1547/21 (0.02-1.7)
<sup>76</sup> Kr		75.92595	14.8 h	EC/1.31		0+			Br k x-ray 0.270/21 0.3158/39 (0.03-1.07)
<sup>77</sup> Kr		76.92467	1.24 h	\$* /80 /3.06 EC/20 /	1.55/ 1.70/ 1.87/	5/2+	- 0.583	+ 0.9	ann.rad. 0.1297/80 0.1465/38 (0.02-2.3)
<sup>78</sup> Kr <sup>79m</sup> Kr <sup>79</sup> Kr	0.355(3)	77.92039	>2.3×10 <sup>20</sup> y 53. s 1.455 d	EC-EC I.T./0.1299 \$* /7 /1.626 EC/93 /		0+ 7/2+ 1/2-	- 0.786 + 0.536	+ 0.40	Kr x-ray ann.rad. 0.2613/13 0.39756/19 0.6061/8 (0.04-1.3)
<sup>80</sup> Kr <sup>81m</sup> Kr <sup>81</sup> Kr	2.286(10)	79.916379	13.1 s 2.1×10 <sup>5</sup> y	I.T./0.1904 EC/0.2807		0+ 1/2- 7/2+	+ 0.586 - 0.908	+ 0.63	0.1904 Br k x-ray 0.2760
<sup>82</sup> Kr <sup>83m</sup> Kr	11.593(3)	81.913485	1.86 h	I.T./0.0416		0+ 1/2-	+ 0.591		Kr k x-ray 0.00940 0.03216
<sup>83</sup> Kr <sup>84</sup> Kr <sup>85m</sup> Kr	11.500(19) 56.987(15)	82.914137 83.911508	4.48 h	\$) /79 / I.T./21 /0.305 \$) /0.687	0.83/79	9/2+ 0+ 1/2-	-0.970699 + 0.633	+0.259	0.30487 0.15118 0.51399
<sup>85</sup> Kr <sup>86</sup> Kr <sup>87</sup> Kr	17.279(41)	84.912530 85.910615 86.913359	10.73 y 1.27 h	\$) /3.887	0.15/0.4 1.33/8 3.49/43 3.89/30	9/2+ 0+ 5/2+	1.005 -1.023	+0.43 - 0.30	0.40258/49.6 2.5548/9.2 (0.13-3.31) 0.19632/26. 2.392/34.6 (0.03-2.8)
<sup>88</sup> Kr		87.91445	2.84 h	\$) /2.91		0+			0.19746 0.2209/19.9 0.5858/16.4 1.4728/6.8 (0.2-4.7)
<sup>89</sup> Kr		88.91764	3.15 m	\$) /4.99	3.8/ 4.6/ 4.9/	5/2+	- 0.330	+ 0.16	0.12182/32.9 0.5395/28.6 1.1187/36.2 (0.1 - 4.2)
<sup>90</sup> Kr		89.91953	32.3 s	\$) /4.39	2.6/77 2.8/6	0+			0.10878/43.5 0.50658/19. (0.2-4.4)
<sup>91</sup> Kr		90.9234	8.6 s	\$) /6.4	4.33/ 4.59/	5/2+	- 0.583	+ 0.30	0.1424/66. (0.14 - 3.7)
<sup>92</sup> Kr <sup>93</sup> Kr		91.92611 92.9312	1.84 s 1.29 s	\$) /5.99 n/ \$) /8.6	7.1/	1/2+ 1/2+	- 0.413		0.1820

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
				n/					0.2534/42. 0.32309/24.6 (0.057-4.03)
<sup>94</sup> Kr		93.9343	0.21 s	\$) /7.3					0.2196/67 0.6293/100. (0.098-0.985)
<sup>95</sup> Kr		94.9397	0.78 s	\$) /9.7			- 0.410		
<sup>96</sup> Kr		95.9431	> 50 ms						
<sup>97</sup> Kr		96.9486	< 0.1 s	\$)					
<sup>98</sup> Kr			>0.15 μs						
<sup>99</sup> Kr			>0.15 μs						
<sup>100</sup> Kr			>0.15 μs						
<b><sup>37</sup>Rb</b>		<b>85.4678(3)</b>							
<sup>71</sup> Rb		70.9653							
<sup>72</sup> Rb		71.9591	<1.2 μs						
<sup>73</sup> Rb		72.9504	<0.03 μs						
<sup>74</sup> Rb		73.9445	64.8 ms	\$* /10.4					
<sup>75</sup> Rb		74.93857	19. s	\$* /7.02	2.31/				ann. rad. 0.179
<sup>76</sup> Rb		75.93508	39. s	\$* /8.50	4.7/	1-	-0.372623	+0.4	ann. rad. 0.4240/92. (0.064-1.68)
<sup>77</sup> Rb		76.93041	3.8 m	\$* /5.34	3.86/	3/2-	+0.654468	+0.70	ann. rad. 0.0665/59 (0.04 - 2.82)
<sup>78m</sup> Rb			5.7 m	I.T./0.1034 \$* / EC/	3.4	4-	+2.549	+0.81	ann. rad. 0.4553/81. (0.103-4.01)
<sup>78</sup> Rb		77.92814	17.7 m	\$* /7.22 EC/		0+			ann. rad. 0.4553/63. (0.42-5.57)
<sup>79</sup> Rb		78.92400	23. m	\$* /84 /3.65 EC/16 /		5/2+	+0.3358	-0.10	ann. rad. 0.68812/23. (0.017-3.02)
<sup>80</sup> Rb		79.92252	34. s	\$* /5.72	4.1/22 4.7/74	1+	-0.0836	+0.35	ann. rad. 0.6167/25. ann. rad.
<sup>81m</sup> Rb			30.5 m	I.T./0.85 \$* EC/	1.4	9/2+	+5.598	-0.74	(0.085-1.9)
<sup>81</sup> Rb		80.91900	4.57 h	\$* /27 /2.24 EC/73	1.05/	3/2-	+2.060	+0.40	ann. rad./ 0.19030/64. (0.05 - 1.9)
<sup>82m</sup> Rb			6.47 h	\$* /26 / EC/74 /	0.80/	5-	+1.5100	+1.0	ann. rad./ 0.5544/63. 0.7765/85. (0.092 - 2.3)
<sup>82</sup> Rb		81.91821	1.258 m	\$* /96 /4.40 EC/4 /	3.3/	1+	+0.554508	+0.19	ann. rad./ 0.7665/13. (0.47 - 3.96)
<sup>83</sup> Rb		82.91511	86.2 d	EC/0.91		5/2-	+1.425	+0.20	Kr x-ray 0.5205/46. (0.03-0.80)
<sup>84m</sup> Rb			20.3 m	I.T./0.216		6-	+0.2129	+0.6	0.2163/34. 0.2482/63. 0.4645/32.
<sup>84</sup> Rb		83.914387	32.9 d	\$* /22 /2.681 EC/75 / \$) /3 /0.894	0.780/11 1.658/11 0.893/	2-	-1.32412	-0.015	ann. rad./ 0.8817/68. (1.02-1.9)
<sup>85</sup> Rb	72.17(2)	84.911792	1.018 m	I.T./0.5560		5/2-	+1.353	+0.23	0.556/98.
<sup>86m</sup> Rb			18.65 d <sup>10</sup>	\$) /1.775	1.774/8.8	6-	+1.815	+0.37	1.0768/8.8
<sup>86</sup> Rb		85.911170	4.88x10 <sup>10</sup> y	\$) /0.283	0.273/100	2-	-1.6920	+0.19	
<sup>87</sup> Rb	27.83(2)	86.909186	17.7 m	\$) /5.316	5.31	3/2-	+2.7512	+0.13	
<sup>88</sup> Rb		87.911323				2-	0.508		0.8980/14. 1.8360/21. (0.34-4.85)
<sup>89</sup> Rb		88.91229	15.4 m	\$) /4.50	1.26/38 1.9/5 2.2/34 4.49/18	3/2-	+2.304	+0.14	1.032/58. 1.248/42. 2.1960/13 (0.12-4.09)
<sup>90m</sup> Rb			4.3 m	\$) /4.50	1.7/ 6.5/	4-	+1.616	+0.20	0.1069(IT) 0.8317/94 (0.20-5.00)
<sup>90</sup> Rb		89.91481	2.6 m	\$) /6.59	6.6	1-			0.8317/28. (0.31-5.60)
<sup>91</sup> Rb		90.91649	58.0 s	\$) /5.861	5.9	3/2-	+2.182	+0.15	0.0936/34. (0.35-4.70)
<sup>92</sup> Rb		91.91968	4.48 s	\$) /8.11	8.1/94	1-			0.8148/8. (0.1-6.1)
<sup>93</sup> Rb		92.92195	5.85 s	\$) /7.46 n/1	7.4/	5/2	+1.410	+0.18	0.2134/4.8 0.4326/12.5 0.9861/4.9 (0.16-5.41)
<sup>94</sup> Rb		93.92643	2.71 s	\$) /10.31 n/10	9.5/	3	+1.498	+0.16	0.8369/87. 1.5775/32. (0.12-6.35)
<sup>95</sup> Rb		94.92929	0.377 s	\$) /9.30 n/8	8.6/	5/2	+1.334	+0.21	0.352/65. 0.680/22. (0.20-2.27)
<sup>96m</sup> Rb			1.7 μs						0.2999 0.4612 0.2400 0.093-0.369
<sup>96</sup> Rb		95.93427	0.199 s	\$) /11.76 n/13/	10.8/	2+	+1.466	+0.25	0.815/76. (0.20-5.42)
<sup>97</sup> Rb		96.93733	0.169 s	\$) /10.42 n/27/	10.0	3/2	+1.841	+0.58	0.167/100. 0.585/79. 0.599/56. 1.258/52. (0.14-2.08)
<sup>98</sup> Rb		97.94174	0.107 s	\$) /12.34	0.144/				

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fi-Energy /Intensity (MeV / %)
<sup>99</sup> Rb		98.9453	59. ms	n/13 \$/11.3					(0.07-3.68)
<sup>100</sup> Rb		99.9499	53. ms	\$/13.5					0.129 (0.058-4.483)
<sup>101</sup> Rb		100.9532	0.03 s	\$/11.8					
<sup>102</sup> Rb		101.9592	0.09 s	\$/					
<b><sup>38</sup>Sr</b>		<b>87.62(1)</b>							
<sup>73</sup> Sr		72.966	> 25 ms						
<sup>74</sup> Sr		73.9563	>1.2 μs						
<sup>75</sup> Sr		74.9499	0.08 s						
<sup>76</sup> Sr		75.9416	8.9 s	\$/6.1					
<sup>77</sup> Sr		76.9378	9.0 s	\$/6.9	5.6 //0.08		-0.35	+1.4	0.147
<sup>78</sup> Sr		77.93218	2.7 m	\$/3.76					(0.047-0.793)
<sup>79</sup> Sr		78.92971	2.1 m	\$/5.32	4.1	3/2-	-0.474	+0.74	ann.rad./ 0.039/28. 0.105/22. (0.135-0.612)
<sup>80</sup> Sr		79.92453	1.77 h	\$/1.87		0+			ann.rad./ 0.174/10. 0.589/39. (0.24-0.55)
<sup>81</sup> Sr		80.92322	22.3 m	\$/87 /3.93 EC/13 /	2.43/ 2.68/	1/2-	+0.544		ann.rad./ 0.148/31. 0.1534/35 (0.06-1.7)
<sup>82</sup> Sr		81.91840	25.36 d	EC/0.18					Rb x-ray
<sup>83a</sup> Sr		81.91840	5.0 s	I.T./0.2591		1/2-	+0.582		0.2591/87.5
<sup>83</sup> Sr		82.91756	1.350 d	\$/24 /2.28 EC/76/	0.465/ 0.803/ 1.227/	7/2+	-0.898	+0.79	ann.rad./ 0.3816/12. 0.3816 0.7627/30. (0.094-2.15)
<sup>84</sup> Sr	0.56(1)	83.913426	1.127 h	I.T./87 /0.2387 EC/13		0+ 1/2-	+0.601		0.2318/84. (0.15-0.24)
<sup>85</sup> Sr		84.912936	64.85 d	EC/1.065		9/2+	-1.001	+0.30	0.51399/99.3
<sup>86</sup> Sr	9.86(1)	85.909265	2.81 h	I.T./0.3884		0+ 1/2-	+0.63		0.3884(IT)
<sup>87a</sup> Sr		86.908882	50.52 d	\$/1.497	1.492/100	5/2+	-1.149	-0.3	0.9092
<sup>87</sup> Sr	7.00(1)	87.905617	29.1 y	\$/0.546	0.546/100	0+ 5/2+	-0.887	+0.044	0.5556/61. 0.7498/24. 1.0243/33. (0.12-2.4)
<sup>88</sup> Sr	82.58(1)	88.907455	9.5 h	\$/2.70	0.61/7 1.09/33 1.36/29 2.66/26 0.55/96 1.5/3	5/2+	-0.794	+0.26	1.3831/90. (0.24-1.1)
<sup>89</sup> Sr		89.907738	50.52 d	\$/1.497	1.492/100	5/2+	-1.149	-0.3	0.9092
<sup>90</sup> Sr		90.91020	9.5 h	\$/2.70	0.61/7 1.09/33 1.36/29 2.66/26 0.55/96 1.5/3	5/2+	-0.887	+0.044	0.5556/61. 0.7498/24. 1.0243/33. (0.12-2.4)
<sup>91</sup> Sr		90.91020	9.5 h	\$/2.70	0.61/7 1.09/33 1.36/29 2.66/26 0.55/96 1.5/3	5/2+	-0.887	+0.044	0.5556/61. 0.7498/24. 1.0243/33. (0.12-2.4)
<sup>92</sup> Sr		91.91098	2.71 h	\$/1.91	2.2/10 2.6/25 3.2/65	0+ 5/2+	-0.794	+0.26	0.5903/ 0.7104 0.87573 0.8883/ (0.17-3.97)
<sup>93</sup> Sr		92.91394	7.4 m	\$/4.08	2.2/10 2.6/25 3.2/65	5/2+	-0.794	+0.26	0.5903/ 0.7104 0.87573 0.8883/ (0.17-3.97)
<sup>94</sup> Sr		93.91537	1.25 m	\$/3.511	2.1/ 3.3/	0+			0.6219 0.7043 0.7241 0.8064 1.4283 0.6859 0.8269 2.7173 2.9332 0.1222 0.5305 0.8094 0.9318 0.2164 0.3071 0.6522 0.9538 1.2580 1.9050 0.0365 0.1190 0.4286 0.4447 0.5636
<sup>95</sup> Sr		94.91931	25.1 s	\$/6.08	6.1/50	1/2+	-0.5379		
<sup>96</sup> Sr		95.92165	1.06 s	\$/5.37	4.2/	0+			
<sup>97</sup> Sr		96.92615	0.42 s	\$/7.47	5.3	(1/2+)	-0.500		
<sup>98</sup> Sr		97.92845	0.65 s	\$/5.83	5.1				
<sup>99</sup> Sr		98.9333	0.27 s	\$/8.0			-0.26	0.8	
<sup>100</sup> Sr		99.9354	0.201 s	\$/7.1					
<sup>101</sup> Sr		100.9405	0.115 s	\$/9.5					
<sup>102</sup> Sr		101.9430	68. ms	\$/8.8					
<sup>103</sup> Sr		102.9490	>0.15 μs						
<sup>104</sup> Sr		103.952	>0.15 μs						
<sup>105</sup> Sr		103.952	>0.15 μs						
<b><sup>39</sup>Y</b>		<b>88.90585(2)</b>							
<sup>76</sup> Y		76.9496	> 0.2 : s						
<sup>77</sup> Y		76.9496	57. ms						
<sup>78a</sup> Y		77.9435	5.8 s	\$/10.5		(5+)			0.279/100 0.504/90 0.713/40 (0.152-1.106)
<sup>78</sup> Y		77.9435	53 ms	\$/10.5					0.2285
<sup>79</sup> Y		78.9374	15. s	\$/7.1					ann.rad./ 0.3858/100 0.5951/42 0.756-1.396
<sup>80a</sup> Y		79.9320	4.8 s	\$/7.0	5.5 5.0/	(4)			
<sup>80</sup> Y		79.9320	30. s	\$/7.0	5.5 5.0/	(4)			

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>81</sup> Y		80.9291	1.21 m	\$ <sup>+</sup> /5.5	3.7/ 4.2/				ann.rad./ 0.428 0.469
<sup>82</sup> Y		81.9268	9.5 s	\$ <sup>+</sup> /7.8	6.3/	1+			ann.rad./ 0.5736 0.6017 0.7375
<sup>83m</sup> Y			2.85 m	\$ <sup>+</sup> /95/4.6 EC/5 /	2.9	1/2-			ann.rad./ 0.2591 0.4218 0.4945
<sup>83</sup> Y		82.92235	7.1 m	\$ <sup>+</sup> /4.47 EC/	3.3	9/2+			ann.rad./ 0.0355 0.4899 0.8821 (0.03 - 3.4)
<sup>84m</sup> Y			4.6 s	\$ <sup>+</sup> / EC/		1+			ann.rad./ 0.7930
<sup>84</sup> Y		83.9203	40. m	\$ <sup>+</sup> /6.4 EC/	1.64/47 2.24/25 2.64/21 3.15/7	5-			ann.rad./ 0.4628 0.6606 0.7931 0.9744 1.0398 (0.2 - 3.3)
<sup>85m</sup> Y			4.9 h	\$ <sup>+</sup> /70 / EC/30 /		9/2+	6.2		ann.rad./ 0.2317 0.5356 0.7673 2.1238 (0.1 - 3.1)
<sup>85</sup> Y		84.91643	2.6 h	\$ <sup>+</sup> /55 /3.26 EC/45 /	1.54/	1/2-			ann.rad./ 0.2317 0.5045 0.9140 (0.07 - 1.4)
<sup>86m</sup> Y			48. m	I.T./99 / \$ <sup>+</sup> / EC/		8+	4.8		ann.rad./ 0.0102(IT) 0.2080 (0.09 - 1.1)
<sup>86</sup> Y		85.91489	14.74 h	\$ <sup>+</sup> /5.24 EC/		4-	<0.6		ann.rad./ 0.3070 0.6277 1.0766 1.1531 1.9207 (0.1 - 3.8)
<sup>87m</sup> Y			13. h	I.T./98 / \$ <sup>+</sup> /0.7 / EC/	1.15/0.7	9/2+	6.1		0.3807
<sup>87</sup> Y		86.910880	3.35 d	EC/99+/1.862	0.78/	1/2-			0.3880 0.4870
<sup>88</sup> Y		87.909506	106.6 d	EC/99+ /3.623 \$ <sup>+</sup> /0.2 /	0.76/	4-			ann.rad./ 0.89802 1.83601 2.73404 3.2190 0.9092(IT)
<sup>89m</sup> Y			15.7 s	I.T./0.909		9/2+			0.2025
<sup>89</sup> Y	100.	88.905849	3.24 h	I.T./99+ /0.68204 \$ /0.002/		1/2- 7+	-0.13742 5.1		0.4794 0.6820
<sup>90</sup> Y		89.907152	2.67 d	\$ /2.282	2.28/	2-	-1.630	-0.155	0.5556(IT)
<sup>91m</sup> Y			49.7 m	I.T./0.555		9/2+	5.96		1.208
<sup>91</sup> Y		90.907301	58.5 d	\$ /1.544	1.545/	1/2-	0.1641		0.4485
<sup>92</sup> Y		91.90893	3.54 h	\$ /3.63	3.64/	2-			0.5611 0.9345 1.4054 (0.4 - 3.3)
<sup>93m</sup> Y			0.82 s	I.T./0.759		9/2+			0.1686(IT)
<sup>93</sup> Y		92.90956	10.2 h	\$ /2.87	2.88/90	1/2-			0.5902 0.2669 0.9471 1.9178
<sup>94m</sup> Y			1.4 μs						0.4322 0.7699 1.2024
<sup>94</sup> Y		93.91160	18.7 m	\$ /4.919	4.92/	2-			0.3816 0.9188 1.1389 (0.3 - 4.1)
<sup>95</sup> Y		94.91279	10.3 m	\$ /4.42		1/2-			0.4324 0.9542 2.1760 3.5770
<sup>96m</sup> Y			9.6 s	\$ /		(3+)			0.1467 0.6174 0.9150 1.1071 1.7507
<sup>96</sup> Y		95.91588	6.2 s	\$ /7.09	7.12/	0-			1.594
<sup>97m</sup> Y			1.21 s	\$ /7.4	4.8/ 6.0/	9/2+			0.1614 0.9700 1.1030
<sup>97</sup> Y		96.91813	3.76 s	\$ /6.69	6.7	1/2-			0.2969 1.9960 3.2876 3.4013
<sup>98m</sup> Y			2.1 s	\$ /9.8	5.5/	(4-)			0.2415

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									0.6205 0.6473 1.2228 1.8016 0.2131 1.2228 1.5907 2.9413 4.4501
<sup>98</sup> Y		97.92224	0.59 s	β <sup>-</sup> /8.83	8.7/	1+			
<sup>99m</sup> Y <sup>99</sup> Y		98.92463	0.011 ms 1.47 s	β <sup>-</sup> /7.57 n	/2.5/	1/2-			0.1218/43.8 0.5362 0.7242 1.0130
<sup>100m</sup> Y <sup>100</sup> Y <sup>101</sup> Y <sup>102</sup> Y <sup>103</sup> Y <sup>104</sup> Y <sup>105</sup> Y <sup>106</sup> Y <sup>107</sup> Y <sup>108</sup> Y		99.9278 100.9303 101.9336 102.9369 103.9414 104.9451 105.950	0.94 s 0.73 s 0.43 s 0.36 s 0.23 s 0.18 s >0.15 μs >0.15 μs >0.15 μs >0.15 μs	β <sup>-</sup> , n / β <sup>-</sup> , n /9.3 β <sup>-</sup> , n /8.6 β <sup>-</sup> , n /9.9 β <sup>-</sup> , n	n/1.8/ n/1.5/ n/4.0/ n/8.3/	3+ 1+ (5/2)			
<b><sup>40</sup>Zr</b>		<b>91.224(2)</b>							
<sup>76</sup> Zr <sup>79</sup> Zr <sup>80</sup> Zr		78.949 79.9406	> 0.2 : s 0.06 s 4.5 s		β <sup>+</sup> /8.0				0.290 0.538
<sup>81</sup> Zr <sup>82</sup> Zr <sup>83m</sup> Zr <sup>83</sup> Zr		80.9368 81.9311	5.3 s 32. s	β <sup>+</sup> /7.2 β <sup>+</sup> /4.0	6.1 3.	(3/2-)			ann.rad./ ann.rad./ ann.rad./ 0.0556 0.1050 0.2560 0.474 1.525
<sup>84</sup> Zr		82.9287	44. s	β <sup>+</sup> /5.9 EC	4.8	(7/2+) (1/2-)			ann.rad./ 0.0449 0.1125 0.3729 0.667
<sup>85m</sup> Zr <sup>85</sup> Zr		83.9233	26. m	β <sup>+</sup> /2.7 EC/		0+			ann.rad./ 0.2922(IT) 0.4165 ann.rad./ 0.2663 0.4163 0.4543 0.0280 0.243 0.612 0.1352(IT) 0.2010
<sup>86</sup> Zr		84.9215	7.9 m	I.T./0.2922 β <sup>+</sup> , EC/	3.1	1/2-			ann.rad./ 0.5877(IT) 1.507
<sup>87m</sup> Zr <sup>87</sup> Zr		84.9215	10.9 s	β <sup>+</sup> /4.7 EC/	3.1	7/2+			ann.rad./ 0.3811 1.228 0.3929 ann.rad./ 0.5877(IT) 1.507
<sup>88</sup> Zr <sup>89m</sup> Zr		85.91647	16.5 h	EC/1.47		0+			ann.rad./ 0.9092 0.1326 2.1862 2.3189(IT)
<sup>89</sup> Zr <sup>90m</sup> Zr		86.91482	14.0 s	I.T./0.3362		1/2-			
<sup>90</sup> Zr <sup>91</sup> Zr <sup>92</sup> Zr <sup>93</sup> Zr <sup>94</sup> Zr <sup>95</sup> Zr	51.45(40) 11.22(5) 17.15(8)	87.91023 87.91023	83.4 d 4.18 m	EC/0.67 I.T./94 /0.5877 β <sup>+</sup> /1.5 / EC/4.7 /	0.9/ 0.366/55 0.400/44	9/2+	-1.07		0.0304
<sup>96</sup> Zr <sup>97</sup> Zr <sup>98</sup> Zr <sup>99</sup> Zr	17.38(28)	88.908889	3.27 d	β <sup>+</sup> /23 /2.832 EC/77 /		9/2+		+0.29	0.7242 0.7567
<sup>100</sup> Zr <sup>101</sup> Zr	2.80(9)	89.908275	0.809 s	I.T./		5-	6.3		0.4692/55.2 0.5459/48 0.028-1.321 0.4006 0.5043
<sup>102</sup> Zr <sup>103</sup> Zr <sup>104</sup> Zr <sup>105</sup> Zr <sup>106</sup> Zr <sup>107</sup> Zr <sup>108</sup> Zr <sup>109</sup> Zr <sup>110</sup> Zr		89.904702 90.905643 91.905039 92.906474 93.906314 94.908041	1.5x10 <sup>6</sup> y > 10 <sup>17</sup> y 64.02 d	β <sup>-</sup> /0.091 β <sup>-</sup>		0+ 5/2+ 0+ 5/2+ 0+			
<sup>110</sup> Zr		95.908275	3x10 <sup>19</sup> y >1.7x10 <sup>18</sup> y	β <sup>-</sup>		0+			
<sup>111</sup> Zr <sup>112</sup> Zr <sup>113</sup> Zr <sup>114</sup> Zr <sup>115</sup> Zr <sup>116</sup> Zr <sup>117</sup> Zr <sup>118</sup> Zr <sup>119</sup> Zr		96.910950 97.91276 98.91651	16.8 h 30.7 s 2.2 s	β <sup>-</sup> /2.658 β <sup>-</sup> /2.26 β <sup>-</sup> /4.56	1.91/ 2.2/100 3.9/ 3.5/	1/2- 0+ 1/2+			0.7434
<sup>120</sup> Zr		99.91776	7.1 s	β <sup>-</sup> /3.34		0+			
<sup>121</sup> Zr		100.92114	2.1 s	β <sup>-</sup> /5.49	6.2/	3/2-			0.1194 0.2057 0.2089
<sup>122</sup> Zr <sup>123</sup> Zr <sup>124</sup> Zr <sup>125</sup> Zr <sup>126</sup> Zr <sup>127</sup> Zr <sup>128</sup> Zr <sup>129</sup> Zr <sup>130</sup> Zr		101.92298 102.9266 103.9288 104.9331 105.9359 106.941 107.944	2.9 s 1.3 s 1.2 s .1. s >0.24 μs >0.24 μs >0.15 μs >0.15 μs >0.15 μs	β <sup>-</sup> /4.61 β <sup>-</sup> /7.0 β <sup>-</sup> /5.9 β <sup>-</sup> /8.5					
<b><sup>41</sup>Nb</b>		<b>92.90638(2)</b>							

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>81</sup> Nb		80.949	< 0.08 s						
<sup>82</sup> Nb		81.9431	50 ms	\$ <sup>+</sup> /11.					
<sup>83</sup> Nb		82.9367	4.1 s	\$ <sup>+</sup> /7.5					
<sup>84</sup> Nb		83.9336	12. s	\$ <sup>+</sup> ,EC/9.6		(3+)			
<sup>85</sup> Nb		84.9279	2.3 m	\$ <sup>+</sup> /6.0					
<sup>86a</sup> Nb			56. s	\$ <sup>+</sup>					
<sup>86b</sup> Nb		85.9250	1.46 m	\$ <sup>+</sup> /8.0					ann.rad./ 0.751 1.003
<sup>87m</sup> Nb			3.7 m	\$ <sup>+</sup> / EC/		1/2-			ann.rad./ 0.1352 0.2010
<sup>87</sup> Nb		86.92036	2.6 m	\$ <sup>+</sup> 5.2/ EC/		(9/2+)			ann.rad./ 0.2010 0.4706 0.6165 1.0665 1.8842
<sup>88m</sup> Nb			7.7 m	\$ <sup>+</sup> / EC/		4-			ann.rad./ 0.2625 0.3996 1.0569 1.0825
<sup>88</sup> Nb		87.9183	14.3 m	\$ <sup>+</sup> /7.6 EC/	3.2/	8+			ann.rad./ 1.0570 1.0828 (0.07 - 2.5)
<sup>89m</sup> Nb			2.0 h	\$ <sup>+</sup> / EC/	3.3/	9/2+			0.5880/10(D) (0.17 - 4.0)
<sup>89</sup> Nb		88.91349	1.10 h	\$ <sup>+</sup> /74 /4.29 EC/26 /	2.8/	1/2-	+6.216		ann.rad./ 0.5074 0.5880 0.7696 1.2775
<sup>90m</sup> Nb			18.8 s	I.T./0.1246		4-			0.002 0.1225
<sup>90</sup> Nb		89.911263	14.6 h	\$53 /6.111 EC/47 /	0.86/5 1.5/92	8+	4.961		ann.rad./ 0.1412 1.1292 2.1862 2.3189
<sup>91m</sup> Nb			62. d	I.T./97 / EC/3 /		1/2-			(0.1 - 3.3) 0.1045(IT) 1.2050
<sup>91</sup> Nb		90.906989	7x10 <sup>2</sup> y	EC/1.253		9/2+			Mo k x-ray
<sup>92m</sup> Nb			10.13 d	EC/99+ /		2+	6.114		0.9126 0.9345 1.8475
<sup>92</sup> Nb		91.907192	3.7x10 <sup>7</sup> y	EC/2.006		7+			0.5611 0.9345
<sup>93m</sup> Nb			16.1 y	I.T./0.0304		1/2-			Nb k x-ray 0.0304
<sup>93</sup> Nb	100.	92.906376	6.26 m	I.T./99+ /2.086 \$) /0.5 /		9/2+ 3+	+6.1705	-0.32	Nb k x-ray 0.0409 0.87109 0.70263 0.87109
<sup>94</sup> Nb		93.907282	2.4x10 <sup>4</sup> y	\$) /2.045	0.47/	6+			0.2040 0.2356
<sup>95m</sup> Nb			3.61 d	I.T./97.5 / \$) /2.5 /	0.2357	1/2-			0.76578 0.7782
<sup>95</sup> Nb		94.906834	34.97 d	\$) /0.926	0.160/	9/2+	6.141		0.2191-1.498
<sup>96</sup> Nb		95.908099	23.4 h	\$) /3.187	0.5/10 0.75/90	6+	4.976		0.7434 0.4809
<sup>97m</sup> Nb			58.1 s	I.T./0.7434 \$) /1.934	0.734/98 1.27/98	1/2- 9/2+	6.15		0.6579 0.7874
<sup>97</sup> Nb		96.908096	1.23 h						0.1726-1.89 0.6451 0.7874 1.0243
<sup>98m</sup> Nb			51. m	\$) /4.67		5+			0.0978/100 (0.138-3.010)
<sup>98</sup> Nb		97.91033	2.9 s	\$) /4.59	4.6/	1+			0.0977 0.1378/3.1
<sup>99m</sup> Nb			2.6 m	\$) /	3.2/	1/2-			
<sup>99</sup> Nb		98.91162	15.0 s	\$) /3.64	3.5/100	9/2+			
<sup>100m2</sup> Nb			0.013 ms						
<sup>100m1</sup> Nb			3.0 s	\$) /6.74	5.8				Nb k x-ray 0.159 0.6364 1.0637
<sup>100</sup> Nb		99.91418	1.5 s	\$) /6.25	6.2/ 5.3/				0.5354 0.6001-1.566 0.1105-0.810
<sup>101</sup> Nb		100.91525	7.1 s	\$) /4.57	4.3/				
<sup>102m</sup> Nb			4.3 s	\$) /					
<sup>102</sup> Nb		101.91804	1.3 s	\$) /7.21	7.2/				0.2960-2.184
<sup>103</sup> Nb		102.91914	1.5 s	\$) /5.53	5.3/	5/2+			
<sup>104m</sup> Nb			0.9 s	\$) ,n/	n/0.06				
<sup>104</sup> Nb		103.9225	4.8 s	\$) ,n/8.1	n/0.05				
<sup>105</sup> Nb		104.9239	3.0 s	\$) ,n/6.5	n/1.7				
<sup>106</sup> Nb		105.9282	1.0 s	\$) ,n/9.3	n/4.5				
<sup>107</sup> Nb		106.9303	0.30 s	\$) ,n/7.9	n/6.0				
<sup>108</sup> Nb		107.9350	0.19 s	\$) ,n/	n/6.2				(0.193-0.590)
<sup>109</sup> Nb		108.9376	0.19 s	\$) ,n/	n/31				
<sup>110</sup> Nb		109.943	0.17 s	\$) ,n/	n/40				
<sup>111</sup> Nb			>0.15 μs						
<sup>112</sup> Nb			>0.15 μs						
<sup>113</sup> Nb			>0.15 μs						
<sup>42</sup> Mo		95.94(1)							
<sup>83</sup> Mo		82.949	. 6. ms						

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>84</sup> Mo		83.9401	3.7 s	\$ <sup>+</sup> /6.					
<sup>85</sup> Mo		84.9366	3.2 s	\$ <sup>+</sup> /8.1		1/2+			
<sup>86</sup> Mo		85.9302	20. s	\$ <sup>+</sup> /4.8					
<sup>87</sup> Mo		86.9273	14. s	EC, \$ <sup>+</sup> /6.5					(0.752-1.004)
<sup>88</sup> Mo		87.92195	8.0 m	\$ <sup>+</sup> /3.4 EC		0+	+0.5		ann.rad./ 0.0800 0.1399 0.1707 0.118(IT) 0.268
<sup>89m</sup> Mo			0.19 s	I.T./0.118		1/2-			
<sup>89</sup> Mo		88.91948	2.2 m	\$ <sup>+</sup> /5.58 EC/		9/2+			ann.rad./ 0.659 0.803 1.155 1.272
<sup>90</sup> Mo		89.91394	5.7 h	\$ <sup>+</sup> /25 /2.489 EC/75 /	1.085/	0+			ann.rad./ 0.04274 0.12237 0.25734
<sup>91m</sup> Mo			1.08 m	I.T./50 /0.653 \$ <sup>+</sup> ,EC/50 /	2.5/ 2.8/ 4.0/	1/2-			ann.rad./ 0.6529 1.2081 1.5080 2.2407
<sup>91</sup> Mo		90.91175	15.5 m	\$ <sup>+</sup> /94 /4.43 EC/6 /	3.44/94	9/2-			ann.rad./ 1.6373 2.6321 3.0286 (0.1 - 4.2)
<sup>92</sup> Mo	14.77(31)	91.906810	>3x10 <sup>17</sup> y	\$ <sup>-</sup> -EC		0+			
<sup>93m</sup> Mo			6.9 h	I.T./99+ /2.425		21/2+	+9.21		0.26306(IT) 0.68461 1.47711 0.0304
<sup>93</sup> Mo		92.906811	3.5x10 <sup>3</sup> y	EC/0.405		5/2+			
<sup>94</sup> Mo	9.226(99)	93.905087				0+			
<sup>95</sup> Mo	15.900(85)	94.905841				5/2+	-0.9142	-0.02	
<sup>96</sup> Mo	16.674(12)	95.904678				0+			
<sup>97</sup> Mo	9.560(50)	96.906020				5/2+	-0.9335	+0.26	
<sup>98</sup> Mo	24.20(25)	97.905407				0+			
<sup>99</sup> Mo		98.907711	2.7476 d	\$) /1.357	0.45/14 0.84/2 1.21/84	1/2+	0.375		0.144048 0.18109 0.36644 0.73947
<sup>100</sup> Mo	9.67(20)	99.90748	1x10 <sup>19</sup> y	\$ <sup>-</sup>		0+			
<sup>101</sup> Mo		100.91035	14.6 m	\$) /2.82	2.23/ 0.7/	1/2+			0.0063 0.19193 0.5909 (0.0809-2.405) 0.1493/89.
<sup>102</sup> Mo		101.91030	11.3 m	\$) /1.01	1.2/	0+			0.2116/100. 0.2243/32. 0.1028(2)/ 0.1440(2) 0.2511(2)
<sup>103</sup> Mo		102.91320	1.13 m	\$) /3.8		3/2+			0.0686(1)/100. 0.4239(4)/21. 0.0642/ 0.0856/ 0.2495/
<sup>104</sup> Mo		103.91376	1.00 m	\$) /2.16		0+			0.1894(2)/22. 0.3644(2)/6. 0.3723(2)/12.
<sup>105</sup> Mo		104.9170	36. s	\$) /4.95		3/2+			
<sup>106</sup> Mo		105.91814	8.4 s	\$) /3.52		0+			
<sup>107</sup> Mo		106.9217	3.5 s	\$) /6.2					
<sup>108</sup> Mo		107.9236	1.1 s	\$) /5.1					
<sup>109</sup> Mo		108.9278	0.5 s	\$) /7.2					(0.028-0.636)
<sup>110</sup> Mo		109.9297	0.30 s	\$) /5.7					Tc k x-ray 0.142 (0.039-0.599)
<sup>111</sup> Mo		110.9345	>0.15 μs						
<sup>112</sup> Mo		111.937	>0.15 μs						
<sup>113</sup> Mo		112.942	>0.15 μs						
<sup>114</sup> Mo			>0.15 μs						
<sup>115</sup> Mo			>0.15 μs						
<sup>116</sup> Mo			>0.15 μs						
<sup>117</sup> Mo			>0.15 μs						
<b><sup>43</sup>Tc</b>									
<sup>85</sup> Tc		84.949	< 0.1 ms						
<sup>86</sup> Tc		85.9430	0.05 s	\$ <sup>+</sup> /11.9					
<sup>87</sup> Tc		86.9365	2.4 s	\$ <sup>+</sup> /8.6					
<sup>88</sup> Tc		87.9328	5.8 s	\$ <sup>+</sup> /10.1					
<sup>89m</sup> Tc			13. s						
<sup>89</sup> Tc		88.9275	13. s	\$ <sup>+</sup> /7.5					
<sup>90m</sup> Tc			49.2 s	\$ <sup>+</sup>	5.3/	6+			ann.rad./ 0.9479/ 1.0542/ ann.rad./ 0.9479/
<sup>90</sup> Tc		89.9235	8.3 s	\$ <sup>+</sup> /8.9	7.0/15 7.9/95.	1+			ann.rad./170. 0.8110(5)/5. 1.6052(1)/7.8 1.6339(1)/9.1 1.9023(1)/6. 2.4509(1)/13.5
<sup>91m</sup> Tc			3.3 m	\$ <sup>+</sup> EC		1/2+			ann.rad./200. ann.rad./200. 0.0850/ 0.1475 0.3293
<sup>91</sup> Tc		90.9184	3.14 m	\$ <sup>+</sup> /6.2	5.2	9/2+			
<sup>92</sup> Tc		91.91526	4.4 m	\$ <sup>+</sup> /7.87 EC	4.1	8+			

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<sup>93m</sup> Tc			43. m	I.T./13 EC/20		1/2-			0.7731 1.5096 0.3924(IT) 0.9437 2.6445
<sup>93</sup> Tc	92.910248		2.73 h	\$ <sup>+</sup> /13/3.201 EC/87/	0.81	9/2+	6.26		ann.rad./ 1.3629 1.4771 1.5203 (0.1 - 3.0)
<sup>94m</sup> Tc			52. m	\$ <sup>+</sup> /72/4.33 EC/28/		2+			ann.rad./ 0.8710 1.8686
<sup>94</sup> Tc	93.909655		4.88 h	\$ <sup>+</sup> /11/4.256 EC/89/		7+	5.08		ann.rad./ 0.4491 0.7026 0.8496 0.8710
<sup>95m</sup> Tc			61. d	I.T./4/ \$ <sup>+</sup> /0.3 EC/96	0.5/ 0.7/	1/2-			ann.rad./ 0.0389(IT) 0.2041 0.5821 0.5821 0.8351
<sup>95</sup> Tc	94.90766		20.0 h	EC/100/1.691		9/2+	5.89		0.7657 1.0738
<sup>96m</sup> Tc			52. m	I.T./90/ \$ <sup>+</sup> , EC/2/		4+			0.0342(IT) 0.7782 1.2002
<sup>96</sup> Tc	95.90787		4.3 d	EC/2.973		7+	+5.04		Mo k x-ray 0.7782 0.8125 0.8498 1.12168
<sup>97m</sup> Tc			91. d	I.T./0.0965 EC	/3.9	1/2-			Tc k x-ray 0.0965
<sup>97</sup> Tc	96.906364		4.2x10 <sup>6</sup> y	EC/100/0.320		9/2+			Mo k x-ray
<sup>98</sup> Tc	97.907215		6.6x10 <sup>5</sup> y	\$) /1.80	0.40/100	6+			0.65241 0.74535
<sup>99m</sup> Tc			6.01 h	I.T./100/0.142		1/2-			Tc k x-ray 0.14049 0.14261
<sup>99</sup> Tc	98.906254		2.13x10 <sup>5</sup> y	\$) /0.294	0.293/100	9/2+	+5.6847	-0.129	0.5396 0.5908
<sup>100</sup> Tc	99.907657		15.8 s	\$) /3.202 EC /1.8(10) <sup>-3</sup> /0.17	2.2/ 3.3	1+ 2.9/			(0.379-2.30)
<sup>101</sup> Tc	100.90731		14.2 m	\$) /1.61	1.32/	9/2+			0.1272 0.1841 0.3068 0.5451 (0.073-0.969)
<sup>102m</sup> Tc			4.4 m	I.T./2/4.8 \$) /98/	1.8/				0.4184 0.4752 0.6281 0.6302 1.0464 1.1033 1.6163 2.2447
<sup>102</sup> Tc	101.90921		5.3 s	\$) /4.53	3.4/ 4.2	1+			0.4686 0.4751 1.1055
<sup>103</sup> Tc	102.90918		54. s	\$) /2.66	2.2/ 2.0/ 2.2/	5/2+			0.1361 0.1743 0.2104 0.3464 0.5629 (0.13 - 1.0)
<sup>104m</sup> Tc			0.005 ms						0.3483 0.3580 0.5305 0.5351 0.8844 0.8931 1.6768 (0.3 - 3.7)
<sup>104</sup> Tc	103.91144		18.2 m	\$) /5.60	5.3/	(3+)			0.1079 0.1432 0.3215 0.2703 0.5222 1.9694 2.2393 2.7893 0.1027 0.1063 0.1770 0.4587 0.2422 0.4656 0.7078 0.7326 1.5835
<sup>105</sup> Tc	104.91166		7.6 m	\$) /3.6	3.4/	5/2+			
<sup>106</sup> Tc	105.91436		36. s	\$) /6.55		2+			
<sup>107</sup> Tc	106.9151		21.2 s	\$) /4.8					
<sup>108</sup> Tc	107.9185		5.1 s	\$) /7.72		(3)			
<sup>109</sup> Tc	108.9200		1.4 s	\$) /6.3	p/0.08				
<sup>110</sup> Tc	109.9234		0.83 s	\$) /8.8	p/0.04				0.2407



T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>111</sup> Tc		110.9250	0.30 s	\$) .n /7.0	n/0.85				0.150/92.7 0.063-1.435
<sup>112</sup> Tc		111.9292	0.26 s	\$,n	n/2.6				
<sup>113</sup> Tc		112.931	0.15 s	\$*,n/8.	/2.1				0.0985/100 0.0658-1.520
<sup>114</sup> Tc		113.936	0.15 s	\$,n	/1.3				
<sup>115</sup> Tc		114.938	>0.15 μs						
<sup>116</sup> Tc			>0.15 μs						
<sup>117</sup> Tc			>0.15 μs						
<sup>118</sup> Tc			>0.15 μs						
<b><sup>44</sup>Ru</b>		<b>101.07(2)</b>							
<sup>87</sup> Ru		86.949	>1.5 μs						
<sup>88</sup> Ru		87.9404	1.2 s			0+			
<sup>89</sup> Ru		88.936	1.4 s	\$*.p/8.					
<sup>90</sup> Ru		89.9298	12. s	\$* /5.9		0+			ann.rad./ 0.155 - 1.551
<sup>91</sup> Ru		90.9264	9. s	\$*,EC/7.4		9/2+			ann.rad./
<sup>92</sup> Ru		91.9201	3.7 m	\$* /53/4.5 EC/47/		0+			ann.rad./ 0.1346 0.2138 0.2593
<sup>93m</sup> Ru			10.8 s	I.T./21/ \$*,EC/79/	5.3/	1/2-			ann.rad./ 0.7344 1.1112 1.3962 2.0931
<sup>93</sup> Ru		92.9171	1.0 m	\$* /6.3 EC/		9/2+			ann.rad./ 0.6807 1.4349 (0.5- 4.2)weak
<sup>94</sup> Ru		93.91137	52. m	EC/100/1.59		0+			0.3672 0.5247 0.8922
<sup>95</sup> Ru		94.91042	1.64 h	EC/85/2.57 \$* /15/	1.20/ 0.91/	5/2+	0.86		ann.rad./ 0.3364 0.6268 0.036-2.424
<sup>96</sup> Ru	5.54(14)	95.90760	>3.1x10 <sup>16</sup> y	\$* \$*		0+			Tc k x-ray
<sup>97</sup> Ru		96.90756	2.89 d	EC/1.12		5/2+	-0.78		0.2157 0.3245 0.4606
<sup>98</sup> Ru	1.87(3)	97.90529				0+			
<sup>99</sup> Ru	12.76(14)	98.905939				5/2+	-0.6413	+0.079	
<sup>100</sup> Ru	12.60(7)	99.904219				0+			
<sup>101</sup> Ru	17.06(2)	100.905582				5/2+	-0.7188	+0.46	
<sup>102</sup> Ru	31.55(14)	101.904349				0+			
<sup>103</sup> Ru		102.906323	39.27 d	\$) /0.763	0.223	3/2+	0.206	+0.62	0.05329 0.29498 0.4438 0.49708 0.55704 0.61033 (0.04 - 1.6)
<sup>104</sup> Ru	18.62(27)	103.905430				0+			
<sup>105</sup> Ru		104.907750	4.44 h	\$) /1.917	1.11/22 1.134/13 1.187/49	3/2+	-0.3		0.12968 0.1491 0.2629 0.31664 0.46943 0.67634 0.72420 (0.1 - 1.8)
<sup>106</sup> Ru		105.90733	1.020 y	\$) /0.0394	0.0394/100	0+			
<sup>107</sup> Ru		106.9099	3.8 m	\$) /2.9	2.1/ 3.2/				0.1939 0.3741 0.4625 0.8488
<sup>108</sup> Ru		107.9102	4.5 m	\$) /1.4	1.2/	0+			0.0923 0.1651 0.4339 0.4975 0.6189 0.6189
<sup>109</sup> Ru		108.91320	34.5 s	\$) /4.2					0.1164 0.3584
<sup>110</sup> Ru		109.9140	15. s	\$) /2.81					0.1121 0.3737 0.4397 0.7967
<sup>111</sup> Ru		110.9176	1.5 s	\$) /5.5					
<sup>112</sup> Ru		111.9188	4.5 s	\$) /4.5					
<sup>113m</sup> Ru			0.6 s						
<sup>113</sup> Ru		112.9225	0.80 s	\$) /7.					0.2632 0.048-2.418
<sup>114</sup> Ru		113.9239	0.57 s	\$) /6.1					0.127/24 (0.053-0.180)
<sup>115</sup> Ru		114.928	. 0.74 s	\$) /8.					
<sup>116</sup> Ru		115.930	>0.15 μs						
<sup>117</sup> Ru		116.935	>0.15 μs						
<sup>118</sup> Ru		117.937	>0.15 μs						
<sup>119</sup> Ru			>0.15 μs						
<sup>120</sup> Ru			>0.15 μs						
<b><sup>45</sup>Rh</b>		<b>102.90550(2)</b>							
<sup>89</sup> Rh		88.9494	>0.15 μs						
<sup>90m</sup> Rh			. 12. ms						
<sup>90</sup> Rh		89.9429	1.0 s						

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>91</sup> Rh		90.9366	1.9 s						
<sup>92</sup> Rh		91.9320	5.6 s	\$ <sup>+</sup> /11.1					
<sup>93</sup> Rh		92.9257	14. s	\$ <sup>+</sup> /8.1					(0.138-1.493)
<sup>94m</sup> Rh			25.8 s	\$ <sup>+</sup> /		8+			ann.rad./ 0.1264 0.3117 0.7562 1.0752 1.4307
<sup>94</sup> Rh		93.9217	1.18 m	\$ <sup>+</sup> /9.6	6.4/	3+			ann.rad./ 0.1461 0.3117 0.7562 1.4307
<sup>95m</sup> Rh			1.96 m	I.T./88/ \$ <sup>+</sup> ,EC/12/		1/2+			ann.rad./ 0.5433(IT)
<sup>95</sup> Rh		94.9159	5.0 m	\$ <sup>+</sup> /5.1	3.2	9/2+			0.7837 ann.rad./ 0.2293 0.4103 0.6610 0.9416 1.3520 (0.2 - 3.8)
<sup>96m</sup> Rh			1.51 m	I.T./60 /0.052 \$ <sup>+</sup> ,EC/40/	4.70/	2+			ann.rad./ Tc,Ru x-rays 0.8326 1.0985 1.6921
<sup>96</sup> Rh		95.91452	9.6 m	\$ <sup>+</sup> /6.45 EC/	3.3/	5+			(0.4 - 3.3) ann.rad./ 0.4299 0.6315 0.6853 0.7418 0.8326 (0.2 - 3.4)
<sup>97m</sup> Rh			46. m	I.T./5 / \$ <sup>+</sup> ,EC/95 /	2.6/	1/2-			ann.rad./ 0.1886 0.4215 2.2452
<sup>97</sup> Rh		96.91134	31.0m	\$ <sup>+</sup> /3.52	2.1/	9/2+			ann.rad./ 0.1886 0.3892 0.4515 0.8398 0.8788 (0.2 - 3.5)
<sup>98m</sup> Rh			3.5 m	\$ <sup>+</sup> /		5+			ann.rad./ 0.6154 0.6524 0.7452
<sup>98</sup> Rh		97.91072	8.7 m	\$ <sup>+</sup> /90 /5.06	3.4/	2+			ann.rad./ 0.6524 0.7623
<sup>99m</sup> Rh			4.7 h	\$ <sup>+</sup> /8 / EC/92 /	.74/	9/2+	5.67		ann.rad./ 0.2766/ 0.3408 0.6178 1.2612
<sup>99</sup> Rh		98.90820	16. d	\$ <sup>+</sup> /4 /2.10 EC/97 /	0.54/ 0.68/	1/2-			ann.rad./ 0.0894/ 0.3530 0.5277 (0.1 - 2.0)
<sup>100m</sup> Rh			4.7 m	I.T./99 / \$ <sup>+</sup> /0.4 /		5+			ann.rad./ 0.0748/ 0.2647(IT)
<sup>100</sup> Rh		99.90812	20.8 h	\$ <sup>+</sup> /3.63 EC/	2.62/ 2.07/	1-			0.4462 0.5396 0.5882 0.8225 1.5534 2.3761
<sup>101m</sup> Rh			4.35 d	EC/92 / I.T./8 /0.1573		9/2+	+5.51		Rh k x-ray 0.1272/ 0.3069 0.5451
<sup>101</sup> Rh		100.90616	3.3 y	EC/0.54		1/2-			Ru k x-ray 0.1272 0.1980 0.3252
<sup>102m</sup> Rh			3.74 y > 1.2x10 <sup>6</sup> y	EC/2.323 IT/0.0419 \$ <sup>+</sup>	/<0.00025	6 <sup>+</sup>	4.04		0.4751 0.6313 0.6975 0.7668 1.0466 1.1032
<sup>102</sup> Rh		101.906842	207. d	EC/62 \$) /19/ \$ <sup>+</sup> /14/			0.5		ann.rad./ 0.4686 0.4751 0.5566 0.6280 1.1032 (0.4 - 1.6)
<sup>103m</sup> Rh			56.12 m	IT		7/2+	4.54		
<sup>103</sup> Rh	100.	102.905504				1/2-	-0.0884		
<sup>104m</sup> Rh			4.36 m	I.T./99+ / \$)	1.3/	5+			Rh k x-ray 0.0514 0.0971 0.5558

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<sup>104</sup> Rh		103.906655	42.3 s	β <sup>-</sup> /99+/2.441 EC/0.4/1.141	1.88/2 2.44/98	1+			0.3581 0.5558 1.2370 (0.35 - 1.8) Rh k x-ray
<sup>105m</sup> Rh			43. s	I.T./1.296		1/2-			0.1296
<sup>105</sup> Rh		104.905692	35.4 h	β <sup>-</sup> /0.567	0.247/30 0.567/70	7/2+	+4.45		0.2801 0.3061 0.3189 0.2217 0.4510 0.5119 0.6162 0.7173 0.7484 1.0458 1.5277
<sup>106m</sup> Rh			2.18 h	β <sup>-</sup> /	0.92/	6+			0.2217 0.4510 0.5119 0.6162 0.7173 0.7484 1.0458 1.5277
<sup>106</sup> Rh		105.90729	29.9 s	β <sup>-</sup> /3.54	2.4/2 3.0/12 3.54/79	1+	+2.58		0.51186/ 0.61612 0.62187 (0.05 - 3.04)
<sup>107</sup> Rh		106.90675	21.7 m	β <sup>-</sup> /1.51	1.20/65 1.5/17	7/2+			0.2776 0.3028 0.3925 0.4339 0.4973 0.6189
<sup>108m</sup> Rh			6.0 m	β <sup>-</sup> /	1.57/				0.4339 0.4973 0.6189
<sup>108</sup> Rh		107.9087	17. s	β <sup>-</sup> /4.5		1+			0.4046 0.4339 0.4973 0.5811 0.6146 0.9014 0.9471
<sup>109</sup> Rh		108.90874	1.34 m	β <sup>-</sup> /2.59	2.25/	7/2+			0.1134 0.1780 0.2914 0.3254 0.3268 0.4261 (0.1 - 1.6)
<sup>110m</sup> Rh			29. s	β <sup>-</sup> /	[.6/				0.3737 0.4397 0.7967
<sup>110</sup> Rh		109.9110	3.1 s	β <sup>-</sup> /5.4	5.5/	1+			0.3737 0.4400 0.5463 0.6877 0.8381 0.9045 0.275
<sup>111</sup> Rh		110.9117	11. s	β <sup>-</sup> /3.7					0.3489
<sup>112m</sup> Rh			6.8 s	β <sup>-</sup> /					0.1285
<sup>112</sup> Rh		111.9140	3.5 s	β <sup>-</sup> /6.2		1+			
<sup>113</sup> Rh		112.9154	0.9 s	β <sup>-</sup> /4.9					
<sup>114m</sup> Rh			1.8 s	β <sup>-</sup> /					
<sup>114</sup> Rh		113.9173	1.8 s	β <sup>-</sup> /6.5		1+			
<sup>115</sup> Rh		114.9201	0.99 s	β <sup>-</sup> /6.0					
<sup>116m</sup> Rh			0.9 s	β <sup>-</sup> /					0.3405
<sup>116</sup> Rh		115.9228	0.7 s	β <sup>-</sup> /8.0		1+			0.340 0.398-1.665
<sup>117</sup> Rh		116.925	0.44 s	β <sup>-</sup> /7.					0.0346 0.1317 0.379
<sup>118</sup> Rh		117.929	0.30 ms						0.575 0.575 <sub>037</sub>
<sup>119</sup> Rh		118.931	>0.15 μs						
<sup>120</sup> Rh		119.936	>0.15 μs						
<sup>121</sup> Rh		120.938	>0.15 μs						
<sup>122</sup> Rh									
<b><sup>46</sup>Pd</b>		<b>106.42(1)</b>							
<sup>91</sup> Pd		90.949	>1.5 μs						
<sup>92</sup> Pd		91.9404	1.0 s						
<sup>93</sup> Pd		92.9359	1.2 s	β <sup>+</sup> , p		9/2			0.240/81 0.382-0.864 0.5582 (0.0546-0.798)
<sup>94</sup> Pd		93.9288	9. s	EC, β <sup>+</sup> / 6.6					
<sup>95m</sup> Pd		94.92684	13.4 s	EC, β <sup>+</sup> /10.2		21/2+			
<sup>95</sup> Pd		95.9182	2.03 m	EC, β <sup>+</sup> /3.5	1.15/				0.1248 0.4995 ann.rad./ 0.2653 0.4752 0.7927
<sup>96</sup> Pd		96.9165	3.1 m	β <sup>+</sup> , EC/4.8	3.5/	5/2+			(0.2 - 3.4) ann.rad./ 0.0677 0.1125 0.6630 0.8379
<sup>97</sup> Pd		97.91273	17.7 m	β <sup>+</sup> /1.87 EC/		0+			ann.rad./ 0.0677 0.1125 0.6630 0.8379
<sup>98</sup> Pd		98.91181	21.4 m	β <sup>+</sup> /49 /3.37 EC/51 /	2.18/	5/2+			ann.rad./ 0.1360 0.2636 0.6734 (0.2 - 2.85)
<sup>99</sup> Pd		99.90851	3.7 d	EC/0.36		0+			0.03271 0.0748 0.0840
<sup>100</sup> Pd		100.90829	8.4 h	β <sup>+</sup> /5 /1.980	0.776/	5/2+	-0.66		ann.rad./

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				EC/95 /					0.0244 0.2963 0.5904
<sup>102</sup> Pd <sup>101</sup> Pd	1.02(1)	101.905607 102.906087	16.99 d	EC/0.543		0+ 5/2+			Rh k x-ray 0.03975 0.3575 0.4971
<sup>104</sup> Pd <sup>105</sup> Pd <sup>106</sup> Pd <sup>107m</sup> Pd	11.14(8) 22.33(8) 27.33(3)	103.904034 104.905083 105.903484		I.T./0.2149		0+ 5/2+ 0+ 11/2-	-0.642	+0.66	Pd k x-ray 0.2149(IT)
<sup>107</sup> Pd <sup>108</sup> Pd <sup>109m</sup> Pd	26.46(9)	106.90513 107.903895	6.5x10 <sup>6</sup> y 4.75 m	\$) /0.033 I.T./0.1889	0.03/ 0.35 0.77	5/2+ 0+ 11/2-			Pd x-ray 0.1889(IT)
<sup>109</sup> Pd <sup>110</sup> Pd <sup>111m</sup> Pd		108.905954 109.905153	13.5 h 5.5 h	\$) /1.116 I.T./73 /0.172 \$) /27 /	1.028 0.35 0.77	5/2+ 0+ 11/2-			0.0880 (0.08 - 1.0) 0.0704 0.1722 0.3912 (0.1 - 1.97)
<sup>111</sup> Pd		110.90764	23.4 m	\$) /2.19	2.2/95	5/2+			0.0598 0.2454 0.5800 0.6504 1.3885 1.4590
<sup>112</sup> Pd <sup>113m</sup> Pd <sup>113</sup> Pd		111.90731 112.91015	21.04 h 1.48 m 1.64 m	\$) /0.29 \$) / \$) /3.34	0.28/ 0.35 0.77	0+ 5/2+			0.018 0.0959 0.0958 0.4824 0.6436 0.7394 0.1266 0.2320 0.5582 0.5760
<sup>114</sup> Pd		113.91037	2.48 m	\$) /1.45		0+			0.1255 0.2554 0.3428 0.1015 0.1147 0.1778 0.2473
<sup>115</sup> Pd		114.9137	47. s	\$) /4.58					0.077-0.403 0.1254 0.028-0.596 0.2566
<sup>116</sup> Pd		115.9142	12.7 s	\$) /2.61					0.070-0.326 0.1581 0.053-0.595
<sup>117</sup> Pd <sup>118</sup> Pd <sup>119</sup> Pd <sup>120</sup> Pd		116.9178 117.9189 118.9227 119.9240	4.4 s 2.4 s 0.9 s 0.5 s	\$) /5.7 \$) /4.1 \$) /6.5 \$) /5.0					
<sup>121</sup> Pd <sup>122</sup> Pd <sup>123</sup> Pd <sup>124</sup> Pd		120.9282 121.9298 122.934	>0.24 μs >0.24 μs >0.15 μs						
<b><sup>47</sup>Ag</b>		<b>107.8682(2)</b>							
<sup>93</sup> Ag <sup>94m</sup> Ag <sup>94</sup> Ag <sup>95</sup> Ag <sup>96m</sup> Ag		93.9428 94.9355	0.03 s 0.38 s 2.0 s 4.4 s	\$+, p/ \$+, p/ \$+, p/ \$+, p	/8.	8+			(0.539-2.025)
<sup>96</sup> Ag		95.9307	7. s	\$+, p EC/ \$+, p	/11.6 /21.	2+			ann.rad./ 0.1248 0.4995 (0.1066-1.416)
<sup>97</sup> Ag		96.9240	19. s	\$+ /7.0 EC/					ann.rad./ 0.6862 1.2941 (0.352-3.294)
<sup>98</sup> Ag		97.9218	47.6 s	\$+ /8.4 EC/ \$+, p	/36. /0.11	5+			ann.rad./ 0.5711 0.6786 0.8631 (0.153-1.185)
<sup>99m</sup> Ag			11. s	I.T./100/		1/2-			Ag k x-ray 0.1636(IT) 0.3426
<sup>99</sup> Ag		98.9176	2.07 m	\$+ /87 /5.4 EC/13 /		9/2+			ann.rad./ 0.2199 0.2645 0.8056 0.8323 (0.2 - 3.5)
<sup>100m</sup> Ag			2.3 m	\$+ / EC/		2+			ann.rad./ 0.6657 1.6941
<sup>100</sup> Ag		99.9161	2.0 m	\$+/7.1 EC/	4.7/	5+			ann.rad./ 0.2807 0.4503 0.6657 0.7508 0.7732
<sup>101m</sup> Ag			3.1 s	I.T./0.23		1/2-			Ag k x-ray 0.0981

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<sup>101</sup> Ag		100.9128	11.1 m	\$ <sup>+</sup> /69 /4.2 EC/31 /	2.7/ 2.18/ 2.73/ 3.38/	9/2+	5.7		0.176(IT) ann.rad./ 0.2610 0.2747 0.3269 0.4392 0.6673 1.1739 (0.2 - 3.1)
<sup>102m</sup> Ag			7.8 m	\$ <sup>+</sup> /38 / EC/13 / I.T./49 /	3.4	2+	+4.14		ann.rad./ 0.5567 0.9777 1.8347 2.0545 2.1594 3.2386
<sup>102</sup> Ag		101.91197	13.0 m	\$ <sup>+</sup> /78 /5.92 EC/22 /	2.26/	5+	4.6		ann.rad./ 0.5564 0.7193 0.163-2.242
<sup>103m</sup> Ag			5.7 s	I.T./0.134		1/2-			Ag k x-ray 0.1344
<sup>103</sup> Ag		102.90897	1.10 h	\$ <sup>+</sup> /28 /2.69 EC/72 /	1.7 1.3	7/2+	+4.47		ann.rad./ 0.1187 0.1482
<sup>104m</sup> Ag			33. m	\$ <sup>+</sup> /64/ EC/36/ I.T./0.07/	2.71/	2+	+3.7		ann.rad./ 0.5558 0.7657
<sup>104</sup> Ag		103.90863	69. m	\$ <sup>+</sup> /16 /4.28 EC/84 /	0.99/	5+	3.92		(0.5 - 3.4) ann.rad./ 0.5558 0.9259 0.9416
<sup>105m</sup> Ag			7.2 m	I.T./98/0.0255 EC/2 /		7/2+	+4.41		(0.18 - 2.27) Ag x-ray 0.3063 0.3192
<sup>105</sup> Ag		104.90653	41.3 d	EC/1.35		1/2-	0.1014		(0.1 - 1.0) 0.0640 0.2804 0.3445 0.4434
<sup>106m</sup> Ag			8.4 d	EC/		6+	3.71	+1.1	Pd k x-ray 0.4510 0.5118 0.7173 1.0458
<sup>106</sup> Ag		105.90667	24.0 m	\$ <sup>+</sup> /59 /2.965 EC/41 /	/1.96	1+	+2.85		ann.rad./ 0.5119
<sup>107m</sup> Ag			44.2 s	I.T./0.093		7/2+	+4.40	1.0	Ag x-ray 0.0931
<sup>107</sup> Ag	51.839(8)	106.905093	418. y	EC/92 / I.T./8 /0.079		1/2- 6+	-0.11357 3.580	+1.3	Ag k x-ray Pd k x-ray 0.43392 0.72290
<sup>108</sup> Ag		107.905954	2.39 m	\$) /97/1.65 EC/2/ \$) /1/1.92	1.02/1.7 1.65/96 0.88/0.3	1+	+2.6884		ann.rad./ 0.43392 0.61885 0.63298
<sup>109m</sup> Ag			39.8 s	I.T./0.088		7/2+	+4.40	+1.0	Ag k x-ray 0.0880
<sup>109</sup> Ag	48.161(8)	108.904756	249.8 d	\$) /99 / I.T./1 /0.1164	0.087 0.530	1/2- 6+	-0.13069 +3.60	+1.4	0.65774 0.76393 0.88467 0.93748 1.38427 (0.447-1.56)
<sup>110</sup> Ag		109.906111	24.6 s	\$) /2.892	2.22/5 2.89/95	1+	+2.7271	0.2	0.65774 0.8154 1.1257
<sup>111m</sup> Ag			1.08 m	IT/99/0.0598 \$) /1/		7/2+			Ag k x-ray 0.0598
<sup>111</sup> Ag		110.905295	7.47 d	\$) /1.037	1.035/	1/2-	-0.146		0.2454 0.2454 0.3421
<sup>112</sup> Ag		111.90701	3.13 h	\$) /3.96	3.94/ 3.4	2-	0.0547		0.6067 0.6174 1.3877 (0.4 - 2.9)
<sup>113m</sup> Ag			1.14 m	I.T./80 /0.043 \$) /20 /	1.5	7/2+			0.1422 0.2983 0.3161 0.3923
<sup>113</sup> Ag		112.90657	5.3 h	\$) /2.02	2.01/	1/2-	0.159		0.2588 0.2986
<sup>114</sup> Ag		113.90881	4.6 s	\$) /5.08	4.9/	1+			0.5582 0.5760 1.9946
<sup>115m</sup> Ag			18.7 s	\$) /		7/2+			0.1134 0.1315 0.2288 0.3887
<sup>115</sup> Ag		114.90876	20. m	\$) /3.10		1/2-			0.1316 0.2128 0.2291 0.4727 (0.13 - 2.49)
<sup>116m</sup> Ag			10.5 s	I.T./2 /	3.2/	5+			0.5134

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>116</sup> Ag		115.91137	2.68 m	\$) /98 / \$) /6.16	2.9 5.3	2-			0.7055 0.255-2.838 0.5134 0.6993 2.4779
<sup>117m</sup> Ag			5.3 s	\$) /	3.2/	7/2+			0.1354 0.2981 0.3868
<sup>117</sup> Ag		116.91171	1.22 m	\$) /4.18	2.3	1/2-			0.1354 0.1571 0.3377 0.1277
<sup>118m</sup> Ag			2.8 s	\$) /59 / I.T./41 /0.1277					0.4878 0.6771 0.7709 1.0586
<sup>118</sup> Ag		117.9145	4.0 s	\$) /7.1					0.4878 0.6771 3.2259
<sup>119</sup> Ag		118.9157	2.1 s	\$) /5.35		7/2+			0.0674 0.3662 0.3991 0.6264
<sup>120m</sup> Ag			0.32 s	\$) / I.T./					0.2030 0.5059 0.6978 0.8300
<sup>120</sup> Ag		119.9188	1.23 s	\$) /8.2					0.9258 0.5059 0.6978 0.8171
<sup>121</sup> Ag		120.9198	0.78 s	\$) /6.4					1.3231 0.1150 0.3148 0.3537 0.3696 0.5007 1.5105 (0.11 - 2.5)
<sup>122m</sup> Ag			1. s	\$) /					
<sup>122</sup> Ag		121.9233	0.44 s	\$) /9.2					
<sup>123</sup> Ag		122.9249	0.31 s	\$) /7.4					
<sup>124</sup> Ag		123.9285	0.22 s	\$) /10.1					
<sup>125</sup> Ag		124.9305	0.17 s	\$-					
<sup>126</sup> Ag		125.9345	0.11 s	\$-					
<sup>127</sup> Ag		126.9369	0.11 s	\$-					
<sup>128</sup> Ag			58 ms	\$-					
<sup>129</sup> Ag			0.05 s	\$-,n					
<b><sup>48</sup>Cd</b>		<b>112.411(8)</b>							
<sup>96</sup> Cd		95.9398							
<sup>97</sup> Cd		96.9349	3. s	\$+, (p)					
<sup>98</sup> Cd		97.9276	9.2 s	\$+ /5.4 (p)	/0.025				
<sup>99</sup> Cd		98.9250	16. s	\$+, EC/6.9					ann. rad./
<sup>100</sup> Cd		99.9203	1.1 m	\$+, EC/3.9					ann. rad./ (0.090-1.043)
<sup>101</sup> Cd		100.9187	1.2 m	\$+ /83 /5.5 EC/17 /	4.5	5/2+			In k x-ray 0.0985 1.7225 0.31 - 2.84)
<sup>102</sup> Cd		101.91474	5.8 m	\$+ /27 /2.59 EC/73		0+			ann. rad./ 0.0974 0.4810 1.0366 1.3598
<sup>103</sup> Cd		102.91342	7.5 m	\$+ /33 /4.14 EC/67 /		5/2+	-0.81	-0.8	ann. rad./ Ag k x-ray 1.0799 1.4487 1.4618 (0.1 - 2.8)
<sup>104</sup> Cd		103.90985	58. m	EC/1.14		0+			Ag k x-ray 0.0835 0.7093
<sup>105</sup> Cd		104.90947	55.5 m	\$+ /26 /2.739 EC/74 /	1.69/	5/2+	-0.7393	+0.43	Ag k x-ray 0.3469 0.6072 0.9618 1.3025 (0.25 - 2.4)
<sup>106</sup> Cd	1.25(6)	105.90646	>2.6x10 <sup>17</sup> y	\$+, EC		0+			
<sup>107</sup> Cd		106.90661	6.52 h	EC/99+ /1.417 \$+ /		5/2+	-0.615055	+0.68	Ag k x-ray 0.0931 0.8289
<sup>108</sup> Cd	0.89(3)	107.90418	>4.1x10 <sup>17</sup> y	EC EC		0+			
<sup>109</sup> Cd		108.904985	462.0 d	EC/0.214		5/2+	-0.827846	+0.69	Ag k x-ray 0.08804
<sup>110</sup> Cd	12.49(18)	109.903006				0+			
<sup>111m</sup> Cd			48.5 m	I.T./		11/2-			Cd k x-ray 0.1508(IT) 0.2454
<sup>111</sup> Cd	12.80(12)	110.904182				1/2+	-0.594886		
<sup>112</sup> Cd	24.13(21)	111.902758				0+			
<sup>113m</sup> Cd			14.1 y	\$) /99.9 /0.59	0.59/99.9	11/2-	-1.087	-0.71	0.2637
<sup>113</sup> Cd	12.22(12)	112.904401	7.7x10 <sup>15</sup> y	\$-		1/2+	-0.622301		
<sup>114</sup> Cd	28.73(42)	113.903359				0+			
<sup>115m</sup> Cd			44.6 d	\$) /1.629	0.68/1.6 1.62/97	11/2-	-1.042	-0.54	0.48450 0.93381 1.29064

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>115</sup> Cd		114.905431	2.228 d	β /1.446	0.593/42 1.11/58	1/2+	-0.648426		0.23141 0.26085 0.33624 0.49227 0.52780
<sup>116</sup> Cd <sup>117m</sup> Cd	7.49(18)	115.904756	3.8×10 <sup>19</sup> y 3.4 h	β <sup>-</sup> β <sup>-</sup> /2.66	0.72/	0+ 11/2-			0.1586 0.5529 0.37 - 2.42 0.2209 0.2733 0.3445 1.3033
<sup>117</sup> Cd		116.907219	2.49 h	β /2.52	0.67/51 2.2/10	1/2+			0.1056 0.7208 1.0250 2.0213 0.1340 0.2929 0.3429
<sup>118</sup> Cd <sup>119m</sup> Cd		117.90692	50.3 m 2.20 m	β /0.52 β /		0+ 11/2-			0.1008 0.9878 1.0209 1.1815 2.0594 0.2102 0.3242 0.3492 1.0403
<sup>119</sup> Cd		118.90992	2.69 m	β /3.8	3.5/	1/2+			0.0365 0.0628 0.1799
<sup>120</sup> Cd <sup>121m</sup> Cd		119.90985	50.8 s 8. s	β /1.76 β /	1.5/	0+ 11/2-			0.0365 0.0628 0.1799
<sup>121</sup> Cd		120.9131	13.5 s	β /4.9		(3/2+)			0.2601
<sup>122</sup> Cd <sup>123m</sup> Cd <sup>123</sup> Cd <sup>124</sup> Cd		121.9135 122.91770 123.9177	5.3 s 1.9 s 2.09 s 1.24 s	β /3.0 β / β /6.12 β /4.17		0+ 3+ 0+			0.247 0.281
<sup>125m</sup> Cd <sup>125</sup> Cd <sup>126</sup> Cd <sup>127</sup> Cd <sup>128</sup> Cd <sup>129</sup> Cd <sup>130</sup> Cd		124.92129 125.9224 126.9264 127.9278 128.9323 129.9340	0.66 s 0.68 s 0.52 s 0.4 s 0.28 s 0.27 s 0.162 s	β / β /7.16 β /5.49 β /8.5 β /7.1 β /5.9 β /		3/+ 0+ 3/+ 0+			0.281
<sup>131</sup> Cd <sup>132</sup> Cd			68 ms 0.10 s	β <sup>-</sup> ,n β <sup>-</sup> ,n/	3.5 /60	0+			
<b><sup>49</sup>In</b>	<b>114.818(3)</b>								
<sup>98m</sup> In <sup>98</sup> In <sup>99</sup> In <sup>100</sup> In <sup>101</sup> In <sup>102</sup> In		97.9422 98.9346 99.9316 100.9266 101.9243	0.03 s 1. s 3.8 s 6. s 15. s 22. s	β / β /8.9 β <sup>+</sup> , (p) /10.5 β <sup>+</sup> /7.3 EC/8.9		(5)			0.1566 0.7767 (0.397-0.923)
<sup>103m</sup> In <sup>103</sup> In		102.91991	34. s 1.1 m	β <sup>+</sup> , EC/6.05 EC	4.2 /45	9/2+			ann.rad./ 0.1879 (0.157-3.98)
<sup>104m</sup> In <sup>104</sup> In		103.9183	16. s 1.84 m	IT/0.0935 β <sup>+</sup> , EC/7.9	4.8	5+	+4.44	+0.7	ann.rad./ 0.6580 0.8341 0.8781 In k x-ray 0.6740 0.1310 0.2600 0.6038 ann.rad./ 0.6326 0.8611 1.7164
<sup>105m</sup> In <sup>105</sup> In		104.91467	43. s 5.1 m	I.T. β <sup>+</sup> , EC/4.85	3.7	1/2- 9/2+		+0.83	0.6038 ann.rad./ 0.6326 0.8611 1.7164
<sup>106m</sup> In			5.3 m	β <sup>+</sup> /85 / EC/15 /	4.90	3+			0.6038 ann.rad./ 0.6326 0.8611 1.7164
<sup>106</sup> In		105.91346	6.2 m	β <sup>+</sup> /65 /6.52 EC/35 /	2.6	7+	+4.92	+0.97	ann.rad./ 0.2259 0.6327 0.8611 0.9978 1.0091 In k x-ray 0.6785
<sup>107m</sup> In <sup>107</sup> In		106.91029	51. s 32.4 m	I.T. /0.6786 β <sup>+</sup> /35 /3.43 E.C/65 /	2.20/	1/2- 9/2+		+0.81	ann.rad./ Cd k x-ray 0.2050 0.3209 0.5055 (0.2 - 2.99) ann.rad./ Cd k x-ray 0.6329 1.9863 3.4522
<sup>108m</sup> In <sup>108</sup> In		107.90971	57. m 40. m	β <sup>+</sup> /53 / EC/47 / β <sup>+</sup> /33 /5.15 EC/67 /	1.3 3.49/	6+ 3+	+4.94	+0.47 +1.01	ann.rad./ Cd k x-ray

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<sup>109m</sup> In			1.3 m	I.T./0.650		1/2-			0.2429 0.6331 0.8756
<sup>109</sup> In		108.90715	4.2 h	\$^+ /8 /2.02 EC/92 /	0.79/	9/2+	+5.54	+0.84	In k x-ray 0.6498 ann.rad./ Cd k x-ray 0.2035 0.6235
<sup>110m</sup> In			4.9 h	EC/		7+	+4.72	+1.00	Cd k x-ray 0.6577 0.8847 0.9375
<sup>110</sup> In		109.90717	1.15 h	\$^+ /62 /3.88 EC/38 /	2.22/	2+	+4.37	+0.35	(0.1 - 1.98) ann.rad./ Cd k x-ray 0.6577
<sup>111m</sup> In			7.7 m	I.T./0.537		1/2-	+5.53		(0.6 - 3.6) In k x-ray 0.537
<sup>111</sup> In		110.90511	2.8049 d	EC/0.866		9/2+	+5.50	+0.80	Cd k x-ray 0.1712 0.2453
<sup>112m</sup> In			20.8 m	I.T./0.155		4+			In k x-ray 0.1555
<sup>112</sup> In		111.90553	14.4 m	\$^+ /22 /2.586 EC/34 / \$) /0.663		1+	+2.82	+0.09	ann.rad./ Cd k x-ray 0.6171
<sup>113m</sup> In			1.658 h	I.T./0.3917		1/2-	-0.210		In k x-ray 0.3917
<sup>113</sup> In	4.29(5)	112.904062	49.51 d	I.T./97 /0.190 EC/3 /		9/2+	+5.529	+0.80	In k x-ray 0.19027
<sup>114m</sup> In						5+	+4.65	+0.74	Cd k x-ray 0.5584 0.5727 1.2998
<sup>114</sup> In		113.904918	1.198 m	\$) /97 /1.989 EC/3 /1.453	1.984/	1+	+2.82		In k x-ray 0.3362 0.4974
<sup>115m</sup> In			4.486 h	I.T./95 /0.336 \$) /5 /0.83		1/2-	-0.255		In k x-ray 0.3362 0.4974
<sup>115</sup> In	95.71(5)	114.903879	4.4x10 <sup>14</sup> y	\$) /0.495		9/2+	+5.541	+0.81	In k x-ray 0.1624
<sup>116m2</sup> In			2.16 s	I.T./0.162 EC	/0.023	8-	+3.22	+0.31	In k x-ray 0.13792 0.41688/27 1.09723/58.5 1.29349/85
<sup>116m1</sup> In			54.1 m	\$) /	1.0	5+	+4.43	+0.80	0.46313 1.2526 1.29349
<sup>116</sup> In		115.905261	14.1 s	\$) /3.274	3.3/99	1+	2.788	0.11	In k x-ray 0.15855 0.31531 0.55294 0.15855 0.3966 0.55294
<sup>117m</sup> In			1.94 h	\$) /53 /1.769 I.T./47 /	1.77/	1/2-	-0.2517		In k x-ray 0.15855 0.31531 0.55294
<sup>117</sup> In		116.90452	44. m	\$) /1.455	0.74/	9/2+	+5.52	+0.83	0.3966 0.55294
<sup>118m2</sup> In			8.5 s	I.T./98 / \$) /2 /		(8-)	+3.32	+0.44	In k x-ray 0.1382
<sup>118m1</sup> In			4.40 m	\$) /	1.3 2.0	5+	+4.23	+0.80	0.2086 0.6833 1.2295
<sup>118</sup> In		117.90636	5.0 s	\$) /4.42	4.2/	1+			0.5282 1.1734 1.2295 2.0432
<sup>119m</sup> In			17.9 m	\$) /97 / I.T./3 /0.311	2.7/	1/2-	-0.32		0.3114 0.7631
<sup>119</sup> In		118.90585	2.3 m	\$) /2.36	1.6/	9/2+	+5.52	+0.85	0.0239 0.6495 0.7631 1.2149
<sup>120m2</sup> In			47 s	\$^- /6.1		8-	+3.692	+0.53	1.171 1.023
<sup>120m1</sup> In			46. s	\$) /5.8	2.2/	5+	+4.30	+0.81	1.171 1.023
<sup>120</sup> In		119.90796	3.1 s	\$) /5.37	5.6/ 3.1/	(1+)			0.4146 0.5924 0.8637 1.0232 1.1714
<sup>121m</sup> In			3.8 m	\$) /99 / I.T./1 /0.313	3.7/	1/2-	-0.36		(0.4 - 2.7) 0.0601 0.3136 0.9256 1.0412 1.1022
<sup>121</sup> In		120.90785	23. s	\$) /3.36	2.5	9/2+	+5.50	+0.81	1.1204 0.2620 0.6573 0.9256
<sup>122m</sup> In			10. s	\$) /	4.4/	8-	+3.78	+0.59	1.0014 1.1403
<sup>122</sup> In		121.91028	1.5 s	\$) /6.37	5.3/	(1+)			0.2391 1.0014 1.1403 1.164
<sup>123m</sup> In			47. s	\$) /	4.6/	(1/2-)	-0.40		1.1903 0.1258





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<sup>113</sup> Sn		112.905174	115.1 d	EC/1.036		1/2+	-0.879		In k x-ray 0.25511 0.39169
<sup>114</sup> Sn	0.66(1)	113.902783				0+			
<sup>115</sup> Sn	0.34(1)	114.903347				1/2+	-0.9188		
<sup>116</sup> Sn	14.54(9)	115.901745				0+			
<sup>117m</sup> Sn			14.0 d	I.T./0.3146		11/2-	-1.396	-0.4	Sn k x-ray 0.15856
<sup>117</sup> Sn	7.68(7)	116.902955				1/2+	-1.0010		
<sup>118</sup> Sn	24.22(9)	117.901608				0+			
<sup>119m</sup> Sn			293. d	I.T./0.0896		11/2-	-1.4	0.21	Sn k x-ray 0.02387
<sup>119</sup> Sn	8.59(4)	118.903311				1/2+	-1.0473		
<sup>120</sup> Sn	32.58(9)	119.902199				0+			
<sup>121m</sup> Sn			44. y	I.T./78 /0.006 \$) /22 /	0.354/ 0.383/100	11/2-	-1.388	-0.14	Sn k x-ray 0.03715
<sup>121</sup> Sn		120.904239	1.128 d	\$) /0.388		3/2+	0.698	-0.02	
<sup>122</sup> Sn	4.63(3)	121.903441				0+			
<sup>123m</sup> Sn			40.1 m	\$) /1.428	1.26/99	3/2+			0.1603 0.3814
<sup>123</sup> Sn		122.905723	129.2 d	\$) /1.404	1.42/99.4	11/2-	-1.370	+0.03	0.1603 1.0302 1.0886
<sup>124</sup> Sn	5.79(5)	123.905275	>2.2x10 <sup>18</sup> y	\$- \$-		0+			0.3321 1.4040
<sup>125m</sup> Sn			9.51 m	\$) /2.387	2.03/98	3/2+			1.0671 1.0671
<sup>125</sup> Sn		124.907785	9.63 d	\$) /2.364	2.35/82	11/2-	-1.35	+0.1	(0.2-2.3) 0.0643 0.0876 0.4148 0.6663 0.6950 0.4909 1.3480 1.5640 0.8231 1.0956 (0.120-2.84)
<sup>126</sup> Sn		125.90765	2.34x10 <sup>5</sup> y	\$) /0.38	0.25/100	0+			0.4823 0.5573 0.6805 1.1611 0.6456 0.1449 0.8992 0.0700 0.1925 0.7798
<sup>127m</sup> Sn			4.15 m	\$) /3.21	2.72/	3/2+			0.3043 0.4500 0.7985 1.2260 (0.08-3.21) see <sup>131m</sup> Sn
<sup>127</sup> Sn		126.91035	2.12 h	\$) /3.20	2.42/ 3.2/	11/2-			0.0855 0.2467 0.3402 0.8985
<sup>128m</sup> Sn			6.5 s	IT/0.091		(7-)			
<sup>128</sup> Sn		127.91054	59.1 m	\$) /1.27	0.48/ 0.63/	0+			
<sup>129m</sup> Sn			6.9 m	\$) /		11/2-			
<sup>129</sup> Sn		128.9134	2.4 m	\$) /4.0		3/2+			
<sup>130m</sup> Sn			1.7 m	\$) /		(7-)			
<sup>130</sup> Sn		129.91386	3.7 m	\$) /2.15	1.10/	0+			
<sup>131m</sup> Sn			1.02 m	\$) /	3.4/	11/2-			
<sup>131</sup> Sn		130.9169	39. s	\$) /4.69	3.8/	3/2+			
<sup>132</sup> Sn		131.91775	40. s	\$) /3.12	1.8/				
<sup>133</sup> Sn		132.9236	1.44 s	\$) /7.8	7.5/	7/2-			
<sup>134</sup> Sn		133.9278	1.04 s	\$) /6.8					
<sup>135</sup> Sn		134.9347	0.53 s	\$-,n	/21.				0.282 0.733-1.855
<sup>136</sup> Sn		135.9393	0.25 s	\$-,n	/30.				
<sup>137</sup> Sn		136.946	0.19 s	\$-,n	/58				
<b><sup>51</sup>Sb</b>		<b>121.760(1)</b>							
<sup>103</sup> Sb		102.9401	>1.5 μs						
<sup>104</sup> Sb		103.9363	0.5 s						
<sup>105</sup> Sb		104.9315	1.1 s						
<sup>106</sup> Sb		105.9288	0.6 s	\$* /10.5					
<sup>107</sup> Sb		106.9242	4.0 s	\$* /7.9					1.280 0.1515 0.6666 0.553-2.046 (0.151-1.280)
<sup>108</sup> Sb		107.9222	7.0 s	\$* /9.5					
<sup>109</sup> Sb		108.91814	17.3 s	\$* /6.38 EC/	4.42/ 4.67/ 4.33/	5/2+			0.925 1.062 0.261-2.127 ann.rad./ 0.6365 0.9847 1.2117 1.2433
<sup>110</sup> Sb		109.9175	24. s	\$* /9.0 EC/	6.8/	3+			ann.rad./ 0.1002 0.1545 0.4891 1.0326
<sup>111</sup> Sb		110.91254	1.25 m	\$* /87 /4.47 EC/13 /	3.3/	5/2+			ann.rad./ 0.6700 0.9909 1.2571
<sup>112</sup> Sb		111.91240	51.4 s	\$* /90 /7.06 EC/10 /	4.75/	3+			(0.3-3.6) ann.rad./ Sn k x-ray 0.3324 0.4980
<sup>113</sup> Sb		112.90937	6.7 m	\$* /65 /3.91 EC/35 /	2.42/	5/2+			ann.rad./ Sn k x-ray 0.3324 0.4980
<sup>114</sup> Sb		113.9091	3.49 m	\$* /78 /5.9 EC/22 /	3.4/	3+	1.7		ann.rad./ Sn k x-ray

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>115</sup> Sb		114.90660	32.1 m	\$^+ /67 /3.03 EC/33 /	1.51/	5/2+	+3.46	-0.4	0.8876 1.2999 ann.rad./ Sn k x-ray
<sup>116m</sup> Sb			1.00 h	\$^+ /78 / EC/22 /	1.16/	8-	2.6		0.4973 ann.rad./ Sn k x-ray 0.4073 0.5429 0.9725 1.2935 (0.0998-1.501)
<sup>116</sup> Sb		115.90680	16. m	\$^+ /50 /4.707 EC/50 /	1.3/ 2.3/	3+	2.72		ann.rad./ Sn k x-ray 0.93180 1.29354 (0.138-3.903)
<sup>117</sup> Sb		116.90484	2.80 h	\$^+ /2 /1.76 EC/98 /	0.57/	5/2+	+3.4		Sn k x-ray 0.1586
<sup>118m</sup> Sb			5.00 h	EC/99 /		8-	2.3		Sn k x-ray 0.25368 1.05069 1.22964
<sup>118</sup> Sb		117.905533	3.6 m	\$^+ /74 /3.657 EC/26 /	2.65/	1+	2.5		ann.rad./ Sn k x-ray 1.22964
<sup>119</sup> Sb		118.90395	38.1 h	EC/0.59		5/2+	+3.45	-0.4	Sn k x-ray 0.0239
<sup>120m</sup> Sb			5.76 d	EC/		8-	2.34		Sn k x-ray 0.0898 0.19730 1.02301 1.17121
<sup>120</sup> Sb		119.90508	15.89 m	\$^+ /41 /2.68 EC/59 /	1.72/	1+	+2.3		ann.rad./ Sn k x-ray 0.7038 1.17121
<sup>121</sup> Sb <sup>122m</sup> Sb	57.21(5)	120.903822	4.19 m	I.T./0.162		5/2+ 8-	+3.363	-0.4	Sb x-ray 0.0614 0.0761
<sup>122</sup> Sb		121.90518	2.72 d	\$) /98 /1.979 \$^+ /2 /1.620	1.414/65 1.980/26	2-	-1.90	+0.9	0.56409 0.69277 1.14050 1.2569
<sup>123</sup> Sb <sup>124m2</sup> Sb <sup>124m1</sup> Sb	42.79(5)	122.904216	20.3 m 1.6 m	I.T./0.035 I.T./80 / \$) /20 /	1.2/ 1.7/	7/2+ 8- 5+	+2.550	-0.5	0.4984 0.6027 0.6458 1.1010
<sup>124</sup> Sb		123.905938	60.20 d	\$) /2.905	0.61/52 2.301/23	3-	1.2	+1.9	0.60271/97.8 0.64583/7.4 0.72277/10.5 1.69094/48.2 (0.0274-2.808)
<sup>125</sup> Sb		124.905247	2.758 y	\$) /0.767	0.13/30 0.302/45 0.62/13	7/2+	+2.63		0.0355 0.17632 0.38044 0.42786 0.46336 0.60060 0.63595 L x-ray 0.0227
<sup>126m2</sup> Sb <sup>126m1</sup> Sb			11. s 19.0 m	I.T./ \$) /86 / I.T./14 /	1.9	3- 5+			0.4148 0.6663 0.6950 0.2786
<sup>126</sup> Sb		125.90725	12.4 d	\$) /3.67	1.9	8-	1.3		0.4148/83.3 0.6663/99.7 0.6950/99 0.7205 0.2524 0.2908 0.4121 0.4370 0.6857 0.7837 0.3140 0.5941 0.7432 0.7539
<sup>127</sup> Sb		126.906914	3.84 d	\$) /1.581	0.89/ 1.10/ 1.50/	7/2+	2.70		0.2148 0.3141 0.5265 0.7433 0.7540 0.4338 0.6578 0.7598 0.0278 0.1808 0.3594 0.4596 0.5447 0.8128 0.9146 1.0301
<sup>128m</sup> Sb <sup>128</sup> Sb			10.1 m 9.1 h	\$) /96 / I.T./4 / \$) /4.38	2.6/ 2.3/	5+ 8-		1.3	0.3141 0.5265 0.7433 0.7540 0.4338 0.6578 0.7598 0.0278 0.1808 0.3594 0.4596 0.5447 0.8128 0.9146 1.0301
<sup>129m</sup> Sb <sup>129</sup> Sb			17.7 m 4.40 h	\$) / \$) /2.38	0.65/	7/2- 7/2-	2.82		0.1023 0.7934 0.8394
<sup>130m</sup> Sb			6.5 m	\$) /2.6	2.12/				

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>130</sup> Sb		129.91155	38.4 m	β <sup>-</sup> /4.96	2.9/	8-			0.1823 0.3309 0.4680 0.7394 0.8394
<sup>131</sup> Sb		130.9120	23.0 m	β <sup>-</sup> /3.20	1.31/ 3.0/	7/2+			0.6423 0.6579 0.9331 0.9434
<sup>132m</sup> Sb			2.8 m	β <sup>-</sup> /	3.9/	4+			0.1034 0.3538 0.6968 0.9739
<sup>132</sup> Sb		131.91420	4.2 m	β <sup>-</sup> /5.49		8-			0.9896 0.1034 0.1506 0.6968 0.9739
<sup>133</sup> Sb		132.9152	2.5 m	β <sup>-</sup> /4.00	1.20/	7/2+	3.00		0.4235 0.6318 0.8165 1.0764
<sup>134m</sup> Sb			10.4 s	β <sup>-</sup> /	6.1	7-			
<sup>134</sup> Sb		133.9206	0.8 s	β <sup>-</sup> /8.4	8.4	0-			0.1152 0.2970 0.7063 1.2791 1.127 1.279
<sup>135</sup> Sb		134.9252	1.71 s	β <sup>-</sup> /8.12		7/2+			
<sup>136</sup> Sb		135.9301	0.82 s	β <sup>-</sup> /9.3					
<sup>137</sup> Sb		136.9353	>0.15 μs						
<sup>138</sup> Sb		137.9410	>0.15 μs						
<sup>139</sup> Sb		138.946	>0.15 μs						
<b><sup>52</sup>Te</b>		<b>127.60(3)</b>							
<sup>106m</sup> Te		105.9377	0.06 ms	" /4.32	/100				
<sup>107</sup> Te		106.9350	3.1 ms	" / 70/	3.86(1)/				
<sup>108</sup> Te		107.9295	2.1 s	β <sup>+</sup> , EC/10.1		0+			
<sup>109</sup> Te		108.9275	4.6 s	" /68 /	3.314(4)/				
<sup>110</sup> Te		109.9224	19. s	β <sup>+</sup> , EC/32 /6.8					0.7523 0.287-2.045 ann. rad. / 0.2191 0.6059
<sup>111</sup> Te		110.9211	19.3 s	β <sup>+</sup> , EC/4.5	3.107(4)/	0+			ann. rad. / 0.267 0.322 0.341
<sup>112</sup> Te		111.9171	2.0 m	β <sup>+</sup> , EC/8.0		(7/2+)			ann. rad. / 0.2962 0.3727 0.4187
<sup>113</sup> Te		112.9154	1.7 s	β <sup>+</sup> , EC/15 /	4.5/	(7/2+)			ann. rad. / Sb k x-ray 0.8144 1.0181 1.1812
<sup>114</sup> Te		113.9125	15. m	β <sup>+</sup> /40 /3.2		0+			ann. rad. / Sb k x-ray 0.0838 0.0903
<sup>115m</sup> Te			6.7 m	β <sup>+</sup> /45 /		(1/2+)			ann. rad. / Sb k x-ray 0.7236 0.7704
<sup>115</sup> Te		114.9116	5.8 m	β <sup>+</sup> , EC/55 /	2.7/	7/2+			ann. rad. / Sb k x-ray 0.7236 1.3268 1.3806
<sup>116</sup> Te		115.9084	2.49 h	EC/1.5		0+			(0.22 - 2.7) Sb k x-ray 0.0937
<sup>117</sup> Te		116.90864	1.03 h	EC/75 /3.54	1.78/	1/2+			ann. rad. / Sb k x-ray 0.9197 1.7164 2.3000
<sup>118m</sup> Te			6.00 d	EC/0.28		0+			Sb k x-ray
<sup>118m</sup> Te			4.69 d	EC/		11/2-	0.89		Sb k x-ray 0.15360 0.2705
<sup>119</sup> Te		118.90641	16.0 h	β <sup>+</sup> /2 /2.293	0.627/	1/2+	0.25		1.21271 ann. rad. Sb k x-ray 0.6440 0.6998
<sup>120</sup> Te	0.09(1)	119.90403				0+			
<sup>121m</sup> Te			154. d	I.T. (89%)		11/2-	0.90		Te k x-ray 0.2122
<sup>121</sup> Te		120.90494	16.8 d	EC(11%)		1/2+			Sb k x-ray 0.5076 0.5731
<sup>122</sup> Te	2.55(12)	121.903056				0+			
<sup>123m</sup> Te			119.7 d	I.T. /0.247		11/2-	-0.93		Te k x-ray 0.1590/84.1
<sup>123</sup> Te	0.89(3)	122.904271				1/2+	-0.73695		
<sup>124</sup> Te	4.74(14)	123.902819				0+			
<sup>125m</sup> Te			58. d	I.T. /0.145		11/2-	-0.99	-0.06	Te k x-ray 0.0355

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<sup>125</sup> Te	7.07(15)	124.904424				1/2+	-0.8885		
<sup>126</sup> Te	18.84(25)	125.903305				0+			
<sup>127m</sup> Te			109. d	I.T./98 /0.088		11/2-	-1.04		Te k x-ray 0.0883
<sup>127</sup> Te		126.905217	9.4 h	\$ /2 /0.77	0.696/	3/2+	0.64		0.3603
<sup>128</sup> Te	31.74(8)	127.904462	2.2x10 <sup>24</sup> y	\$ \$		0+			
<sup>129m</sup> Te			33.6 d	I.T./63 /0.105	1.60/	11/2-	-1.09		Te k x-ray 0.45984
<sup>129</sup> Te		128.906596	1.16 h	\$ /1.498	0.99/9 1.45/89	3/2+	0.70	0.06	0.6959 0.0278 0.45984 0.48728
<sup>130</sup> Te	34.08(62)	129.906223	8x10 <sup>20</sup> y	\$ \$-		0+			0.0811
<sup>131m</sup> Te			1.35 d	I.T./78 /2.4	0.42/	11/2-	-1.04		0.1021 0.14973 0.77369 0.79375 0.85225
<sup>131</sup> Te		130.908522	25.0 m	\$ /2.233	1.35/12 1.69/22 2.14/60	3/2+	0.70		0.14973 0.45327 0.49269 0.049725 0.11198 0.22830
<sup>132</sup> Te		131.90852	3.26 d	\$ /0.51	0.215	0+			0.0949 0.1689 0.3121 0.3341
<sup>133m</sup> Te			55.4 m	I.T./82 /	2.4/30	11/2-			Te k x-ray 0.0949 0.1689 0.3121 0.3341
<sup>133</sup> Te		132.9109	12.4 m	\$ /2.94	2.25/25 2.65	3/2+			0.3121 0.4079 1.3334
<sup>134</sup> Te		133.9116	42. m	\$ /1.51	0.6/ 0.7/	0+			0.7672/29 0.0794-0.9255
<sup>135</sup> Te		134.9165	19.0 s	\$ /6.0	5.4/ 6.0				0.267 0.603 0.870
<sup>136</sup> Te		135.92010	17.5 s	\$ /5.1	2.5/	0+			2.0779/25 0.0873-3.235 0.2436
<sup>137</sup> Te		136.9253	2.5 s	\$ /98 /6.9	6.8	7/2-			
<sup>138</sup> Te		137.9292	1.4 s	n/2 /					
<sup>139</sup> Te		138.9347	>0.15 μs	\$ /6.4					
<sup>140</sup> Te		139.9387	>0.15 μs						
<sup>141</sup> Te		140.9444	>0.15 μs						
<sup>142</sup> Te		141.949	>0.15 μs						
<b><sup>53</sup>I</b>	<b>126.90447(3)</b>								
<sup>108</sup> I		107.9436	0.04 s	" /91 /4.	3.95				0.593/100
<sup>109</sup> I		108.9382	0.11 ms	p					0.717/63 0.496-1.057 ann.rad./
<sup>110</sup> I		109.9346	0.65 s	\$ <sup>+</sup> , EC/83 /11.4	3.457(10)/				ann.rad./
<sup>111</sup> I		110.9303	2.5 s	" /17 /3.6 p /11 / \$ <sup>+</sup> , E.. /8.5					0.2665 0.3215 0.3412 ann.rad./
<sup>112</sup> I		111.9280	3.4 s	\$ <sup>+</sup> , EC/10.2					0.6889 0.7869 ann.rad./
<sup>113</sup> I		112.9237	5.9 s	\$ <sup>+</sup> , EC/7.6					0.4625/100 0.6224/74 0.0550-1.422 ann.rad./
<sup>114</sup> I		113.9219	2.1 s	\$ <sup>+</sup> , EC/8.7					0.6826 0.7088 ann.rad./
<sup>115</sup> I		114.9188	1.3 m	\$ <sup>+</sup> , EC/6.7		5/2+			0.275 0.284 0.460 0.709 ann.rad./
<sup>116</sup> I		115.9167	2.9 s	\$ <sup>+</sup> /97 /7.8 EC/3 /	6.7/	1+			0.5402 0.6789 ann.rad./
<sup>117</sup> I		116.9136	2.22 m	\$ <sup>+</sup> , EC/4.7	3.2/	(5/2+)	3.1		0.2744 0.3259 ann.rad./
<sup>118m</sup> I			8.5 m	\$ <sup>+</sup> , EC/ I.T.	4.9/	7-	4.2		0.104 0.5998 0.6052 0.6138 ann.rad./
<sup>118</sup> I		117.9134	14. m	\$ <sup>+</sup> , EC/7.0		2-	2.0		0.5448 0.6052 1.3384 ann.rad./
<sup>119</sup> I		118.9102	19. m	\$ <sup>+</sup> /54 /3.5 EC/46 /	2.4/	(5/2+)	+2.9		Te k x-ray 0.2575 ann.rad./
<sup>120m</sup> I			53. m	\$ <sup>+</sup> /80 / EC/20 /	3.8		4.2		0.4257 0.5604 0.6147 1.3459

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<sup>120</sup> I		119.91005	1.35 h	\$* /56/5.62 EC/	4.03 4.60	2-	1.23		ann.rad./ Te k x-ray 0.5604 0.6411 1.5230 (0.43 - 3.1)
<sup>121</sup> I		120.90737	2.12 h	\$* /13 /2.27 EC/87 /	1.2/	5/2+	2.3		ann.rad./ Te k x-ray 0.2122 (0.14 - 1.1)
<sup>122</sup> I		121.90760	3.6 m	\$* /4.234 EC/	3.1/	1+	+0.94		ann.rad./ Te k x-ray 0.5641
<sup>123</sup> I		122.905605	13.2 h	EC/1.242		5/2+	2.82		Te k x-ray 0.1590
<sup>124</sup> I		123.906211	4.18 d	\$* /23 /3.160 EC/77 /	1.54/ 2.14/ 0.75/	2-	1.44		ann.rad./ Te k x-ray 0.6027/62.9 0.7228/10.3 1.6910/11.2 (0.31-1.73)
<sup>125</sup> I		124.904624	59.4 d	EC/0.1861		5/2+	2.82	-0.89	Te k x-ray 0.0355
<sup>126</sup> I		125.905619	13.0 d	EC/ \$* /2.155 \$/1.258/47	1.13/ 0.87/ 1.25/	2-	1.44		ann.rad./ Te k x-ray 0.3887 0.6622
<sup>127</sup> I	100.	126.904468				5/2+	+2.8133	-0.79	
<sup>128</sup> I		127.905805	25.00 m	\$) /2.118 EC/1.251	2.13/	1+			
<sup>129</sup> I		128.904988	1.7x10 <sup>7</sup> y	\$) /0.194	0.15/	7/2+	+2.621	-0.55	Xe k x-ray 0.0396
<sup>130m</sup> I			9.0 m	I.T./83 /0.048		2+			I k x-ray 0.5361
<sup>130</sup> I		129.906674	12.36 h	\$) /17 / \$/2.949	1.04/ 0.62	5+	3.35		0.4180 0.5361 0.6685 0.7395
<sup>131</sup> I		130.906125	8.021 d	\$) /0.971	0.606/	7/2+	+2.742	-0.40	0.08017 0.28431 0.36446 0.63699
<sup>132m</sup> I			1.39 h	IT		8-			
<sup>132</sup> I		131.90800	2.28 h	\$) /14 /3.58 I.T./86 /	0.80/ 1.03/ 1.2/ 1.6/ 2.16/	4+	3.09	0.09	I k x-ray 0.0980 0.5059 0.52264 0.63019 0.6506 0.66768 0.77260 0.95457
<sup>133m</sup> I			9. s	I.T./1.63		19/2-			I kx-ray 0.0730 0.6474 0.9126
<sup>133</sup> I		132.90781	20.8 h	\$) /1.77	1.24/85	7/2+	+2.86	-0.27	0.51056 0.52989 0.87537
<sup>134m</sup> I			3.7 m	I.T./98 /0.316 \$/2 /		8-			I k x-ray 0.0444 0.2719 0.1354
<sup>134</sup> I		133.9099	52.6 m	\$) /4.05	1.2/	4+			0.84702 0.88409
<sup>135</sup> I		134.91005	6.57 h	\$) /2.63	0.9/ 1.3/	7/2+	2.94		0.2884 0.41768 0.52658 1.13156 1.26046
<sup>136m</sup> I			47. s	\$) /	4.7/ 5.2/	6-			0.1973 0.3468 0.3701 0.3814 1.3130
<sup>136</sup> I		135.91466	1.39 m	\$) /6.93	4.3/ 5.6/	2-			(0.16 - 2.36) 0.3447 1.3130 1.3211 2.2896 (0.3 - 6.1)
<sup>137</sup> I		136.91787	24.5 s	\$) /5.88	5.0/	(7/2+)			0.6010 1.2180 1.2201 1.3026 1.5343
<sup>138</sup> I		137.9224	6.5 s	\$) /7.8	6.9/ 7.4/	2-			(0.25 - 4.4) 0.4836 0.5888 0.8752
<sup>139</sup> I		138.92609	2.30 s	\$) /6.81 n/					(0.4 - 5.3) 0.192 0.198 0.273 0.382 0.386 0.468 0.683 1.313

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>140</sup> I		139.9310	0.86 s	\$) /8.8 n/		(3)			0.372 0.377 0.457
<sup>141</sup> I		140.9351	0.45 s	\$) /7.8					
<sup>142</sup> I		141.9402	0.2 s	\$)					
<sup>143</sup> I		142.9441	>0.15 μs						
<sup>144</sup> I		143.9496	>0.15 μs						
<b><sup>54</sup>Xe</b>		<b>131.293(6)</b>							
<sup>110</sup> Xe		109.9445	0.2 s	\$ <sup>+</sup> /9.2					
<sup>111m</sup> Xe			0.9 s	EC, \$ <sup>+</sup>	/ . 64				
<sup>111</sup> Xe		110.9416	0.7 s	EC, \$ <sup>+</sup> /10.6					
<sup>112</sup> Xe		111.9357	3. s	EC, \$ <sup>+</sup> /7.2 "	3.58(1) / 0.8 /				
<sup>113</sup> Xe		112.9334	2.8 s	EC, \$ <sup>+</sup> /9.1					
<sup>114</sup> Xe		113.9281	10.0 s	\$ <sup>+</sup> , EC/5.9		0+			ann.rad./ 0.1031 0.1616 0.3085 0.6826 0.7088
<sup>115</sup> Xe		114.9270	18. s	\$ <sup>+</sup> , EC/7.6		(5/2+)			ann.rad./
<sup>116</sup> Xe		115.9214	56. s	\$ <sup>+</sup> , EC/4.3	3.3/	0+			ann.rad./ 0.1042 0.1916 0.2477 0.3107 0.4127
<sup>117</sup> Xe		116.9206	1.02 m	\$ <sup>+</sup> , EC/6.5		(5/2+)	-0.594	+1.16	ann.rad./ 0.2214 0.5190 0.6389 0.6613
<sup>118</sup> Xe		117.917	4. m	\$ <sup>+</sup> , EC/3.	2.7/	0+			ann.rad./ 0.0535 0.0600 0.1199
<sup>119</sup> Xe		118.9156	5.8 m	\$ <sup>+</sup> , EC/5.0	3.5/	7/2+	-0.654	+1.31	0.0873 0.1000 0.2318 0.4615
<sup>120</sup> Xe		119.91216	40. m	\$ <sup>+</sup> , EC/97/1.96 \$ <sup>+</sup> /3 /		0+			I k x-ray 0.0251 0.0726 0.1781
<sup>121</sup> Xe		120.91138	39. m	\$ <sup>+</sup> /44 /3.73 EC/56 /	2.8/	5/2+	-0.701	+1.33	(0.1 - 1.03) ann.rad./ I k x-ray 0.1328 0.2527 0.4452
<sup>122</sup> Xe		121.9086	20.1 h	EC/0.9		0+			(0.1 - 3.1) I k x-ray 0.3501
<sup>123</sup> Xe		122.90848	2.00 h	\$ <sup>+</sup> /23 /2.68 EC/77 /	1.51/	1/2+	-0.150		ann.rad./ I k x-ray 0.1489 0.1781 (0.1 - 2.1)
<sup>124</sup> Xe	0.0953(27)	123.905895	> 10 <sup>17</sup> y	\$ \$ <sup>-</sup>					Xe k x-ray
<sup>125m</sup> Xe			57. s	I.T./0.252		(9/2-)	-0.745	+0.42	0.1111 0.141
<sup>125</sup> Xe		124.906398	17.1 h	EC/1.653	0.47/	1/2+	-0.269		I k x-ray 0.1884 0.2434
<sup>126</sup> Xe	0.0890(14)	125.90427	1.15 m	I.T./0.297		0+ (9/2-)	-0.884	+0.69	Xe k x-ray 0.1246 0.1725
<sup>127</sup> Xe		126.905179	36.34 d	EC/0.662		1/2+	-0.504		I k x-ray 0.1721 0.2029 0.3750
<sup>128</sup> Xe	1.910(22)	127.903531	8.89 d	I.T./0.236		0+ 11/2-	-0.891	+0.64	Xe k x-ray 0.0396 0.1966
<sup>129</sup> Xe	26.40(18)	128.904780				1/2+	-0.7780		
<sup>130</sup> Xe	4.071(53)	129.903509				0+ 11/2-	-0.9940	+0.73	Xe k x-ray 0.16398
<sup>131m</sup> Xe			11.9 d	I.T./0.164					
<sup>131</sup> Xe	21.233(62)	130.905083				3/2+	+0.69186	-0.12	
<sup>132</sup> Xe	26.9087(680)	131.904155				0+ 11/2-	-1.082	+0.77	Xe k x-ray 0.23325
<sup>133m</sup> Xe			2.19 d	I.T./0.233					Cs k x-ray 0.080998 0.1606
<sup>133</sup> Xe		132.905906	5.243 d	\$) /0.427	0.346/99	3/2+	+0.813	+0.14	
<sup>134</sup> Xe	10.436(29)	133.905395	>1.1x10 <sup>16</sup> Y	\$ \$ <sup>-</sup>		0+ 11/2-	1.103	+0.62	Xe k x-ray 0.52658 0.24975 0.60807
<sup>135m</sup> Xe			15.3 m	I.T./					
<sup>135</sup> Xe		134.90721	9.10 h	\$) /1.15	0.91/	3/2+	0.903	+0.21	
<sup>136</sup> Xe	8.858(33)	135.90722	>0.8x10 <sup>21</sup> Y	\$ \$ <sup>-</sup>		0+ 7/2-	-0.970	-0.49	0.45549 0.8489 0.9822 1.2732 1.7834
<sup>137</sup> Xe		136.91156	3.82 m	\$) /4.17	4.1/ 3.6/				

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<sup>138</sup> Xe		137.91399	14.1 m	\$) /2.77	0.8/ 2.4/	0+			2.8498 0.1538 0.2426 0.2583 0.4345 1.76826 2.0158
<sup>139</sup> Xe		138.91879	39.7 s	\$) /5.06	4.5/ 5.0/		-0.304	+0.40	0.1750 0.2186 0.2965 (0.1 - 3.37)
<sup>140</sup> Xe		139.9216	13.6 s	\$) /4.1	2.6	0+			0.0801 0.6220 0.8055 1.4137 (0.04 - 2.3)
<sup>141</sup> Xe		140.9267	1.72 s	\$) /6.2	6.2/	5/2+	+0.010	-0.58	0.1187 0.9095 (0.05 - 2.55)
<sup>142</sup> Xe		141.9297	1.22 s	\$) /5.0	3.7/ 4.2/	0+			0.0338 0.0729 0.2038 0.3091 0.4145 0.5382 0.5718 0.6181 0.6448
<sup>143m</sup> Xe			0.96 s	\$)					
<sup>143</sup> Xe		142.9352	0.30 s	\$) /7.3			-0.460	+0.93	
<sup>144</sup> Xe		143.9385	1.2 s	\$) /6.1					
<sup>145</sup> Xe		144.9437	0.9 s	\$) , (n)					
<sup>146</sup> Xe		145.9473	>0.15 μs						
<sup>147</sup> Xe		146.9530	>0.15 μs						
<b><sup>55</sup>Cs</b>		<b>132.90545(2)</b>							
<sup>112</sup> Cs		111.9503	0.5 ms	p	0.81				
<sup>113</sup> Cs		112.9445	17. s	p	0.96				
<sup>114</sup> Cs		113.9408	0.58 s	\$ <sup>+</sup> ,EC/11.8		1+			ann.rad./ 0.6826 0.7088
<sup>115</sup> Cs		114.9359	1.4 s	\$ <sup>+</sup> ,EC/8.4					ann.rad./
<sup>116m</sup> Cs			0.7 s	\$ <sup>+</sup> ,EC/					ann.rad./ 0.3935
<sup>116</sup> Cs		115.9330	3.8 s	\$ <sup>+</sup> ,EC/10.8					ann.rad./ 0.3935 0.5243 0.6151 0.6223
<sup>117m</sup> Cs			6.5 s	\$ <sup>+</sup> ,EC/					
<sup>117</sup> Cs		116.9286	8.4 s	\$ <sup>+</sup> ,EC/7.5					ann.rad./
<sup>118m</sup> Cs			17. s	\$ <sup>+</sup> ,EC/			5.		
<sup>118</sup> Cs		117.92654	14. s	\$ <sup>+</sup> ,EC/9.		2	+3.88	+1.4	ann.rad./ 0.3372 0.4727 0.5865 0.5906
<sup>119m</sup> Cs			29. s			3/2	+0.84	+0.9	
<sup>119</sup> Cs		118.92234	43. s	\$ <sup>+</sup> ,EC/6.3		9/2+	+5.5	+2.8	ann.rad./ 0.169 0.176 0.224 0.257
<sup>120m</sup> Cs			60. s	\$ <sup>+</sup> ,EC/					
<sup>120</sup> Cs		119.92066	64. s	\$ <sup>+</sup> ,EC/7.92		2+	+3.87	+1.45	ann.rad./ 0.3224 0.4735 0.5534 (0.3 - 3.28)
<sup>121m</sup> Cs			2.0 m	I.T./60 / \$ <sup>+</sup> /40 /	4.4	(9/2+)	+5.41	+2.7	ann.rad./ 0.1794 0.1961
<sup>121</sup> Cs		120.91718	2.3 m	\$ <sup>+</sup> ,EC/5.40	4.38/	3/2+	+0.77	+0.84	ann.rad./ 0.1537 (0.08 - 0.56)
<sup>122m2</sup> Cs			4.4 m	\$ <sup>+</sup> ,EC		8-	+4.77	+3.3	ann.rad./
<sup>122m1</sup> Cs			0.36 s	IT					0.3311 0.4971 0.6385 (0.27 - 2.22)
<sup>122</sup> Cs		121.91614	21. s	\$ <sup>+</sup> ,EC/7.1	5.8/	(1+)	-0.133	-0.19	ann.rad./ 0.3311 0.5120 0.8179
<sup>123m</sup> Cs			1.6 s	I.T./		11/2-			Cs k x-ray 0.0946
<sup>123</sup> Cs		122.91299	5.87 m	\$ <sup>+</sup> /75 /4.20 EC/25 /	3.0/	1/2+	+1.38		ann.rad./ Xe k x-ray 0.0974 0.5964
<sup>124m</sup> Cs			6.3 s	IT		7+			
<sup>124</sup> Cs		123.91225	30. s	\$ <sup>+</sup> /92 /5.92 EC/8 /	5.	1+	+0.673	-0.74	ann.rad./ Xe k x-ray 0.3539 0.4925 0.9418
<sup>125</sup> Cs		124.90972	45. m	\$ <sup>+</sup> /40 /3.09 EC/60 /	2.06/	1/2+	+1.41		ann.rad./ Xe k x-ray 0.112 0.526



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<sup>126</sup> Cs		125.90945	1.64 m.	\$^+ /81 /4.83 EC/19 /	3.4 3.7/	1+	+0.78	-0.68	ann.rad./ Xe k x-ray 0.3886 0.4912 0.9252
<sup>127</sup> Cs		126.90741	6.2 h	\$^+ /96 /2.08 EC/4 /	0.65/ 1.06	1/2+	+1.46		Xe k x-ray 0.1247 0.4119
<sup>128</sup> Cs		127.90775	3.62 m	\$^+ /68 /3.930 EC/32 /	2.44/ 2.88/	1+	+0.97	-0.57	ann.rad./ Xe k x-ray 0.4429 0.3719 0.4115
<sup>129</sup> Cs		128.90606	1.336 d	EC/1.195		1/2+	+1.49		Xe k x-ray 0.3719 0.4115
<sup>130m</sup> Cs <sup>130</sup> Cs		129.90671	3.5 m 29.21 m	IT,\$^+ ,EC \$^+ /55 /2.98 EC/43 / \$) /1.6 /0.37	1.98/ 0.44/1.6	5- 1+	+0.629 +1.46	+1.45 -0.06	ann.rad./ Xe k x-ray 0.5361
<sup>131</sup> Cs <sup>132</sup> Cs		130.90546 131.906430	9.69 d 6.48 d	EC/0.352 EC/98 / \$^+ /0.3 /2.120 \$) / /1.280		5/2+ 2-	+3.54 +2.22	-0.58 +0.51	Xe k x-ray Xe k x-ray 0.4646 0.6302 0.66769
<sup>133</sup> Cs <sup>134m</sup> Cs	100.	132.905447	2.91 h	I.T./0.139		7/2+ 8-	+2.582 +1.098	-0.0037 +1.0	Cs k x-ray 0.12749
<sup>134</sup> Cs		133.906714	2.065 y	\$) /2.059 EC/1.22	0.089/27 0.658/70	4+	+2.994	+0.39	0.56327 0.56935 0.60473 0.79584 0.7869 0.8402
<sup>135m</sup> Cs			53. m	I.T./1.627		19/2-	+2.18	+0.9	
<sup>135</sup> Cs <sup>136m</sup> Cs <sup>136</sup> Cs		134.905972	2.3x10 <sup>6</sup> y 19. s 13.16 d	\$) /0.269 I.T./ \$) /2.548	0.205/100	7/2+ 8 5+	+2.732 +1.32 +3.71	+0.05 +0.7 +0.2	0.06691 0.34057 0.81850 1.04807
<sup>137</sup> Cs		136.907085	30.2 y	\$) /1.176	0.514/95	7/2+	+2.84	+0.05	Ba k x-ray 0.66164
<sup>138m</sup> Cs			2.9 m	I.T./75 /0.080 \$) /25 /	3.3	6-	+1.71	-0.40	Cs k x-ray 0.0799 0.1917 0.4628 1.43579 0.1381 0.46269 1.00969 1.43579 2.21788 0.6272 1.2832 (0.4 - 3.66)
<sup>138</sup> Cs		137.91101	32.2 m	\$) /5.37	2.9/	3-	+0.700	+0.12	0.5283 0.6023 0.9084 (0.41 - 3.94)
<sup>139</sup> Cs		138.913359	9.3 m	\$) /4.213	4.21	7/2+	+2.70	-0.07	Ba k x-ray 0.0485 0.5616 0.5887 1.1940 (0.05 - 3.33)
<sup>140</sup> Cs		139.91727	1.06 m	\$) /6.22	5.7/ 6.21/	1-	+0.13390	-0.11	0.3596 0.9668 1.1759 1.3265 0.1955 0.2324 0.3064 (0.17 - 1.98)
<sup>141</sup> Cs		140.92005	24.9 s	\$) /5.26	5.20/	7/2+	+2.44	-0.4	0.1993 0.5598 0.6392 0.7587 0.1126 0.1755 0.1990
<sup>142</sup> Cs		141.92430	1.8 s	\$) /7.31	6.9/ 7.28				
<sup>143</sup> Cs		142.92732	1.78 s	\$) /6.24	6.1	(3/2+)	+0.87	+0.47	
<sup>144</sup> Cs		143.93203	1.01 s	\$) /8.47	8.46/ 7.9/	1	-0.546	+0.30	
<sup>145</sup> Cs		144.93541	0.59 s	\$) /7.89	7.4/ 7.9/	3/2+	+0.784	+0.6	
<sup>146</sup> Cs <sup>147</sup> Cs <sup>148</sup> Cs <sup>149</sup> Cs <sup>150</sup> Cs <sup>151</sup> Cs		145.94024 146.9439 147.9490 148.9527 149.9580 150.9620	0.322 s 0.227 s 0.15 s > 50 ms > 50 ms > 50 ms	\$) ,(n)/9.38 \$) ,(n)/9.3 \$) ,(n)/10.5	9.0	2-	-0.515	+0.22	
<b><sup>56</sup>Ba</b>		<b>137.327(7)</b>							
<sup>114</sup> Ba		113.9509	0.43 s	\$^+ ,(p)	p/20 /0.9				
<sup>115</sup> Ba <sup>116</sup> Ba <sup>117</sup> Ba <sup>118</sup> Ba <sup>119</sup> Ba <sup>120</sup> Ba		114.948 115.9417 116.9377 117.9466 118.931 119.9260	0.45 s 1.3 s 1.8 s 5.2 s 5.4 s 24. s	\$^+ ,(p) \$^+ ,(p) \$^+ ,(p),EC/8.4 \$^+ , \$^+ ,EC/8. \$^+ ,EC/5.0	p/<15 p/3 p/13	(3/2-)			(0.0457-0.364) (0.040-0.156)
<sup>121</sup> Ba <sup>122</sup> Ba <sup>123</sup> Ba		120.9245 121.9203 122.9189	30. s 2.0 m 2.7 m	\$^+ ,EC/6.8 \$^+ ,EC/3.8 \$^+ ,EC/5.5		5/2 0+	+0.660 -0.68	+1.8 +1.5	ann.rad./ 0.140 (0.075-0.146) ann.rad./ ann.rad./ ann.rad./

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<sup>124</sup> Ba		123.91509	12. m	\$ <sup>+</sup> , EC/2.65					0.0306 0.0927 0.1161 0.1235 ann.rad./ 0.1695 0.1888 1.2160
<sup>125m</sup> Ba <sup>125</sup> Ba		124.9146	8. m 3.5 m	\$ <sup>+</sup> , EC/ \$ <sup>+</sup> , EC/4.6	4.5 3.4	1/2+	0.174 +0.18		ann.rad./ 0.0550 0.0776 0.0854 0.1409 Cs k x-ray 0.2179 0.2336 0.2576
<sup>126</sup> Ba		125.91124	1.65 h	\$ <sup>+</sup> /2 /1.67 EC/98 /		0+			ann.rad./ 0.0550 0.0776 0.0854 0.1409 Cs k x-ray 0.2179 0.2336 0.2576
<sup>127m</sup> Ba <sup>127</sup> Ba		126.9111	1.9 s 12.9 m	IT \$ <sup>+</sup> /54 /3.5 EC/46 /		7/2- 1/2+	-0.723 +0.083	1.6	ann.rad./ Cs k x-ray 0.1148 0.1808 (0.07 - 2.5) Cs k x-ray 0.27344 Cs k x-ray 0.1769 0.1823 0.2023 1.4593 ann.rad./ Cs k x-ray 0.1291 0.2143 0.2208 0.080-0.802
<sup>128</sup> Ba <sup>129m</sup> Ba		127.90831	2.43 d 2.17 h	EC/0.52 EC/98 / \$ <sup>+</sup> /2 /		0+ 7/2+		+1.6	ann.rad./ Cs k x-ray 0.1148 0.1808 (0.07 - 2.5) Cs k x-ray 0.27344 Cs k x-ray 0.1769 0.1823 0.2023 1.4593 ann.rad./ Cs k x-ray 0.1291 0.2143 0.2208 0.080-0.802
<sup>129</sup> Ba		128.90868	2.2 h	\$ <sup>+</sup> /20 /2.43 EC/80 /	1.42/	1/2+	-0.40		ann.rad./ Cs k x-ray 0.1291 0.2143 0.2208 0.080-0.802
<sup>130m</sup> Ba <sup>130</sup> Ba <sup>131m</sup> Ba	0.106(1)	129.90631	9.5 ms <sub>n1</sub> 2.2x10 <sup>21</sup> y 14.6 m	I.T./2.475 \$ <sup>+</sup> \$ <sup>+</sup> I.T./0.187	/100.	8- 0+ 9/2-	-0.04 -0.87	+2.8 +1.5	Ba k x-ray 0.1085 Cs k x-ray 0.12381/28.4 0.21608/21.3 0.49636/42.9 (0.059-1.171)
<sup>131</sup> Ba		130.90693	11.7 d	EC/1.37		1/2+	0.7081		Ba k x-ray 0.1085 Cs k x-ray 0.12381/28.4 0.21608/21.3 0.49636/42.9 (0.059-1.171)
<sup>132</sup> Ba <sup>133m</sup> Ba	0.101(1)	131.905056	1.3x10 <sup>21</sup> y 1.621 d	EC EC I.T./0.288		0+ 11/2-	-0.91	+0.9	Ba k x-ray 0.2761 Cs k x-ray 0.08099 0.35600
<sup>133</sup> Ba		132.906003	10.53 y	EC/0.517		1/2+	0.7717		Ba k x-ray 0.2761 Cs k x-ray 0.08099 0.35600
<sup>134</sup> Ba <sup>135m</sup> Ba	2.417(18)	133.904504	1.20 d	I.T./0.2682		0+ 11/2-	-1.00	+1.0	Ba k x-ray 0.2682
<sup>135</sup> Ba <sup>136m</sup> Ba	6.592(12)	134.905684	0.308 s	I.T./2.0305		3/2+ 7-	+0.838	+0.16	Ba k x-ray 0.8185 1.0481
<sup>136</sup> Ba <sup>137m</sup> Ba	7.854(24)	135.904571	2.552 m	I.T./0.6617		0+ 11/2-	-0.99	+0.8	Ba k x-ray 0.66164
<sup>137</sup> Ba <sup>138</sup> Ba <sup>139</sup> Ba	11.232(24) 71.698(42)	136.905822 137.905242 138.908836	1.396 h	\$) /2.317	2.14/27 2.27/72	3/2+ 0+ 7/2-	+0.9374 -0.97	+0.245 -0.57	0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>140</sup> Ba		139.91060	12.75 d	\$) /1.05	0.48 1.0/ 1.02/ 2.59/ 2.73/	0+			0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>141</sup> Ba		140.91441	18.3 m	\$) /3.22	0.48 1.0/ 1.02/ 2.59/ 2.73/	3/2-	-0.34	+0.45	0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>142</sup> Ba		141.91645	10.7 m	\$) /2.212	1.0/ 1.10/	0+			0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>143</sup> Ba		142.92061	14.3 s	\$) /4.24	4.2/	5/2+	+0.44	-0.88	0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>144</sup> Ba		143.92294	11.4 s	\$) /3.1	2.4/ 2.9/	0+			0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>145</sup> Ba		144.9269	4.0 s	\$) /4.9	4.9/	(5/2-)	-0.28	+1.22	0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>146</sup> Ba		145.9302	2.20 s	\$) /4.12	3.9/	0+			0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048
<sup>147</sup> Ba <sup>148</sup> Ba <sup>149</sup> Ba <sup>150</sup> Ba <sup>151</sup> Ba <sup>152</sup> Ba <sup>153</sup> Ba		146.9340 147.9377 148.9421 149.9456 150.9507 151.9542 151.9596	0.892 s 0.64 s 0.36 s 0.3 s >0.15 μs	\$) /5.75 \$) ,n/5.11 \$) , (n)/7.3	5.5/				0.16585 1.2544 1.42033 0.16268 0.30485 0.53727 0.1903 0.2770 0.3042 (0.1 - 2.5) 0.23152 0.25512 0.3090 1.2040 0.1786 0.21148 0.7988 (0.17 - 2.4) La k x-ray 0.10386 0.1566 0.1728 0.3882 0.43048

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<b>57La</b>		<b>138.9055(2)</b>							
<sup>117</sup> La		116.950	23 ms	p	0.806/	3/2+			
<sup>118</sup> La		117.946							
<sup>119</sup> La		118.941							
<sup>120</sup> La		119.938	2.8 s	EC,\$^+ /11.					
<sup>121</sup> La		120.9330	5.3 s						
<sup>122</sup> La		121.9307	9. s	EC,\$^+ / . 9.7					
<sup>123</sup> La		122.9262	17. s	EC /7.					
<sup>124</sup> La		123.9245	30. s	EC/. 8.8		(7+)			
<sup>125m</sup> La			0.39 s						
<sup>125</sup> La		124.9207	1.2 m	\$^+ ,EC/5.6		11/2-			ann.rad./ 0.0436 0.0676
<sup>126m</sup> La			< 50. s						
<sup>126</sup> La		125.9194	54. s	\$^+ ,EC/7.6					ann.rad./ 0.256 0.455 0.117-3.853
<sup>127</sup> La		126.9162	3.8 m	\$^+ ,EC/4.7		3/2+			ann.rad./ 0.025 0.0562
<sup>128</sup> La		127.9155	5.0 m	\$^+ /80 /6.7 EC/20 /		(5-)			ann.rad./ Ba k x-ray 0.2841/87 0.4793/54 (0.315-2.212)
<sup>129m</sup> La			0.56 s	IT		(11/2-)			
<sup>129</sup> La		128.91267	11.6 m	\$^+ /58 /3.72 EC/42 /	2.42/	3/2+			ann.rad./ Ba k x-ray 0.1105 0.2786 (0.1 - 1.8)
<sup>130</sup> La		129.9123	8.7 m	\$^+ /78 /5.6 EC/22 /		3+			ann.rad./ Ba k x-ray 0.3573/81 0.5506/27 (0.1965-1.989)
<sup>131</sup> La		130.9101	59. m	\$^+ /76 /3.0 EC/24 /	1.42/ 1.94/	3/2+			ann.rad./ Ba k x-ray 0.1085 0.3658 0.5263
<sup>132m</sup> La			24. m	I.T./76 / \$^+ ,EC/24 /		6-			La k x-ray 0.1352 0.4645
<sup>132</sup> La		131.91011	4.8 h	\$^+ /40 /4.71 EC/60 /	2.6/ 3.2 3.7/	2-			ann.rad./ Ba k x-ray 0.4645 0.5671
<sup>133</sup> La		132.9084	3.91 h	\$^+ /4 /2.2 EC/96 /	1.2/	5/2+			Ba k x-ray 0.2788 0.2901 0.3024
<sup>134</sup> La		133.90849	6.5 m	\$^+ /63 /3.71 EC/37/	2.67/	1+			ann.rad./ Ba k x-ray 0.6047 (0.5 - 1.9)
<sup>135</sup> La		134.90697	19.5 h	EC/1.20		5/2+			Ba k x-ray 0.4805
<sup>136</sup> La		135.9077	9.87 m	\$^+ /36 /2.9 EC/64 /	1.8/	1+			ann.rad./ Ba k x-ray 0.8185 0.2836
<sup>137</sup> La		136.90647	6x10 <sup>4</sup> y	EC/0.60		7/2+	+2.70	+0.2	0.7887/35
<sup>138</sup> La	0.090(1)	137.907107	1.06x10 <sup>11</sup> y			5+	+3.7136	+0.4	1.4358/65
<sup>139</sup> La	99.910(1)	138.906349	1.678 d	\$) /3.762	1.35	7/2+	+2.7830	+0.20	
<sup>140</sup> La		139.909473			1.24/ 1.67/	3-	+0.73	+0.09	
<sup>141</sup> La		140.910958	3.90 h	\$) /2.502	2.43/	7/2+			
<sup>142</sup> La		141.91408	1.54 h	\$) /4.505	2.11/ 2.98/ 4.52/	2-			
<sup>143</sup> La		142.91606	14.1 m	\$) /3.43	3.3/	7/2-			
<sup>144</sup> La		143.9196	40.7 s	\$) /5.5	4.1/				
<sup>145</sup> La		144.9217	24. s	\$) /4.1	4.1/	3/2+			
<sup>146m</sup> La			10.0 s	\$) /6.7	5.5/	(6)			
<sup>146</sup> La		145.9258	6.3 s	\$) /6.6	6.2/	(2-)			
<sup>147</sup> La		146.9278	4.02 s	\$) /5.0	4.6/				
<sup>148</sup> La		147.9322	1.1 s	\$) /7.26		2-			
<sup>149</sup> La		148.9342	1.10 s	\$) /5.5					0.1335 0.009-1.709 x-ray (0.097-0.209)
<sup>150</sup> La		149.9386	0.51 s						
<sup>151</sup> La		150.9416	>0.15 μs						
<sup>152</sup> La		151.946	>0.15 μs						
<sup>153</sup> La		152.949	>0.15 μs						
<sup>154</sup> La		153.954							
<sup>155</sup> La		154.958							
<b>58Ce</b>		<b>140.116(1)</b>							
<sup>119</sup> Ce		118.953							
<sup>120</sup> Ce		119.947							
<sup>121</sup> Ce		120.944	1.1 s	\$^+ ,p					
<sup>122</sup> Ce		121.938							
<sup>123</sup> Ce		122.936	3.8 s	\$^+ ,EC/. 8.6					ann.rad./
<sup>124</sup> Ce		123.931	6. s	EC / . 5.6					
<sup>125</sup> Ce		124.929	9.6 s	\$^+ ,EC/7.		7/2-			ann.rad./ 0.1346

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	$\beta$ -Energy /Intensity (MeV / %)
									0.1666 0.056-1.329
<sup>126</sup> Ce		125.9241	50. s	EC/4.					
<sup>127</sup> Ce		126.9228	32. s	$\beta^+$ , EC/6.1					ann.rad./ (0.058-1.148)
<sup>128</sup> Ce		127.9189	4.1 m	$\beta^+$ , EC/3.2					ann.rad./ (0.023-0.880)
<sup>129</sup> Ce		128.9187	3.5 m	$\beta^+$ , EC/5.6					ann.rad./ (0.0675-1.015)
<sup>130</sup> Ce		129.9147	26. m	$\beta^+$ , EC/2.2		0+			ann.rad./ La k x-ray 0.047-1.431
<sup>131m</sup> Ce			5. m	$\beta^+$ EC					ann.rad./ 0.2304 0.3955 0.4213
<sup>131</sup> Ce		130.9144	10. m	$\beta^+$ , EC/4.0	2.8/				ann.rad. 0.119 0.169 0.414 0.3255
<sup>132m</sup> Ce			9.4 ms	IT/2.340					0.10-0.955
<sup>132</sup> Ce		131.9115	3.5 h	EC/1.3		0+			La k x-ray 0.1554 0.1821
<sup>133m</sup> Ce			1.6 h	$\beta^+$ , EC/		1/2+			ann.rad. 0.0769 0.0973 0.5577
<sup>133</sup> Ce		132.9116	5.4 h	$\beta^+$ /8/2.9 EC/92/	1.3/	9/2-			ann.rad. 0.0584 0.1308 0.4722 0.5104
<sup>134</sup> Ce		133.9090	3.16 d	EC/0.5		0+			La k x-ray 0.1304 0.1623 0.6047

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<sup>135m</sup> Ce			20. s	I.T./0.446		11/2-			Ce k x-ray 0.0826 0.1497 0.2134
<sup>135</sup> Ce		134.90915	17.7 h	\$^+ /1 /2.026 EC/99 /	0.8/	1/2+			La k x-ray 0.0345 0.2656 0.3001 0.6068
<sup>136</sup> Ce	0.185(2)	135.90714	>0.7x10 <sup>14</sup> y	EC EC		0+			
<sup>137m</sup> Ce			1.43 d	I.T./99 /0.254 EC/0.8 /		11/2-	1.0		Ce k x-ray 0.1693 0.2543
<sup>137</sup> Ce		136.90778	9.0 h	\$^+ /1.222		3/2+	0.96		La k x-ray 0.4472
<sup>138</sup> Ce	0.251(2)	137.90599	>0.9x10 <sup>14</sup> y	EC EC		0+			
<sup>139m</sup> Ce			56.4 s	I.T./0.7542		11/2-			Ce k x-ray 0.7542
<sup>139</sup> Ce		138.90665	137.6 d	EC/0.28		3/2+	1.06		La k x-ray 0.16585
<sup>140</sup> Ce	88.450(51)	139.905435				0+			
<sup>141</sup> Ce		140.908272	32.50 d	\$) /0.581	0.436/69 0.581/31	7/2-	1.1		Pr k x-ray 0.14544/48.0
<sup>142</sup> Ce	11.114(51)	141.909241	>1.6x10 <sup>17</sup> y	\$^- \$^-		0+			
<sup>143</sup> Ce		142.912382	1.38 d	\$) /1.462	1.404/ 1.110/47	3/2-	0.43		Pr k x-ray 0.0574 0.2933
<sup>144</sup> Ce		143.913643	284.6 d	\$) /0.319	0.185/20 0.318/	0+			Pr k x-ray 0.0801 0.1335
<sup>145</sup> Ce		144.91723	3.00 m	\$) /2.54	1.7/24 1.3	3/2-			Pr k x-ray 0.0627 0.7245
<sup>146</sup> Ce		145.9187	13.5 m	\$) /1.04	0.7/90	0+			Pr k x-ray 0.0986 0.2182 0.3167
<sup>147</sup> Ce		146.9225	56. s	\$) /3.29	3.3/				0.0930 0.2687
<sup>148</sup> Ce		147.9244	56. s	\$) /2.1	1.66/	0+			0.0904 0.0985 0.1212 0.2918
<sup>149</sup> Ce		148.9283	5.2 s	\$) /4.2					0.0577 0.0864 0.3800
<sup>150</sup> Ce		149.9302	4.4 s	\$) /3.0					0.1099
<sup>151</sup> Ce		150.9340	1.0 s	\$) /5.3					0.0526
<sup>152</sup> Ce		151.9366	1.4 s	\$) /4.4					Pr k x-ray 0.098 0.115
<sup>153</sup> Ce		152.9406	>0.15 μs						
<sup>154</sup> Ce		153.943	>0.15 μs						
<sup>155</sup> Ce		154.947	>0.15 μs						
<sup>156</sup> Ce		155.951							
<sup>157</sup> Ce		156.956							
<b><sup>59</sup>Pr</b>	<b>140.90765(2)</b>								
<sup>121</sup> Pr		120.955	0.6 s						
<sup>122</sup> Pr		121.952							
<sup>123</sup> Pr		122.946							
<sup>124</sup> Pr		123.943	1.2 s	\$^+ ,EC/12.					ann.rad./ 0.1358
<sup>125</sup> Pr		124.9378	3.3 s	\$^+ ,EC/12.					ann.rad./ (0.170-0.985)
<sup>126</sup> Pr		125.9353	3.1 s	\$^+ ,EC/10.4					ann.rad./ (0.028-0.8949)
<sup>127</sup> Pr		126.9308	4.2 s	\$^+ /7.5					0.207/100 0.400-1.373
<sup>128</sup> Pr		127.9288	3.0 s	\$^+ ,EC/9.3					ann.rad./ (0.0395-1.865)
<sup>129</sup> Pr		128.9249	32 s	\$^+ ,EC/5.8					ann.rad./ (0.06 - 0.16)
<sup>130</sup> Pr		129.9234	40. s	\$^+ ,EC/8.1					ann.rad./ (0.059-0.980)
<sup>131m</sup> Pr			5.7 s						ann.rad./ 0.325 0.496 0.533
<sup>131</sup> Pr		130.9201	1.7 m	\$^+ ,EC/5.3				5.5	0.1305 0.0617
<sup>132</sup> Pr		131.9191	1.6 m	\$^+ ,EC/7.1					ann.rad./ 0.074 0.1343 0.2419 0.3156 0.3308 0.4650
<sup>133m</sup> Pr			1.1 s	IT/0.192					
<sup>133</sup> Pr		132.9162	6.5 m	\$^+ ,EC/4.3		5/2+			ann.rad./ 0.294 0.460 0.495 0.632
<sup>134m</sup> Pr			11. m	\$^+ ,EC/					ann.rad./ 0.294 0.495 0.632
<sup>134</sup> Pr		133.9157	17. m	\$^+ ,EC/6.2		2+			ann.rad./ 0.294 0.495
<sup>135</sup> Pr		134.9131	24. m	\$^+ ,EC/3.7	2.5/	3/2+			ann.rad./ 0.0826

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<sup>136</sup> Pr		135.91265	13.1 m	\$^+ /57 /5.13 EC/43	2.98/	2+			0.2135 0.2961 0.5832 ann.rad./ Ce k x-ray 0.5398 0.5522
<sup>137</sup> Pr		136.91068	1.28 h	\$^+ /26 /2.70 EC/74 /	1.68/	5/2+			ann.rad./ Ce k x-ray 0.4339 0.5140 0.8367 (0.16 - 1.8)
<sup>138m</sup> Pr			2.1 h	\$^+ /24 / EC/76 /	1.65/	7-			ann.rad./ Ce k x-ray 0.3027 0.7887 1.0378 (0.07 - 2.0)
<sup>138</sup> Pr		137.91075	1.45 m	\$^+ /75 /4.44 EC/25 /	3.42/	1+			ann.rad./ Ce k x-ray 0.7887
<sup>139</sup> Pr		138.90893	4.41 h	\$^+ /8 /2.129 EC/92 /	1.09/	5/2+			ann.rad./ Ce k x-ray 0.2551 1.3473 1.6307
<sup>140</sup> Pr		139.90907	3.39 m	\$^+ /51 /3.39 EC/49 /	2.37/	1+			ann.rad./ Ce k x-ray 0.3069 1.5965
<sup>141</sup> Pr	100.	140.907648	14.6 m	I.T./0.004	c.e./	5/2+	+4.275	-0.08	
<sup>142m</sup> Pr			19.12 h	\$) /2.162 EC/0.744	0.58/4 2.16/96	5- 2-	2.2 +0.234	+0.030	0.5088 1.57580
<sup>142</sup> Pr		141.910041	13.57 d	\$) /0.934 IT/99+/0.059	0.933/	7/2+	+2.70	+0.8	0.7420 Pr k x-ray
<sup>143</sup> Pr		142.910813	7.2 m	\$) /		3-			0.0590 0.6965 0.8142 0.69649 1.48912 2.18562
<sup>144</sup> Pr		143.913301	17.28 m	\$) /2.998	0.807/1 2.30/ 2.996/98	0-			0.0725 0.6758 0.7483 0.4539/48 1.5247
<sup>145</sup> Pr		144.91451	5.98 h	\$) /1.81	1.80/97	7/2+			0.3146/24. 0.5779/16 0.6413/19.
<sup>146</sup> Pr		145.9176	24.2 m	\$) /4.2	2.2/30 3.7/10 4.2/40	2-			0.3016 0.4506 0.6975 0.3017
<sup>147</sup> Pr		146.91898	13.4 m	\$) /2.69	1.5/ 2.1/	3/2+			0.1085 0.1385 0.1651 0.1302 0.8044 0.8527
<sup>148m</sup> Pr			2.0 m	\$) /	4.0/ 3.8/	(4)			0.0726 0.164 0.285
<sup>148</sup> Pr		147.9222	2.27 m	\$) /4.9	4.8/	1-			
<sup>149</sup> Pr		148.92379	2.3 m	\$) /3.40	4.5/ 3.0	(5/2*)			
<sup>150</sup> Pr		149.9270	6.2 s	\$) /5.7	5.5	1-			
<sup>151</sup> Pr		150.9283	22.4 s	\$) /4.2		4+			
<sup>152</sup> Pr		151.9319	3.2 s	\$) /6.7					
<sup>153</sup> Pr		152.9339	4.3 s	\$) /5.5					
<sup>154</sup> Pr		153.9381	2.3 s	\$) /7.9					
<sup>155</sup> Pr		154.9400							
<sup>156</sup> Pr		155.944							
<sup>157</sup> Pr		156.947							
<sup>158</sup> Pr		157.952							
<sup>159</sup> Pr		158.955							
<b><sup>60</sup>Nd</b>		<b>144.24(3)</b>							
<sup>125</sup> Nd			0.6 s	\$^+,p					
<sup>126</sup> Nd		125.943	1.8 s	\$^+,EC/9.		(5/2)			ann.rad./
<sup>127</sup> Nd		126.941	4. s	\$^+,EC/6.					ann.rad./
<sup>128</sup> Nd		127.935	4.9 s	\$^+,EC/8.		5/2(-)			ann.rad./ (0.091-0.875)
<sup>129</sup> Nd		128.933	28. s	\$^+,EC/5.					ann.rad./
<sup>130</sup> Nd		129.929	0.5 m	\$^+,EC/6.6					ann.rad./ (0.09-0.36)
<sup>131</sup> Nd		130.9271	1.5 m	\$^+,EC/3.7					ann.rad./ (0.099-0.567)
<sup>132</sup> Nd		131.9231	1.2 m	\$^+,EC/5.6					ann.rad./ (0.06-0.37)
<sup>133</sup> Nd		132.9222	8.5 m	\$^+ /17 /2.8 EC/83 /		0+			ann.rad./ Pr k x-ray 0.1631/58 (0.09-1.00)
<sup>134</sup> Nd		133.9187	5.5 m	\$^+ /					
<sup>135m</sup> Nd			12. m	\$^+ /65 /4.8 EC/35 /		9/2-	-0.78	+2.0	ann.rad./ Pr k x-ray 0.0415/23. 0.204/51. (0.11-1.8)
<sup>135</sup> Nd		134.9182	50.6 m	EC/94 /2.21	1.04/	0+			Pr kx-ray
<sup>136</sup> Nd		135.9150							

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
				\$^+ /6 /					0.0401/21. 0.1091/35. (0.10-0.97)
<sup>137m</sup> Nd			1.6 s	I.T./0.5196		11/2-			Nd k x-ray 0.1084 0.1775 0.2337
<sup>137</sup> Nd		136.9146	38. m	\$^+ /40 /3.69 EC/60 /	1.7/20 2.40/20	1/2+	-0.63		ann.rad./ Pr k x-ray 0.0755 0.5806
<sup>138</sup> Nd		137.9119	5.1 h	EC/1.1		0+			Pr k x-ray 0.1995 0.3258
<sup>139m</sup> Nd			5.5 h	I.T./12 /0.231 \$^+ /88 /	1.17/	11/2-			Nd k x-ray Pr k x-ray 0.1139/34. 0.7382/30.
<sup>139</sup> Nd		138.91192	30. m	\$^+ /25 /2.79 EC/75 /	1.77/	3/2+	0.91	+0.3	ann.rad./ Pr k x-ray 0.4050
<sup>140</sup> Nd		139.90931	3.37 d	EC /0.22		0+			Pr k x-ray
<sup>141m</sup> Nd			1.04 m	IT/99+/0.756		11/2-			Nd k x-ray 0.7565
<sup>141</sup> Nd		140.909605	2.49 h	EC/98 /1.823 \$^+ /2 /	0.802/	3/2+	1.01	+0.3	Pr k x-ray (0.15-1.7)
<sup>142</sup> Nd	27.2(5)	141.907719				0+			
<sup>143</sup> Nd	12.2(2)	142.909810				7/2-	-1.07	-0.60	
<sup>144</sup> Nd	23.8(3)	143.910083	2.1x10 <sup>15</sup> y			0+			
<sup>145</sup> Nd	8.3(1)	144.912569				7/2-	-0.66	-0.31	
<sup>146</sup> Nd	17.2(3)	145.913113				0+			
<sup>147</sup> Nd		146.916096	10.98 d	\$) /0.896	0.805/	5/2-	0.58	0.9	Pr k x-ray 0.53102 0.09111-0.686
<sup>148</sup> Nd	5.7(1)	147.916889				0+			
<sup>149</sup> Nd		148.920145	1.73 h	\$) /1.691	1.03/25 1.13/26 1.42/	5/2-	0.35	1.3	Pr k x-ray 0.1143/19. 0.2113/27. (0.06 - 1.6)
<sup>150</sup> Nd	5.6(2)	149.920887	.1x10 <sup>19</sup> y	\$ \$^-		0+			
<sup>151</sup> Nd		150.923825	12.4 m	\$) /2.442	1.2/	(3/2+)			Pm k x-ray 0.1168 0.2557 1.1806 (0.10 - 1.9)m
<sup>152</sup> Nd		151.92468	11.4 m	\$) /1.1		0+			0.2785/29. 0.2501/18. (0.016 - 0.66)
<sup>153</sup> Nd		152.9280	28.9 s	\$) /3.6					0.418
<sup>154</sup> Nd		153.9296	25.9 s	\$) /2.8					0.1519 0.7998 0.1807 0.0848
<sup>155</sup> Nd		154.9334	8.9 s	\$) /5.0					
<sup>156</sup> Nd		155.9355	5.5 s	\$) /4.1					
<sup>157</sup> Nd		156.9393							
<sup>158</sup> Nd		157.942							
<sup>159</sup> Nd		158.946							
<sup>160</sup> Nd		159.949							
<sup>161</sup> Nd		160.954							
<b><sup>61</sup>Pm</b>									
<sup>128</sup> Pm		127.948	1.0 s	\$^+,p					Ann.rad.
<sup>129</sup> Pm		128.943							
<sup>130</sup> Pm		129.940	2.5 s	\$^+,EC/11.					0.1589 0.326-1.062
<sup>131</sup> Pm		130.936	6.3 s	\$^+					0.185 0.220 0.146
<sup>132</sup> Pm		131.934	6. s	\$^+,EC/10.					ann.rad./
<sup>133</sup> Pm		132.930	12. s	\$^+,EC/. 7.0					ann.rad./
<sup>134</sup> Pm		133.9282	24. s	\$^+,EC/. 8.9		(5+)			ann.rad./ 0.294 0.495
<sup>135</sup> Pm		134.9247	0.8 m	\$^+,EC/6.0		11/2-			(0.13-0.47)
<sup>136</sup> Pm		135.9235	1.8 m	\$^+ /89 /7.9 EC/11 /		(3+)			ann.rad./ Nd k x-ray 0.3735 0.6027
<sup>137</sup> Pm		136.9206	2.4 m	\$^+,EC/5.6		(11/2-)			ann.rad./ 0.1086 0.1775
<sup>138m</sup> Pm			3.2 m	\$^+ /50 /. 7.0 EC/50 /	3.9/	3+	3.		ann.rad./ Nd k x-ray 0.5209 0.7290
<sup>138</sup> Pm		137.9193	10. s	\$^+ /6.9	6.1/	1+			ann.rad./
<sup>139m</sup> Pm			0.18 s	IT/		(11/2-)			0.1887
<sup>139</sup> Pm		138.91678	4.14 m	\$^+ /68 /4.52 EC/32 /	3.52/	(5/2+)			ann.rad./ Nd k x-ray 0.4028 (0.27 - 2.4)
<sup>140m</sup> Pm			5.87 m	\$^+ /70 / EC/30 /	3.2	7/2-			ann.rad./ Nd k x-ray 0.4199 0.7738
<sup>140</sup> Pm		139.91585	9.2 s	\$^+ /89 /6.09 EC/11 /	5.07/74	1+			1.0283 ann.rad./ Nd k x-ray 0.7738 1.4898

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>141</sup> Pm		140.91359	20.9 m	\$ <sup>+</sup> /52 /3.72 EC/48 /	2.71	5/2+			ann.rad./ Nd k x-ray 0.8862 1.2233
<sup>142</sup> Pm		141.91295	40.5 s	\$ <sup>+</sup> /86 /4.87 EC/20 /	3.8/	1+			ann.rad./ Nd k x-ray 0.6414 1.5758
<sup>143</sup> Pm		142.910928	265. d	EC/1.041 \$ <sup>+</sup> /<6 x 10 <sup>-6</sup> /		5/2+	3.8		Nd k x-ray 0.7420
<sup>144</sup> Pm		143.912586	360. d	EC/2.332 \$ <sup>+</sup> /7x10 <sup>-6</sup> /		5-	1.7		Nd k x-ray 0.6180 0.6965
<sup>145</sup> Pm		144.912745	17.7 y	EC/0.163		5/2+	+3.8	+0.2	Nd k x-ray 0.0723
<sup>146</sup> Pm		145.914693	5.53 y	EC/63 /1.472 \$) /37 /1.542	0.795/	3-			Nd k x-ray 0.4538 0.7362 0.7474 0.1974
<sup>147</sup> Pm		146.915134	2.623 y	\$) /0.224	0.224/	7/2+	+2.6	+0.7	0.1213 0.1974
<sup>148m</sup> Pm			41.3 d	\$) /95 /2.6 I.T./5 /0.137	0.4/60 0.5/17 0.7/21	6-	1.8		0.5503/94. 0.6300/89. 0.7257/33
<sup>148</sup> Pm		147.91747	5.37 d	\$) /2.47	1.02/ 2.47/	1-	+2.0	+0.2	0.5503 0.9149 1.4651
<sup>149</sup> Pm		148.918330	2.212 d	\$) /1.071	0.78/9 1.072/90	7/2+	3.3		0.2859 0.5909 0.8594
<sup>150</sup> Pm		149.92098	2.68 h	\$) /3.45	1.6/ 2.3/ 1.8/	(1-)			0.3339/69. 1.1658/16. 1.3245/17. (0.25 - 2.9)
<sup>151</sup> Pm		150.92120	1.183 d	\$) /1.187	0.84/	5/2+	+1.8	1.9	0.1677/8 0.2751/7 0.3401/22 (0.14-1.4)
<sup>152m2</sup> Pm			15. m	\$) ,I.T./		(>6)			0.1218
<sup>152m1</sup> Pm			7.5 m	\$) /		(4-)			0.2447 0.3404 1.0971 1.4375
<sup>152</sup> Pm		151.9235	4.1 m	\$) /3.5	3.5/20 3.50/60	1+			0.1218 (0.12 - 2.1)
<sup>153</sup> Pm		152.92414	5.4 m	\$) /1.90	1.7/	(5/2-)			0.0910 0.1198 0.1273 0.0820 0.1848 1.4403
<sup>154m</sup> Pm			2.7 m	\$) /	2.0/				0.0820 0.8396 1.3940 2.0589
<sup>154</sup> Pm		153.9266	1.7 m	\$) /4.1	1.9/				(0.08 - 2.8) (0.05-0.78)
<sup>155</sup> Pm		154.9280	48. s	\$) /3.2		(5/2-)			
<sup>156</sup> Pm		155.93106	26.7 s	\$) /5.16					
<sup>157</sup> Pm		156.9332	10.9 s	\$) /4.6					
<sup>158</sup> Pm		157.9367	5. s	\$) /6.3					
<sup>159</sup> Pm		158.939	1.5 s						
<sup>160</sup> Pm		159.943							
<sup>161</sup> Pm		160.946							
<sup>162</sup> Pm		161.950							
<sup>163</sup> Pm		162.954							
<b><sup>62</sup>Sm</b>		<b>150.36(3)</b>							
<sup>129</sup> Sm			0.55 s	\$ <sup>+</sup> ,p					
<sup>130</sup> Sm		129.949							
<sup>131</sup> Sm		130.946	1.2 s	\$ <sup>+</sup> ,EC/					ann.rad./
<sup>132</sup> Sm		131.941	4.0 s	\$ <sup>+</sup>					
<sup>133</sup> Sm		132.939	2.9 s	\$ <sup>+</sup> ,EC/ 8.4		5/2+			ann.rad./ 0.3696 0.0845
<sup>134</sup> Sm		133.934	11. s	\$ <sup>+</sup> ,EC/5.		0+			ann.rad./
<sup>135</sup> Sm		134.932	10. s	\$ <sup>+</sup> ,EC/7.		7/2+			ann.rad./
<sup>136</sup> Sm		135.9283	42. s	\$ <sup>+</sup> ,EC/4.5		0+			ann.rad./
<sup>137</sup> Sm		136.9271	45. s	\$ <sup>+</sup> ,EC/6.1					ann.rad./
<sup>138</sup> Sm		137.9235	3.0 m	\$ <sup>+</sup> ,EC/3.9		0+			ann.rad./ 0.0536 0.0747
<sup>139m</sup> Sm			10. s	I.T./94 /0.457 \$ <sup>+</sup> /6 /	4.7	(11/2-)	1.1		Sm k x-ray 0.1118 0.1553 0.1901 0.2673
<sup>139</sup> Sm		138.9226	2.6 m	\$ <sup>+</sup> /75 /5.5 EC/25 /	4.1/	1/2+	-0.53		Pm k x-ray 0.3678 0.4028 (0.27 - 2.4)
<sup>140</sup> Sm		139.9195	14.8 m	\$ <sup>+</sup> ,EC/3.4	1.9/	0+			ann.rad./ Pm k x-ray 0.1396 0.2255 (0.07 - 1.7)
<sup>141m</sup> Sm			22.6 m	\$ <sup>+</sup> /32 / EC/68 / I.T./0.3 /0.1758	1.6/ 2.19/	11/2-	-0.83	+1.6	ann.rad./ Pm k x-ray 0.1966 0.4318 0.7774
<sup>141</sup> Sm		140.91847	10.2 m	\$ <sup>+</sup> /52 /4.54	3.2/	1/2+	-0.74		ann.rad./



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<sup>142</sup> Sm		141.91520	1.208 h	EC/48 /	1.0/	0+			Pm k x-ray 0.4382 ann.rad./
<sup>143m</sup> Sm			1.10 m	EC/94 / IT/99/0.7540		11/2-			Pm k x-ray Sm k x-ray 0.7540 ann.rad./
<sup>143</sup> Sm		142.914624	8.83 m	\$ <sup>+</sup> /46 /3.443 EC/54 /	2.47/	3/2+	+1.01	+0.4	Pm k x-ray 1.0565
<sup>144</sup> Sm	3.07(7)	143.911996				0+			
<sup>145</sup> Sm		144.913407	340. d	EC/0.617		7/2-	-1.12	-0.60	Pm k x-ray 0.0613 0.4924
<sup>146</sup> Sm		145.913038	1.03x10 <sup>8</sup> y	" /	2.50/	0+			
<sup>147</sup> Sm	14.99(18)	146.914894	1.06x10 <sup>11</sup> y	" /	2.23/	7/2-	-0.815	-0.26	
<sup>148</sup> Sm	11.24(10)	147.914818	7x10 <sup>15</sup> y	" /	1.96/	0+			
<sup>149</sup> Sm	13.82(7)	148.917180	10 <sup>16</sup> y	" /		7/2-	-0.672	+0.075	
<sup>150</sup> Sm	7.38(1)	149.917272				0+			
<sup>151</sup> Sm		150.919929	90. y	\$) /0.0768	0.076/	5/2-	-0.363	+0.7	0.02154
<sup>152</sup> Sm	26.75(16)	151.919729				0+			
<sup>153</sup> Sm		152.922094	1.929 d	\$) /0.808	0.64/ 0.69/	3/2+	-0.0216	+1.3	Eu k x-ray 0.0697/4.7 0.10318/29 0.075-0.714
<sup>154</sup> Sm	22.75(29)	153.922206				0+			
<sup>155</sup> Sm		154.924636	22.2 m	\$) /1.627	1.52	3/2-		1.1	Eu k x-ray 0.1043/75. 0.0872 0.1657 0.2038
<sup>156</sup> Sm		155.92553	9.4 h	\$) /0.72	0.43/ 0.71/	0+			Eu k x-ray 0.1964 0.1978 0.3942 0.1894/100. 0.3636/82. 0.1898
<sup>157</sup> Sm		156.9283	8.0 m	\$) /2.7	2.4/	3/2-			0.110 0.264
<sup>158</sup> Sm		157.9299	5.5 m	\$) /2.0		0+			
<sup>159</sup> Sm		158.9332	11.3 s	\$) /3.8		0+			
<sup>160</sup> Sm		159.9353	9.6 s	\$) /3.6		0+			
<sup>161</sup> Sm		160.9388	4.8 s						
<sup>162</sup> Sm		161.941							
<sup>163</sup> Sm		162.945							
<sup>164</sup> Sm		163.948							
<sup>165</sup> Sm		164.953							
<b><sup>63</sup>Eu</b>	<b>151.964(1)</b>								
<sup>130</sup> Eu			0.9 ms	p	1.027/				
<sup>131</sup> Eu			.26. ms	\$ <sup>+</sup> ,p	p/0.95				
<sup>132</sup> Eu	131.954								
<sup>133</sup> Eu	132.949								
<sup>134</sup> Eu	133.946		0.5 s	EC, \$ <sup>+</sup>					ann.rad./
<sup>135</sup> Eu	133.942		1.5 s	EC, \$ <sup>+</sup> / 8.7					ann.rad./
<sup>136m</sup> Eu			3.2 s			7+			0.255
<sup>137</sup> Eu	135.940		3.9 s	EC, \$ <sup>+</sup> /10.		1+			ann.rad./
<sup>138</sup> Eu	136.935		11. s	EC / 7.5		11/2-			ann.rad./
<sup>139</sup> Eu	137.9335		12. s	EC, \$ <sup>+</sup> / 9.2		7+	5		ann.rad./
<sup>140</sup> Eu	138.9298		18. s	EC, \$ <sup>+</sup> / 6.7			6		ann.rad./
<sup>140m</sup> Eu			0.125 s	EC, \$ <sup>+</sup>					ann.rad./
<sup>141</sup> Eu	139.9285		1.51 s	EC, \$ <sup>+</sup> / 8.4		1-			ann.rad./
<sup>141m</sup> Eu			3.0 s	\$ <sup>+</sup> / 58 / EC/9 / I.T. / 33 / 0.0964		11/2-			ann.rad./ Eu k x-ray (0.09 - 1.6)
<sup>141</sup> Eu	140.9244		40. s	\$ <sup>+</sup> / 81 / 5.6 EC/15 /		5/2+	+3.49	+0.85	ann.rad./ Sm k x-ray 0.3845 0.3940
<sup>142m</sup> Eu			1.22 m	\$ <sup>+</sup> / 83 / EC/17 /	4.8/	8-	+2.98	+1.4	ann.rad./ Sm k x-ray 0.5566 0.7680 1.0233
<sup>142</sup> Eu	141.9231		2.4 s	\$) / 94 / 7.4 EC/6 /	7.0/	1+	+1.54	+0.12	ann.rad./ 0.7680
<sup>143</sup> Eu	142.92017		2.62 m	\$ <sup>+</sup> / 72 / 5.17 EC/28 /	4.1/ 5.1/	5/2+	+3.67	+0.51	ann.rad./ Sm k x-ray 0.1107/7 1.5368/3. 1.9127/2.
<sup>144</sup> Eu	143.91879		10.2 s	\$ <sup>+</sup> / 86 / 6.33 EC/13 /	5.31/	1+	+1.89	+0.10	ann.rad./ Sm k x-ray 1.6601
<sup>145</sup> Eu	144.916263		5.93 d	\$ <sup>+</sup> / 2 / 2.660 EC/98 / 1.71	0.79/	5/2+	+4.00	+0.29	ann.rad./ Sm k x-ray 0.6535 0.8937 1.6587
<sup>146</sup> Eu	145.91720		4.57 d	\$ <sup>+</sup> / 5 / 3.88 EC/95 /	1.47/	4-	+1.42	-0.18	ann.rad./ Sm k x-ray 0.6336 0.6341 0.7470 (0.27 - 2.64)
<sup>147</sup> Eu	146.916742		24.4 d	EC/99. / 1.722 \$ <sup>+</sup> / 0.4 /		5/2+	+3.72	+0.53	Sm k x-ray 0.12113 0.19725 0.6776
<sup>148</sup> Eu	147.91815		54.5 d	EC/3.11	0.92	5-	+2.34	+0.35	Sm k x-ray 0.5503/99. 0.6299/71. (0.067-2.17)
<sup>149</sup> Eu	148.91792		93.1 d	EC/0.692		5/2+	+3.57	+0.75	Sm k x-ray 0.2770

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<sup>150</sup> Eu		149.91970	36. y	EC/2.26		5-	+2.71	+1.13	0.3275 Sm k x-ray 0.3340 0.4394 0.5843 (0.25 - 1.8)
<sup>150m</sup> Eu			12.8 h	\$) /92 / \$* /0.4 / EC/8 /	1.013/ 1.24/	0-			Sm k x-ray 0.3339 0.4065
<sup>151</sup> Eu	47.81(6)	150.919846	1.60 h	I.T./0.1478		5/2+	+3.472	+0.90	
<sup>152m2</sup> Eu			1.60 h	I.T./0.1478		8-			Eu k x-ray 0.0898
<sup>152m1</sup> Eu			9.30 h	\$) /72 / EC/28 /	1.85/ 0.89/	0-			Sm k x-ray 0.12178 0.84153 0.96334
<sup>152</sup> Eu		151.921741	13.5 y	EC/72 /1.874 \$) /28 /1.818	0.69/ 1.47/	3-	-1.941	+2.71	Sm k x-ray Gd k x-ray 0.12178 0.34427 1.40802 (0.252-1.528)
<sup>153</sup> Eu	52.19(6)	152.921227	46.1 m	I.T./0.16		5/2+	+1.533	+2.41	
<sup>154m</sup> Eu			46.1 m	I.T./0.16		8-			Eu k x-ray 0.0682 0.1009
<sup>154</sup> Eu		153.922976	8.59 y	\$) /99.9/1.969 EC/0.02/0.717	0.27/29 0.58/38 0.84/17 0.98/4 1.87/11	3-	-2.01	+2.8	Gd k x-ray 0.12299/40. 0.72331/20. 1.2745/36 (0.059-1.90)
<sup>155</sup> Eu		154.922890	4.76 y	\$) /0.252	0.15/	5/2+	+1.52	+2.4	Gd k x-ray 0.0865/30 0.1053/20 0.08899/9. 0.64623/7. 0.723441/6. 0.8118/10.
<sup>156</sup> Eu		155.92475	15.2 d	\$) /2.451	0.30/11 0.49/30 1.2/12 2.45/31	1+	1.1		
<sup>157</sup> Eu		156.92542	15.13 h	\$) /1.36	0.98/ 1.30/41	(5/2+)	+1.50	+2.6	Gd k x-ray 0.0639/100. 0.3705/48. 0.4107/76.
<sup>158</sup> Eu		157.9278	45.9 m	\$) /3.5	2.5/	(1-)	+1.44	+0.7	0.0795 0.8976 0.9442 0.9771
<sup>159</sup> Eu		158.92909	18.1 m	\$) /2.51	2.4/ 2.57/	(5/2+)	+1.38	+2.7	0.0678 0.0786 0.0957 0.0753 0.1735 0.4131 0.5155 0.8217 0.9110 0.9246 0.0719
<sup>160</sup> Eu		159.9315	38. s	\$) /4.1	2.7/ 4.1/	(0-)			
<sup>161</sup> Eu		160.9337	27. s	\$) /3.7					
<sup>162</sup> Eu		161.9370	11. s	\$) /5.6					
<sup>163</sup> Eu		162.9392							
<sup>164</sup> Eu		163.943							
<sup>165</sup> Eu		164.946							
<sup>166</sup> Eu		165.950							
<sup>167</sup> Eu		166.953							
<b><sup>64</sup>Gd</b>		<b>157.25(3)</b>							
<sup>135</sup> Gd			1.1 s	\$*					(0.163-0.360)
<sup>136</sup> Gd		135.947							
<sup>137</sup> Gd		136.945	7. s	EC,\$* / 8.8					ann.rad./
<sup>138</sup> Gd		137.9400	4.7 s	EC,\$*					0.0647
<sup>139m</sup> Gd			4.8 s						0.1216
<sup>139</sup> Gd		138.9381	5. s	EC,\$* / 7.7					0.104-0.323
<sup>140</sup> Gd		139.934	16. s	EC/4.8		0+			0.1748
<sup>141m</sup> Gd			25. s	EC,\$* /		11/2-			ann.rad./
<sup>141</sup> Gd		140.9322	21. s	\$* /7.3		0+			ann.rad./
<sup>142</sup> Gd		141.9276	1.17 m	EC,\$* /4.2		1/2+			ann.rad./
<sup>143m</sup> Gd			1.84 m	\$* /67 / EC/33 / I.T./		11/2-			ann.rad./ Eu k x-ray 0.1176 0.2719 0.5880 0.6681 0.7999
<sup>143</sup> Gd		142.9266	39. s	\$* /82 /6.0 EC/18 /		1/2+			ann.rad./ Eu k x-ray 0.2048 0.2588
<sup>144</sup> Gd		143.9234	4.5 m	\$* /45 /4.3 EC/55 /	3.3/	0+			ann.rad./ Eu k x-ray 0.3332 0.0273 0.3295 0.3866 0.7214
<sup>145m</sup> Gd			1.44 m	I.T./95 /0.749 \$* /4 /5.7		11/2-			ann.rad./ Eu k x-ray 1.7579 1.8806
<sup>145</sup> Gd		144.92169	23.4 m	\$* /33 /5.05 EC/67 /	2.5/	1/2+			

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>146</sup> Gd		145.91831	48.3 d	EC/99.9 /1.03 \$^+ /0.2	0.35/	0+			(0.32 - 3.69) Eu k x-ray 0.1147 0.1155 0.1546
<sup>147</sup> Gd		146.919090	1.588 d	EC/99.8 /2.188 EC/0.2 /	0.93/	7/2-	1.0		Eu k x-ray 0.2293 0.3699 0.3960 0.9289 (0.1 - 1.8)
<sup>148</sup> Gd		147.918111	75. y	" /3.27	3.1828/	0+			
<sup>149</sup> Gd		148.919339	9.3 d	EC/1.32		7/2-	0.9		Eu k x-ray 0.1496 0.2985 0.3465
<sup>150</sup> Gd		149.91866	1.8x10 <sup>6</sup> y	" /2.80	2.73/	0+			
<sup>151</sup> Gd		150.920345	124. d	EC/0.464		7/2-	0.8		Eu k x-ray 0.1536 0.2432
<sup>152</sup> Gd	0.20(1)	151.919789				0+			
<sup>153</sup> Gd		152.921747	240. d	EC/0.485		3/2-	0.4		Eu k x-ray 0.09743 0.10318
<sup>154</sup> Gd	2.18(3)	153.920862				0+			
<sup>155</sup> Gd	14.80(12)	154.922619				3/2-	-0.259	+1.30	
<sup>156</sup> Gd	20.47(9)	155.922120				0+			
<sup>157</sup> Gd	15.65(2)	156.923957				3/2-	-0.340	+1.36	
<sup>158</sup> Gd	24.84(7)	157.924101				0+			
<sup>159</sup> Gd		158.926385	18.6 h	\$) 0.971	0.971/58 0.913/29 0.607/12	3/2-	-0.44		Tb k x-ray 0.36351 0.058-0.855
<sup>160</sup> Gd	21.86(19)	159.927051	>1.9x10 <sup>19</sup> y	\$^- \$^-		0+			
<sup>161</sup> Gd		160.929666	3.66 m	\$) /1.956	1.56/85	5/2-			Tb k x-ray 0.1023 0.3149 0.3609 0.4030 0.4421 0.2868 0.214 1.685
<sup>162</sup> Gd		161.930981	8.4 m	\$) /1.39	1.0/	0+			
<sup>163</sup> Gd		162.9340	1.13 m	\$) /3.1					
<sup>164</sup> Gd		163.9359	45. s	\$) /2.3					
<sup>165</sup> Gd		164.9394	10 s	\$^-					
<sup>166</sup> Gd		165.942							
<sup>167</sup> Gd		166.946							
<sup>168</sup> Gd		167.948							
<sup>169</sup> Gd		168.953							
<b><sup>65</sup>Tb</b>		<b>158.92534(2)</b>							
<sup>138</sup> Tb									
<sup>139</sup> Tb		138.948	1.6 s						0.109 0.120 0.329 0.355-0.740
<sup>140</sup> Tb		139.946	2.4 s	\$^+, EC/11					
<sup>141</sup> Tb		140.941	3.5 s	\$^+, EC/. 8.3					
<sup>142m</sup> Tb			0.30 s	\$^+, EC/		4-			
<sup>142</sup> Tb		141.939	0.60 s	\$^+, EC/10.		0+			
<sup>143</sup> Tb		142.9346	12. s	\$^+, EC/7.4		11/2-			
<sup>144m</sup> Tb			4.1 s	IT		5-			
<sup>144</sup> Tb		143.9324	< 1.5 s	\$^+, EC/8.4		1+			
<sup>145m</sup> Tb			30. s	\$^+, EC/. 6.6		11/2-			ann.rad./ 0.2577 0.5370 0.9876
<sup>145</sup> Tb		144.9287		\$^+, EC/6.5		1/2+			
<sup>146m</sup> Tb			23. s	\$^+ /76 / EC/24 /		(5-)			ann.rad./ Gd k x-ray 1.0789 1.5795
<sup>146</sup> Tb		145.9270	. 8. s	\$^+ /8.1		1+			
<sup>147m</sup> Tb			1.8 m	\$^+ /35 / EC/65 /		11/2-			ann.rad./ Gd k x-ray 1.3977 1.7978
<sup>147</sup> Tb		146.92404	1.6 h	\$^+ /42 /4.61 EC/58 /		5/2+	+1.70		ann.rad./ Gd k x-ray 0.6944 1.1522 (0.120-3.318)
<sup>148m</sup> Tb			2.3 m	\$^+ /25 / EC/75 /		9+			ann.rad./ Gd k x-ray 0.3945 0.6319 0.7845 0.8824
<sup>148</sup> Tb		147.92422	1.00 h	\$^+, EC/5.69		2-	-1.75	-0.3	ann.rad./ Gd k x-ray 0.4888 0.7845 (0.14 - 3.8)
<sup>149m</sup> Tb			4.16 m	EC/88 / \$^+ /12 /		11/2-			ann.rad./ Gd k x-ray 0.1650 0.7960
<sup>149</sup> Tb		148.923243	4.13 h	\$^+ /4 /3.636 "/16/	1.8/ 3.97/	1/2+	+1.35		Gd k x-ray 0.1650 0.3522 0.3886 (0.1 - 3.2)
<sup>150m</sup> Tb			6.0 m	\$^+ /17 /					ann.rad./

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				EC/83 /					Gd k x-ray 0.4384 0.6380 0.6504 0.8275 ann.rad./ 0.4963 0.6380 (0.3 - 4.29)
<sup>150</sup> Tb		149.92366	3.3 h	\$^+\$ ,EC/4.66		2-	-0.90		0.0229 0.0495 0.3797 0.8305 Gd k x-ray 0.1083 0.2517 0.2870 (0.1 - 1.8)
<sup>151m</sup> Tb			25. s	I.T./95 / \$^+\$ ,EC/7 /		11/2-			
<sup>153</sup> Tb		150.923099	17.61 h	\$^+\$ /1 /2.565 EC/99 /	0.70/	1/2+	+0.92		
<sup>152m</sup> Tb			4.3 m	I.T./79 /0.5018 EC/21 /4.35		(8+)			Tb k x-ray Gd k x-ray 0.2833 0.3443 0.4111
<sup>152</sup> Tb		151.92407	17.5 h	\$^+\$ /20 /3.99 EC/80 /	2.5/ 2.8/	2-	-0.58	+0.3	ann.rad./ Gd k x-ray 0.3443 (0.2 - 2.88)
<sup>153</sup> Tb		152.923433	2.34 d	EC/1.570		5/2+	+3.44	+1.1	Gd k x-ray 0.2119 (0.05 - 1.1)
<sup>154m2</sup> Tb			23.1 h	EC/98 / I.T./2 /		(7-)	0.9		Gd k x-ray 0.1231 0.2479 0.3467 1.4199
<sup>154m1</sup> Tb			9. h	\$^+\$ /78 / I.T./22 /		(3-)	1.7	+3.	Gd k x-ray 0.1231 0.2479 0.5401 (0.12 - 2.57)
<sup>154</sup> Tb		153.92469	21.5 h	EC/99 /3.56 \$^+\$ /1 /	1.86/ 2.45	0-			Gd k x-ray 0.1231 1.2744 2.1872 (0.12 - 3.14)
<sup>155</sup> Tb		154.92350	5.3 d	EC/0.82		3/2+	+2.01	+1.41	Gd k x-ray 0.08654 0.10530
<sup>156m2</sup> Tb			1.02 d	I.T./		(7-)			Tb k x-ray 0.0496
<sup>156m1</sup> Tb			5.3 h	I.T./0.0884		(0+)			Tb k x-ray 0.0884
<sup>156</sup> Tb		155.924744	5.3 d	EC/2.444		3-	1.7	+2.	Gd k x-ray 0.08896 0.19921 0.53435 1.22245
<sup>157</sup> Tb		156.924021	1.1x10 <sup>2</sup> y	EC/0.0601		3/2+	+2.01	+1.4	Gd k x-ray 0.0545
<sup>158m</sup> Tb			10.5 s	I.T./0.11		0-			Gd k x-ray 0.0110
<sup>158</sup> Tb		157.925410	1.8x10 <sup>2</sup> y	EC/80 /1.220 \$) /20 /0.937		3-	+1.76	+2.7	Gd k x-ray 0.0795 0.9442 0.9621
<sup>159</sup> Tb	100.	158.925343				3/2+	+2.014	+1.43	Dy k x-ray 0.08678 0.29857 0.87936 0.96615
<sup>160</sup> Tb		159.927164	72.3 d	\$) /1.835	0.57/47 0.86/27	3-	+1.79	3.8	Dy k x-ray 0.02565 0.04892 0.07458
<sup>161</sup> Tb		160.927566	6.91 d	\$) /0.593	0.46/23 0.52/66 0.6/10	3/2+	2.2	+1.2	Dy k x-ray 0.2600 0.8075 0.8882
<sup>162</sup> Tb		161.92948	7.6 m	\$) /2.51	1.4	(1/2-)			Dy k x-ray 0.6110 0.6885 0.7548
<sup>163</sup> Tb		162.930644	19.5 m	\$) /1.785	0.80/	3/2+			Dy k x-ray 0.3511 0.3897 0.4945
<sup>164</sup> Tb		163.9334	3.0 m	\$) /3.9	1.7/	(5+)			Dy k x-ray 0.1689 0.2157 0.6110 0.6885 0.7548
<sup>165</sup> Tb		164.9349	2.1 m	\$) /3.0		3/2+			0.5389 1.1785 1.2920 1.6648
<sup>166</sup> Tb		165.9380	. 21 s	\$^- /					0.057
<sup>167</sup> Tb		166.9401	19 s						0.070
<sup>168</sup> Tb		167.9436	8 s						0.075-0.227
<sup>169</sup> Tb		168.946							

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<sup>170</sup> Tb		169.950							
<sup>171</sup> Tb		170.953							
<b><sup>66</sup>Dy</b>		<b>162.50(3)</b>							
<sup>139</sup> Dy			0.6 s	\$ <sup>+</sup> ,p					
<sup>140</sup> Dy		139.954							
<sup>141</sup> Dy		140.951	0.9 s	EC,\$ <sup>+</sup> /9.					
<sup>142</sup> Dy		141.946	2.3 s	EC,\$ <sup>+</sup> /7.1					
<sup>143</sup> Dy		142.9440	3.9 s	EC,\$ <sup>+</sup> / 8.8					
<sup>144</sup> Dy		143.9391	9.1 s	EC,\$ <sup>+</sup> / 6.2					
<sup>145m</sup> Dy		144.9365	14. s	EC,\$ <sup>+</sup>		11/2-			
<sup>146m</sup> Dy			0.15 s	I.T.		10+			
<sup>146</sup> Dy		145.9325	30. s	EC,\$ <sup>+</sup> /5.2					
<sup>147m</sup> Dy			56. s	I.T./40 / \$ <sup>+</sup> ,EC/60 /		(11/2-)	-0.66	+0.7	Dy k x-ray 0.072 0.6787 ann.rad./ 0.1007 0.2534 0.3653
<sup>147</sup> Dy		146.9309	75. s	EC,\$ <sup>+</sup> /6.37		1/2+	-0.92		ann.rad./ 0.1007 0.2534 0.3653
<sup>148</sup> Dy		147.92710	3.1 m	\$ <sup>+</sup> /4 /2.68 EC/96 /	1.2/	0+			ann.rad./ Tb k x-ray 0.6202
<sup>149</sup> Dy		148.92734	4.2 m	\$ <sup>+</sup> ,EC/3.81		(7/2-)	-0.12	-0.62	ann.rad./ 0.1008 0.1063 0.2534 0.6536 0.7894 1.7765 1.8062
<sup>150</sup> Dy		149.92558	7.18 m	\$ <sup>+</sup> ,EC/67 /1.79 " /33 /	4.233/	0+			Tb k x-ray 0.3967
<sup>151</sup> Dy		150.926181	17. m	\$ <sup>+</sup> /5 /2.871 EC/89 / " /6 /	4.067/	7/2-	-0.95	-0.30	Tb k x-ray 0.1764 0.3030 0.3861 0.5463 (0.16 - 2.09)
<sup>152</sup> Dy		151.92472	2.37 h	EC/0.60 " /	3.63/	0+			Tb k x-ray 0.2569
<sup>153</sup> Dy		152.925763	6.3 h	\$ <sup>+</sup> /1 /2.171 EC/99 / " /0.01 /	0.89/ 3.46/	(7/2-)	-0.78	-0.15	Tb k x-ray 0.0807 0.0997 0.2137 (0.08 - 1.66)
<sup>154</sup> Dy		153.92442	3.x10 <sup>6</sup> y	" /2.95	2.87/	0+			
<sup>155</sup> Dy		154.92575	9.9 h	\$ <sup>+</sup> /2 /2.095 EC/98 /	0.845/	3/2-	-0.385	+1.04	Tb k x-ray 0.0655 0.2269
<sup>156</sup> Dy	0.056(3)	155.92428				0+			
<sup>157</sup> Dy		156.92546	8.1 h	EC/1.34		3/2-	-0.301	+1.30	Tb k x-ray (0.0609-1.319)
<sup>158</sup> Dy	0.095(3)	157.924405				0+			
<sup>159</sup> Dy		158.925736	144. d	EC/0.366		3/2-	-0.354	+1.37	Tb k x-ray 0.3262
<sup>160</sup> Dy	2.39(18)	159.925194				0+			
<sup>161</sup> Dy	18.889(42)	160.926930				5/2+	-0.480	+2.51	
<sup>162</sup> Dy	25.475(36)	161.926795				0+			
<sup>163</sup> Dy	24.896(42)	162.928728				5/2-	+0.673	+2.65	
<sup>164</sup> Dy	28.260(54)	163.929171				0+			
<sup>165m</sup> Dy			1.26 m	I.T./98 /0.108 \$) /2 /		1/2-			Dy k x-ray 0.1082 0.5155
<sup>165</sup> Dy		164.931700	2.33 h	\$) /1.286	1.29/	7/2+	-0.52	+3.5	Ho k x-ray 0.09468
<sup>166</sup> Dy		165.932803	3.400 d	\$) /0.486	0.40/	0+			Ho k x-ray 0.0282 0.0825
<sup>167</sup> Dy		166.9357	6.2 m	\$) / 2.35	1.78	(1/2-)			Ho k x-ray 0.2593 0.3103 0.5697 (0.06 - 1.4)
<sup>168</sup> Dy		167.9372	8.5 m	\$) /1.6		0+			Ho k x-ray 0.1925 0.4867
<sup>169</sup> Dy		168.9403	39. s	\$) /3.2					
<sup>170</sup> Dy		169.9427							
<sup>171</sup> Dy		170.9465							
<sup>172</sup> Dy		171.949							
<sup>173</sup> Dy		172.953							
<b><sup>67</sup>Ho</b>		<b>164.93032(2)</b>							
<sup>140</sup> Ho			6 ms	p/	p/1.09				
<sup>141m</sup> Ho			8 : s	p/	p/1.23				
<sup>141</sup> Ho			4.2 ms	\$ <sup>+</sup> ,p	p/1.71				
<sup>142</sup> Ho		141.960	0.4 s	EC/\$ <sup>+</sup> ,p					0.307
<sup>143</sup> Ho		142.955							
<sup>144</sup> Ho		143.952	0.7 s	\$ <sup>+</sup> ,EC/12					
<sup>145</sup> Ho		144.947	2.4 s	\$ <sup>+</sup>					
<sup>146</sup> Ho		145.9440	3.3 s	\$ <sup>+</sup> ,EC/10.7		(10+)			ann.rad./
<sup>147</sup> Ho		146.9396	5.8 s	\$ <sup>+</sup> ,EC/8.2		11/2-			ann.rad./
<sup>148m</sup> Ho			9. s	\$ <sup>+</sup> ,EC/		4-			ann.rad./
<sup>148</sup> Ho		147.9372	2. s	\$ <sup>+</sup> ,EC/9.4		1+			ann.rad./ 0.6615 1.6883
<sup>149m</sup> Ho			21. s	\$ <sup>+</sup> ,EC/		11/2-			ann.rad./ 1.0733 1.0911

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<sup>149</sup> Ho		148.93379	> 30. s	\$^+\$ ,EC/6.01		1/2+			
<sup>150m</sup> Ho			25. s	\$^+\$ ,EC/		(9+)			ann.rad./ 0.3939 0.5511 0.6534 0.8034
<sup>150</sup> Ho		149.9326	1.3 m	\$^+\$ ,EC/6.6					ann.rad./ 0.5913 0.6534 0.8034
<sup>151m</sup> Ho			47. s	\$^+\$ ,EC/87 / "/13	4.605/				ann.rad./ 0.2102 0.4889 0.6948 0.7762
<sup>151</sup> Ho		150.93169	35.2 s	\$^+\$ ,EC/80/5.13 "/20 /	4.519/				ann.rad./ 0.3522 0.5274 0.9676 1.0471
<sup>152m</sup> Ho			50. s	\$^+\$ ,EC/90/ "/10/	4.453/	(9+)	+5.9	-1.	ann.rad./ 0.4929 0.6138 0.6474 0.6835
<sup>152</sup> Ho		151.93166	2.4 m	\$^+\$ ,EC/88/6.47 "/12/	4.387/	(3+)	-1.02	+0.1	ann.rad./ 0.6140 0.6476
<sup>153m</sup> Ho			9.3 m	\$^+\$ ,EC/99+/4.12 "/	4.01/	5/2	+1.19		ann.rad./ 0.0905 0.1089 0.1618 0.2302 0.2707 0.3659 0.4565
<sup>153</sup> Ho		152.93020	2.0 m	\$^+\$ ,EC/99+/4.13 "/	3.91/	11/2-	+6.8	-1.1	ann.rad./ 0.2958 0.3346 0.4381 0.6383
<sup>154m</sup> Ho			3.3 m	\$^+\$ ,EC/		(8+)	5.7	-1.0	ann.rad./ 0.3346 0.4124 0.4771
<sup>154</sup> Ho		153.93060	12. m	\$^+\$ ,EC/5.75		1-	-0.64	+0.2	ann.rad./ Dy k x-ray 0.3346 0.5700 0.8734
<sup>155</sup> Ho		154.92908	48. m	\$^+\$ /6/3.10 EC/94 /		(5/2+)	+3.51	+1.5	ann.rad./ Dy k x-ray 0.0474 0.1363 0.3254 (0.06 - 2.24)
<sup>156m</sup> Ho			5.8 m	I.T./0.0352 \$^+\$ /25 / EC/75 /	1.8/ 2.9/		+2.99	+2.3	ann.rad./ Dy k x-ray 0.1378 0.2666 (0.28 - 2.9)
<sup>156</sup> Ho		155.9290	56. m	\$^+\$ ,EC/4.4		(5+)			ann.rad./ 0.1378 0.2665
<sup>157</sup> Ho		156.92819	12.6 m	\$^+\$ /5/2.54 EC/95/	1.18/	7/2-	+4.35	+3.0	ann.rad./ Dy k x-ray 0.2800 0.3411
<sup>158m2</sup> Ho			28. m	I.T./44/ EC/56/		2-	+2.44	+1.6	ann.rad./ Dy k x-ray 0.0989 0.2182 0.1664
<sup>158m1</sup> Ho			21. m	\$^+\$ ,EC/		(9+)			ann.rad./ 0.0981 0.1664 0.2182 0.3205 0.4062 0.9774 1.0532 0.4846
<sup>158</sup> Ho		157.92895	11.3 m	\$^+\$ /8/4.24 EC/92/	1.30/	5+	+3.77	+4.1	ann.rad./ Dy k x-ray 0.0989 0.2182 0.9488
<sup>159m</sup> Ho			8.3 s	IT/0.206		1/2+			Ho k x-ray 0.1660 0.2059
<sup>159</sup> Ho		158.927708	33.0 m	EC/1.838		7/2-	+4.28	+3.2	Dy k x-ray 0.1210 0.1320 0.2529 0.3096 (0.06 - 1.2)
<sup>160m2</sup> Ho			3. s			1+			
<sup>160m</sup> Ho			5.0 h	IT/67/0.060		2-	+2.52	+1.8	0.0868

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
				EC/33/3.35					0.1970 0.6464 0.7281 0.8791 0.9619 0.9658
<sup>160</sup> Ho		159.92873	25.6 m	\$ <sup>+</sup> ,EC/3.29	0.57/	5+	+3.71	+4.0	See Ho[166m] 0.7282 0.8794
<sup>161m</sup> Ho			6.8 s	IT/0.211					Ho k x-ray 0.2112
<sup>161</sup> Ho		160.927852	2.48 h	EC/0.859		7/2-	+4.25	+3.2	Dy k x-ray 0.0256 0.0592 0.0774 0.1031
<sup>162m</sup> Ho			1.12 h	IT/61/ EC/39/		6-	+3.60	+4.	Dy k x-ray Ho k x-ray 0.0807 0.1850 0.2828 0.9372 1.2200
<sup>162</sup> Ho		161.929092	15. m	EC/96 /0.295 \$ <sup>+</sup> /4 /		1+			Dy k x-ray 0.0807 1.3196 1.3728
<sup>163m</sup> Ho			1.09 s	I.T./0.298		(1/2+)			Ho k x-ray 0.2798
<sup>163</sup> Ho		162.928730	4.57x10 <sup>3</sup> y	EC/0.00258		7/2-	+4.23	+3.6	Dy M x-rays
<sup>164m</sup> Ho			38. m	I.T./0.140		(6-)			Ho k x-ray 0.0373 0.0566 0.0940
<sup>164</sup> Ho		163.930231	29. m	EC/58 /0.987 \$) /42 /0.963		1+			Dy k x-ray 0.0734 0.0914
<sup>165</sup> Ho	100.	164.930319	1.2x10 <sup>3</sup> y	\$) /		7/2-	+4.17	+3.49	
<sup>166m</sup> Ho						7-	3.6	-3.	Er k x-ray 0.18407 0.71169 0.81031
<sup>166</sup> Ho		165.932281	1.117 d	\$) /1.855	1.776/48 1.855/51	0-			Er k x-ray 0.08057 1.37943
<sup>167</sup> Ho		166.933127	3.1 h	\$) /1.007	0.31/43 0.61/21 0.96/15 0.97/15	(7/2-)			Er k x-ray 0.0793 0.0835 0.2379 0.3213 0.3465
<sup>168m</sup> Ho			2.2 m	I.T./					
<sup>168</sup> Ho		167.93550	3.0 m	\$) /2.91	2.0/	3+			Er k x-ray 0.7413 0.8159 0.8211 (0.08 - 2.34)
<sup>169</sup> Ho		168.93687	4.7 m	\$) /2.12	1.2/ 2.0/	(7/2-)			0.1496 0.7610 0.7784 0.7884 0.8529 0.0787 0.8123 1.8940 1.9726
<sup>170m</sup> Ho			43. s	\$) /		1+			Er k x-ray 0.1816 0.2582 0.8902 0.9321 0.9414 1.1387
<sup>170</sup> Ho		169.93962	2.8 m	\$) /3.87		6+			
<sup>171</sup> Ho		170.941	53 s	\$ <sup>-</sup> /					
<sup>172</sup> Ho		171.9448	25. s	\$) /					Er k x-ray (0.077-1.186)
<sup>173</sup> Ho		172.947							
<sup>174</sup> Ho		173.951							
<sup>175</sup> Ho		174.954							
<b><sup>68</sup>Er</b>		<b>167.259(3)</b>							
<sup>144</sup> Er		143.961							
<sup>145</sup> Er		144.957	0.9 s	\$ <sup>+</sup>					
<sup>146</sup> Er		145.952	1.7 s	\$ <sup>+</sup>					
<sup>147</sup> Er		146.9494	2.5 s	E.C,\$ <sup>+</sup> / 9.1					
<sup>148</sup> Er		147.9444	4.5 s	\$ <sup>+</sup> ,EC/6.8					
<sup>149m</sup> Er			10. s	IT		11/2-			
<sup>149</sup> Er		148.9425	10.7 s	EC\$ <sup>+</sup> /8.1		1/2+			
<sup>150</sup> Er		149.9370	18. s	\$ <sup>+</sup> /36 /4.11 EC/64 /		0+			ann.rad./ Ho k x-ray 0.4758
<sup>151</sup> Er		150.9373	23. s	\$ <sup>+</sup> ,EC/5.2		7/2-			ann.rad./
<sup>152</sup> Er		151.93500	10.2 s	\$ <sup>+</sup> ,EC/10/3.11 "/90/	4.804/	0+			ann.rad./
<sup>153</sup> Er		152.93509	37.1 s	" /	4.674		-0.934	-0.42	0.351 (0.0945-1.700)
<sup>154</sup> Er		153.93278	3.7 m	\$ <sup>+</sup> ,EC/47/4.56 \$ <sup>+</sup> ,EC/99+/2.03 "/0.5/	4.35/ 4.166/	0+			ann.rad./
<sup>155</sup> Er		154.93321	5.3 m	\$ <sup>+</sup> ,EC/47/3.84 EC/53 /		(7/2-)	-0.669	-0.27	ann.rad./ Ho k x-ray

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<sup>156</sup> Er		155.9308	20. m	\$^+\$ ,EC/1.7		0+			0.1101 0.2415 ann.rad./ 0.0298 0.0352 0.0522 0.1336
<sup>157</sup> Er		156.9319	25. m	\$^+\$ ,EC/3.5		3/2-	-0.412	+0.92	ann.rad./ 0.117 0.385 1.320 1.660 1.820 2.000
<sup>158</sup> Er		157.93087	2.2 h	EC/99.5 /1.78 \$^+\$ /0.5 /	0.74/	0+			Ho k x-ray 0.0719 0.2486 0.3868
<sup>159</sup> Er		158.930681	36. m	\$^+\$ /7 /2.769 EC/93 /		3/2-	-0.304	+1.17	ann.rad./ Ho k x-ray 0.6245 0.6493 (0.07 - 2.5)
<sup>160</sup> Er		159.92908	1.191 d	EC/0.33		0+			Ho k x-ray (0.05 - 0.96)
<sup>161</sup> Er		160.93000	3.21 h	EC/2.00		3/2-	-0.37	+1.36	Ho k x-ray 0.8265 (0.07 - 1.74)
<sup>162</sup> Er	0.139(5)	161.928775				0+			
<sup>163</sup> Er		162.93003	1.25 h	EC/1.210		5/2-	+0.557	+2.55	Ho k x-ray 0.4361 0.4399 1.1135
<sup>164</sup> Er	1.601(3)	163.929197				0+			
<sup>165</sup> Er		164.930723	10.36 h	EC/0.376		5/2-	+0.643	+2.71	Ho k x-ray
<sup>166</sup> Er	33.503(36)	165.930290				0+			
<sup>167m</sup> Er			2.27 s	I.T./0.208		1/2-			Er k x-ray 0.2078
<sup>167</sup> Er	22.869(9)	166.932046				7/2+	-0.5639	+3.57	
<sup>168</sup> Er	26.978(18)	167.932368				0+			
<sup>169</sup> Er		168.934588	9.40 d	\$\beta\$ /0.351	0.35/. 100	1/2-	+0.485		Tm k x-ray 0.1098 0.1182
<sup>170</sup> Er	14.910(36)	169.935461				0+			
<sup>171</sup> Er		170.938026	7.52 h	\$\beta\$ /1.491		5/2-	0.66	2.9	Tm k x-ray 0.11160 0.29591 0.30832 (0.08 - 1.4)
<sup>172</sup> Er		171.939352	2.05 d	\$\beta\$ /0.891	0.28/48 0.36/46				Tm k x-ray 0.0597 0.4073 0.6101
<sup>173</sup> Er		172.9424	1.4 m	\$\beta\$ /2.6		(7/2-)			Tm k x-ray 0.1928 0.1992 0.8952
<sup>174</sup> Er		173.9441	3.1 m	\$\beta\$ /1.8					Tm k x-ray (0.100-0.152) (0.0765-1.168)
<sup>175</sup> Er		174.9479							
<sup>176</sup> Er		175.9503	1.2 m	\$\beta^-\$					
<sup>177</sup> Er		176.954							
<b><sup>69</sup>Tm</b>		<b>168.93421(2)</b>							
<sup>145</sup> Tm			3.5 : s	p	1.73/91 1.4/9				
<sup>146m</sup> Tm			0.21 s	\$^+\$ ,p	p/1.118 1.01/ 0.89/				
<sup>146</sup> Tm		145.967	0.06 s	\$^+\$ /14. p	1.119/ 0.94/				
<sup>147m</sup> Tm			0.4 ms	\$^+\$ ,p	p/1.115				
<sup>147</sup> Tm		146.961	0.56 s	EC,\$^+\$ /85 p/15/	10.7 1.052/				
<sup>148m</sup> Tm			0.7 s	\$^+\$ ,EC/12.					ann.rad./
<sup>148</sup> Tm		148.9524	0.9 s	\$^+\$ ,EC/. 9.2		11/2-			
<sup>149</sup> Tm		149.9494	2.3 s	\$^+\$ ,EC/. 11.5		6-			(0.1007-2.177)
<sup>150</sup> Tm		150.9454	4. s	\$^+\$ ,EC/7.5					ann.rad./
<sup>151m</sup> Tm			8. s	\$^+\$ ,EC/		9+			
<sup>152</sup> Tm		151.9443	5. s	\$^+\$ ,EC/8.8					ann.rad./
<sup>153</sup> Tm		152.94203	1.6 s	\$^+\$ ,EC/10 /6.46 "/90 /	5.109/ "/5.031/100				ann.rad./
<sup>154m</sup> Tm			3.3 s	\$^+\$ ,EC/15 / "/	4.84/0.24 "/4.956/100				ann.rad./
<sup>154</sup> Tm		153.9407	8.1 s	\$^+\$ ,EC/56 /7.4 "/44 /	4.83/0.45				ann.rad./
<sup>155</sup> Tm		154.93919	30. s	\$^+\$ ,EC/5.58 "/	4.46/				0.0315 0.0638 0.0881 0.2268 0.5320 0.6067
<sup>156m</sup> Tm			19. s	"/	4.46/				
<sup>156</sup> Tm		155.9389	1.40 m	\$^+\$ ,EC/7.6 "/	4.23/	2-	+0.40	-0.5	ann.rad./ 0.3446 0.4529 0.5860
<sup>157</sup> Tm		156.9367	3.6 m	\$^+\$ ,EC/4.5 "/	2.6 3.97/	1/2	+0.48		ann.rad./ 0.1104



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									0.3484 0.3855 0.4550 (0.1 - 1.58) ann.rad./ Er k x-ray 0.1921 0.3351 0.6280 1.1498 (0.18 - 2.81) ann.rad./ Er k x-ray 0.0591 0.0848 0.2713 (0.05 - 1.27)
<sup>158</sup> Tm		157.9379	4.0 m	\$^+, EC/74 /6.5 EC/26 /		(2-)	+0.04	+0.7	
<sup>159</sup> Tm		158.9348	9.1 m	\$^+ /23 /3.9 EC/77 /		5/2+	+3.42	+1.9	
<sup>160m</sup> Tm <sup>160</sup> Tm		159.9354	1.24 m 9.4 m	IT \$^+ /15 /5.9 EC/85 /		(5) 1-	+0.16	+0.58	
<sup>161</sup> Tm		160.9334	31. m	\$^+, EC/3.2		7/2+	+2.40	+2.9	
<sup>162m</sup> Tm			24. s	I.T./90 / \$^+, EC/10 /		5+			
<sup>162</sup> Tm		161.93394	21.7 m	\$^+ /8 /4.81 EC/92 /		1-	+0.07	+0.69	
<sup>163</sup> Tm		162.93265	1.81 h	EC/98 /2.439 \$^+ /1 /		1/2+	-0.082		
<sup>164m</sup> Tm			5.1 m	I.T./80 / \$^+, EC/20 /		6-			
<sup>164</sup> Tm		163.93345	2.0 m	\$^+ /36 /3.96 EC/64 /	2.94/	1+	+2.38	+0.71	
<sup>165</sup> Tm		164.932433	1.253 d	EC/1.593		1/2+	-0.139		
<sup>166</sup> Tm		165.93355	7.70 h	EC/98 /3.04 \$^+ /2 /		2+	+0.092	+2.14	
<sup>167</sup> Tm		166.932849	9.24 d	EC/0.748		1/2+	-0.197		
<sup>168</sup> Tm		167.934171	93.1 d	EC/1.679		3+	+0.23	+3.2	
<sup>169</sup> Tm <sup>170</sup> Tm	100	168.934211 169.935798	128.6 d	\$) /99.8/0.968 EC/0.2 /0.314	0.883/24 0.968/76	1/2+ 1-	-0.232 +0.247	-1.2 +0.74	
<sup>171</sup> Tm		170.936426	1.92 y	\$) /0.096	0.03/2 0.096/98	1/2+	-0.230		
<sup>172</sup> Tm		171.93840	2.65 d	\$) /1.88	1.79/36 1.88/29	2-			
<sup>173</sup> Tm		172.93960	8.2 h	\$) /1.298	0.80/21 0.86/71	1/2+			
<sup>174</sup> Tm		173.94216	5.4 m	\$) /3.08	0.70/14 1.20/83	(4-)			
<sup>175</sup> Tm		174.94383	15.2 m	\$) /2.39	0.9/36 1.9/23	(1/2+)			

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<sup>176</sup> Tm		175.9471	1.9 m	β / 4.2	2.0/ 1.2/	(4+)			0.98247 Yb k x-ray 0.1898 0.3819 1.0691
<sup>177</sup> Tm		176.9490	1.4 m	β <sup>-</sup>					
<sup>176m</sup> Tm		177.9526							
<sup>179</sup> Tm		178.9553							
<b><sup>70</sup>Yb</b>		<b>173.04(3)</b>							
<sup>148</sup> Yb		147.967							
<sup>149</sup> Yb		148.963	0.7 s	\$+,p	p/2.5-6.4/				0.647
<sup>150</sup> Yb		149.958							
<sup>151</sup> Yb		150.9545	1.6 s	\$+ / 8.5					
<sup>152</sup> Yb		151.9502	3.2 s	\$+ ,EC/5.5					
<sup>153</sup> Yb		152.9492	4. s	\$+ ,EC/6.7					
<sup>154</sup> Yb		153.9455	0.40 s	\$+ ,EC/7 / 4.49					ann.rad./
<sup>155</sup> Yb		154.9456	1.7 s	\$+ ,EC/16 / 6.0	5.32/		-0.8	-1.	ann.rad./
<sup>156</sup> Yb		155.94277	26. s	\$+ ,EC/21/3.57	5.19/	0+			ann.rad./
<sup>157</sup> Yb		156.9427	39. s	\$+ ,EC/99+/5.5	4.69/		-0.64		ann.rad./
<sup>158</sup> Yb		157.93986	1.5 m	\$+ ,EC/1.9	4.69/	0+			0.231 (0.035-0.670) ann.rad./
<sup>159</sup> Yb		158.9402	1.4 m	EC,\$+ / 5.1			-0.37	-0.022	0.0741 0.2526 Tm k x-ray
<sup>160</sup> Yb		159.9376	4.8 m	\$+ ,EC/2.0		0+			0.1661 0.1772 0.3297 0.3903 ann.rad./
<sup>161</sup> Yb		160.9375	4.2 m	\$+ ,EC/3.9		3/2-	-0.33	+1.03	0.1404 0.1737 0.2158 ann.rad./
<sup>162</sup> Yb		161.9358	18.9 m	\$+ ,EC/1.7		0+			Tm k x-ray 0.0782 0.5999 0.6315 ann.rad./
<sup>163</sup> Yb		162.9363	11.1 m	\$+ / 26 / 3.4	1.4/	3/2-	-0.37	+1.24	Tm k x-ray 0.1188 0.1635 ann.rad./
<sup>164</sup> Yb		163.9345	1.26 h	EC/1.0		0+			Tm k x-ray 0.0636 0.8603 (0.06 - 1.9)
<sup>165</sup> Yb		164.93540	9.9 m	\$+ / 10 / 2.76	1.58/	(5/2-)	+0.48	+2.48	0.0914 0.6752 ann.rad./
<sup>166</sup> Yb		165.93388	2.363 d	EC/0.30		0+			Tm k x-ray 0.0801 1.0903 0.0828 0.1844 0.7789 1.2734 2.0524
<sup>167</sup> Yb		166.934947	17.5 m	\$+ / 0.5 / 1.954	0.639/	5/2-	+0.62	+2.70	Tm k x-ray 0.06296 0.10616 0.11337 0.17633
<sup>168</sup> Yb	0.13(1)	167.933895				0+			
<sup>169m</sup> Yb			46. s	I.T./0.0242		1/2-			Yb L x-ray
<sup>169</sup> Yb		168.935187	32.02 d	EC/0.909		7/2+	-0.63	+3.5	0.0242 0.1979/35.9 0.3078/10.05 0.0207-0.2611
<sup>170</sup> Yb	3.04(15)	169.934759				0+			
<sup>171</sup> Yb	14.28(57)	170.936323				1/2-	+0.49367		
<sup>172</sup> Yb	21.83(67)	171.936378				0+			
<sup>173</sup> Yb	16.13(27)	172.938207				5/2-	-0.67989	+2.80	
<sup>174</sup> Yb	31.83(92)	173.938858				0+			
<sup>175</sup> Yb		174.941273	4.19 d	β / 0.470	0.466/73 0.071/21 0.353/6.2	7/2-	0.77		Lu k x-ray 0.3963/13 (0.114 - 0.28)
<sup>176m</sup> Yb			11.4 s	I.T./1.051		(8-)			Yb k x-ray 0.0961 0.1901 0.2929 0.3897
<sup>176</sup> Yb	12.76(41)	175.942569	10 <sup>26</sup> y	\$β <sup>-</sup>		0+			
<sup>177m</sup> Yb			6.41 s	I.T./0.3315		1/2-			Yb k x-ray 0.1131 0.2084 Lu k x-ray
<sup>177</sup> Yb		176.945257	1.9 h	β / 1.399	1.40	9/2+			0.1504 0.1415 0.3246 0.3516 0.3815
<sup>178</sup> Yb		177.94664	1.23 h	β / 0.65	0.25/	0+			

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<sup>179</sup> Yb		178.9499	8. m	β /2.4					0.6125
<sup>180</sup> Yb		179.9523	2. m	β					0.1028-0.4423
<sup>181</sup> Yb		180.9561							
<b><sup>71</sup>Lu</b>		<b>174.967(1)</b>							
<sup>150m</sup> Lu			.0.03 ms	p/1.295					
<sup>150</sup> Lu		149.973	49. ms	p					
<sup>151m</sup> Lu			16. s	p/1.31					
<sup>151</sup> Lu		150.967	0.08 s	p/1.231					
<sup>152</sup> Lu		151.963	0.7 s						
<sup>153</sup> Lu		152.959							
<sup>154</sup> Lu		153.9571	1.0 s	\$^+\$, EC/10.8					
<sup>155m</sup> Lu			2.6 ms	" /7.41					
<sup>155</sup> Lu		154.9542	0.07 s	EC/8.0					
<sup>156m</sup> Lu			0.20 s	" /	5.66/90				
<sup>156</sup> Lu		155.9529	.0.5 s	\$^+\$, EC/9.5	5.57/				ann.rad./
<sup>157m</sup> Lu			.9.6 s	" /	5.45/				
<sup>157</sup> Lu		156.95010	4.8 s	\$^+\$, EC/94 /6.93	4.925/				ann.rad./
<sup>158</sup> Lu		157.94984	10.4 s	\$^+\$, EC/99 /8.0	5.00/				ann.rad./
				" /	4.67/				0.3682 0.4770
<sup>159</sup> Lu		158.9467	12.3 s	\$^+\$, EC/6.0					ann.rad./ 0.1505 0.1875 0.3693
<sup>160</sup> Lu		159.94654	36.1 s	\$^+\$, EC/7.3					ann.rad./ 0.2434 0.3957 0.5773
<sup>161</sup> Lu		160.9432	1.2 m	\$^+\$, EC/5.3					ann.rad./ 0.0437 0.0671 0.1003 0.1108 0.1562 0.2562
<sup>162m</sup> Lu			.1.5 m	EC/		4-			
<sup>162</sup> Lu		161.9432	1.37 m	\$^+\$, EC/6.9		1-			ann.rad./ 0.1666 0.6314
<sup>163</sup> Lu		162.9412	4.1 m	\$^+\$, EC/4.6					ann.rad./ 0.0539 0.0581 0.1504 0.1631 0.3717
<sup>164</sup> Lu		163.9412	3.14 m	\$^+\$, EC/6.3	1.6/ 3.8/				0.1238 0.2621 0.7404 0.8639 0.8804
<sup>165</sup> Lu		164.9396	10.7 m	\$^+\$, EC/3.9	2.06/	1/2+			ann.rad./ 0.1206 0.1324 0.1742 0.2036
<sup>166m2</sup> Lu			2.1 m	\$^+\$ /35 / EC/65 /		(0-)			(0.04 - 2.0) ann.rad./ Yb k x-ray 1.0673 1.2566 2.0986
<sup>166m1</sup> Lu			1.4 m	\$^+\$, EC/58 / I.T./42 /0.0344		(3-)			ann.rad./ 0.1024 0.2281 0.2861 0.8119 0.8301
<sup>166</sup> Lu		165.9398	2.8 m	\$^+\$ /25 /5.5 EC/75 /		(6-)			ann.rad./ Yb k x-ray 0.1024 0.2281 0.3375 0.3679
<sup>167</sup> Lu		166.9383	52. m	\$^+\$ /2 /3.1 EC/98 /	2.1/	7/2+			Yb k x-ray 0.0297 0.2392
<sup>168m</sup> Lu			6.7 m	\$^+\$ /12 / EC/88 / IT/<0.8		3+			(0.03 - 2.0) ann.rad./ Yb k x-ray 0.1988/190 0.8960/100 0.9792/128 0.018-2.65
<sup>168</sup> Lu		167.9387	5.5 m	\$^+\$ /6 /4.5 EC/94 /	1.2/	(6-)			ann.rad./ Yb k x-ray 0.1114 0.1124 0.2286 0.3483 1.4836
<sup>169m</sup> Lu			2.7 m	I.T./0.0290		1/2-			Lu L x-ray 0.0290
<sup>169</sup> Lu		168.93765	1.419 d	EC/2.293	1.271/	7/2+	2.30	3.5	Yb k x-ray 0.19121

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>170m</sup> Lu			0.7 s	I.T./0.0929		4-			0.9606 (0.08 - 2.1) Lu L x-ray 0.04449 0.0484
<sup>170</sup> Lu		169.93847	2.01 d	EC/3.46	2.44/	0+			Yb k x-ray 0.58711 0.5908 1.28029 (0.1 - 3.38) Lu k x-ray 0.07119
<sup>171m</sup> Lu			1.31 m	I.T./0.0711		1/2-			Yb k x-ray 0.01939 0.66744 (0.02 - 1.3) Lu L x-rays 0.04186
<sup>171</sup> Lu		170.937910	8.24 d	EC/1.479	0.362/	7/2+	2.30	3.42	Yb k x-ray 0.18156 1.09367 (0.07 - 2.2) Yb k x-ray 0.07860 0.27198
<sup>172m</sup> Lu			3.7 m	I.T./0.0419		1-			Lu k x-ray 0.067055 Yb k x-ray 0.07664 1.2419
<sup>172</sup> Lu		171.939082	6.64 d	EC/2.519		4-	2.90	3.80	
<sup>173</sup> Lu		172.938927	1.37 y	EC/0.671		7/2+	2.28	3.63	
<sup>174m</sup> Lu			142. d	IT/99.3/ EC/0.7 / EC/1.374	0.17086	6-	1.50		
<sup>174</sup> Lu		173.940334	3.3 y			1-	1.9		
<sup>175</sup> Lu <sup>176m</sup> Lu	97.41(2)	174.940768	3.66 h	\$) /1.315	1.229/ 1.317/	7/2+ 1-	+2.2327 +0.318	+3.49 -1.47	Hf k x-ray 0.088372
<sup>176</sup> Lu	2.59(2)	175.942683	3.73x10 <sup>10</sup> y	\$) /1.192		7-	+3.169	+4.92	Hf k x-ray 0.20187 0.30691
<sup>177m2</sup> Lu <sup>177m</sup> Lu			6. m 160.7 d	\$ <sup>-</sup> IT/22/0.9702 \$) /78		39/2- 23/2-	2.33	5.4	Lu k x-ray Hf k x-ray 0.11295 0.20836 0.37850 0.41853 0.11295 0.20836 0.2166 0.3317
<sup>177</sup> Lu		176.943755	6.65 d	\$) /0.498	0.497/	7/2+	+2.239	+3.39	Hf k x-ray 0.0932 1.3099 1.3408 (0.09 - 1.7) 0.2143 0.3377 0.40795/50. (0.07-1.9) 0.0458 0.2059 0.5749 0.0978 0.7208 0.8182
<sup>178m</sup> Lu			23.1 m	\$) /		(9-)			
<sup>178</sup> Lu		177.945952	28.5 m	\$) /2.099	2.03/	1+			
<sup>179</sup> Lu		178.94732	4.6 h	\$) /1.405	1.35/	7/2+			
<sup>180</sup> Lu		179.9499	5.7 m	\$) /3.1	1.49/				
<sup>181</sup> Lu		180.9518	3.5 m	\$) /2.5		(7/2+)			
<sup>182</sup> Lu		181.9552	2.0 m	\$) / 4.1					
<sup>183</sup> Lu <sup>184</sup> Lu		182.9576 183.9612	58. s 20 s	\$) / \$ <sup>-</sup>		7/2+			
<b><sup>72</sup>Hf</b>		<b>178.49(2)</b>							
<sup>154</sup> Hf		153.964	2. s	EC,\$ <sup>+</sup> / 6.7					
<sup>155</sup> Hf		154.963	0.9 s	EC,\$ <sup>+</sup> /8.					
<sup>156</sup> Hf		155.9593	25. ms	" /					
<sup>157</sup> Hf		156.9581	0.11 s	" /					
<sup>158</sup> Hf		157.9539	2.9 s	EC/54 /5.1 "/46 /	5.27/	0+			
<sup>159</sup> Hf		158.9538	5.6 s	\$ <sup>+</sup> ,EC/88 /6.9 "/12 /	5.09/				ann.rad./
<sup>160</sup> Hf		159.95063	12. s	\$ <sup>+</sup> ,EC/97 /4.9 "/4.78		0+			ann.rad./
<sup>161</sup> Hf <sup>162</sup> Hf		160.9503 161.94720	17. s 38. s	" / \$ <sup>+</sup> ,EC/3.7	4.60/	0+			ann.rad./ 0.1739 0.1963 0.4101 ann.rad./ 0.0454 0.0621 0.0710 0.6882
<sup>163</sup> Hf		162.9471	40. s	\$ <sup>+</sup> ,EC/5.5					
<sup>164</sup> Hf <sup>165</sup> Hf <sup>166</sup> Hf		163.9536 164.9445 165.9423	2.8 m 1.32 m 6.8 m	EC,\$ <sup>+</sup> /3.0 EC/4.6 EC/93 /2.3 \$ <sup>+</sup> /7 /		11/2-			ann.rad./ Lu k x-ray 0.0788
<sup>167</sup> Hf		166.9426	2.0 m	\$ <sup>+</sup> /40 /4.0 EC/60 /		(5/2-)			ann.rad./ Lu k x-ray 0.1754 0.3152
<sup>168</sup> Hf		167.9406	25.9 m	\$ <sup>+</sup> ,EC/1.8		0+			ann.rad./ (0.044-1.311)
<sup>169</sup> Hf		168.9412	3.25 m	EC/85 /3.3 \$ <sup>+</sup> /15 /		(5/2-)			ann.rad./ Lu k x-ray 0.3695

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>170</sup> Hf		169.9397	16.0 h	EC/1.1		0+			0.4929 Lu k x-ray 0.0985 0.1202 0.1647 0.5729 0.6207
<sup>171m</sup> Hf <sup>171</sup> Hf		170.9405	30. s 12.2 h	EC,\$^+ /2.4		(1/2-) 7/2+	+0.53 -0.67	+3.46	ann.rad./ Lu k x-ray 0.1221 0.6620 1.0714 Lu k x-ray 0.02399 0.12582 (0.0818-0.123) Lu k x-ray 0.12367 0.13963 0.29697 0.31124 (0.1 - 2.1)
<sup>172</sup> Hf		171.93946	1.87 y	EC/0.35		0+			Lu k x-ray 0.02399 0.12582 (0.0818-0.123) Lu k x-ray 0.12367 0.13963 0.29697 0.31124 (0.1 - 2.1)
<sup>173</sup> Hf		172.9407	23.6 h	EC/1.6		1/2-			Lu k x-ray 0.08936 0.34340
<sup>174</sup> Hf <sup>175</sup> Hf	0.16(1)	173.940042 174.941504	2.0x10 <sup>15</sup> y 71. d	EC/0.686		0+ 5/2-	-0.60	+2.7	Lu k x-ray 0.08936 0.34340
<sup>176</sup> Hf <sup>177m2</sup> Hf	5.26(7)	175.941403	51.4 m	I.T./2.740		0+ 37/2-			Hf k x-ray 0.2140 0.2951 0.3115 0.3267 Hf k x-ray 0.20836 0.22847 0.37851
<sup>177m1</sup> Hf			1.1 s	I.T./		23/2+			Hf k x-ray 0.20836 0.22847 0.37851
<sup>177</sup> Hf <sup>178m2</sup> Hf	18.60(9)	176.943220	31. y	I.T./		7/2- 16+	+0.7935 +8.16	+0.337 +6.00	Hf k x-ray 0.32555 0.42635 0.089-0.574 Hf k x-ray 0.21342 0.32555 0.42635
<sup>178m1</sup> Hf			4.0 s	I.T./		8-			Hf k x-ray 0.21342 0.32555 0.42635
<sup>178</sup> Hf <sup>179m2</sup> Hf	27.28(7)	177.943698	25.1 d	I.T./1.1057		0+ 25/2-	7.4		Hf k x-ray 0.1227 0.1461 0.3626 0.4537 Hf k x-ray 0.1607 0.2141
<sup>179m1</sup> Hf			18.7 s	I.T./0.375		1/2-			Hf k x-ray 0.1607 0.2141
<sup>179</sup> Hf <sup>180m</sup> Hf	13.62(2)	178.945815	5.52 h	I.T./1.1416		9/2+ 8-	-0.641 +9.	+3.79 +4.6	Hf k x-ray 0.2152 0.3323 0.4432
<sup>180</sup> Hf <sup>181m</sup> Hf <sup>181</sup> Hf	35.08(16)	179.946549 180.949099	1.5 ms 42.4 d	/1.738 \$/1.027	0.408/	0+ 25/2- 1/2-			Ta k x-ray 0.13294/54 0.48200/100 0.3459/20 Hf k x-ray 0.0509 0.2244 0.3441 0.4558 0.5066 0.9428 Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>182m</sup> Hf			62. m	\$/54 /1.60 IT/46 /1.173	0.49/43 0.95/10	8-			Ta k x-ray 0.13294/54 0.48200/100 0.3459/20 Hf k x-ray 0.0509 0.2244 0.3441 0.4558 0.5066 0.9428 Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>182</sup> Hf		181.95055	9.x10 <sup>6</sup> y	\$/0.37		0+			Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>183</sup> Hf		182.95353	1.07 h	\$/2.01	1.18/68 1.54/25	3/2-			Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>184</sup> Hf		183.95545	4.1 h	\$/1.34	0.74/38 0.85/16 1.10/46	0+			Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>185</sup> Hf <sup>186</sup> Hf		184.9588 185.9609	3.5 m 2.6 m	\$/					Ta k x-ray 0.2704 Ta k x-ray 0.0732 0.4591 0.7837 Ta k x-ray 0.0414 0.1391 0.3449 0.165 0.738
<sup>73</sup> Ta		<b>180.9479(1)</b>							
<sup>155</sup> Ta <sup>156</sup> Ta		155.972	12. s 0.11 s	p/1.77 \$/11.6					
<sup>157</sup> Ta		156.968	10 ms	p/	1.02/100 6.117				
<sup>158</sup> Ta		157.9664	37. ms	p/	0.927/3.4 6.05/100 5.97/100				
<sup>159</sup> Ta		158.9629	0.6 s	\$/80 /	"/5.52/34 5.60/55				ann.rad./
<sup>160</sup> Ta		159.9615	1.4 s	\$/EC/10.1					ann.rad./
<sup>161</sup> Ta		160.9584	2.9 s	\$/EC/7.5	5.41/				ann.rad./
<sup>162</sup> Ta		161.9564	4. s	EC/8.6	5.15				

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<sup>163</sup> Ta		162.9544	10.6 s	EC/6.8					
<sup>164</sup> Ta		163.9536	14.2 s	\$^+ /8.5 "/	4.62/	3+			ann.rad./ 0.2110 0.3768
<sup>165</sup> Ta		164.9508	31. s	EC\$^+ /5.9					
<sup>166</sup> Ta		165.9505	34. s	\$^+ /82 /7.7 EC/18 /					ann.rad./ Hf k x-ray 0.1587 0.3117 0.8101 ann.rad./
<sup>167</sup> Ta		166.9486	1.4 m	\$^+ ,EC/5.6					
<sup>168</sup> Ta		167.9478	2.4 m	\$^+ /77 /6.7 EC/23 /		3+			ann.rad./ Hf k x-ray 0.1239 0.2615 0.7502
<sup>169</sup> Ta		168.9459	4.9 m	\$^+ ,EC/4.4					ann.rad./ 0.0288 0.1535 0.1924
<sup>170</sup> Ta		169.9461	6.8 m	\$^+ /70 /6.0 EC/35 /		(3+)			ann.rad./ Hf k x-ray 0.1008 0.2212 0.0496
<sup>171</sup> Ta		170.9445	23.3 m	\$^+ ,EC/3.7		(5/2-)			0.5018 0.5064 (0.05 - 1.02)
<sup>172</sup> Ta		171.9447	36.8 m	\$^+ /25 /4.9 EC/75 /		(3-)			ann.rad./ Hf k x-ray 0.21396 1.10923 (0.09 - 3.8)
<sup>173</sup> Ta		172.9446	3.6 h	\$^+ /24 /3.7 EC/76 /		(5/2-)	1.70	-1.9	ann.rad./ Hf k x-ray 0.06972 0.17219 (0.06 - 2.7)
<sup>174</sup> Ta		173.9442	1.12 h	\$^+ /27 /3.8 EC/73 /		(3+)			ann.rad./ Hf k x-ray 0.09089 0.20638 (0.09 - 3.64)
<sup>175</sup> Ta		174.9437	10.5 h	EC/2.0		7/2+	2.27	+3.7	Hf k x-ray 0.2077 0.2671 0.3487
<sup>176</sup> Ta		175.9447	8.1 h	EC/3.1		1-			Hf k x-ray 0.08837 1.15735
<sup>177</sup> Ta		176.944472	2.356 d	EC/1.166		7/2+	2.25		Hf k x-ray 0.11295 (0.07 - 1.06)
<sup>178m</sup> Ta			2.4 h	EC/		(7-)			Hf k x-ray 0.08886 0.21342 0.32555 0.42635
<sup>178</sup> Ta		177.9458	9.29 m	EC/99 /1.9 \$^+ /1 /		1+	+2.74	+0.65	ann.rad./ Hf k x-ray 0.09316
<sup>179</sup> Ta		178.94593	1.8 y	EC/0.110		7/2+	2.29	3.37	Hf k x-ray
<sup>180m</sup> Ta	0.012(2)		>1.2x10 <sup>15</sup> y			(9-)	4.82		
<sup>180</sup> Ta		179.947466	8.15 h	EC/87 /0.854 \$) /13 /0.708	0.61/3 0.71/10	1+			Hf k x-ray W k x-ray 0.09333 0.10340
<sup>181</sup> Ta	99.988(2)	180.947996		I.T./0.5198		7/2+	+2.370	+3.3	Ta k x-ray 0.14678 0.17157
<sup>182m</sup> Ta			15.8 m			10-			W k x-ray 1.12127/100 1.22138/79 0.085-1.289
<sup>182</sup> Ta		181.950152	114.43 d	\$) /1.814	0.25/30 0.44/20 0.52/40	3-	+3.02	+2.6	W k x-ray 0.085-1.289
<sup>183</sup> Ta		182.951373	5.1 d	\$) /1.070	0.45/5 0.62/91	7/2+	+2.36		W k x-ray 0.0847 0.0991 0.1079 0.2461 0.3540
<sup>184</sup> Ta		183.95401	8.7 h	\$) /2.87	1.11/15 1.17/81	(5-)			W k x-ray 0.2528/44. 0.4140/74. (0.09-1.4)
<sup>185</sup> Ta		184.95556	49. m	\$) /1.99	1.21/5 1.77/81	(7/2+)			W k x-ray 0.0697 0.1739 0.1776
<sup>186</sup> Ta		185.9586	10.5 m	\$) /3.9	2.2/	(3-)			W k x-ray 0.1979 0.2149 0.5106 (0.09 - 1.5)
<sup>187</sup> Ta		186.9604							
<sup>188</sup> Ta		187.9637							
<sup>74</sup> W		<b>183.84(1)</b>							

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<sup>158m</sup> W			0.14 ms	"	8.28(3)/				
<sup>158</sup> W		157.974	1.3 ms	" /	6.433/96				
<sup>159</sup> W		158.972	7. ms	" /					
<sup>160</sup> W		159.9684	0.08 s	" /	5.92/	0+			
<sup>161</sup> W		160.9671	0.41 s	\$ <sup>+</sup> ,EC/18 /8.1 "/82 /	5.78/				
<sup>162</sup> W		161.9626	1.39 s	\$ <sup>+</sup> ,EC/54 /5.8 "/46 /	5.54/	0+			
<sup>163</sup> W		162.9624	2.8 s	\$ <sup>+</sup> ,EC/59 /7.5 "/41 /	5.38/				
<sup>164</sup> W		163.95890	6. s	\$ <sup>+</sup> ,EC/97 /5.0 "/3 /	5.15/	0+			ann.rad./
<sup>165</sup> W		164.9583	5.1 s	\$ <sup>+</sup> ,EC/99 /7.0 "/1 /	4.91/				ann.rad./
<sup>166</sup> W		165.95502	16. s	\$ <sup>+</sup> ,EC/99 /4.2 "/1 /	4.74/	0+			ann.rad./
<sup>167</sup> W		166.9547	20. s	EC/5.6					
<sup>168</sup> W		167.9519	53. s	EC/3.8 "/10 <sup>15</sup> /	4.40(1)				ann.rad./ Ta k x-ray 0.1755 (0.037-0.573)
<sup>169</sup> W		168.9518	1.3 m	EC/5.4					ann.rad./ Ta k x-ray 0.123 (0.097-0.699)
<sup>170</sup> W		169.9485	2.4 m	EC/2.2					ann.rad./ Ta k x-ray 0.3162 (0.060-0.144)
<sup>171</sup> W		170.9494	2.4 m	EC/4.6					ann.rad./ Ta k x-ray 0.1842 (0.052-0.479)
<sup>172</sup> W		171.9474	6.6 m	\$ <sup>+</sup> ,EC/2.5					ann.rad./ Ta k x-ray 0.0389 (0.034-0.674)
<sup>173</sup> W		172.9489	6.3 m	EC/4.0					ann.rad./ Ta k x-ray 0.4576 (0.035-0.623)
<sup>174</sup> W		173.9462	35. m	EC/1.9		0+			ann.rad./ Ta k x-ray 0.3287 0.4288 (0.056-0.429)
<sup>175</sup> W		174.9468	35. m	EC/2.9		1/2-			(0.015-0.27)
<sup>176</sup> W		175.9456	2.5 h	\$ <sup>+</sup> ,EC/0.8		0+			0.03358 0.06129 0.09487 0.10020
<sup>177</sup> W		176.9466	2.21 h	EC/2.0		(1/2-)			Ta k x-ray 0.15505 0.18569 0.42694
<sup>178</sup> W		177.9459	21.6 d	EC/0.091		0+			Ta k x-ray
<sup>179m</sup> W			6.4 m	IT/99.7/0.222		(1/2-)			W k x-ray
<sup>179</sup> W		178.94707	38. m	EC/0.3/ EC/1.06		(7/2-)			0.2220 Ta k x-ray 0.0307
<sup>180</sup> W	0.12(1)	179.946706	7.4x10 <sup>16</sup> y	" /		0+			
<sup>181</sup> W		180.94820	121.1 d	EC/0.188		9/2+			Ta k x-ray 0.13617 0.15221
<sup>182</sup> W	26.50(16)	181.948205	8.3x10 <sup>18</sup> y	" /		0+			
<sup>183m</sup> W			5.15 s	I.T. /		(11/2+)			W k x-ray 0.0465 0.0526 0.0991 0.1605
<sup>183</sup> W	14.31(4)	182.950224	1.9x10 <sup>18</sup> y	" /		1/2-	+0.1177848		
<sup>184</sup> W	30.64(2)	183.950932	4.0x10 <sup>18</sup> y	" /		0+			
<sup>185m</sup> W			1.6 m	I.T. /0.1974		11/2+			W k x-ray 0.0659 0.1315 0.1737 0.12536
<sup>185</sup> W		184.953420	74.8 d	\$) /0.433	0.433/99.9	3/2-			
<sup>186</sup> W	28.43(19)	185.954362	6.5x10 <sup>18</sup> y	" /		0+			
<sup>187</sup> W		186.957158	23.9 h	\$) /1.311	0.624/66 1.315/16 0.081-1.18 0.349/99	3/2-	0.62		Re k x-ray 0.68572/33 0.134-0.773
<sup>188</sup> W		187.958487	69.78 d	\$) /0.349		0+			0.0636 0.2271 0.2907 (0.1262-1.466)
<sup>189</sup> W		188.9619	10.6 m	\$) /2.5	1.4/ 2.5/	(3/2-)			
<sup>190m</sup> W			0.3 ms						
<sup>190</sup> W		189.9632	30. m	\$) /1.3	0.95/	0+			Re k x-ray 0.1576 0.1621
<b><sup>75</sup>Re</b>	<b>186.207(1)</b>								
<sup>160</sup> Re		159.981	0.7 ms	β/ "/	1.261(6)/91 6.54/				
<sup>161</sup> Re		160.978	14 ms	" /	6.24 1.35				
<sup>162</sup> Re		161.9757	0.10 s	β/ "/	6.12/94 6.09/94				
<sup>163</sup> Re		162.9721	0.26 s	\$ <sup>+</sup> ,EC/9.0 "/	"/5.87/32 5.92/66				

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<sup>164</sup> Re		163.9704	0.9 s	\$^+\$,EC/10.7					
<sup>165</sup> Re		164.9671	2. s	\$^+\$,EC/87 /8.1	5.78/				
<sup>166</sup> Re		165.9651	2.5 s	\$^+\$,EC/9.4	5.51/				
<sup>167m</sup> Re			6.2 s	EC/	5.50/				
<sup>167</sup> Re		166.9626	3.4 s	\$^+\$,EC/7.4	5.015/				
<sup>168</sup> Re		167.9616	4.4 s	\$^+\$,EC/9.1	4.833/				0.1117
<sup>169m</sup> Re			8.1 s	" /	4.70/				
<sup>169</sup> Re		168.9588	16. s		4.87/				
<sup>170m</sup> Re		169.9582	9.2 s	\$^+\$, EC/9.0					0.1560 0.3055 0.4125
<sup>171</sup> Re		170.9555	15.2 s	EC/. 5.7					
<sup>172m</sup> Re			55. s	\$^+\$,EC/		(2)			ann.rad./ 0.1234 0.2537 0.3504 ann.rad./ 0.1234 0.2537
<sup>172</sup> Re		171.9553	15. s	\$^+\$,EC/7.3					ann.rad./ 0.1119 0.2430
<sup>173</sup> Re		172.9531	2.0 m	EC/. 3.9					ann.rad./
<sup>174</sup> Re		173.9521	2.4 m	\$^+\$,EC/5.6					ann.rad./ 0.1119 0.2430
<sup>175</sup> Re		174.9514	5.8 m	\$^+\$,EC/4.3					ann.rad./
<sup>176</sup> Re		175.9516	5.3 m	\$^+\$,EC/5.6		(3+)			ann.rad./ 0.1089 0.2406
<sup>177</sup> Re		176.9503	14. m	EC/78 /3.4 \$^+\$ /22 /		(5/2-)			ann.rad./ W k x-ray 0.0797 0.0843 0.1968
<sup>178</sup> Re		177.9509	13.2 m	\$^+\$ /11 /4.7 EC/89 /	3.3/	(3)			ann.rad./ W k x-ray 0.1059 0.2373 0.9391
<sup>179</sup> Re		178.9500	19.7 m	EC/99 /2.71 \$^+\$ /1 /	0.95/	(5/2+)	2.8		W k x-ray 0.1199 0.2900 0.4154 0.4302 1.6803
<sup>180</sup> Re		179.95079	2.45 m	EC/92 /3.80 \$^+\$ /8 /	1.76/	1-	1.6		ann.rad./ W k x-ray 0.1036 0.9028 (0.07 - 2.2)
<sup>181</sup> Re		180.95006	20. h	EC /1.74		5/2+	3.19		W k x-ray 0.3607 0.3655 0.6390
<sup>182m</sup> Re			12.7 h	EC/	0.55/ 1.74/	2+	3.3	+1.8	W k x-ray 0.0677 1.1214 1.2215
<sup>182</sup> Re		181.9512	2.67 d	EC/2.8		(7+)	2.8	+4.1	(0.06 - 2.2) W k x-ray 0.0678 0.2293 1.1213 1.2214
<sup>183</sup> Re		182.95082	70. d	EC/0.56		(5/2+)	+3.17	+2.3	W k x-ray 0.16232
<sup>184m</sup> Re			165. d	I.T./75 /0.188 EC/25 /		8+	+2.9		Re k x-ray 0.1047 0.2165 0.92093 (0.10 - 1.1)
<sup>184</sup> Re		183.95252	38. d	EC/1.48		3-	+2.53	+2.8	W k x-ray 0.79207 0.90328 (0.1 - 1.4)
<sup>185</sup> Re	37.40(2)	184.952955				5/2+	+3.1871	+2.18	
<sup>186m</sup> Re			2.0x10 <sup>5</sup> y	I.T./0.150		8+			Re k x-ray 0.0590
<sup>186</sup> Re		185.954986	3.718 d	\$) /92 /1.070 EC/8 /0.582	0.973/21 1.07/71	1-	+1.739	+0.62	W k x-ray 0.1227/0.6 0.1372/9.5 (0.63-0.77)
<sup>187</sup> Re	62.60(2)	186.955751	4.2x10 <sup>10</sup> y	\$) /0.00266	0.0025/	5/2+	+3.2197	+2.07	
<sup>188m</sup> Re			18.6 m	I.T./0.172		(6-)			Re k x-ray 0.0925 0.1059
<sup>188</sup> Re		187.958112	17.00 h	\$) /2.120	1.962/20 2.118/79	1-	+1.788	+0.57	Os k x-ray 0.15502 0.309-2.022
<sup>189</sup> Re		188.959228	24. h	\$) /1.01	1.01/	(5/2+)			0.1471 0.2167 0.2194 0.2451
<sup>190m</sup> Re			3.0 h	\$) /51 /		(6-)			Re k x-ray





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<sup>192</sup> Os	40.78(19)	191.961479				0+			0.5692/70 (0.201-1.000)
<sup>193</sup> Os		192.964148	30.5 h	\$) /1.141	1.04/20	3/2-	+0.730	+0.47	Ir k x-ray 0.1389 0.4605
<sup>194</sup> Os		193.965179	6.0 y	\$) /0.097	0.054/33 0.096/67	0+			Ir L x-ray 0.0429
<sup>195</sup> Os		194.9681	6.5 m	\$) /2.0	2.0/				
<sup>196</sup> Os		195.96962	34.9 m	\$) /1.16	0.84/	0+			0.1262/5 0.4079/5.9
<b>77Ir</b>		<b>192.217(3)</b>							
<sup>164</sup> Ir			0.06 ms	p	1.78				
<sup>165</sup> Ir		164.9876	0.3 ms	p/87 "/13	1.71 6.72				
<sup>166m</sup> Ir			15 ms	"/98.2	6.56				
<sup>166</sup> Ir		165.9855	. 11 ms	p/1.8 "/93	1.32 6.56				
<sup>167m</sup> Ir			30 ms	p/6.9 "/48,\$*	1.15 6.41/80				
<sup>167</sup> Ir		166.9817	35. ms	p/32 "/80,\$*	1.24/0.4 6.35/48				
<sup>168</sup> Ir		167.9799	0.16 s	p/0.4 "/82	1.04/32				
<sup>169m</sup> Ir			0.3 s	"/	6.11/84				
<sup>169</sup> Ir		168.9764	0.6 s	"/	6.00/50				
<sup>170</sup> Ir		169.9743	0.43 s	"/	6.03/				
<sup>171</sup> Ir		170.9718	1.3 s	"/	5.91/				
<sup>172</sup> Ir		171.9706	2.1 s	"/	5.811/				0.228 (0.379-0.475)
<sup>173</sup> Ir		172.9677	3.0 s	"/	5.665/				0.0493 (0.092-0.296)
<sup>174</sup> Ir		173.9668	4. s	"/	5.478/				0.1587 (0.276-1.33)
<sup>175</sup> Ir		174.9641	. 4.5 s	"/	5.393/				0.1056
<sup>176</sup> Ir		175.9635	8. s	EC, \$*/80 "/3.2/	5.118/				0.260 (0.135-0.415)
<sup>177</sup> Ir		176.9612	30. s	EC, \$*/5.7 "/0.06/	5.011/				0.184 (0.062-0.194)
<sup>178</sup> Ir		177.9601	12. s	\$*,EC/6.3					
<sup>179</sup> Ir		178.9592	4. m	EC/4.9					0.1320 0.2667 0.3633 0.0975 (0.045-0.220)
<sup>180</sup> Ir		179.9593	1.5 m	EC/6.4					0.2765 (0.132-1.106)
<sup>181</sup> Ir		180.9576	4.9 m	\$*,EC/4.1		(7/2+)			ann.rad./ 0.1076 (0.0196-1.715)
<sup>182</sup> Ir		181.9582	15. m	\$*/44 /5.6 EC/56 /					ann.rad./ Os k x-ray 0.1273 0.2370
<sup>183</sup> Ir		182.9568	57. m	\$*,EC/3.5					ann.rad./ 0.0877 0.2285 0.2824
<sup>184</sup> Ir		183.9574	3.0 h	\$*/12 /4.6 EC/88 /	2.3/ 2.9/	5-	0.70	+2.41	ann.rad./ Os k x-ray 0.11968 0.2640 0.3904
<sup>185</sup> Ir		184.9566	14. h	\$*/3 /2.4 EC/97 /		(5/2-)	2.60	-2.1	ann.rad./ Os k x-ray 0.2543 1.8288
<sup>186m</sup> Ir			1.7 h	EC /		(2-)	0.64	+1.46	Os k x-ray 0.1371 0.7675
<sup>186</sup> Ir		185.95795	15.7 h	EC/98 /3.83 \$*/2 /		(5+)	3.9	-2.55	Os k x-ray 0.1372 0.2968 0.4348
<sup>187</sup> Ir		186.95736	10.5 h	EC/1.50		3/2+		+0.94	(0.13 - 3.0) Os k x-ray 0.0743 0.4009 0.4271 0.6109 0.9128
<sup>188</sup> Ir		187.95885	1.72 d	\$*/2.81 EC/99+ /	1.13/ 1.64/	(2-)	0.30	+0.48	Os k x-ray 0.1550 0.4780 0.6330 2.2146
<sup>189</sup> Ir		188.95872	13.2 d	EC/0.53		3/2+	0.13	+0.88	Os k x-ray 0.2449 0.376
<sup>190m2</sup> Ir			3.09 h	\$*,EC/95 / I.T./5 /		(11-)			
<sup>190m1</sup> Ir			1.12 h	I.T./0.0263		7+			Ir L x-ray
<sup>190</sup> Ir		189.9606	11.8 d	EC/2.0		(4+)	0.04	+2.8	Os k x-ray 0.1867 0.4072 0.5186 0.5580 0.6051 (0.2 - 1.4)
<sup>191m</sup> Ir			4.93 s	I.T./0.1714		11/2-	+0.603		Ir k x-ray

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<sup>191</sup> Ir	37.3(2)	190.960591	241. y 1.44 m	I.T./0.161 I.T./0.0580		3/2+ (9+) (1+)	+0.151	+0.82	0.1294
<sup>192m1</sup> Ir									Ir k x-ray Ir L x-ray 0.0580 0.3165
<sup>192m2</sup> Ir									
<sup>192</sup> Ir		191.962602	73.83 d	) /1.460		(4-)	+1.92	+2.15	Pt k x-ray 0.31649/83. 0.46806/48.
<sup>193m</sup> Ir			10.53 d	I.T./0.0802		11/2-			Ir L x-ray 0.0803
<sup>193</sup> Ir	62.7(2)	192.962923	170. d	) /		3/2+ 11	+0.164	+0.75	Pt k x-ray 0.3284 0.4829 0.5624
<sup>194m</sup> Ir									
<sup>194</sup> Ir		193.965075	19.3 h	) /2.247	1.92/9 2.25/86	1-	+0.39	+0.34	0.2935 0.3284 0.6451 (0.1 - 2.2)
<sup>195m</sup> Ir			3.9 h	) /	0.41/ 0.97/	(11/2-)			Pt k x-ray 0.3199/9.6 0.3649/9.5 0.4329/9.6 0.6849/9.6
<sup>195</sup> Ir		194.965976	2.8 h	) /1.120	1.0/80 1.11/13	(3/2+)			Pt k x-ray 0.0989/9.7
<sup>196m</sup> Ir			1.40 h	) /	1.16/				Pt k x-ray 0.3557 0.3935 0.4471 0.5214 0.6473
<sup>196</sup> Ir		195.96838	52. s	) /3.21	2.1/15 3.2/80	0-			0.3329 0.3557 0.7796 0.3465
<sup>197m</sup> Ir			8.9 m	) / I.T./		(11/2-)			See Ir[197]
<sup>197</sup> Ir		196.96964	5.8 m	) /2.16	1.5/ 2.0/	(3/2+)			0.0531 0.1351 0.4306 0.4697 0.4074 0.5070
<sup>198</sup> Ir		197.9723	8. s	) /4.1					
<sup>199</sup> Ir		198.97378							
<sup>78</sup> Pt		<b>195.078(2)</b>							
<sup>166</sup> Pt			0.3 ms	" /	7.11/				
<sup>167</sup> Pt			0.7 ms	" /	6.99/				
<sup>168</sup> Pt		167.9880	2.0 ms	"	6.83				0.582/69 0.594/69 0.725/62
<sup>169</sup> Pt		168.9864	3. ms	"					
<sup>170</sup> Pt		169.9816	14 ms	"	6.55				0.509/100 0.662/86 0.214-0.726
<sup>171</sup> Pt		170.9811	0.05 s	"	6.45				
<sup>172</sup> Pt		171.97730	0.10 s	" /	6.31/94	0+			
<sup>173</sup> Pt		172.9765	0.36 s	\$+ ,EC/8.2	6.23 6.20/				
<sup>174</sup> Pt		173.97281	0.89 s	\$+ ,EC/17 /5.6 "/83 /	6.040/	0+			
<sup>175</sup> Pt		174.9723	2.5 s	\$+ ,EC/65 /7.6 "/35 /	5.831/5 5.96/54 6.038/				0.0774 0.1354 0.2128
<sup>176</sup> Pt		175.9690	6.3 s	\$+ ,EC/60 /5.1 "/40 /	5.528/0.6 5.750/41	0+			ann.rad./ 0.2277
<sup>177</sup> Pt		176.9685	11. s	EC/91 /6.8 "/9 /	5.53/ 5.485/3 5.525/6				0.0908
<sup>178</sup> Pt		177.9649	21. s	EC/93 /4.5 "/7 /	5.286/0.2 5.442/7	0+			
<sup>179</sup> Pt		178.9653	33. s	\$+ ,EC/5.7 "/ /	5.16/		+0.43		
<sup>180</sup> Pt		179.9632	52. s	\$+ ,EC/99.7 /3.7 "/0.3 /	5.140/	0+			
<sup>181</sup> Pt		180.9632	51. s	\$+ ,EC/5.2		0+	+0.48		
<sup>182</sup> Pt		181.9613	2.7 m	\$+ ,EC/2.9					ann.rad./ 0.1360 0.1460 0.2100
<sup>183m</sup> Pt			43. s	\$+ ,EC/ I.T./		(7/2-)	+0.78	+3.4	ann.rad./ 0.3132/26 0.3164/59 0.6296/100 0.058-1.75
<sup>183</sup> Pt		182.9617	7. m	\$+ ,EC/4.6			+0.50		ann.rad./ 0.119/100 0.307/93 0.260/90 0.058-1.377
<sup>184</sup> Pt		183.9599	17.3 m	\$+ ,EC/2.3					ann.rad./ 0.1549 0.1919 0.5484
<sup>185m</sup> Pt			33. m	\$+ ,EC/		1/2-	+0.5		

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<sup>185</sup> Pt		184.9607	1.18 h	\$ <sup>+</sup> , EC/3.8		(9/2+)	-0.75	+3.7	ann. rad. / 0.1353 0.1974 0.2296 0.2551
<sup>186</sup> Pt		185.95943	2.0 h	\$ <sup>+</sup> , EC/1.38		0+			ann. rad. / 0.6115 0.6892
<sup>187</sup> Pt		186.9607	2.35 h	\$ <sup>+</sup> , EC/3.1		3/2	-0.41	-1.1	ann. rad. / Ir k x-ray 0.1064 0.1100 0.2015 0.2849 0.7092
<sup>188</sup> Pt		187.95940	10.2 d	EC/0.51		0+			Ir k x-ray 0.1876 0.1951
<sup>189</sup> Pt		188.96083	10.9 h	\$ <sup>+</sup> , EC/1.97		3/2-	-0.43	-1.2	Ir k x-ray 0.0943 0.6076 0.7214 (0.09 - 1.47)
<sup>190</sup> Pt	0.014(1)	189.95993	4.5x10 <sup>11</sup> y			0+			
<sup>191</sup> Pt		190.961684	2.86 d	EC/1.02		(3/2-)	-0.50	-0.9	Ir k x-ray 0.3599 0.4094 0.5389
<sup>192</sup> Pt	0.782(7)	191.961035	4.33 d	I.T./0.1498		0+			
<sup>193m</sup> Pt						13/2+	-0.75		Pt k x-ray 0.1355
<sup>193</sup> Pt		192.962984	60. y	EC/0.0566		(1/2-)	+0.60		Ir k x-rays
<sup>194</sup> Pt	32.967(99)	193.962663				0+			
<sup>195m</sup> Pt			4.01 d	I.T./0.2952		13/2+	-0.61	+1.4	Pt k x-ray 0.0989
<sup>195</sup> Pt	33.832(10)	194.964774				1/2-	+0.6095		
<sup>196</sup> Pt	25.242(41)	195.964934				0+			
<sup>197m</sup> Pt			1.590 h	I.T./97 / \$) /3 /		13/2+			Pt k x-ray 0.0530 0.3465
<sup>197</sup> Pt		196.967323	19.9 h	\$) /0.719		1/2-	0.51		Au k x-ray 0.1914 0.2688
<sup>198</sup> Pt	7.163(55)	197.967875				0+			
<sup>199m</sup> Pt			13.6 s	I.T./0.424		13/2+			Pt k x-ray 0.3919
<sup>199</sup> Pt		198.970576	30.8 m	\$) /1.70	0.90/18 1.14/14	(5/2-)			0.3170/4.9 0.49375/5.7 0.5430/14.8 (0.055-1.293)
<sup>200</sup> Pt		199.97142	12.5 h	\$) /0.66		0+			Au k x-ray 0.13590 0.22747 0.24371
<sup>201</sup> Pt		200.9745	2.5 m	\$) /2.66		(5/2-)			0.070 0.152 0.222 1.760 0.440
<sup>202</sup> Pt		201.9757	1.8 d						
<b><sup>79</sup>Au</b>		<b>196.96655(2)</b>							
<sup>170m</sup> Au			0.62 ms	p/58 /42	1.74/ 7.11/				
<sup>170</sup> Au			0.30 ms	p/85 /15	1.47/ 7.01/				
<sup>171</sup> Au		170.9918	1.0 ms	p/46 /54	1.44/100 7.00				
<sup>172</sup> Au		171.9901	4 ms	" /7.02	6.86				
<sup>173m</sup> Au			15 ms	" /92	6.732				
<sup>173</sup> Au		172.9864	0.02 s	" /94	6.672				
<sup>174</sup> Au		173.9842	0.14 s	"	6.54				
<sup>175</sup> Au		174.9817	0.15 s	"					
<sup>176</sup> Au		175.9803	0.9 s	\$ <sup>+</sup> , EC/10.5 /	6.260/80 6.290/20				
<sup>177</sup> Au		176.9772	1.2 s	" /	6.115/ 6.150/				
<sup>178</sup> Au		177.9760	2.6 s	" /	5.920/				
<sup>179</sup> Au		178.9732	7.5 s	" /	5.85/				
<sup>180</sup> Au		179.9724	8.1 s	EC/8.6 /	5.65 5.61 5.50				0.1522 0.2564 0.5242 0.6765 0.8084 0.8597
<sup>181</sup> Au		180.9700	11.4 s	EC/97.5/6.3 /2.7/	5.482/				
<sup>182</sup> Au		181.9686	21. s	\$ <sup>+</sup> , EC/6.9 /0.13/					ann. rad. / 0.1549 0.2649 (0.13 - 1.4)
<sup>183</sup> Au		182.9676	42. s	EC/5.5 /0.8/			+1.97		0.1630 0.2730 0.3625
<sup>184m</sup> Au			48 s			(2+)	+1.44	+1.9	0.069(IT)
<sup>184</sup> Au		183.9675	21. s	EC, \$ <sup>+</sup> /7.1 /0.013/		(5+)	+2.07	+4.7	
<sup>185m</sup> Au			6.8 m	\$ <sup>+</sup> , EC/ I.T./0.145					
<sup>185</sup> Au		184.9657	4.3 m	\$ <sup>+</sup> , EC/4.71 /0.26/		(5/2-)	+2.17	-1.1	ann. rad. /

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>186m</sup> Au <sup>186</sup> Au		185.9659	< 2. m 10.7 m	\$^+\$ ,EC/ \$^+\$ ,EC/6.0 "/8(10) <sup>-4</sup> /		3-	-1.26	+3.1	0.1915 ann.rad./ 0.1915 0.2988
<sup>187m</sup> Au <sup>187</sup> Au		186.9646	2.3 s 8.3 m	IT \$^+\$ ,EC/3.60		9/2- 1/2+	+0.54		ann.rad./ 0.9152 1.2668 1.3321 1.4081
<sup>188</sup> Au		187.9651	8.8 m	\$^+\$ ,EC/5.3		(1-)	-0.07		ann.rad./ 0.2660 0.3404 0.6061 0.1667
<sup>189m</sup> Au <sup>189</sup> Au		188.9642	4.6 m 28.7 m	\$^+\$ ,EC/ EC/96 /3.2 \$^+\$ /4 /		11/2- 1/2+	+6.19 +0.49		ann.rad./ Pt k x-ray 0.4478 0.7133 0.8128
<sup>190</sup> Au		189.96470	43. m	\$^+\$ /2 /4.44 EC/98 /		1-	-0.07		ann.rad./ Pt k x-ray 0.2958 0.3018 0.5977
<sup>191m</sup> Au			0.9 s	I.T./0.2663		(11/2-	6.6		Au k x-ray 0.2414 0.2526
<sup>191</sup> Au		190.96365	3.2 h	EC/1.83		3/2+	+0.137	+0.72	Pt k x-ray 0.5864/16 (0.088-1.30)
<sup>192</sup> Au		191.96481	4.9 h	\$^+\$ /5 /3.52 EC/95 /	2.19/ 2.49/	1-	-0.011	-0.23	ann.rad./ Pt k x-ray 0.2959 0.3165
<sup>193m</sup> Au			3.9 s	I.T./0.2901		11/2-	6.2	+1.98	Au k x-ray 0.2580
<sup>193</sup> Au		192.96413	17.6 h	EC/1.07		3/2+	+0.140	+0.66	Pt k x-ray 0.1862 0.2556
<sup>194</sup> Au		193.96534	1.64 d	\$^+\$ /3 /2.49 EC/97 /	1.49/	1-	+0.076	-0.24	ann.rad./ Pt k x-ray 0.2935 0.3284/61
<sup>195m</sup> Au			30.5 s	I.T./0.3186		11/2-	6.2	+1.9	Au k x-ray 0.2617
<sup>195</sup> Au <sup>196m2</sup> Au		194.965017	186.10 d 9.7 h	EC/0.227 I.T./0.5954		3/2+ 12-	+0.149 5.7	+0.61	Pt k x-ray Au k x-ray 0.1478 0.1883 0.0847
<sup>196m1</sup> Au <sup>196</sup> Au <sup>197m</sup> Au		195.966551	8.1 s 6.17 d 7.8 s	I.T./0.0846 EC/92 /1.506 I.T./0.4094 \$) /8 /0.686		8+ 2- 11/2-	+0.591 +6.0	0.81 +1.7	Pt k x-ray Au k x-ray 0.1302 0.2790
<sup>197</sup> Au <sup>198m</sup> Au	100.	196.966551	2.30 d	I.T./0.812		3/2+ (12-)	+0.14575	+0.55	Au k x-ray 0.0972 0.1803 0.2419
<sup>198</sup> Au		197.968225	2.695 d	\$) /1.372	0.290/1 0.961/99	2-	+0.5934	+0.64	Hg k x-ray 0.411794
<sup>199</sup> Au		198.968748	3.14 d	\$) /0.453	0.25/22 0.292/72 0.462/6	3/2+	+0.2715	+0.51	Hg k x-ray 0.15837 0.20820
<sup>200m</sup> Au			18.7 h	\$) /84 /1.0 I.T./16 /	0.56/	12-	5.9		Au k x-ray 0.2559/71 0.3680/77 0.4978/73 0.5793/72 0.084-0.904)
<sup>200</sup> Au		199.97072	48.4 m	\$) /2.24	0.7/15 2.2/77	1-			0.3679/19 1.2254/10.6 (0.077-1.570) (0.027-0.732)
<sup>201</sup> Au <sup>202</sup> Au <sup>203</sup> Au <sup>204</sup> Au		200.97165 201.97738 202.97515 203.9783	26. m 29. s 1.0 m 40. s	\$) /1.28 \$) /3.0 \$) /2.14 \$) /4.5	1.27/82 1.9/	3/2+ (1-) 3/2+ (2-)			0.4396 (0.04-0.37) 0.4366 1.5113
<sup>205</sup> Au		204.9796	31. s	\$) /					(0.38 - 1.33)
<sup>80</sup> Hg		<b>200.59(2)</b>							
<sup>172</sup> Hg <sup>173</sup> Hg <sup>174</sup> Hg <sup>175</sup> Hg <sup>176</sup> Hg <sup>177</sup> Hg <sup>178</sup> Hg			.0.25 ms 0.9 ms 1.9 ms 0.02 s 21 ms 0.13 s 0.26 s	" " " " " EC/50 /6.1 "/50 /	7.35 7.21 7.07 6.74/94 6.58 6.43/				0+
<sup>178</sup> Hg <sup>180</sup> Hg		178.9818 179.9783	1.05 s 2.6 s	EC/8.0 "/ EC/5.5 /	6.29/ 6.12/33 5.69/.03				0+
<sup>181</sup> Hg		180.9778	3.6 s	\$^+\$ EC/74 / .7.3 "/26 /		(1/2-)	+0.507		0.1250 0.3005 0.3812 0.0663 0.0811 0.0924 0.1474 0.1587

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	β-Energy /Intensity (MeV / %)
<sup>182</sup> Hg		181.9739	10.8 s	\$^+\$, EC/85/5.0 "/15/	5.87/8.6 5.45/0.03	0+			0.2142 0.2398 0.129/122 0.2176/66 0.0256-0.543
<sup>183</sup> Hg		182.9744	9. s	\$^+\$, EC/77/6.3 "/	5.83/ 5.91/	1/2-	+0.524		0.0714 0.0874 0.1538 0.0915 0.1265 0.1560 0.2362
<sup>184</sup> Hg		183.9719	30.9 s	\$^+\$, EC/99/4.1 "/1/	5.54/1.3 5.07/0.002	0+			0.211 0.292
<sup>185m</sup> Hg			21. s	\$^+\$, EC, IT, "/	5.37/	13/2+	-1.02	+0.2	0.02-0.55 0.1119 0.2518
<sup>185</sup> Hg		184.9720	51. s	\$^+\$, EC/95/5.8		1/2-	+0.509		
<sup>186</sup> Hg		185.9695	1.4 m	\$^+\$, EC/3.3	5.09/0.02	0+			see Hg187
<sup>187m</sup> Hg			1.7 m	\$^+\$, EC/		13/2+	-1.04	+0.5	0.1034/32 0.2334/100 0.2403/33 0.27151/31 0.3763/38 0.5254/30 0.10-2.18
<sup>187</sup> Hg		186.9698	2.4 m	\$^+\$, EC/4.9		3/2-	-0.594	-0.8	

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<sup>188</sup> Hg		187.9676	3.2 m	\$^+\$ ,EC/2.3	4.61	0+			0.0988 0.1148 0.1424
<sup>189m</sup> Hg			8.6 m	EC/		13/2+	-1.06	+0.7	0.1900 0.0780 0.3210 0.4345 0.5655 (0.08 - 2.170)
<sup>189</sup> Hg		188.9687	7.6 m	EC/4.2		3/2-	-0.6086	-0.8	0.2005 0.2038 0.2386 0.2485 0.1296 0.1426
<sup>190</sup> Hg		189.9663	20.0 m	EC/1.5		0+			0.1426
<sup>191m</sup> Hg			51. m	\$^+\$ /6 / EC/94 /		13/2+	-1.07	+0.6	ann.rad./ Au k x-ray 0.2741 0.4203 0.5787
<sup>191</sup> Hg		190.9671	50. m	\$^+\$ ,EC/3.2		(3/2-)	-0.62	-0.8	(0.07 - 1.9) 0.1963 0.2247 0.2524
<sup>192</sup> Hg		191.9653	5.0 h	EC/.0.5		0+			Au k x-ray 0.1572 0.2748 0.3065
<sup>193m</sup> Hg			11.8 h	\$^+\$ ,EC/91 / I.T./9 /0.2901		13/2+	-1.05843	+0.92	Hg k x-ray 0.1866 0.2580 0.4076 0.5733 0.9324 (0.1 - 1.96)
<sup>193</sup> Hg		192.96664	3.8 h	EC,B <sup>+</sup> /2.34		3/2-	-0.6276	-0.7	0.1866 0.2580 0.8611
<sup>194</sup> Hg <sup>195m</sup> Hg		193.96538	520. y 1.67 d	EC/0.04 I.T./ (54)/0.3186 EC/(46)/		0+ 13/2+	-1.04465	+1.1	Au L x-rays Hg k x-ray Au k x-ray 0.2617 0.5603 0.7798
<sup>195</sup> Hg		194.96664	10.5 h	EC/1.51		1/2-	+0.541475		Au k x-ray 0.0614 0.7798
<sup>196</sup> Hg <sup>197m</sup> Hg	0.15(1)	195.965814	>2.5x10 <sup>18</sup> y 23.8 h	I.T./ (93)/0.2989		0+ 13/2+	-1.02768	+1.2	Hg k x-ray Au k x-ray 0.13398 Au k x-ray 0.07735
<sup>197</sup> Hg		196.967195	2.69 d	EC/0.600		1/2-	+0.527374		Au k x-ray 0.07735
<sup>198</sup> Hg <sup>199m</sup> Hg	9.97(20)	197.966752	42.7 m	I.T./0.532		0+ 13/2+	-1.014703	+1.2	Hg k x-ray 0.15841
<sup>199</sup> Hg <sup>200</sup> Hg <sup>201</sup> Hg <sup>202</sup> Hg <sup>203</sup> Hg	16.87(22) 23.10(19) 13.18(9) 29.86(26)	198.968262 199.968309 200.970285 201.970625 202.972857	46.61 d	\$) /0.492	0.213/100	1/2- 0+ 3/2- 0+ 5/2-	+0.505885 -0.560226	+0.39	
<sup>204</sup> Hg <sup>205</sup> Hg	6.87(15)	203.973475 204.976056	5.2 m	\$) /1.531	1.33/4	0+ 1/2-	+0.6010		0.20378 (0.2 - 1.4)
<sup>206</sup> Hg		205.97750	8.2 m	\$) /1.31	0.935/34 1.3/63	0+			Tl k x-ray 0.3052 0.6502
<sup>207</sup> Hg <sup>208</sup> Hg		206.9825 207.9859	2.9 m 0.7 h	\$) /4.8 \$)		(9/2+)			0.474
<b><sup>81</sup>Tl</b>		<b>204.3833(2)</b>							
<sup>177m</sup> Tl			0.23 ms	p/51 "/49					
<sup>177</sup> Tl		176.9969	0.017 s	"/73					
<sup>178</sup> Tl		177.9952	0.25 s	p/27 "/	6.704 6.785 6.62 6.859				
<sup>179m</sup> Tl			1.7 ms	"/	/7.21/80 /7.10/20				
<sup>179</sup> Tl <sup>180</sup> Tl		178.9917 179.9912	0.3 s 1.5 s	"/ "/	6.57/ 6.28/30 6.36/30 6.21/18 6.56/15 6.47/7				
<sup>181m</sup> Tl <sup>181</sup> Tl		180.9869	1.4 ms 3.2 ms	"/ "/	6.58/100 6.19/100				
<sup>182</sup> Tl		181.9856	3. s	\$^+\$ , EC/10.9					0.351 (0.26 - 0.41)
<sup>183m</sup> Tl <sup>183</sup> Tl <sup>184</sup> Tl		182.9826 183.9818	0.06 s 5. s 11. s	"/ \$^+\$ , EC/7.7 \$^+\$ , EC/(98)/9.2 "/(2)/	6.16/	9/2- 1/2+			0.208 0.2868 0.3399 0.3667 0.1688 0.2840
<sup>185m</sup> Tl <sup>185</sup> Tl		184.9791	1.8 s 20. s	I.T./0.453 "/5.97 EC/\$^+\$ /6.6	6.01	(9/2-)			

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<sup>186m</sup> Tl <sup>186</sup> Tl		185.9776	4. s 28. s	I.T./0.374 \$^+\$,EC/7.5					0.3738 0.3567 0.4026 0.4053 0.2995
<sup>187m</sup> Tl <sup>187</sup> Tl <sup>186m</sup> Tl		186.9762	15.6 s 50. s 1.18 m	I.T./0.33 \$^+\$,EC/6.0 \$^+\$,EC/		(9/2+) 1/2+ (7+)	+3.8 1.6	-2.4	Hg k x-ray 0.4129 0.5043 0.5921
<sup>188</sup> Tl <sup>189m</sup> Tl		187.9759	1.2 m 1.4 m	\$^+\$,EC/7.8 \$^+\$,EC/		(2-) (9/2-)	+0.48 +3.878	+0.13 -2.29	See Tl[188m] 0.4129 0.2156 0.2284 0.3175 0.4452 0.3337 0.4510 0.5223 0.9422
<sup>189</sup> Tl		188.9743	2.3 m	\$^+\$,EC/5.2		(1/2+)			0.1968 0.4164 0.7311
<sup>190m</sup> Tl <sup>190</sup> Tl		189.9738	3.7 m 2.6 m	\$^+\$,EC/ \$^+\$,EC/7.0	4.2/ 5.7/	(7+) (2-)	+0.495 +0.25	+0.29 -0.33	0.4164 0.6254 0.6838 1.0999 0.2157 0.2647 0.3256 0.3359
<sup>191m</sup> Tl <sup>191</sup> Tl <sup>192m</sup> Tl		190.9723	5.2 m 10.8 m	\$^+\$,EC/(98)/ \$^+\$,EC/		(9/2+) (1/2) (7+)	+3.903 1.59 +0.518	-2.3 0.46	0.1740 0.4228 0.6348 0.7863 0.7455
<sup>192</sup> Tl		191.972	9.6 m	\$^+\$,EC/6.4		(2-)	+0.20	-0.33	0.3975 0.4228 0.6908
<sup>193m</sup> Tl <sup>193</sup> Tl		192.9706	2.1 m 22. m	I.T./((75)/ \$^+\$,EC/3.6		(9/2-) (1/2+)	+3.948 +1.591	-2.2	0.3650 0.2077 0.3244 0.3440 0.6761 1.0447 1.5793
<sup>194m</sup> Tl			32.8 m	\$^+/(20)/0.30 EC/(80)/		(7+)	+0.540	+0.61	ann.rad./ Hg k x-ray 0.4282 0.6363 0.7490
<sup>194</sup> Tl		193.9711	34. m	\$^+\$,EC/5.3		2-	0.140	-0.28	0.3955 0.4282 0.6363
<sup>195m</sup> Tl <sup>195</sup> Tl		194.9697	3.6 s 1.16 h	I.T./0.483 EC/97/2.8 \$^+/(3)/		9/2- 1/2+	+1.58		Tl k x-ray 0.0990 0.3836 ann.rad./ Hg k x-ray 0.2422 0.5635 0.8845 1.3639
<sup>196m</sup> Tl			1.41 h	\$^+\$,EC/95/4.9		(7+)	0.55	+0.76	(0.13 - 2.5) 0.0840 0.4261 0.6353 0.6954
<sup>196</sup> Tl		195.9705	1.84 h	\$^+/(15)/4.4 EC/(85)/		2-	+0.072	-0.18	(0.08 - 1.0) ann.rad./ Hg k x-ray 0.4257 0.6105
<sup>197m</sup> Tl			0.54 s	IT/53/0.608 \$^+\$,EC/47/		9/2-			(0.03 - 2.4) Tl k x-ray 0.2262 0.4118 0.5872 0.6367
<sup>197</sup> Tl		196.96954	2.83 h	\$^+/(1)/2.18 EC/(99)/		1/2+	+1.58		Hg k x-ray 0.1522/8.2 0.4258
<sup>198m</sup> Tl <sup>198</sup> Tl		197.9405	1.87 h 5.3 h	\$^+\$,EC/(53)/ IT/47/0.5347 EC,\$^+/(1)/3.5	1.4/ 2.1/ 2.4/	7+ 2-	+0.64		Hg k x-ray Tl k x-ray 0.4118 0.5872 0.6367 Hg k x-ray 0.4118 0.6367 0.6759
<sup>199</sup> Tl		198.9698	7.4 h	EC/1.4		1/2-	+1.60		(0.23 - 2.8) Hg k x-ray 0.2082 0.2473 0.4555
<sup>200</sup> Tl		199.97095	1.087 d	EC/2.46	1.07/ 1.44/	2-	0.04		Hg k x-ray 0.36799 1.2057



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<sup>201</sup> Tl		200.97080	3.042 d	EC/0.48		1/2+	+1.605		(0.11 - 2.3) Hg k x-ray 0.13528
<sup>202</sup> Tl		201.97209	12.47 d	EC/1.36		2-	0.06		0.16740/10.0 Hg k x-ray 0.43957
<sup>203</sup> Tl	29.524(14)	202.972329	3.78 y	\$) /97/0.7637 EC/(3)/0.347	0.763/97	1/2+	+1.622258		Hg k x-ray
<sup>204</sup> Tl		203.973848				2-	0.09		
<sup>205</sup> Tl	70.476(14)	204.974412	3.76 m	I.T./2.644		1/2+	+1.638215		Tl k x-ray 0.2166 0.2661 0.4534 0.6866 1.0219
<sup>206m</sup> Tl						12-			
<sup>206</sup> Tl		205.976095	4.20 m	\$) /1.533	1.53/99.9	0-			Pb k x-ray 0.80313
<sup>207m</sup> Tl			1.3 s	I.T./1.350		11/2-			Tl k x-ray 0.3501 1.0000
<sup>207</sup> Tl		206.97741	4.77 m	\$) /1.423	1.43/99.8	1/2+	+1.88		0.89723
<sup>208</sup> Tl		207.982004	3.053 m	\$) /5.001	1.28/23 1.52/22 1.796/51	(5+)	+0.29		Pb k x-ray 0.27728 0.51061 0.58302 2.61448
<sup>209</sup> Tl		208.98535	2.16 m	\$) /3.98	1.8 /100	(1/2+)			Pb k x-ray 1.5670/100 0.4651/95 (0.12 - 1.33)
<sup>210</sup> Tl		209.99006	1.30 m	\$) /5.48	1.3/25 1.9/56	(5+)			Pb k x-ray 0.081 0.2981 0.79788
<b><sup>82</sup>Pb</b>		<b>207.2(1)</b>							
<sup>178</sup> Pb			0.2 ms	" /	7.25				
<sup>180</sup> Pb			5 ms	" /	7.07				
<sup>181</sup> Pb	180.9967		0.05 s	" /	6.90				
<sup>182</sup> Pb	181.99268		55 ms	"	6.70/82.7	13/2+			
<sup>183m</sup> Pb			0.42 s	"	6.86/1.9				
<sup>183</sup> Pb	182.9919		0.54 s	" /	6.57/4.3 6.78/11.0	(3/2-)			
<sup>184</sup> Pb	183.9882		0.48 s	" /94	6.63/	0+			
<sup>185m</sup> Pb			4.3 s	" /	6.41/	13/2+	-1.2		
<sup>185</sup> Pb	184.9876		6.3 s	" /	6.29/56 6.49/44 6.48/	3/2-	-1.1		0.205 0.269
<sup>186</sup> Pb	185.9835		5. s	\$*, EC/95/5.5 "/(5)/	6.32/ 6.34/<100 6.01/<0.2	0+			
<sup>187m</sup> Pb			15.2 s	\$*, EC/ "/12	5.99/ 6.19/	(1/2-)			0.0674 0.2080 0.2755 0.2995 0.4487 0.7477
<sup>187</sup> Pb	186.9839		18.3 s	EC/7.2 "/7	6.08/	13/2+			0.1930 0.3314 0.3435 0.3934 0.1850 0.7582
<sup>188</sup> Pb	187.9811		23. s	EC/(78)/4.8 "/(22)/	5.98/<10 5.61/<0.1	0+			
<sup>189</sup> Pb	188.9809		51. s	EC/6.1 "/	5.58/				
<sup>190</sup> Pb	189.9782		1.2 m	\$* (13)/4.1 EC/(86)/ "/(0.9)/	5.58/	0+			ann.rad./ Tl k x-ray 0.1415 0.1512 0.9422
<sup>191m</sup> Pb			2.2 m	\$*, EC/		13/2+	-1.17	+0.085	ann.rad./ 0.3871 0.6135 0.7122
<sup>191</sup> Pb	190.9782		1.3 m	\$*, EC/5.5					ann.rad./ 0.9368
<sup>192</sup> Pb	191.9758		3.5 m	\$*, EC/. 3.4 "/.006/	5.11	0+			ann.rad./ 0.1675 0.6082 1.1954
<sup>193m</sup> Pb			5.8 m	\$*, EC/		13/2+	-1.15	+0.19	ann.rad./ 0.3650 0.3922
<sup>193</sup> Pb	192.9761		2. m	EC/5.2		3/2			ann.rad./ 0.2036
<sup>194</sup> Pb	193.9740		11. m	\$*, EC/2.7	4.64	0+			ann.rad./ Tl k x-ray 0.3836 0.3942 0.8784
<sup>195m</sup> Pb			15. m	\$* /(8)/ EC/(92)/		13/2+	-1.132	+0.30	ann.rad./ 0.3836 0.3937 0.7776
<sup>195</sup> Pb	194.976		15. m	\$*, EC/5.8					

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>196</sup> Pb		195.9727	37. m	\$ <sup>+</sup> , EC/2.1		0+			Tl k x-ray 0.2531 0.5021
<sup>197m</sup> Pb			43. m	EC/79/ \$ <sup>+</sup> /2/ IT/19/0.3193		13/2+	-1.104	+0.38	Tl k x-ray 0.3079 0.3877 0.7743
<sup>197</sup> Pb		196.9734	8. m	EC/97/3.6 \$ <sup>+</sup> /3/		(3/2-)	-1.075	-0.08	(0.2 - 2.2) Tl k x-ray 0.3755 0.3858 0.7611
<sup>198</sup> Pb		197.9720	2.4 h	EC/1.4		0+			Tl k x-ray 0.1734 0.2903 0.3654
<sup>199m</sup> Pb			12.2 m	IT/93/0.4248		13/2+			Pb k x-ray 0.4255
<sup>199</sup> Pb		198.9729	1.5 h	EC/(99)/2.9 \$ <sup>+</sup> /(1)/		5/2-	-1.074	+0.08	Tl k x-ray 0.3534 0.7202 1.1350
<sup>200</sup> Pb		199.97182	21.5 h	EC/0.81		0+			(0.22 - 2.4) Tl k x-ray 0.14763
<sup>201m</sup> Pb			1.02 m	I.T./0.6291		13/2+			Pb k x-ray 0.6288
<sup>201</sup> Pb		200.97285	9.33 h	EC/1.90		5/2-	+0.675	-0.009	Tl k x-ray 0.33120 0.36131
<sup>202m</sup> Pb			3.53 h	IT/90/2.170 \$ <sup>+</sup> /10/		9-	-0.228	+0.58	(0.11 - 1.8) Pb k x-ray Tl k x-ray 0.42219 0.78700 0.96271
<sup>202</sup> Pb		201.97214	5.3x10 <sup>4</sup> y	EC/0.05		0+			Tl L x-ray
<sup>203m</sup> Pb			6.2 s	I.T./0.8252		13/2+			Pb k x-ray 0.8203 0.8252
<sup>203</sup> Pb		202.97338	2.163 d	EC/0.98		5/2-	+0.686	+0.10	Tl k x-ray 0.279188
<sup>204m</sup> Pb			1.13 h	I.T./2.185		9-			Pb k x-ray 0.37481 0.89922 0.91175
<sup>204</sup> Pb	1.4(1)	203.973028				0+			
<sup>205</sup> Pb		204.974467	1.51x10 <sup>7</sup> y	EC/0.0512		5/2-	+0.712	+0.23	Tl L x-ray
<sup>206</sup> Pb	24.1(1)	205.974449				0+			
<sup>207m</sup> Pb			0.80 s	I.T./1.632		13/2+			Pb k x-ray 0.56915 1.06310
<sup>207</sup> Pb	22.1(1)	206.975880				1/2-	+0.59258		
<sup>208</sup> Pb	52.4(1)	207.976636	>2x10 <sup>19</sup> y	SF		0+			
<sup>209</sup> Pb		208.981075	3.25 h	\$) /0.644	0.645/100	9/2+	-1.474	-0.3	
<sup>210</sup> Pb		209.984174	22.6 y	\$) /0.0635	0.017/81 0.061/19 3.72	0+			
<sup>211</sup> Pb		210.988732	36.1 m	\$) /1.37	0.57/5 1.36/92	(9/2+)	-1.404	+0.09	0.40486 0.42700 0.83186 (0.09 - 1.27)
<sup>212</sup> Pb		211.991887	10.64 h	\$) /0.574	0.28/83 0.57/12	0+			Bi k x-ray 0.23858
<sup>213</sup> Pb		212.9966	10.2 m	\$) /2.1					
<sup>214</sup> Pb		213.999797	26.9 m	\$) /1.0	0.67/48 0.73/42	0+			Bi k x-ray 0.24192 0.29509 0.35187
<sup>215</sup> Pb			36 s						
<b><sup>83</sup>Bi</b>		<b>208.98038(2)</b>							
<sup>185</sup> Bi		184.9977	0.04 ms	P/86	1.59				
<sup>186</sup> Bi		185.9965	10 ms	" /14	7.16 7.26				
<sup>187m</sup> Bi			8. ms	" /12					
<sup>187</sup> Bi		186.9935	32. ms	" /7	7.00/88.3 7.61/8.0 7.37/3.7				
<sup>188</sup> Bi		187.9922		"					
<sup>189m</sup> Bi			7.0 ms	"	7.30				
<sup>189</sup> Bi		188.9895	0.68 s	"					
<sup>190</sup> Bi		189.9875	5. s	\$ <sup>+</sup> , EC/(10)/8.7 " / (90)/	6.45/ 6.87				
<sup>191m</sup> Bi			0.12 ms	"					
<sup>191</sup> Bi		190.9861	12. s	\$ <sup>+</sup> , EC/(60)/7.3 " / (40)/	6.32/				
<sup>192</sup> Bi		191.9854	40. s	\$ <sup>+</sup> , EC/(80)/9.0 " / (20)/	6.06/				
<sup>193m</sup> Bi			3.2 s	\$ <sup>+</sup> , EC/ " /	6.48/	1/2+			
<sup>193</sup> Bi		192.9837	1.11 m	\$ <sup>+</sup> , EC/40/7.1 " / (60)/	5.91/	9/2+			
<sup>194</sup> Bi		193.9828	1.8 m	\$ <sup>+</sup> , EC/99.9/8.2 " /0.1/		(10-)			0.1661 0.1740 0.2802 0.421 0.5754 0.9650
<sup>195m</sup> Bi			1.45 m	\$ <sup>+</sup> , EC/(94)/					



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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>188</sup> Po			0.30 ms	"	7.91				
<sup>189</sup> Po			5 ms	"	7.35 7.54 7.25 7.32 7.53				
<sup>190</sup> Po		189.9951	2.4 ms	" /	7.376/50				
<sup>191m</sup> Po			93. ms	" /	6.888/46				
<sup>191</sup> Po		190.9947	22 ms	" /	7.334/77 6.97/8				
<sup>192</sup> Po		191.9915	34. ms	" /8.5	7.17				
<sup>193m</sup> Po			0.24 s	" /	7.00				
<sup>193</sup> Po		192.9911	0.45 s	" /	6.95				
<sup>194</sup> Po		193.9883	0.39 s	" /	6.84/93 6.19/0.22	0+			
<sup>195m</sup> Po			1.9 s	" /	6.70/				
<sup>195</sup> Po		194.9881	4.6 s	" /	6.61/				
<sup>196</sup> Po		195.9855	5.8 s	" / (95) /	6.52/94	0+			
<sup>197m</sup> Po			25.8 s	\$ <sup>+</sup> , EC / (5) / 4.6	5.77/0.02				
<sup>197</sup> Po		196.9856	53. s	" / (84) /	6.385(3)/55	13/2+			
<sup>198</sup> Po		197.9834	1.76 m	\$ <sup>+</sup> , EC / (16) /	6.282(4)/76	(3/2-)			
<sup>199m</sup> Po			4.2 m	" / (44) /	6.18/57	0+			
<sup>199</sup> Po		198.985	5.2 m	\$ <sup>+</sup> , EC / (56) / 6.2	5.27/7.6x10 <sup>-4</sup>	13/2+	0.99		ann.rad. / 0.2745 0.4998 1.0020 Bi k x-ray 0.1877 0.3616 1.0214 1.0344 0.14748 0.32792 0.6176 0.6709
<sup>200</sup> Po		199.9817	11.5 m	\$ <sup>+</sup> , EC / (30) / 4.0	5.863/11.1	0+			
<sup>201m</sup> Po			8.9 m	\$ <sup>+</sup> , EC / (51) /	6.059/24				
<sup>201</sup> Po		200.9822	15.3 m	" / (39) /	5.952/7.5	(3/2-)			
<sup>202</sup> Po		201.9807	45. m	\$ <sup>+</sup> , EC / (88) / 7.	5.786/. 3.	13/2+	1.00		Bi k x-ray Po k x-ray 0.2726 0.4123 0.4179 0.9670 Bi k x-ray 0.2056 0.2250 0.8483 0.9048 0.0410 0.1656 0.3158 0.6884 Bi k x-ray Po k x-ray 0.6414 0.17516 0.21477 0.89350 0.90863 1.09095
<sup>203m</sup> Po			1.2 m	IT/96/0.6414	5.683(3)/1.1	3/2-	0.94		
<sup>203</sup> Po		202.9814	35. m	\$) EC / (4) /	5.588/1.9	0+			
<sup>204</sup> Po		203.98031	3.53 h	\$ <sup>+</sup> , EC / 4.2	5.377/0.66	0+			0.9670 Bi k x-ray 0.2702 0.8844 1.0162 (0.11 - 1.9) Bi k x-ray 0.83681 0.84983 0.87241 1.00124 (0.12 - 2.7) Bi k x-ray 0.28644 0.31156 0.51134 0.80737 1.03228
<sup>205</sup> Po		204.98117	1.7 h	EC/2.34	5.223/5.5	0+			
<sup>206</sup> Po		205.98047	8.8 d	EC / (95) / 1.85	5.377/0.66	0+			
<sup>207m</sup> Po			2.8 s	" / (5) /	5.223/5.5	0+			
<sup>207</sup> Po		206.98158	5.80 h	I.T. / 1.383	5.377/0.66	19/2-			Po k x-ray 0.2682 0.30074 0.81448 Bi k x-ray 0.74263 0.91176 0.99225
<sup>208</sup> Po		207.981231	2.898 y	EC, \$ <sup>+</sup> / 2.91	5.377/0.66	5/2-	+0.79	+0.28	
<sup>209</sup> Po		208.982415	102. y	" / 5.213	4.233/0.0002	0+			
<sup>210</sup> Po		209.982857	138.4 d	" / 4.976	5.1158/100	1/2-	+0.77		0.26049 0.8964 0.80313
<sup>211m</sup> Po			25.2 s	" / 5.407	4.624/0.56 4.879/99.2 4.516/0.001 5.304/100	0+			
<sup>211</sup> Po		210.986637	0.516 s	" /	7.273/91 7.994/1.7 8.316/0.25 8.875/7.0	25/2+			Pb k x-ray 0.32808 0.56915 0.89723 1.06310 0.56915

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>212m</sup> Po			45. s	/	6.892/0.55 7.450/98.9 8.514/2.0 9.086/1.0 11.650/97	16+			0.89723
<sup>212</sup> Po		211.988852	0.298 :s	"/8.953	8.784/100	0+			
<sup>213</sup> Po		212.992843	3.7 :s	"/8.537	7.614/0.003 8.375/100	9/2+			
<sup>214</sup> Po		213.995186	163.7 :s	"/7.833	6.904/0.01 7.686/99.99	0+			0.7995 0.298
<sup>215</sup> Po		214.999415	1.780 ms	"/7.526	6.950/0.02 6.957/0.03 7.386/100	(9/2+)			
<sup>216</sup> Po		216.001905	0.145 s	"/6.906	5.895/0.002 6.778/99.99	0+			
<sup>217</sup> Po		217.0064	< 10. s	"/6.662	6.539/				
<sup>218</sup> Po		218.008965	3.04 m	"/6.114	5.181/1.00	0+			
<b><sup>85</sup>At</b>									
<sup>193</sup> At		192.9998	40 ms	/					
<sup>194</sup> At		193.9990	40 ms	/					
<sup>195m</sup> At			0.39 s		6.96				
<sup>195</sup> At		194.9965	140 ms	/	7.11				
<sup>196m</sup> At			8 :s						0.158
<sup>196</sup> At		195.9957	0.39 s	/	7.05/				
<sup>197m</sup> At			4. s						
<sup>197</sup> At		196.9939	0.35 s	\$^+,EC/7.8	6.96/	(1/2+)			
<sup>198m</sup> At			1.5 s	\$^+,EC/(75)/	6.85/86	(9/2-)			
<sup>198</sup> At		197.9928	5. s	"/(25)/	6.75/94				
<sup>199</sup> At		198.9910	7.1 s	\$^+,EC/8/5.6	6.64/	9/2-			
<sup>200m</sup> At			4.3 s	"/(92)/					
<sup>200</sup> At		199.990	43. s	\$^+,EC/(80)	6.536/12	10-			
<sup>201</sup> At		200.9885	1.48 s	"/(20)/	6.412/44 6.465/57	5+			
<sup>202m</sup> At			1.5 s	\$^+,EC/65/.8.0	6.344/	9/2-			
<sup>202</sup> At		201.9885	3.02 m	"/(35)/	6.135/7.7 6.225/4.3	5+			ann.rad./ 0.4413 0.5697 0.6753 0.1458 0.2459 0.6414 1.0020 1.0340
<sup>203</sup> At		202.9868	7.4 m	\$^+,EC/29/5.9	6.088/	9/2-			
<sup>204</sup> At		203.9873	9.1 m	"/(71)/6.474	5.951/	(5+)			Po k x-ray 0.3271 0.4254 0.5156 0.6837
<sup>205</sup> At		204.98604	26. m	\$^+,EC/88/7.2	5.902/	(9/2-)			Po k x-ray 0.1543 0.6696 0.7194
<sup>206</sup> At		205.98660	29.4 m	"/(5)/	5.703/	5+			Po k x-ray 0.20186 0.39561 0.47716 0.70071
<sup>207</sup> At		206.98578	1.81 h	\$^+,EC/90/4.54	5.758/	9/2-			Po k x-ray 0.16801 0.58842 0.81448
<sup>208</sup> At		207.98657	1.63 h	"/(10)/6.020	5.626/0.01 5.641/0.53	(6+)			Po k x-ray 0.1770 0.2060 0.6601 0.6852 0.8450 1.0281
<sup>209</sup> At		208.98616	5.4 h	\$^+,EC/99/5.72	5.647/4.1	(6+)			Po k x-ray 0.10422 0.54503 0.78189 0.79020 (0.1 - 2.6)
<sup>210</sup> At		209.98713	8.1 h	"/(1)/5.881	5.361/0.05 5.442/0.05	5+			Po k x-ray 0.24535 0.52758 1.18143 1.43678 1.48335 (0.04 - 2.4)
<sup>211</sup> At		210.987481	7.21 h	EC/99.8/3.98	5.211/0.004 5.868/42	9/2-			Po k x-ray 0.66956 0.6870 0.74263
<sup>212m</sup> At			0.119 s	"/(42)/5.980	7.837/65	(9-)			
<sup>212</sup> At		211.990735	0.314 s	/	7.897/33 7.058/0.4 7.088/0.6 7.618/15 7.681/84	(1-)			
<sup>213</sup> At		212.992922	0.11 :s	"/(10)/5.873	9.080/	9/2-			
<sup>214m</sup> At			0.76 :s	"/(10)/5.873		(9-)			
<sup>214</sup> At		213.996357	0.56 :s	"/(1)/5.752	8.819/100	(1-)			

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<sup>215</sup> At		214.99864	0.10 ms	" /8.178	7.626/0.045	(9/2-)			0.40486
<sup>216</sup> At		216.002408	0.30 ms	" /7.947	8.023/99.9 7.595/0.2 7.697/2.1 7.800/97	(1-)			
<sup>217</sup> At		217.00471	32. ms	" /7.202	6.812/0.06 7.067/99.9	(9/2-)			0.2595 0.3345 0.5940
<sup>218</sup> At		218.00868	1.6 s	" /6.883	6.654/6 6.695/90 6.748/4 6.275/				
<sup>219</sup> At		219.0113	50. s	" /6.390					
<sup>220</sup> At		220.0153	3.71 m	\$) /3.7					(0.24-0.70)
<sup>221</sup> At		221.0181	2.3 m	\$					
<sup>222</sup> At		222.0223	0.9 m	\$					
<sup>223</sup> At		223.0253	50. s	\$					
<b><sup>86</sup>Rn</b>									
<sup>195m</sup> Rn			5 ms	"	7.56				
<sup>195</sup> Rn			6 ms	"	7.54				
<sup>196</sup> Rn		195.9977	4. ms	" /	7.46				
<sup>197m</sup> Rn			0.02 s	" /	7.36				
<sup>197</sup> Rn		196.9983	0.07 s	" /	7.26				
<sup>198</sup> Rn		197.9988	0.05 s	"					
<sup>199m</sup> Rn			0.3 s	"		(13/2+)			
<sup>199</sup> Rn		198.9983	0.62 s	" /		3/2-			
<sup>200</sup> Rn		199.9957	1.06 s	" / (98) / EC / (2) / 5.	6.901 /	0+			0.4329 0.5043
<sup>201m</sup> Rn			3.8 s	EC / (10) / " / (90) /	6.773 /	13/2+			
<sup>201</sup> Rn		200.9955	7.0 s	" / (80) / EC / (20) /	6.725 / " / 6.778	(3/2-)			
<sup>202</sup> Rn		201.9932	9.9 s	" / (12) / EC / (88) /	6.641 /	0+			0.5695 0.2876-0.6255
<sup>203m</sup> Rn			28. s	" /	6.551	13/2+	-0.96	+1.3	
<sup>203</sup> Rn		202.9948	45. s	" / (66) / 6.629 EC / (34) / 7.4	6.499 /	0			
<sup>204</sup> Rn		203.9914	1.24 m	" / (68) / EC / (32) / 3.8	6.420 /	0+			
<sup>205</sup> Rn		204.9917	2.8 m	" / (23) / 6.390 EC / (77) / 5.2	6.123(3) / 0.02 6.262(3) / 23	(5/2-)	+0.80	+0.06	0.2652 0.3553 0.4648 0.6205 0.6753 0.7300 0.06170 0.0968 0.3245 0.3862 0.4822 0.4973 0.7728
<sup>206</sup> Rn		205.9902	5.7 m	" / (68) / 6.384 EC / (32) / 3.3	6.258(3) /	0+			At k x-ray 0.32947 0.34455 0.36767 0.40267 0.74723 (0.18 - 1.4)
<sup>207</sup> Rn		206.9907	9.3 m	\$*, EC / 77 / 4.6 " / (23) / 6.252	5.995(4) / 0.02 6.068(3) / 0.15 6.126(3) / 22.8	5/2-	+0.82	+0.22	0.2652 0.3553 0.4648 0.6205 0.6753 0.7300 0.06170 0.0968 0.3245 0.3862 0.4822 0.4973 0.7728
<sup>208</sup> Rn		207.98963	24.3 m	" / (60) / 6.260 EC / (40) / 2.85	5.469(2) / 0.003 6.140(2) / 60	0+			
<sup>209</sup> Rn		208.99038	29. m	\$* / (83) / 3.93 " / (17) /	2.16 / 2.3 5.887(3) / 0.04 5.898(3) / 0.02 6.039(2) / 16.9	5/2-	+0.8388	+0.31	At k x-ray 0.27933 0.33753 0.40841 0.68942 0.74594 (0.18 - 3.2)
<sup>210</sup> Rn		209.98968	2.4 h	" / (96) / 6.157 EC / (4) / 2.37	5.351(2) / 0.005 6.039(2) / 96	0+			At k x-ray 0.19625 0.45824 0.57104 0.64868 (0.14 - 1.7)
<sup>211</sup> Rn		210.99059	14.6 h	\$*, EC / 74 / 2.89 " / (26) / 5.964	5.619(1) / 0.7 5.784(1) / 16.4 5.851(1) / 8.8	1/2-	+0.60		At k x-ray 0.16877 0.25022 0.37049 0.67412 0.67839 1.36298 (0.11 - 2.7)
<sup>212</sup> Rn		211.990689	24. m	" / 6.385	5.587(4) / 0.05 6.260(4) / 99.95	0+			
<sup>213</sup> Rn		212.99387	20 ms	" / 8.243	7.552(8) / 1.0 8.087(8) / 98.2 7.254 / 0.8	9/2+			0.540
<sup>214</sup> Rn		213.99535	0.27 :s	" / 9.209	9.037(9) /	0+			
<sup>215</sup> Rn		214.99873	2.3 :s	" / 8.840	8.674(8) /	(9/2+)			
<sup>216</sup> Rn		216.00026	45. :s	"					
<sup>217</sup> Rn		217.003915	0.6 ms	" / 7.885	7.500 / 0.1 7.742(4) / 100	9/2+			
<sup>218</sup> Rn		218.005586	35. ms	" / 7.267	6.534(1) / 0.16 7.133(1) / 99.8	0+			0.6093 0.6653
<sup>219</sup> Rn		219.009475	3.96 s	" / 6.946(1)	6.3130(5) / 0.05 6.425(3) / 7.5 6.5309(4) / 0.12 6.5531(3) / 12.2 6.8193(3) / 81	(5/2+)	-0.44	+0.93	Po k x-ray 0.13057 0.27113 0.40170 (0.1 - 1.05)
<sup>220</sup> Rn		220.011384	55.6 s	" / 6.404	5.7486(5) / 0.07	0+			

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>221</sup> Rn		221.0156	25. m	" / (22) / 6.148 \$) / (78) / 1.2	6.2883(1) / 99.9 5.778(3) / 1.8 5.788(3) / 2.2 6.037(3) / 18	7/2+	-0.020	-0.38	Fr L x-ray 0.07384 0.08323 0.0610 0.18639 0.510
<sup>222</sup> Rn		222.017570	3.823 d	" / 5.590	4.987(1) / 0.08 5.4897(3) / 99.9	0+			
<sup>223</sup> Rn		223.0218	23. m	\$) /			-0.78	+0.80	
<sup>224</sup> Rn		224.0241	1.8 h	\$) /		0+			0.1085 0.2601 0.2655
<sup>225</sup> Rn		225.0284	4.5 m	\$) /		7/2	-0.70	+0.84	
<sup>226</sup> Rn		226.0309	7.4 m	\$) /					
<sup>227</sup> Rn		227.0354	2. s	\$) /					
<sup>228</sup> Rn		228.0381	65. s	\$) /					
<b>87Fr</b>									
<sup>199</sup> Fr			12 s	"	7.66				
<sup>200</sup> Fr		200.0065	. 20 ms	"	7.47				
<sup>201</sup> Fr		201.0046	0.05 s	" /	7.36 /	(9/2-)			
<sup>202</sup> Fr		202.0033	0.34 s	" / 7.590	7.237(8) / 100				
<sup>203</sup> Fr		203.0014	0.55 s	" / 7.280	7.132(5) /	(9/2-)			
<sup>204</sup> Fr		204.001	2.1 s	" /	7.03/96 6.97/90 7.01/74				
<sup>205</sup> Fr		204.9987	3.9 s	" / 7.050	6.914(5) /	(9/2-)			
<sup>206m</sup> Fr			0.7 s	" /	6.93				0.531(IT)
<sup>206</sup> Fr		205.9985	16.0 s	" / 7.416	6.792(5) / 84				
<sup>207</sup> Fr		206.9969	14.8 s	" / 6.900	6.766(5) /	9/2-	+3.9	-0.16	
<sup>208</sup> Fr		207.99713	59.1 s	" / (77) / 6.770 EC / (23) / 6.99	6.636(5) /	7+	-4.8	+0.004	
<sup>209</sup> Fr		208.99592	50.0 s	" / (89) / 5.1 EC / (11) / 5.16	6.646(3) /	9/2-	+3.9	-0.24	0.7978 (0.1103-1.384)
<sup>210</sup> Fr		209.99640	3.2 m	" / 6.670 EC / 6.26	6.543(5) /	6+	+4.4	+0.19	0.2030 0.6438 0.8175 0.9008 0.220 0.2799 0.5389 0.9169
<sup>211</sup> Fr		210.99553	3.10 m	" / 6.660 EC / 4.61	6.534(5) /	9/2-	+4.0	-0.19	0.220 0.2799 0.5389 0.9169
<sup>212</sup> Fr		211.99618	20. m	EC / (57) / 5.12 " / (43) / 6.529	6.261(1) / 16 6.335(1) / 4 6.335(1) / 4 6.343(1) / 1.3 6.383(1) / 10 6.406(1) / 9.5 6.08-6.18	(5+)	+4.6	-0.10	Rn x-ray 0.08107 0.08378 0.2277 1.1856 1.2748 0.014-1.178
<sup>213</sup> Fr		212.99617	34.6 s	" / 6.905	8.476(4) / 51	9/2-	+4.0	-0.14	
<sup>214m</sup> Fr			3.4 ms	" /	8.547(4) / 46 6.775-8.046	9-			
<sup>214</sup> Fr		213.99895	5.1 ms	" / 8.587	7.409(3) / 0.3 7.605(8) / 1.0 7.940(3) / 1.0 8.355(3) / 4.7 8.427(3) / 93	(1-)			
<sup>215</sup> Fr		215.00033	0.12 : s	" / 9.537	9.360(8) /	(9/2-)			
<sup>216</sup> Fr		216.00319	0.70 : s	" / 9.175	9.005(10) / 95				(0.045-0.160)
<sup>217</sup> Fr		217.00462	0.016 ms	" / 8.471	8.315(8) /	(9/2-)			
<sup>218m</sup> Fr			22. ms	"					
<sup>218</sup> Fr		218.00756	1. ms	" / 8.014	7.384(10) / 0.5 7.542(15) / 1.0 7.572(10) / 5 7.732(10) / 0.5 7.867(2) / 93	(1-)			
<sup>219</sup> Fr		219.00924	21. ms	" / 8.132	6.802(2) / 0.25 6.967(2) / 0.6 7.146(2) / 0.25 7.313(2) / 99	(9/2-)			
<sup>220</sup> Fr		220.012313	27.4 s	" / 6.800	6.582(1) / 10 6.630(2) / 6 6.641(1) / 12 6.686(1) / 61 6.39-6.58	1+	-0.67	+0.47	0.0450 0.061 0.1060 0.1539 0.1617
<sup>221</sup> Fr		221.01425	4.8 m	" / 6.457	5.9393(7) / 0.17 5.9797(7) / 0.49 6.0751(7) / 0.15 6.1270(7) / 6.2433(3) / 1.3 6.3410(7) / 83.4 1.78 /	(5/2-)	+1.58	-1.0	At k x-ray 0.0995 0.21798 0.4091
<sup>222</sup> Fr		222.01754	14.3 m	\$) / 2.03 " / 5.850		2-	+0.63	+0.51	
<sup>223</sup> Fr		223.019731	22.0 m	\$) / 1.149 " / 0.006	" / 5.291 5.314 5.403	(3/2+)	+1.17	+1.17	0.1509 0.0589 0.1453 0.13150 0.21575 0.8367 (0.1 - 2.21)
<sup>224</sup> Fr		224.02323	3.0 m	\$) / 2.82		1-	+0.40	+0.517	
<sup>225</sup> Fr		225.02561	3.9 m	\$) / 1.87		3/2	+1.07	+1.3	
<sup>226</sup> Fr		226.0293	49. s	\$) / 3.6		1	+0.071	-1.35	0.18606 0.25373
<sup>227</sup> Fr		227.0318	2.48 m	\$) / 2.5		1/2	+1.50	+2.4	
<sup>228</sup> Fr		228.0357	39. s	\$) / 3.5		2-	-0.76		
<sup>229</sup> Fr		229.0384	50. s	\$) /					
<sup>230</sup> Fr		230.0425	19. s	\$) /		(3)			
<sup>231</sup> Fr		231.0454	17. s	\$) /					

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>232</sup> Fr		232.0500	5. s	α /					
<b>88</b> Ra									
<sup>202</sup> Ra			. 3 ms	"	7.86				
<sup>203m</sup> Ra			0.03 s	"	7.62				
<sup>203</sup> Ra		203.0092	. 4 ms	"	7.58				
<sup>204</sup> Ra		204.0065	0.06 s	"	7.48				
<sup>205m</sup> Ra			. 0.17 s	"					
<sup>205</sup> Ra		205.0062	0.22 s	"	7.34				
<sup>206</sup> Ra		206.0038	0.4 s	" /7.416	7.272(5) /	0+			
<sup>207</sup> Ra		207.0037	1.3 s	" /7.270	7.133(5) /				
<sup>208</sup> Ra		208.0018	1.4 s	" /7.273	7.133(5) /	0+			
<sup>209</sup> Ra		209.0019	4.6 s	" /7.150	7.008(5) /	5/2	+0.87	+0.40	
<sup>210</sup> Ra		210.0005	3.7 s	" /7.610	7.020(5) /	0+			
<sup>211</sup> Ra		211.0009	13. s	" /7.046	6.912(5) /	(5/2-)	+0.878	+0.48	
				EC/5.0					
<sup>212</sup> Ra		211.99978	13.0 s	" /7.033	6.901(2) /	0+			
<sup>213m</sup> Ra			2.1 ms	IT					
<sup>213</sup> Ra		213.00034	2.7 m	EC/(20)/3.88		(1/2-)	+0.613		0.1024
				"/(80)/6.860	6.521(3)/4.8				0.11010
					6.622(3)/39				0.2125
					6.730(3)/36				
<sup>214</sup> Ra		214.00009	2.46 s	" /7.272	7.14/99.8 /	0+			0.642
					6.51/0.2				
<sup>215</sup> Ra		215.00270	1.7 ms	" /8.864	7.883(6)/2.8	(9/2+)			0.773/100
					8.171(3)/1.4				0.852/74
					8.700(3)/95.9				0.055-1.048
<sup>216</sup> Ra		216.00352	0.18 :s	" /9.526	9.349(8) /	0+			
<sup>217</sup> Ra		217.00631	1.6 :s	" /9.161	8.992(8) /	9/2-			
<sup>218</sup> Ra		218.00712	26. :s	" /8.547	8.390(8) /	0+			
<sup>219</sup> Ra		219.01006	0.010 s	" /8.132	7.680(10) /65				
					7.982(9) /35				
<sup>220</sup> Ra		220.01101	18. ms	" /7.593	7.39/5	0+			0.465
					7.45/95				
<sup>221</sup> Ra		221.01391	29. s	" /6.879	6.254(10) /0.7	5/2	-0.180	+1.9	
					6.578(5) /3				
					6.585(3) /8				
					6.608(3) /35				
					6.669(3) /21				
					6.758(3) /31				
<sup>222</sup> Ra		222.015361	36.2 s	" /5.590	6.237(2) /3.0	0+			0.324
					6.556(2) /97				0.1448-0.8402
<sup>223</sup> Ra		223.018497	11.43 d	" /5.979	5.287(1) /0.15	(3/2+)	+0.271	+1.25	Rn k x-ray
					5.338(1) /0.13				0.12231
					5.365(1) /0.13				0.14418
					5.433(5) /2.3				0.15418
					5.502(1) /1.0				0.15859
					5.540(1) /9.2				0.26939
					5.607(3) /24				0.32388
					5.716(3) /52				0.33328
					5.747(1) /9				0.44494
					5.857(1) /0.32				(0.10 - 0.7)
					5.872(1) /0.85				
<sup>224</sup> Ra		224.020202	3.66 d	" /5.789	5.034(10) /0.003	0+			Rn k x-ray
					5.047(1) /0.007				0.2407
					5.164(5) /0.007				0.4093
					5.449(2) /4.9				0.6501
					5.685(2) /95				
<sup>225</sup> Ra		225.023603	14.9 d	α /0.36	0.32/100	(3/2+)	-0.734		Ac k x-ray
					5.01/2x <sup>-5</sup>				0.0434
					4.98x10 <sup>-5</sup>				
<sup>226</sup> Ra		226.025402	1599. y >4x10 <sup>15</sup> y	" /4.870 Sf/4x10 <sup>-14</sup>	4.194(1) /0.001	0+			Rn k x-ray
					4.343(1) /0.006				0.1861/3.64
					4.601(1) /6.16				0.2624
					4.784(1) /93.8				0.053-2.448
<sup>227</sup> Ra		227.029170	42. m	α /1.325	1.03 /	(3/2+)	-0.404	+1.5	Ac L x-ray
					1.30 /				Ac k x-ray
									0.02739
<sup>228</sup> Ra		228.031063	5.76 y	α /0.046	0.039/50	0+			0.0135
					0.014/30				(0.006-0.0306)
					0.026/20				
<sup>229</sup> Ra		229.0348	4.0 m	α /1.76	1.76 /	(3/2+)	+0.503	+3.1	0.0145-0.1715
<sup>230</sup> Ra		230.03708	1.5 h	α /1.0	0.7 /	0+			0.0631
									0.0720
									0.2028
									0.4698
									0.4787
<sup>231</sup> Ra		231.0412	1.7 m	α /					
<sup>232</sup> Ra		232.0437	4. m	α /					
<sup>233</sup> Ra		233.0480	30. s	α /					
<sup>234</sup> Ra		234.051	. 30. s	α /					
<b>89</b> Ac									
<sup>206m</sup> Ac			0.04 s	"	7.79				
<sup>206</sup> Ac			. 26 ms	"	7.75				
<sup>207</sup> Ac		207.0121	27 ms	" /	7.69				
<sup>208m</sup> Ac			. 25. ms	" /	7.72				
<sup>208</sup> Ac		208.0115	. 0.1 s	" /	7.62				
<sup>209</sup> Ac		209.0096	. 0.10 s	" /	7.58				
<sup>210</sup> Ac		210.0093	0.34 s	" /7.610	7.462(8) /				
<sup>211</sup> Ac		211.0076	0.20 s	" /7.620	7.480(8) /				
<sup>212</sup> Ac		212.0078	0.9 s	" /7.520	7.379(8) /				
<sup>213</sup> Ac		213.0066	0.73 s	" /7.500	7.364(8) /	(9/2-)			
<sup>214</sup> Ac		214.0069	8.2 s	" /((86) /7.350	7.007(8) /3	(5+)			
				EC/(14) /6.34	7.082(5) /38				
					7.214(5) /45				
<sup>215</sup> Ac		215.0065	0.17 s	" /7.750	7.60/99.2	(9/2-)			0.399
					7.21/0.46				0.582
					7.03/0.20				0.654
					6.96/0.14				
<sup>216m</sup> Ac			0.44 ms	" /	8.198(8) /1.7	(9-)			



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					8.283(8)/2.5 9.028(5)/49 9.106(5)/46 8.990(2)/10 9.070(8)/90	(1)			
<sup>216</sup> Ac		216.00871	0.3 ms	"/9.241					
<sup>217m</sup> Ac			0.7 :s	"/	10.540/100				
<sup>217</sup> Ac		217.00933	0.07 :s	"/9.832	9.650(10)/100	9/2-			
<sup>218</sup> Ac		218.01162	1.1 :s	"/9.380	9.205(15)/				
<sup>219</sup> Ac		219.01241	0.012 ms	"/8.830	8.664(10)/	(9/2-)			
<sup>220</sup> Ac		220.0148	26. ms	"/8.350	7.610(20)/23 4.680(20)/21 7.790(10)/13 7.850(10)/24 7.985(10)/4 8.005(10)/5 8.060(10)/6 8.195(10)/3 7.170(10)/2 7.375(10)/10 7.440(15)/20 7.645(10)/70				
<sup>221</sup> Ac		221.01558	52. ms	"/7.790	6.710(20)/7 6.750(20)/13 6.810(20)/24 6.840(20)/9 6.890(20)/13 6.970(20)/7 7.000(20)/13				
<sup>222m</sup> Ac			63. s	"/(>89)/ EC/(1)/ I.T./(<10)/	6.967(10)/6 7.013(2)/94				
<sup>222</sup> Ac		222.01782	5. s	"/7.141		1-			
<sup>223</sup> Ac		223.01913	2.1 m	"/(99)/6.783 EC/(1)/0.59	6.131(2)/0.12 6.177(2)/0.94 6.293(1)/0.47 6.326(1)/0.3 6.332(2)/0.14 6.360(1)/0.22 6.397(1)/0.13 6.448(1)/0.2 6.473(1)/3.1 6.523(2)/0.6 6.528(1)/3.1 6.563(1)/13.6 6.582(3)/0.3 6.646(1)/44 6.661(1)/31	(5/2-)	0.0725 0.0839 0.0927 0.0990 0.1917 0.2158 0.3588 0.4768		
<sup>224</sup> Ac		224.021708	2.7 h	EC/(90)/1.403 "/(10)/6.323	5.841(1)/0.5 5.860(1)/0.75 5.875(1)/1.7 5.941(1)/4.4 6.000(1)/6.7 6.013(1)/1.4 6.056(1)/22 6.138(1)/26 6.154(1)/1.0 6.204(1)/12 6.210(1)/20	0-		Ra L kx-ray Ra k x-ray 0.08426 0.13150 0.1571 0.21575 0.2619 (0.03 - 0.3)	
<sup>225</sup> Ac		225.02322	10.0 d	"/5.935	5.286(1)/0.2 5.444(3)/0.1 5.554(1)/0.1 5.608(1)/1.1 5.636(1)/4.5 5.681(1)/1.4 5.722(1)/2.9 5.731(1)/10 5.791(1)/9 5.793(1)/18	3/2		Fr k x-ray 0.06296/0.48 0.09982/1.36 0.1084 0.1116 0.1451 0.15002/0.691 0.15724 0.18795/0.54 0.0075-0.8085	
<sup>226</sup> Ac		226.026089	1.224 d	EC/(17)/0.640 \$/ (83)/1.116 "/(0.006)/5.51	5.399(5)/0.006	(1-)			Ra k x-ray Th k x-ray 0.07218 0.15816 0.23034
<sup>227</sup> Ac		227.027747	21.77 y	\$/98.6/0.045 "/(1.4)/5.043	0.045/54 4.869(1)/0.09 4.938(1)/0.52 4.951(1)/0.65	(3/2-)	+1.1	+1.7	0.0838/23. 0.0811/14. 0.2696/13. (0.044 - 1.27)
<sup>228</sup> Ac		228.031014	6.15 h	\$/ /2.127	1.11/32 1.85/12 2.18/11	(3+)			Th L x-ray Th k x-ray 0.12903 0.33842 0.91116 0.96897 (0.2 - 1.96)
<sup>229</sup> Ac		229.03293	1.04 h	\$/ /1.10	1.1/	(3/2+)			0.09335/2.43 0.16451/2.61 0.56916/2.24 0.0111-0.898
<sup>230</sup> Ac		230.0360	2.03 m	\$/ /2.7 \$/ sf	1.4/ /0.000119	1+			Th k x-ray 0.45497 0.50820 (0.12 - 2.5)
<sup>231</sup> Ac		231.0386	7.5 m	\$/ /2.1	2.1/100	(1/2+)			0.14379 0.18574 0.22140 0.28250 0.3070
<sup>232</sup> Ac		232.0420	2.0 m	\$/ /3.7		(2-)			
<sup>233</sup> Ac		233.0446	2.4 m	\$/ /		(1/2+)			
<sup>234</sup> Ac		234.0484	40. s	\$/ /		(1+)			
<sup>90</sup> Th		<b>232.0381(1)</b>							

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<sup>209</sup> Th			0.01 s	"	8.08				
<sup>210</sup> Th			12 ms	"	7.90				
<sup>211</sup> Th		210.0150	0.04 s	"	7.79				
<sup>212</sup> Th		211.0149	0.04 s	"	7.80/	0+			
<sup>213</sup> Th		212.0129	30. ms	" /	7.80/				
<sup>213m</sup> Th		213.0130	0.14 s	" /7.840	7.692(10)/				
<sup>214</sup> Th		214.0115	0.09 s	" /7.825	7.677(10)/	0+			
<sup>215</sup> Th		215.0117	1.2 s	" /7.660	7.33(10)/8	(1/2-)			0.134
					7.395(8)/52				0.192
					7.524(8)/40				
<sup>216m</sup> Th			0.14 ms	"	9.93				
<sup>216</sup> Th		216.01105	28. ms	" /8.071	7.92/99.46	0+			0.628
					7.30/0.54				
<sup>217</sup> Th		217.01306	0.25 ms	" /9.424	9.27/94.6				
					8.46/3.8				
					8.73/1.6				
<sup>218</sup> Th		218.01327	0.11 :s	" /9.847	9.665(10)/	0+			
<sup>219</sup> Th		219.01552	1.05 :s	" /9.510	9.340(20)/				
<sup>220</sup> Th		220.01573	10. :s	" /8.953	8.790(20)/	0+			
<sup>221</sup> Th		221.01817	1.73 ms	" /8.628	7.732/7				
					8.142/72				
<sup>222</sup> Th		222.01845	2.24 ms	" /8.129	8.469/21	0+			
					7.980/97.7				
<sup>223</sup> Th		223.02079	0.65 s	" /7.454	7.599/2.3				
					7.29(1)/41(5)				
					7.32(1)/29(5)				
					7.350(15)/20(5)				
<sup>224</sup> Th		224.02146	1.05 s	" /7.305	7.390(15)/10(4)				
					6.768(5)/1.2				
					6.997(5)/19				
<sup>225</sup> Th		225.02394	8.72 m	EC/(10)/0.68 "/(90)/6.920	7.170(5)/7	(3/2+)			
					6.441(2)/15				
					6.479(2)/43				
					6.501(3)/14				
					6.627(3)/3				
					6.650(5)/3				
					6.700(5)/2				
					6.743(3)/7				
<sup>226</sup> Th		226.024891	30.83 m	" /6.454	6.796(2)/9	0+			Ra k x-ray
					6.026(1)/0.2				0.1112
					6.041(1)/0.19				0.2421
					6.098(1)/1.3				0.1310
					6.2283(4)/23				0.1733-0.9295
					6.3375(4)/75				Ra L x-ray
<sup>227</sup> Th		227.027699	18.72 d	" /6.146		(3/2+)			Ra k x-ray
									0.05014
									0.23597
									0.25624
									(0.02 - 1.0)
<sup>228</sup> Th		228.028731	1.913 y	" /5.520	5.1770(2)/0.18	0+			
					5.2114(1)/0.4				
					5.3405(1)/26.7				
<sup>229</sup> Th		229.031754	7.9x10 <sup>3</sup> y	" /5.168	5.4233(1)/73	5/2+	+0.46	+4.	0.1935/4.3
					4.814/9.3				0.21089/277
					4.845(5)/56				0.13697/1.21
					4.9008(5)/10.2				0.0111-0.6036
<sup>230</sup> Th		230.033126	7.54x10 <sup>4</sup> y	" /4.771	4.689-5.077	0+			0.0677/0.46
			>2. x10 <sup>18</sup> y	SF/<4x10 <sup>-12</sup>	4.4383(6)/0.03				0.1439/0.078
					4.4798(6)/0.12				
					4.6211(6)/23.4				
					4.6876(6)/76.3				
<sup>231</sup> Th		231.036296	1.063 d	β) /0.390	0.138/22	5/2+			Pa L x-ray
					0.218/20				Pa k x-ray
					0.305/52				0.02564
									0.084203/
									(0.02 - 0.3)
<sup>232</sup> Th	100.	232.038050	1.40x10 <sup>10</sup> y	" /4.081	3.830(10)/0.2	0+			0.0590
			1.2x10 <sup>21</sup> y	SF/1.1x10 <sup>-9</sup>	3.952(5)/23				0.124
					4.010(5)/77				
<sup>233</sup> Th		233.041576	22.3 m	β) /1.245	1.245/	1/2+			Pa L x-ray
									Pa k x-ray
									0.02938
									0.08653
									0.45930
									(0.02 - 1.2)
<sup>234</sup> Th		234.043596	24.10 d	β) /0.273	0.102/20	0+			Pa L x-ray
					0.198/72				0.06329/4.1
									0.09235/2.4
<sup>235</sup> Th		235.04751	7.2 m	β) /1.9					0.09278/2.4
									0.4162
									0.6594
									0.7272
									0.747
									0.9318
<sup>236</sup> Th		236.0497	37.5 m	β) /1.0					Pa k x-ray
<sup>237</sup> Th		237.0539	5.0 m	β)					0.1107
<sup>238</sup> Th			9.4 m						0.0890
<sup>91</sup> Pa		<b>231.03588(2)</b>							
<sup>212</sup> Pa			5 ms	"	8.27				
<sup>213</sup> Pa		213.0212	7 ms	"	8.24				
<sup>214</sup> Pa		214.0207	17 ms	"	8.12				
<sup>215</sup> Pa		215.0190	15. ms	"	8.08/100				
<sup>216</sup> Pa		216.0190	0.19 s	" /	7.95/51				0.134
					7.82/45				
					7.79/4				

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom. (nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>217m</sup> Pa			1.5 ms	" /	10.16/72 8.306/11 9.55/6 9.69/2				0.4504-0.8208
<sup>217</sup> Pa		217.0183	3.8 ms	" /8.490	8.337/99 7.873/0.4 7.728/0.3 7.710/0.3				0.0466-0.634
<sup>218</sup> Pa		218.0200	0.12 ms	" /	9.54/31 9.61/69				0.092
<sup>219</sup> Pa		219.0199	0.05 : s	"					
<sup>220</sup> Pa		220.0219	0.8 : s	"					
<sup>221</sup> Pa		221.0219	6. : s	"	9.08(3)				
<sup>222</sup> Pa		222.0237	4.3 ms	" /8.700	8.180/50 8.330/20 8.540/30				
<sup>223</sup> Pa		223.0240	6.5 ms	" /8.340	8.006(10)/55 8.196(10)/45				
<sup>224</sup> Pa		224.0256	0.84 s	" /7.630	7.555(10)/75(3) 7.46(1)/25(3)				0.1945 (0.028-0.412)
<sup>225</sup> Pa		225.0261	1.8 s	" /7.380	7.195(10)/30 7.245(10)/70				
<sup>226</sup> Pa		226.02792	1.8 m	" / (74) /6.987 EC / (26) /2.83	6.728(10)/0.7 6.823(10)/35 6.863(10)/39				
<sup>227</sup> Pa		227.02879	38.3 m	" / (85) /6.582 EC / (15) /1.02	6.357(4)/7 6.376(10)/2.2 6.401(4)/8 6.416(4)/13 6.423(10)/10 6.465(4)/43	(5/2-)			0.0649 0.0669 0.1100
<sup>228</sup> Pa		228.03100	22. h	EC / (98) /2.111 " / (2)	5.779/0.23 5.805/0.15 6.078/0.4 6.105/0.25 6.118/0.22	(3+)	+3.5		Th k x-ray 0.409/100 0.4631/222 0.91116/242 0.96464/120 0.96897/149 0.058-1.96 0.04244 (0.024 - 0.18)
<sup>229</sup> Pa		229.03209	1.5 d	EC / (99.8) /0.32 " / (0.2) /5.836	5.536(2)/0.02 5.579(2)/0.09 5.668(2)/0.05	(5/2)			
<sup>230</sup> Pa		230.034532	17.4 d	EC / (90) /1.310 \$) / (10) /0.563	0.51/	(2-)	2.0		Th L x-ray Th k x-ray 0.4437 0.45477 0.89876 0.91856 0.95199 (0.053-1.07)
<sup>231</sup> Pa		231.035878	3.25x10 <sup>4</sup> y >2x10 <sup>17</sup> y	" /5.148 SF / <1.6x10 <sup>-15</sup>	4.6781(5)/1.5 4.7102(5)/1.0 4.7343(5)/8.4 4.8513(5)/1.4 4.9339(5)/3 4.9505(5)/22.8 4.9858(5)/1.4 5.0131(5)/25.4 5.0292(5)/20 5.0318(5)/2.5 5.0587(5)/11	3/2-	2.01	-1.7	Ac L x-ray Ac k x-ray 0.01899 0.027396 0.03823 0.04639 0.25586 0.26029 0.28367 0.30007 0.30264 0.33007 (0.02 - 0.61)
<sup>232</sup> Pa		232.03858	1.31 d	\$) /1.34		(2-)			U k x-ray 0.10900 0.15009 0.89439 0.96934 (0.10 - 1.17)
<sup>233</sup> Pa		233.040239	27.0 d	\$) /0.571	0.15/40 0.256/60	3/2-	+4.0	-3.0	U L x-ray U k x-ray 0.30017 0.31201 0.34059
<sup>234m</sup> Pa			1.17 m	\$) /99.9/2.29 IT/0.13/		(0-)			U k x-ray 0.25818/0.07 0.76641/0.32 1.0009/0.85 (0.06 - 1.96)
<sup>234</sup> Pa		234.043303	6.69 h	\$) /2.197	0.51/	(4+)			U L x-ray U k x-ray 0.1312/0.03 0.5695/0.02 0.9256/0.02 (0.02 - 1.99)
<sup>235</sup> Pa		235.04544	24.4 m	\$) /1.41	1.4/97	(3/2-)			0.0308-0.65893
<sup>236</sup> Pa		236.0487	9.1 m	\$) /2.9	1.1/40 2.0/50 3.1/10	(1-)			U k x-ray 0.64235 0.68759 1.7630 (0.04 - 2.18)
<sup>237</sup> Pa		237.0511	8.7 m	\$) /2.3	1.1/60 1.6/30 2.3/10	(1/2+)			0.4986 0.5293 0.5407 0.8536 0.8650 (0.04 - 1.4)
<sup>238</sup> Pa		238.0545	2.3 m	\$) /3.5	1.2/ 1.7/	(3-)			0.10350 0.1785 0.4484 0.6350 0.6800

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>239</sup> Pa		239.0571	1.8 h						1.01446 (0.04 - 2.5)
<b>92U</b>		<b>238.02891(3)</b>							
<sup>217</sup> U			.16 ms	"	8.005				
<sup>218</sup> U		218.0235	.0.002 s	"	8.63(3)/				
<sup>219</sup> U		219.0249	0.04 ms	"	9.68(4)/				
<sup>222</sup> U		222.0261	. 1. s	"					
<sup>223</sup> U		223.0277	0.02 s	" /	8.78(4)/				
<sup>224</sup> U		224.02759	. 1. ms	" /	8.46/100				
<sup>225</sup> U		225.02938	84. ms	" /	7.87/83 7.82/15 7.63/2				
<sup>226</sup> U		226.02933	0.26 s	" /7.560	7.56/86 7.38/14	0+			
<sup>227</sup> U		227.03113	1.1 m	" /7.200	6.870/				
<sup>228</sup> U		228.03137	9.1 m	" /6.803	6.404(6)/0.6 6.440(5)/0.7 6.589(5)/29 6.681(6)/70	0+		0.095 0.152 0.187 0.246	
<sup>229</sup> U		229.03350	58. m	EC/(80)/1.31 "/(20)/6.473	6.223/3 6.297(3)/11 6.332(3)/20 6.360(3)/64	(3/2+)			
<sup>230</sup> U		230.033927	20.8 d >4x10 <sup>10</sup> y	" /5.992 SF/<10 <sup>-10</sup>	5.5866(3)/0.01 5.6624(3)/0.26 5.6663(3)/0.38 5.8178(3)/32 5.8887(3)/67	0+		Th L x-ray 0.07218 0.15421 0.23034 (0.081-0.8565)	
<sup>231</sup> U		231.03626	4.2 d	EC/0.36 "/(10) <sup>3</sup>	5.46/1.6 x 10) <sup>3</sup> 5.47/1.4 x 10) <sup>3</sup> 5.40/1. x 10) <sup>3</sup>	(5/2-)		Pa L x-ray Pa k x-ray 0.02564 0.08420	
<sup>232</sup> U		232.037146	70. y 2.6x10 <sup>15</sup> y	" /5.414 SF/2.7x10 <sup>-12</sup>	4.9979(1)/0.003 5.1367(1)/0.3 5.2635(1)/31 5.3203(1)/69	0+			
<sup>233</sup> U		233.039627	1.592x10 <sup>5</sup> y >2.7x10 <sup>17</sup> y	" /4.909 SF/6x10 <sup>-11</sup>	4.7830(8)/13.2 4.8247(8)/84.4 4.510-4.804	5/2+	+0.59	3.66	Th L x-ray 0.04244 0.09714 (0.0252-1.119)
<sup>234</sup> U	0.0054(5)	234.040945	2.455x10 <sup>5</sup> y 1.5x10 <sup>16</sup> y	" /4.856 SF/1.6x10 <sup>-9</sup>	4.604(1)/0.24 4.7231(1)/27.5 4.776(1)/72.5	0+			0.05323/0.156 0.12091
<sup>235m</sup> U			26. m	IT/0.0007		1/2+			
<sup>235</sup> U	0.7204(6)	235.043922	7.04x10 <sup>8</sup> y 1.0x10 <sup>9</sup> y	" /4.6793 SF/7x10 <sup>-9</sup>	4.1525(9)/0.9 4.2157(9)/5.7 4.3237(9)/4.6 4.3641(9)/11 4.370(4)/6 4.3952(9)/55 4.4144(9)/2.1 4.5025(9)/1.7 4.5558(9)/4.2 4.5970(9)/5.0	7/2-	-0.38	4.9	Th L x-ray Th k x-ray 0.10917 0.14378 0.16338 0.18574 0.20213 0.20533 0.22140 (0.03 - 0.79)
<sup>236</sup> U		236.045561	2.342x10 <sup>7</sup> y 2.5x10 <sup>16</sup> y	" /4.569 SF/9x10 <sup>-8</sup>	4.332(8)/0.26 4.445(5)/26 4.494(3)/74	0+			Th L x-ray 0.04946/100 0.11279/24.1 0.17115/0.080
<sup>237</sup> U		237.048723	6.75 d	\$) /0.519	0.24/ 0.25/	1/2+			Np L x-ray Np k x-ray 0.05953 0.20801
<sup>238</sup> U	99.2742(10)	238.050784	4.47x10 <sup>9</sup> y 8.2x10 <sup>15</sup> y	" / SF/5x10 <sup>-5</sup>	4.0395/0.23 4.147(5)/23 4.196(5)/77	0+			Th L x-ray 0.04955/.06 0.1135/.01 (0.522-0.681)
<sup>239</sup> U		239.054289	23.5 m	\$) /1.265	1.2/ 1.3/	5/2+			
<sup>240</sup> U		240.056585	14.1 h	\$) /0.39	0.36/	0+			Np L x-ray 0.04410 0.05558 0.06760
<sup>242</sup> U		242.0629	16.8 m	\$) / 1.2					
<b>93NP</b>									
<sup>225</sup> Np		225.0339	> 2 μs	" /					
<sup>226</sup> Np		226.0351	0.03 s	" /	8.04(2)/				
<sup>227</sup> Np		227.0350	0.51 s	" /	7.65(2)/ 7.68(1)/				
<sup>228</sup> Np		228.0362	61. s	EC/60(7)/ "/40(7)/,SF					
<sup>229</sup> Np		229.0363	4.0 m	" /7.010	6.890(20)				
<sup>230</sup> Np		230.0378	4.6 m	EC/97 /3.6 "/3	6.660(20)				
<sup>231</sup> Np		231.03823	48.8 m	EC/98 /1.8 "/2 /6.368	6.280/2	5/2			0.2629 0.3475 0.3703
<sup>232</sup> Np		232.0400	14.7 m	EC/99 /2.7		(4-)			U L x-ray U k x-ray 0.3268 0.81925 0.86683
<sup>233</sup> Np		233.0410	36.2 m	EC/1.2		(5/2+)			U L x-ray

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<sup>234</sup> Np		234.04289	4.4 d	\$* ,EC/1.81	0.79/	(0+)			U k x-ray 0.29887 0.31201 U L x-ray U k x-ray 1.5272 1.5587 1.6022
<sup>235</sup> Np		235.044055	1.085 y	EC/99.9 /0.124 "/0.001/5.191		5/2+			U k x-ray
<sup>236m</sup> Np			22.5 h	EC/52 / \$) /48 /		(1-)			U L x-ray Pu L x-ray U k x-ray 0.64235 0.68759
<sup>236</sup> Np		236.04657	1.55x10 <sup>5</sup> y	EC/91 /0.94 \$) /9 /0.49		(6-)			U L x-ray U k x-ray 0.10423 0.16031
<sup>237</sup> Np		237.048166	2.14x10 <sup>6</sup> y 1x10 <sup>18</sup> y	" /4.957 SF/2.1x10 <sup>-10</sup>	4.6395(5)/6.5 4.766(5)/9.7 4.7715(5)/22.7 4.7884(5)/47.8 4.558-4.873	5/2+	+3.14	+3.89	Pa L x-ray Pa k x-ray 0.029378/15 0.08653/12 (0.03-0.28)
<sup>238</sup> Np		238.050940	2.117 d	\$) /1.292	1.2/	2+			Pu L x-ray Pu k x-ray 0.98447/25.2 1.02855/18.3 (.044-1.026)
<sup>239</sup> Np		239.052931	2.355 d	\$) /0.722	0.341/30 0.438/48	5/2+			Pu L x-ray Pu k x-ray 0.10613 0.228186/11 0.27760/15 (0.04-0.50)
<sup>240m</sup> Np			7.22 m	\$) /99.9 / IT/0.1 /	2.18/	(1+)			0.25143 0.26333 0.55454 0.59735
<sup>240</sup> Np		240.05617	1.032 h	\$) /2.20	0.89/	5+			0.1471/ 0.5664 0.6008
<sup>241</sup> Np		241.0583	13.9 m	\$) /1.3	1.3/	5/2+			0.1330/ 0.1740 0.280
<sup>242m</sup> Np			2.2 m	\$) /		(1+)			0.15910 0.2651/ 0.78570 0.9448/
<sup>242</sup> Np		242.0616	5.5 m	\$) /2.7	2.7/	6+			0.6209 0.73620 0.78074 1.47340 (0.04-2.37)
<sup>243</sup> Np		243.0643	1.9 m						
<sup>244</sup> Np		244.0678	2.3 m						
<sup>94</sup> Pu									
<sup>228</sup> Pu		228.0387		" /	7.81(2) /				
<sup>229</sup> Pu		229.0362	1.5 m	" /	7.46/				
<sup>230</sup> Pu		230.03964	1.7 m	" /	7.06/81 7.00/19				
<sup>231</sup> Pu		231.04126	8.6 m	EC/90 "/10	6.72				
<sup>232</sup> Pu		232.04118	34. m	EC/>80/1.1 "/<20/6.716	6.542(10)/38 6.600(10)/62	0+			
<sup>233</sup> Pu		233.04299	20.9 m	EC(99.9)/1.9 "/0.1 /6.416	6.300(20)/0.1				0.1503 0.1804 0.2353 0.5002 0.5346/ 1.0352/
<sup>234</sup> Pu		234.04331	8.8 h	EC/94 /0.39 "/6 /6.310	6.035(3)/0.024 6.149(3)/1.9 6.200(3)/4.	0+			
<sup>235</sup> Pu		235.0453	25.3 m	EC/99+ /1.2 "/0.003/5.957	5.850(20)/0.003	(5/2+)			
<sup>236</sup> Pu		236.046048	2.87 y 1.5x10 <sup>9</sup> y	" /5.867 SF/1.9x10 <sup>-7</sup>	5.611/0.21 5.7210/30.5 5.7677(1)/69.3	0+			0.0476/0.07 0.109/0.02 (0.17 - 0.97)
<sup>237</sup> Pu		237.048403	45.7 d	EC/99.9 /0.220 "/0.003 /5.747	5.334(4)/0.0015 5.356(4)/0.0006 5.650(4)/0.0007	7/2-			Np L x-ray Np k x-ray 0.026344 0.03319 0.05954 (0.03-0.5)
<sup>238</sup> Pu		238.049553	87.7 y 4.75x10 <sup>10</sup> y	" /5.593 SF/1.8x10 <sup>-7</sup>	5.3583(1)/0.10 5.465(1)/28.3 5.4992(1)/71.6	0+			U k x-ray 0.04347 (0.04-1.1)
<sup>239</sup> Pu		239.052156	2.410x10 <sup>4</sup> y 8.x10 <sup>15</sup> y	" /5.244 SF/3x10 <sup>-10</sup>	5.055/0.047 5.076/0.078 5.106/11.9 5.144/17.1 5.157/70.8 (4.74 -5.03)	1/2+	+0.203		U k x-ray 0.05162 0.05682 0.12928 0.37502 0.41369
<sup>240</sup> Pu		240.053807	6.56x10 <sup>3</sup> y 1.14x10 <sup>11</sup> y	" /5.255 SF/5.7x10 <sup>-6</sup>	5.0212(1)/0.07 5.1237(1)/26.4 5.1681(1)/73.5	0+			U L x-ray 0.04524 0.10423

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	f-Energy /Intensity (MeV / %)
<sup>241</sup> Pu		241.056844	14.4 y	\$/99+/0.0208 "/0.002 /5.139	4.853(7)/3x10 <sup>4</sup> 4.8966(7)/0.002	5/2+	-0.683	+6.	(0.04-0.97) 0.14854 0.1600
<sup>242</sup> Pu		242.058736	<6.×10 <sup>16</sup> y 3.75×10 <sup>5</sup> y 6.77×10 <sup>10</sup> y	SF/>2.4×10 <sup>-14</sup> "/4.983 SF/5.5×10 <sup>-4</sup>	4.7546(7)/0.098 4.8564(7)/22.4 4.9006(7)/78	0+			U L x-ray 0.04491 0.10350
<sup>243</sup> Pu		243.061996	4.956 h	\$/ /0.582	0.49/21 0.58/60	7/2+			Am L x-ray 0.0417 0.0839
<sup>244</sup> Pu		244.064197	8.00x10 <sup>7</sup> y 6.6x10 <sup>10</sup> y	"/99.9/4.665 SF/0.12	4.546(1)/19.4 4.589(1)/80.5	0+			U L x-ray 0.0439
<sup>245</sup> Pu		245.06774	10.5 h	\$/ /1.21	0.93/57 1.21/11	(9/2-)			Am L x-ray Am k x-ray 0.2804 / 0.30832 0.32752 0.56014 (0.03-1.2)
<sup>246</sup> Pu		246.07020	10.85 d	\$/ /0.40	0.150/85 0.35/10	0+			Am L x-ray Am k x-ray 0.04379 0.22371
<sup>247</sup> Pu		247.0741	2.3 d						
<sup>95</sup> Am									
<sup>232</sup> Am		232.0466	0.9 m	EC/ . 5.0					
<sup>233</sup> Am		233.0465	. 3.2 m	"	6.78				
<sup>234</sup> Am		234.0478	2.3 m	EC/4.2					
<sup>235</sup> Am		235.0480	. 15 m	EC					
<sup>236</sup> Am		236.0456	54. s						Pu K x-ray
<sup>237</sup> Am		237.0503	1.22 h	EC/99.98 /1.7 "/0.02 /6.20	6.042(5)/0.02	(5/2-)			Pu k x-ray 0.14559 0.28026 0.43845
<sup>238</sup> Am		238.05198	1.63 h	EC/2.26 "/0.0001 /6.04	5.940/0.0001	1+			Pu L x-ray Pu k x-ray 0.91870 0.96278
<sup>239</sup> Am		239.053018	11.9 h	EC/99.99/0.803 a/0.01/5.924	5.734(2)/0.001 5.776(2)/0.008	5/2-			Pu L x-ray Pu k x-ray 0.18172 0.22818 0.27760
<sup>240</sup> Am		240.05529	2.12 d	EC/1.38 "/5.592	5.378(1)/16x10 <sup>4</sup>	(3-)			Pu L x-ray Pu k x-ray 0.88878 0.98764 (0.1-1.3)
<sup>241</sup> Am		241.056822	432.7 y 1.2×10 <sup>14</sup> y	"/5.637 SF/3.6×10 <sup>-10</sup>	5.2443(1)/0.002 5.3221(1)/0.015 5.3884(1)/1.4 5.4431(1)/12.8 5.4857(1)/85.2 5.5116(1)/0.20 5.5442(1)/0.34	5/2-	+1.58	+3.1	Np L x-ray 0.02634 / .024 0.03319/.00126 0.05954/0.359 (0.03-1.128)
<sup>242m</sup> Am			141. y >3.×10 <sup>12</sup> y	IT/99.5/0.048 "/0.5/5.62 SF/<4.7×10 <sup>-9</sup>	5.141(4)/0.026 5.2070(2)/0.4	5-	+1.0	+6.5	Am L x-ray 0.04863 0.08648 0.10944 0.16304
<sup>242</sup> Am		242.059542	16.02 h	\$/ /83 /0.665 EC/17 /0.750	0.63/46 0.67/37	1-	+0.388	-2.4	Pu L x-ray Cm L x-ray Pu k x-ray 0.0422 0.04453 0.04354 0.07467 0.08657 0.11770 0.14197 0.0429
<sup>243</sup> Am		243.061372	7.37x10 <sup>3</sup> y 2.×10 <sup>14</sup> y	"/5.438 SF/3.7×10 <sup>-9</sup>	5.1798(5)/1.1 5.2343(5)/11 5.2766(5)/88 5.394(5)/0.12 5.3500(5)/0.16	5/2-	+1.5	+2.9	0.0429 Am L x-ray Cm k x-ray 0.7460 0.9000 Cm L x-ray Cm k x-ray 0.25299
<sup>244m</sup> Am			. 26. m	\$/ /1.498		(1-)			Cm L x-ray Cm k x-ray 0.27002 0.79881 1.06201 1.07885 (0.04-2.29)
<sup>244</sup> Am		244.064279	10.1 h	\$/ /1.428					Cm L x-ray Cm k x-ray 0.2267 / 0.2853 /
<sup>245</sup> Am		245.066444	2.05 h	\$/ /0.894	0.65/19 0.90/77	(5/2+)			
<sup>246m</sup> Am			25.0 m	\$/ /	1.3/79. 1.60/14 2.1/7	2-			
<sup>246</sup> Am		246.06977	39. m	\$/ /2.38	1.2/	(7-)			
<sup>247</sup> Am		247.0722	22. m	\$/ /1.7					
<sup>96</sup> Cm									
<sup>233</sup> Cm		233.0508		"/ /	7.34/				

T A B L E O F T H E I S O T O P E S

Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fl-Energy /Intensity (MeV / %)
<sup>234</sup> Cm		234.0502	.51. s	"	7.24/				
<sup>235</sup> Cm		235.0516							
<sup>236</sup> Cm		236.0514		EC/1.7					
<sup>237</sup> Cm		237.0529		EC/2.5					
<sup>238</sup> Cm		238.05302	2.4 h	EC/>90 /0.97 "/<10 /6.632	6.520(50)/<10	0+			0.0407 0.1466 0.1874
<sup>239</sup> Cm		239.0548	. 3. h	EC/1.7					
<sup>240</sup> Cm		240.055519	27. d	"/6.397	5.989/0.014 6.147/0.05	0+			
			1.9×10 <sup>6</sup> y	SF/3.9×10 <sup>-6</sup>	6.2478(6) /28.8 6.2906(6) /70.6				
<sup>241</sup> Cm		241.057646	32.8 d	EC/99 /0.768 "/1 /6.184	5.8842(4)/0.12 5.9291(4)/0.18 5.9389(4)/0.69	1/2+			Am k x-ray 0.13241 0.16505 0.18028 0.43063 0.47181
<sup>242</sup> Cm		242.058828	162.8 d	"/6.216	5.9694(1)/0.035	0+			
			7.0×10 <sup>6</sup> y	SF/6.4×10 <sup>-6</sup>	6.069(1)/25 6.1129(1)/74				Pu L x-ray 0.04408 0.10189 (0.04-1.2)
<sup>243</sup> Cm		243.061381	29.1 y	"/6.167	5.6815(5) /0.2 5.6856(5)/1.6	5/2+	0.41		Pu L x-ray Pu k x-ray 0.10612 0.20975 0.22819 0.27760 0.28546 0.33431 (0.04-0.7)
			5.5×10 <sup>11</sup> y	SF/5.3×10 <sup>-9</sup>	5.7420(5)/10.6 5.7859(5)/73.3 5.9922(5)/6.5 6.0103(5)/1.0 6.0589(5)/5 6.0666(5)/1.5				
<sup>244</sup> Cm		244.062745	18.1 y	"/5.902	5.6656/0.02 5.7528/23	0+			Pu L x-ray 0.04282 0.09885 0.15262
			1.32×10 <sup>7</sup> y	SF/1.4×10 <sup>-4</sup>	5.8050/77 5.515/0.004				
<sup>245</sup> Cm		245.065485	8.48×10 <sup>3</sup> y	"/5.623	5.235(10)/0.3 5.3038(10)/5.0	7/2+	0.5		Pu L x-ray Pu k x-ray 0.04195 0.13299 0.13606 0.17494
			1.4×10 <sup>12</sup> y	SF/6.1×10 <sup>-7</sup>	5.3620(7)/93 5.4927(11)/0.8 5.5331(11)/0.6				
<sup>246</sup> Cm		246.067217	4.76×10 <sup>3</sup> y	"/5.476	5.343(3)/21	0+			Pu L x-ray 0.04453
			1.8×10 <sup>7</sup> y	SF/0.026	5.386(3)/79				
<sup>247</sup> Cm		247.070346	1.56×10 <sup>7</sup> y	"/5.352	4.818(4)/4.7 4.8690(20)/71	9/2- 9/2-	0.37		Pu k x-ray 0.2792 0.2886 0.3471 0.4035
					4.941(4)/1.6 4.9820(20)/2.0 5.1436(20)/1.2 5.2104(20)/5.7 5.2659(20)/13.8				
<sup>248</sup> Cm		248.072341	3.48×10 <sup>5</sup> y	"/99.92 /5.162	4.931(5)/0.07 5.0349(2)/16.5 5.0784(2)/(75)/1	0+			
<sup>249</sup> Cm		249.075946	4.15×10 <sup>6</sup> y 64.15 m	SF/8.38 \$/ /0.900	0.9/	1/2+			Bk k x-ray 0.56039 0.63431
<sup>250</sup> Cm		250.07835	. 9.7×10 <sup>3</sup> y	SF/85.8 "/5.27		0+			
<sup>251</sup> Cm		251.08228	16.8 m	\$/ /1.42	0.90/16	(1/2+)			0.3896 / 0.5299 0.5425
<sup>252</sup> Cm		252.0849	< 2 d						
<sup>97</sup> Bk									
<sup>238</sup> Bk		238.0583	2.4 m	EC/5.0					
<sup>239</sup> Bk		239.0584							
<sup>240</sup> Bk		240.0598	. 4.8 m						
<sup>242</sup> Bk		242.0621	7.0 m	EC/3.0					
<sup>243</sup> Bk		243.063001	4.5 h	EC/99.8 /1.508 "/0.15 /6.871	6.542(4)/0.03 6.5738(2)/0.04 6.7180(22)/0.02 6.7581(20)/0.02	(3/2-)		0.1466 0.1874 0.755 0.840 0.946	
<sup>244</sup> Bk		244.0652	4.4 h	EC/99.99 /2.26 "/0.01 /6.778	6.625(4)/0.003 6.667(4)/0.003	(4-)		0.1445 0.1876 0.2176 0.9815 0.9215/	
<sup>245</sup> Bk		245.066355	4.94 d	EC/99.9 /0.810 "/0.1 /6.453	5.8851(5)/0.03 6.1176(9)/0.01 6.1467(5)/0.02 6.3087(5)/0.014 6.3492(5)/0.018	3/2-		Cm L x-ray Cm k x-ray 0.25299 0.3809 0.3851	
<sup>246</sup> Bk		246.0687	1.80 d	EC/1.35		(2-)			Cm L x-ray Cm k x-ray 0.79881 1.08142
<sup>247</sup> Bk		247.07030	1.4×10 <sup>3</sup> y	"/5.889	5.465(5)/1.5 5.501(5)/7 5.532(5)/45 5.6535(20)/5.5 5.678(2)/13 5.712(2)/17 5.753(2)/4.3 5.794(2)/5.5	(3/2-)		0.04175 0.0839 0.268	
<sup>248</sup> Bk		248.07311	23.7 h	\$/ /70 /0.87 EC/30 /0.72	0.86/	(1-)			Cm L x-ray Cf L x-ray Cm k x-ray

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<sup>249</sup> Bk		249.074980	320. d	\$/0.125 "/0.001 /5.525	0.125/100 5.390(1)/0.0002 5.4174(6)/0.001	7/2+	2.0		Cf k x-ray 0.5507 0.327/10) <sup>5</sup> 0.308/10) <sup>6</sup>
<sup>250</sup> Bk		250.078309	1.8×10 <sup>9</sup> y 3.217 h	SF/4.9×10 <sup>-5</sup> \$/1.780	0.74/	2-			Cf L x-ray Cf k x-ray 0.98912 1.03184 (0.04-1.6) 0.02481 0.1528 0.1776
<sup>251</sup> Bk		251.08075	56. m	\$/1.09		(3/2-)			
<sup>252</sup> Bk		252.0843	1.8 m						
<b><sup>98</sup>Cf</b>									
<sup>237</sup> Cf		237.0621	2.1 s	" ,SF/10					
<sup>238</sup> Cf		238.0614	21 ms	SF/					
<sup>239</sup> Cf		239.0626	0.7 m	"					
<sup>240</sup> Cf		240.0623	1.1 m	" /7.719	7.590(10)/	0+			
<sup>241</sup> Cf		241.0637	4. m	SF/ .2.1 EC/3.3					
<sup>242</sup> Cf		242.06369	3.5 m	" /7.60	7.335(5)/ 7.351(6)/20	0+			
<sup>243</sup> Cf		243.0654	11. m	SF/0.014 EC/86 /2.2	7.385(4)/80 7.060(6)/20	(1/2+)			
<sup>244</sup> Cf		244.065990	20. m	" /14 /7.40 "/7.328	7.170/4 7.168(5)/25 7.210(5)/75	0+			
<sup>245</sup> Cf		245.068038	44. m	" /36 /7.255 EC/64 /1.569	7.15/91.7 6.983/0.31 7.09/7 7.065/0.68				Cm K x-ray 0.5709 0.6014 0.6163
<sup>246</sup> Cf		246.068798	1.49 d 1.8×10 <sup>3</sup> y	" /6.869 SF/2.3×10 <sup>-4</sup>	6.6156(10)/0.18 6.7086(7)/21.8 6.7501(7)/78.0	0+			Cm L x-ray 0.04221 0.0945 0.147
<sup>247</sup> Cf		247.07099	3.11 h	EC/99.96 /0.65 "/0.04 /6.55	6.301(5)/	7/2+			Bk k x-ray 0.2941 0.4778
<sup>248</sup> Cf		248.07218	334. d 3.2×10 <sup>4</sup> y	" /6.369 SF/0.0029	6.220(5)/17 6.262(5)/83	0+			
<sup>249</sup> Cf		249.074846	351. y 8.×10 <sup>10</sup> y	" /6.295 SF/4.4×10 <sup>-7</sup>	5.758/3.7 5.812/85.7 5.8488(2)/1.0 5.9029(2)/2.8 5.9451(2)/4.0 6.1401(2)/1.1 6.1940(2)/2.2	9/2-		Cm L x-ray Cm k x-ray 0.25299/2.5 0.33351/13.6 0.38832/63.6 (0.0376-1.103)	
<sup>250</sup> Cf		250.076399	13.1 y 1.7×10 <sup>4</sup> y	" /6.129 SF/0.077	5.8913(4)/0.3 5.9889(4)/15 6.0310(4)/84.5	0+			Cm L x-ray 0.04285
<sup>251</sup> Cf		251.079579	9.0×10 <sup>2</sup> y	" /6.172	5.56448(7)/1.5 5.632(1)/4.5 5.648(1)/3.5 5.6773(6)/35 5.762(3)/3.8 5.7937(7)/2.0 5.8124(8)/4.2 5.8514(6)/27 6.0140(7)/11.6 6.0744(7)/2.7	1/2+			
<sup>252</sup> Cf		252.081619	2.65 y 86. Y	" /96.9 /6.217 SF/3.1/	5.7977(1)/0.23 6.0756(4)/15.2 6.1184(4)/81.6	0+			Cm L x-ray 0.04339 0.1002
<sup>253</sup> Cf		253.08512	17.8 d	\$/99.7 /0.29 "/0.3 /6.126	0.27/100 5.921(5)/0.02	(7/2+)			
<sup>254</sup> Cf		254.08732	60.5 d	SF/99.7/ "/0.3/5.930	5.792(5)/0.05 5.834(5)/0.26	0+			
<sup>255</sup> Cf		255.0910	1.4 h	\$/0.7					
<sup>256</sup> Cf		256.0934	12. m	SF					
<b><sup>99</sup>Es</b>									
<sup>241</sup> Es		241.0687	. 8 s	"	8.11				
<sup>242</sup> Es		242.0697	16 s	"	7.92				
<sup>243</sup> Es		243.0696	21. s	" />30 / EC/<70 /4.0	7.89/>30				
<sup>244</sup> Es		244.0709	37. s	EC/76 /4.6 "/4 /	7.57/4 7.74				
<sup>245</sup> Es		245.0713	1.3 m	" /40 /7.858 EC/60 /3.1					
<sup>246</sup> Es		246.0730	7.7 m	EC/90 /3.9 "/10 /	7.35				
<sup>247</sup> Es		247.07365	4.8 m	EC/93 /2.48 "/7 /	7.32				
<sup>248</sup> Es		248.0755	26. m	EC/99.7 /3.1 "/0.3 /	6.87				
<sup>249</sup> Es		249.07640	1.70 h	EC/99.4 /1.45 "/0.6 /	6.77	(7/2+)			0.3795 0.8132
<sup>250m</sup> Es			2.2 h	EC/ \$+		(1-)			Cf L x-ray Cf k x-ray 0.9891 1.0319
<sup>250</sup> Es		250.0787	8.6 h	EC/2.1		(6+)			Cf L x-ray Cf k x-ray 0.30339



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<sup>251</sup> Es		251.07998	1.38 d	EC/99.5 /0.38 "/0.5 /	6.462/0.05 6.492/0.4	(3/2-)			0.34948 0.82883
<sup>252</sup> Es		252.08297	1.29 y	" /76 / EC/24 /1.26	6.632/61.0 6.562/10.3	(5-)			
<sup>253</sup> Es		253.084818	20.47 d	" / SF/8.9×10 <sup>-6</sup>	6.633/89.8 6.5916/6.6	7/2+	+4.10	7.	0.04180 0.3892
<sup>254m</sup> Es			1.64 d	\$) /99.6 / "/0.3 /6.67	0.475 6.382	2+	2.9	3.7	Fm L x-ray Fm k x-ray 0.6488 0.6938 0.064
<sup>254</sup> Es		254.088017	276. d	" / SF/<3×10 <sup>-5</sup>	6.429	(7+)			
<sup>255</sup> Es		255.09027	>2.5×10 <sup>7</sup> y	\$) /92 /0.29 "/8 /	6.26 6.300	(7/2+)			
<sup>256m</sup> Es			2.6×10 <sup>3</sup> y	SF/0.0042 \$) /		(8+)			0.218 0.232 0.862
<sup>256</sup> Es		256.0936	25. m	\$) /1.7		(1+)			
<sup>257</sup> Es		257.0960	7.7 d	\$-					
<b>100</b> <sup>Fm</sup>									
<sup>242</sup> Fm		242.0734	0.8 ms	SF/>96					
<sup>243</sup> Fm		243.0745	0.2 s	" / <SF/0.4	8.55				
<sup>244</sup> Fm		244.0741	3.3 ms	SF/>97		0+			
<sup>245</sup> Fm		245.0754	4. s	" / SF/<0.1	8.15/ 8.24/				
<sup>246</sup> Fm		246.07528	1.2 s	" /85 / SF/15/		0+			
<sup>247m</sup> Fm			9. s	" /	8.18/				
<sup>247</sup> Fm		247.0768	35. s	" /8.20 EC/2.9	7.87/70 7.93/30				
<sup>248</sup> Fm		248.07718	34. s	" /99.9 /8.001 SF/0.1/	7.83/20 7.87/80	0+			
<sup>249</sup> Fm		249.0790	3. m	EC/2.4 "/	7.53	(7/2+)			
<sup>250m</sup> Fm			1.8 s	IT/ SF/<8×10 <sup>-5</sup>					
<sup>250</sup> Fm		250.07951	30. m	" / EC/0.8 SF/0.007	7.43/ 6.833	0+			
<sup>251</sup> Fm		251.08157	5.3 h	EC/98 /1.47 "/2 /		(9/2-)			
<sup>252</sup> Fm		252.08246	1.058 d	" /7.154 SF/0.0023	6.998/15 7.039/85	0+			
<sup>253</sup> Fm		253.085175	3.0 d	EC(88%)/0.333 "/12 /	6.676/ 6.943/	1/2+			Es k x-ray 0.2719
<sup>254</sup> Fm		254.086847	3.240 h	" / SF/0.059	7.150 7.192	0+			
<sup>255</sup> Fm		255.089955	20.1 h	" / SF/2.3×10 <sup>-5</sup>	6.9635(5)/5.0 7.0225(5)/93.4	7/2+			
<sup>256</sup> Fm		256.09177	1.0×10 <sup>4</sup> y	SF/91 "/19		0+			
<sup>257</sup> Fm		257.09510	2.63 h	" /99.79 SF/0.21	6.92/ 6.519	(9/2+)			0.1794 0.2410
<sup>258</sup> Fm		258.0971	0.37 ms	SF/					
<sup>259</sup> Fm		259.1006	1.5 s	SF/					
<sup>260</sup> Fm			.4 ms	SF/					
<b>101</b> <sup>Md</sup>									
<sup>245m</sup> Md			.0.4 s	"	8.64, 8.68				
<sup>245</sup> Md		245.0810	0.9 ms	SF					
<sup>246</sup> Md		246.0819	1.0 s	"	8.74 8.50-8.56				
<sup>247m</sup> Md			.0.2 s	SF/					
<sup>247</sup> Md		247.0818	3. s	"	8.43				
<sup>248</sup> Md		248.0828	7. s	EC/80 /5.3 "/20 / SF/<0.05	8.32/15 8.36/5				
<sup>249</sup> Md		249.0830	24. s	EC>/<80 /3.7 "/>20 /8.46	8.030(20)/ 7.75/4				
<sup>250</sup> Md		250.0845	50. s	EC/94 /4.6 "/6 /8.25	7.83/2				
<sup>251</sup> Md		251.0849	4.0 m	EC/>94 /3.1 "/<6 /	7.55/				
<sup>252</sup> Md		252.0866	2. m	EC/>50 /3.9 "/<50 /	7.73/				
<sup>253</sup> Md		253.0873	.6 m	EC/2.0					
<sup>254m</sup> Md			30. m	EC/					
<sup>254</sup> Md		254.0897	10. m	EC/2.7					
<sup>255</sup> Md		255.09108	27. m	EC/92 /1.04 "/8 / SF/, 0.15	" /7.33/93 7.27/5 7.75/1 7.71/1	(7/2-)			0.121/100 0.115/65 0.136/35 0.141-0.453
<sup>256</sup> Md		256.0941	1.30 h	EC/89 /2.13 "/11 / SF/<2.6	7.21/71 7.14/22 7.68/2.5 7.25/2.5 7.64/2.1				Fm k x-ray 0.121/409 0.115/266 0.136/143 0.634/119 0.141-1.37
<sup>257</sup> Md		257.095535	5.5 h	EC/85 /0.41 "/15,SF/, 1	7.074 7.014	(7/2-)			Fm k x-ray (0.181-0.389)
<sup>258m</sup> Md			57. m	EC/ SF/, 30		(1-)			Fm k x-ray

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fi-Energy /Intensity (MeV / %)
<sup>258</sup> Md		258.098427	51.5 d	" /7.40	6.718(2)/	(8-)			0.3678
<sup>259</sup> Md		259.1005	1.64 h	SF/0.003 SF/>98.7	6.763(4)/	7/2+			0.057 - 0.448
<sup>260</sup> Md		260.104	27.8 d	" /<1.3 SF/73-100					
<b>102No</b>									
<sup>250</sup> No		250.0875	0.036 ms	SF/		0+			
<sup>251</sup> No		251.0889	0.76 s	" /91	8.62/96				
				SF/0.26	8.58/4				
<sup>252</sup> No		252.08897	2.44 s	" /68/8.551	8.42	0+			
			7.6 s	SF/32/	8.37				
<sup>253</sup> No		253.0907	1.7 m	EC, S /<1.6 "	8.010(20)	(9/2-)			
				EC/3.2					
<sup>254m</sup> No			0.28 s	I.T. /					
<sup>254</sup> No		254.09095	49. s	SF/. .2 "	8.09	0+			
				EC/1.1					
<sup>255</sup> No		255.09323	3.1 m	SF/0.17 "/62 /	8.12/	1/2+			0.187
				EC/38/2.01	7.93				
<sup>256</sup> No		256.09428	2.9 s	" /	8.08	0+			
				SF/0.5	8.43				
<sup>257</sup> No		257.09685	25. s	" /	8.22	(7/2+)			
				SF/<1.5	8.27				
					8.32				
<sup>258</sup> No		258.0983	1.2 ms	SF/		0+			
<sup>259</sup> No		259.1011	58. m	" /78 /7.794	7.52	(9/2+)			
				EC/22/0.5	7.55				
<sup>260</sup> No		260.103	0.11 s	SF/					
<sup>262</sup> No		262.108	8. ms	SF/					
<b>103Lr</b>									
<sup>251</sup> Lr		251.0944	39 m	SF					
<sup>252</sup> Lr		252.0953	0.36 s	"	9.02/73				
				SF/<1	8.97/27				
<sup>253m</sup> Lr			0.57 s	"	8.79				
<sup>253</sup> Lr		253.0953	1.5 s	SF/1.3 "	8.72				
				SF/8					
<sup>254</sup> Lr		254.0965	13. s	" /	8.45				
				EC/5.2					
<sup>255</sup> Lr		255.0967	22. s	SF/<0.1 "	8.37/60				
				EC/3.2	8.43/40				
<sup>256</sup> Lr		256.0988	28. s	SF/<0.1 "/99.7 /8.554	8.43/				
				EC/4.2	8.39				
<sup>257</sup> Lr		257.0996	0.65 s	SF/<0.03 "	8.80	7/2+			
				EC/2.5	8.80				
<sup>258</sup> Lr		258.1019	3.9 s	SF/<0.03 "	8.60/46				
				EC/3.4	8.62/25				
				SF/<5	8.56/20				
<sup>259</sup> Lr		259.1030	6.1 s	" /80	8.65/9				
				SF/20	8.44(1)				
<sup>260</sup> Lr		260.1056	3. m	" /	8.03				
<sup>261</sup> Lr		261.1069	40. m	SF					
<sup>262</sup> Lr		262.1097	3.6 h	EC/2. SF/<10					
<b>104Rf</b>									
<sup>253</sup> Rf		253.1007	48. : s	SF "/<10					
<sup>254</sup> Rf		254.1002	23. : s	SF/>98.5 "/<1.5					
<sup>255</sup> Rf		255.1015	1.6 s	"	8.72/<0.05				0.203
				SF/52	8.77/94				0.142
					8.67/<0.05				
					8.58/<0.05				
					8.92/<0.05				
<sup>256</sup> Rf		256.10118	6.2 ms	SF/99.68 "/0.32	8.81				
<sup>257</sup> Rf		257.1031	4.7 s	" /9.22 EC/11	8.77				0.117
				SF/<1.4	9.01				
					8.95				
<sup>258</sup> Rf		258.1036	12. ms	SF/87 "/13	8.62				
<sup>259</sup> Rf		259.1056	3.4 s.	" /9.09/93	8.77(2)/				
				SF/7	8.86/				
<sup>260</sup> Rf		260.1064	20. ms	SF/					
<sup>261</sup> Rf		261.1088	1.1 m	" /8.78, SF/<10	8.28/				
<sup>262</sup> Rf		262.1099	2.1 s	SF/>99.2					
<sup>263</sup> Rf		263.1125	22. m	SF, "					
<b>105Db</b>									
<sup>255</sup> Db		255.1074	1.5 s	" , SF/. 20					
<sup>256</sup> Db		256.1081	1.6 s	" /64 EC/35	9.02/67				
				SF/0.05	8.89/11				
					9.08/11				

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Elem. or Isot.	Natural Abundance (Atom %)	Atomic Mass or Weight	Half-life/ Resonance Width(MeV)	Decay Mode/Energy (/MeV)	Particle Energy /Intensity (MeV / %)	Spin (h/2B)	Nuclear Magnetic Mom.(nm)	Elect. Quadr. Mom. (b)	fI-Energy /Intensity (MeV / %)
<sup>257m</sup> Db			0.8 s	"	9.12/11 9.16				
<sup>257</sup> Db		257.1079	1.5 s	SF/<13 "/ SF/<6	8.97/33 9.07/38 9.12/5.5 8.94/9 9.02/9 8.89/5.5				
<sup>258</sup> Db		258.1094	4.2 s	" / E.C/5.3 SF/<33	9.30/ 9.17/ 9.08/				
<sup>259</sup> Db		259.1097	0.51 s	SF/					
<sup>260</sup> Db		260.1114	1.5 s	" / SF/<9.6	9.47/ 9.05/ 9.08/ 9.13/ 8.93/				
<sup>261</sup> Db		261.1121	1.8 s	" /					
<sup>262</sup> Db		262.1141	34. s	SF/<18 SF/<33 "/					
<sup>263</sup> Db		263.1151	0.45 m	SF/57 "/41 EC/3	8.45/ 8.53/ 8.67/ 8.36/ 8.41/				
<b><sup>106</sup>Sg</b>									
<sup>258</sup> Sg		258.1132	2.9 ms	SF "/<20					
<sup>259</sup> Sg		259.1147	0.5 s	" / SF/<20	9.62 9.35 9.03				
<sup>260</sup> Sg		260.11444	4. ms	" /50 SF/50	9.76 9.72 9.81				
<sup>261</sup> Sg		261.1162	0.3 s	" ,SF/<10	9.56				
<sup>262</sup> Sg		262.1162	0.007 s	SF "/<22					
<sup>263</sup> Sg		263.1183	0.8 s	" /	9.06				
<sup>265</sup> Sg		265.1211	7.4 s	SF/<30 "/>65 SF/<35	9.25 8.84/46 8.76/23 8.94/23 8.69/8				
<sup>266</sup> Sg		266.1219	21. s	" / SF/<82	8.77/66 8.52/33				
<b><sup>107</sup>Bh</b>									
<sup>260</sup> Bh		260.122		"					
<sup>261</sup> Bh		261.1218	12. ms	" /,SF<10	10.40 10.10 10.03				
<sup>262m</sup> Bh			8. ms	" /	10.37				
<sup>262</sup> Bh		262.1230	0.10 s	SF/<12 "/ SF/<12	10.24 10.06 9.91				
<sup>264</sup> Bh		264.1247	0.44 s	" /	9.74				
<sup>266</sup> Bh		266.1270	.1 s	SF/	9.48				
<sup>267</sup> Bh		267.1277	.17 s	9.29 8.83	9.62				
<b><sup>108</sup>Hs</b>									
<sup>263</sup> Hs		263.1287		" /					
<sup>264</sup> Hs		264.1284	0.08 ms	" /,SF/. 50	11.0				
<sup>265m</sup> Hs			0.75 ms	" /	10.57/63 10.73 10.52 10.34				
<sup>265</sup> Hs		265.1300	2.0 ms	" / SF/<1	10.30/90 10.43 10.37 10.25				
<sup>266</sup> Hs		266.1300	2.3 ms	"	10.2				
<sup>267</sup> Hs		267.1371	33 ms	" />88	9.88 9.83 9.75				
<sup>269</sup> Hs		269.1341	9.3 s	"	9.23 9.17 9.16				
<sup>270</sup> Hs			2-7 s	"					
<sup>271</sup> Hs			.11 m	SF					
<b><sup>109</sup>Mt</b>									
<sup>266m</sup> Mt			.1.2 ms	"	10.46-10.81				
<sup>266</sup> Mt		266.1379	.0.7 ms	"	10.48-11.31				
<sup>267</sup> Mt		267.138	19 ms	"					
<sup>268</sup> Mt		268.1388	0.07 s	" />68	10.10,10.24				
<b><sup>110</sup></b>									
<sup>267</sup> 110		267.1440	.3 s	" />32	11.6				
<sup>269</sup> 110		269.1451	0.17 ms	" />75	11.11				
<sup>271m</sup> 110			.1.1 ms	"	10.68 10.74				
<sup>270m</sup> 110			.6 ms	"	10.95 11.15 12.15				

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<sup>270</sup> 110		270.1446	0.1 ms	"	11.03				
<sup>271</sup> 110		271.1461	. 56 ms	"	10.71				
<sup>273m</sup> 110			0.076 ms	"	11.8				
<sup>273</sup> 110		273.1492	118 ms	" /	9.73				
<sup>280</sup> 110			. 7.5 s	SF/					
<sup>281</sup> 110			. 1 m	"	8.83				
<b>111</b>									
<sup>272</sup> 111		272.1535	. 1.5 ms	" />68	10.82				
<b>112</b>									
<sup>277</sup> 112			. 0.24 ms	"	11.45				
<sup>283</sup> 112			. 3. m	sf/>0.7	11.65				
<sup>284</sup> 112			. 9.8 s	" /<0.3	9.17				
<sup>285</sup> 112			. 11. m	"	8.67				
<b>114</b>									
<sup>287</sup> 114			. 5.5 s	"	10.3				
<sup>288</sup> 114			. 1.9 s	"	9.84				
<sup>289</sup> 114			. 20. s	"	9.71				
<b>116</b>									
<sup>292</sup> 116			. 0.03 s	"	10.6				