1.E.2:
6.D

Nuclear Physics **67** (1965) 1—31;

1964 ATOMIC MASS TABLE

J. H. E. MATTAUCH, W. THIELE
Max-Planck-Institut für Chemie (Otto-Hahn-Institut), Mainz

and

A. H. WAPSTRA
Instituut voor Kernphysisch Onderzoek, Amsterdam †

Received 24 August 1964

Abstract: A completely new mass table is derived from experimental data.

Several reasons prompted us to prepare a mass table superseding our 1961 table [1].

Firstly, very superior new mass doublets [2,3] have been published in the region $70 < A < 130$; they are even considerably better that those used in the more recent mass table of Kravtsov [4]. Also much better doublets [3,5] in the region $140 < A < 170$ have become available, and some very important ones [6] for Hg, Tl and Pb isotopes.

Secondly, the problem of the calibration of most nuclear reactions which was still somewhat in doubt in the preceding calculation has now been solved; Rytz [7] has prepared a list of recalibrated reaction energies in the region $A < 70$. Furthermore, many new reaction energies in higher mass regions have been reported; also, the new technique of measuring ${}^{A}Z^{37}\mathrm{Cl} - {}^{A+2}Z^{35}\mathrm{Cl}$ mass doublets [3,6] has yielded many important and accurate mass differences.

Thirdly, a computer program for an IBM-7090 written by one of us (W. T.), executes the following duties: arranging the input data, weeding out false or unimportant data, calculation of best values by least square methods, comparing input data with adjusted values (determination of χ^2) and calculation of linear combinations of masses such as α and β decay energies, binding energies of several combinations of protons and neutrons and nuclear energies.

Fig. 1 shows the differences between mass values in 1961 and in 1964, compared to the errors in the first data. We think that the results presented in this drawing justify our multiplying the errors in the mass spectroscopic data with a factor of about 3 in the 1961 calculation; the errors given in fig. 1 include this factor, and even so it is clear that in many cases the differences exceed the errors. In scrutinizing this figure one should realize that the errors in the adjusted mass values in 1961 were often smaller than those in the input mass spectroscopic data, thanks to the correlation due to much more

† This work has been undertaken with the encouragement of the IUPAP-Commission on Atomic Masses and Related Constants.
Copies of this paper may be obtained from Professor H.E.Duckworth, McMaster University, Hamilton, Ontario, Canada, (Secretary of the Commission) at a cost of fifty cents per copy or ten copies for $4.00 payable in advance.

accurate mass differences obtained from reaction measurements, the differences between separate mass doublet values from 1961 and the present adjusted values is therefore not as excessive as one might be inclined to think. The situation has now changed considerably: in most parts of the periodic system the accuracy in mass doublets is now comparable or superior to that in nuclear reactions.

Also, we find from separate adjustments that the consistency of the recent mass doublets from Minnesota and Hamilton is much better than that of their older ones. Therefore, a smaller consistency factor 1.5 has been applied to these data, although errors in the old mass spectroscopic data retained in this adjustment and in the new Russian measurements have still been multiplied with a factor 2.5. Full reasons for these and other procedures adopted in preparing the present mass list, and a complete list of input data, will be given in an accompanying paper [8]. The present paper gives only mass table and a schematical diagram fig. 2, of the connections used in its calculation.

As was also the case in our preceding computations, the nuclides have been divided into two groups: primary and secondary ones. The primary masses have often been calculated from rather involved combinations of data; changing one of these masses therefore introduces rather complex changes in the other data. Some secondary masses have been derived from a single mass doublet involving only very well-known masses like ^{1}H, ^{2}D, ^{12}C, ^{14}N etc. besides the desired mass; it is then marked *M* in the sixth column of the table. Others have been obtained from a nearby mass as indicated by signs explained in table A.

Table A
Explanation of origin of secondary data

The mass ^{A}Z has been derived from	
$^{A}Z\pm1$	when marked ±
$^{(A\pm2)}Z$	when marked ± NN
$^{(A\pm1)}Z$	when marked ± N
$^{(A\pm2)}Z\pm2$	when marked ± PP
$^{(A\pm1)}Z\pm1$	when marked ± P
$^{(A\pm4)}Z+2$	when marked ± A

Changes in these data may still affect a few other secondary data; this can be seen from fig. 2.

A new feature in this table is that masses have been added that have been derived from estimated beta or alpha decay energies. By assigning token errors of 1000 keV to these input data, it was achieved that all derived data are marked with errors of 1000 keV or larger (if about 1400, 1700, 2000, 2200... keV, two, three, four, five... estimated data were used in the derivation); conversely from interpolated data with the sole exceptions of ^{4}H, ^{5}H, and ^{8}He. In the region with $A > 180$, the estimated data were obtained from Dr. V. Viola, whom we thank for his kind cooperation. We have limited use of estimated data to cases which could be obtained by interpolation: extrapolation has been avoided with the exception of some cases where chains of alpha decays could be connected through their use.

The accompanying table gives mass excesses in energy and mass units, total binding energies and beta decay energies. Other linear combinations of the data presented in this mass table, such as binding energies of some com-

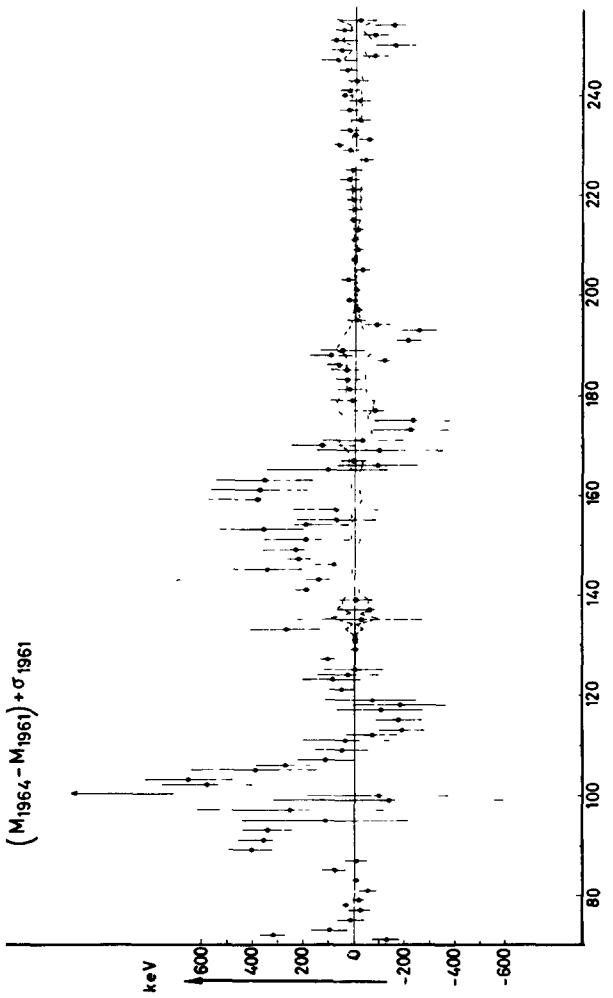

Fig. 1. Differences between masses in the 1964 and 1961 adjustments

The difference $M_{1964} - M_{1961}$ has been plotted for those isobars to which the smallest errors had been attached in 1961; these errors are indicated by the vertical bars. These data are indicated for odd A and for those even values of A where they are considerably different from neighbouring odd A data. The errors in the corresponding data in 1964 have been indicated as the distances of the central axis to the two dashed lines. For A below 130, these errors are about 10 keV or lower which is too small to be seen clearly in the graph.

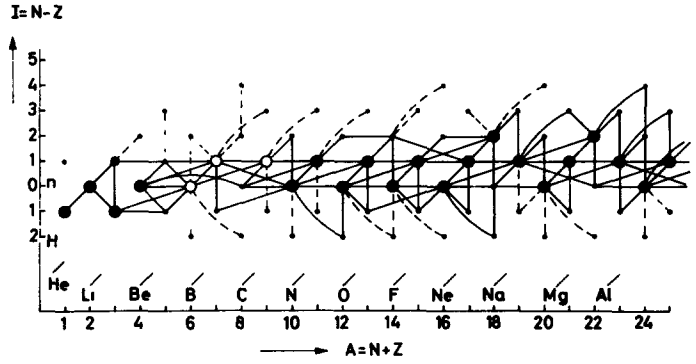

Fig. 2a

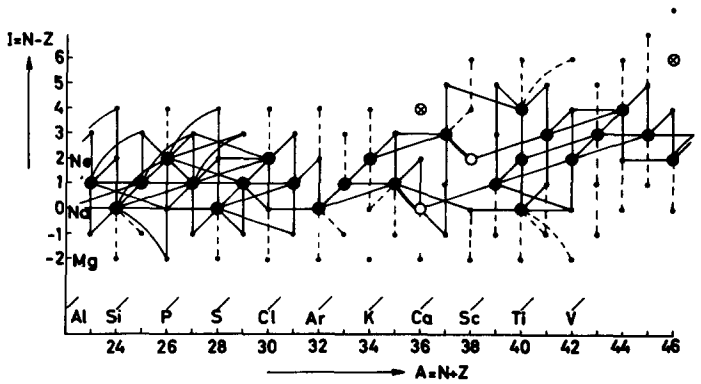

Fig. 2b

Fig. 2. Schematic diagram of the input data for the mass adjustment

Large circles denote nuclides occurring in nature, black small circles artificially produced nuclides. If the large circles are shaded they represent nuclides compared mass-spectroscopically with "standard" masses (^{1}H, ^{2}D, ^{12}C, ^{13}C, ^{14}N, ^{16}O, sometimes ^{35}Cl, ^{37}Cl and such), if they are crossed they represent nuclides determined by secondary mass spectroscopic doublets. Mass spectroscopic comparisons between nearby masses have been indicated by double and slightly bent lines. Drawn lines represent nuclear reactions or α and β decay links between "primary" nuclides, dashed lines those used in deriving "secondary" masses. Decays for which decay energies were estimated by interpolation from α and β systematics have been indicated by thin dotted lines, nuclides for which masses were computed using these estimated data are shown as small open circles.

The reason for giving two diagrams containing the region $236 \leq A \leq 240$ is outlined in an accompanying paper. Part of the data in this region in fig. 2l is artificial and only meant to represent correlations between the corresponding atomic masses due to the real experimental data represented in fig. 2k.

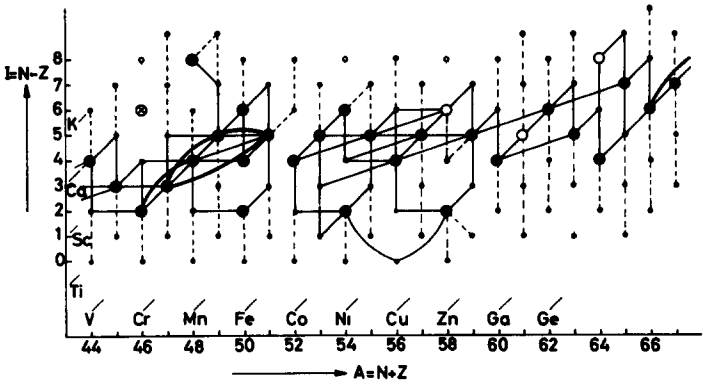
I=N-Z
K
Ca
Sc
Ti
V
Cr
Mn
Fe
Co
Ni
Cu
Zn
Ga
Ge
A=N+Z

Fig 2c

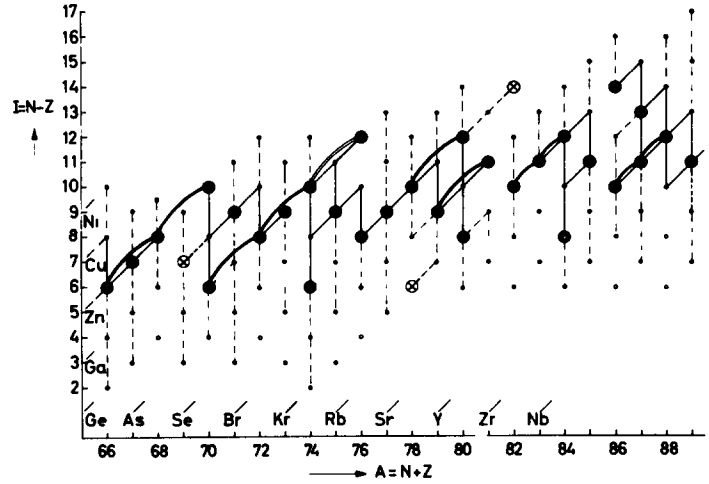
I=N-Z
Ni
Cu
Zn
Ga
Ge
As
Se
Br
Kr
Rb
Sr
Y
Zr
Nb
A=N+Z

Fig 2d

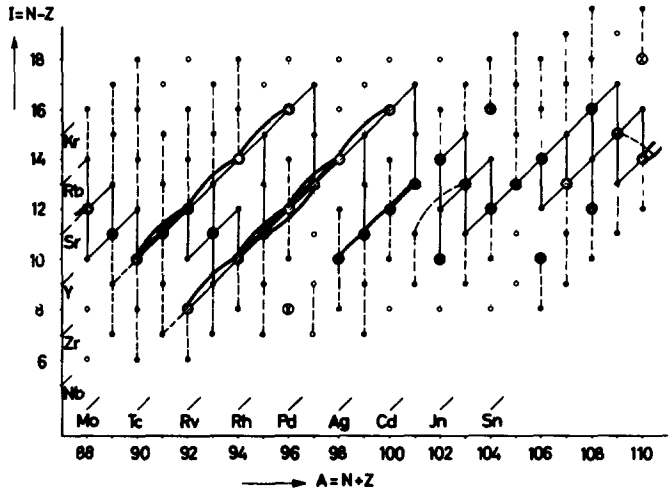
I=N-Z
18
16
14
12
10
8
6
Kr
Rb
Sr
Y
Zr
Nb
Mo
Tc
Ru
Rh
Pd
Ag
Cd
In
Sn
88
90
92
94
96
98
100
102
104
106
108
110
A=N+Z

Fig. 2e

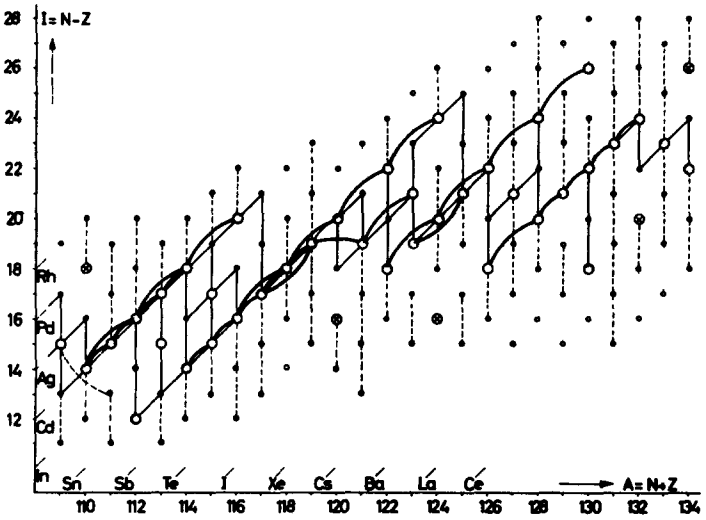
I=N-Z
28
26
24
22
20
18
16
14
12
Rh
Pd
Ag
Cd
In
Sn
Sb
Te
I
Xe
Cs
Ba
La
Ce
110
112
114
116
118
120
122
124
126
128
130
132
134
A=N+Z

Fig. 2f

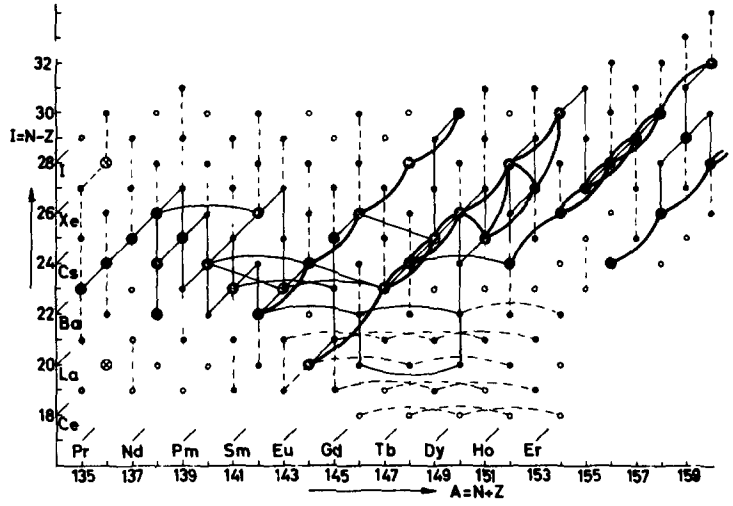
I=N-Z
32
30
28
26
24
22
20
18
I
Xe
Cs
Ba
La
Ce
Pr Nd Pm Sm Eu Gd Tb Dy Ho Er
135 137 139 141 143 145 147 149 151 153 155 157 159
A=N+Z

Fig. 2g

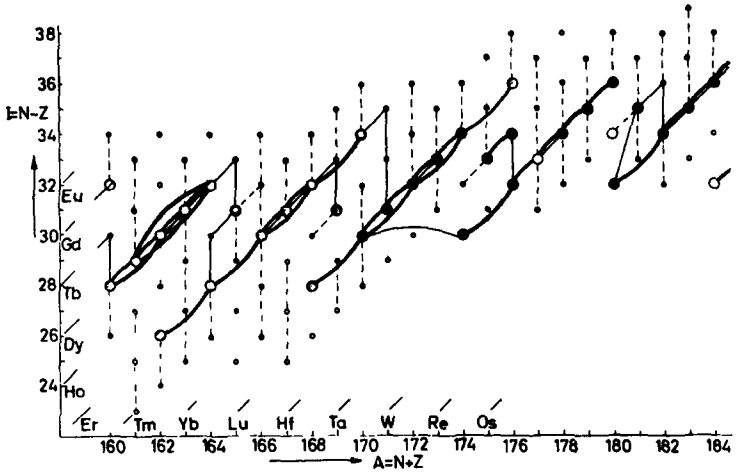
I=N-Z
38
36
34
32
30
28
26
24
Eu
Gd
Tb
Dy
Ho
Er Tm Yb Lu Hf Ta W Re Os
160 162 164 166 168 170 172 174 176 178 180 182 184
A=N+Z

Fig. 2h

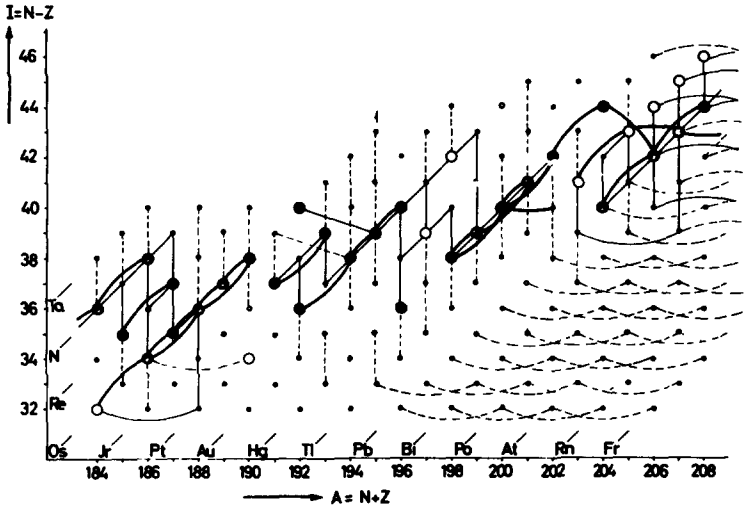
I=N-Z
46
44
42
40
38
36
34
32
Ta
N
Re
Os
Ir
Pt
Au
Hg
Tl
Pb
Bi
Po
At
Rn
Fr
184
186
188
190
192
194
196
198
200
202
204
206
208
A = N+Z

Fig. 2i

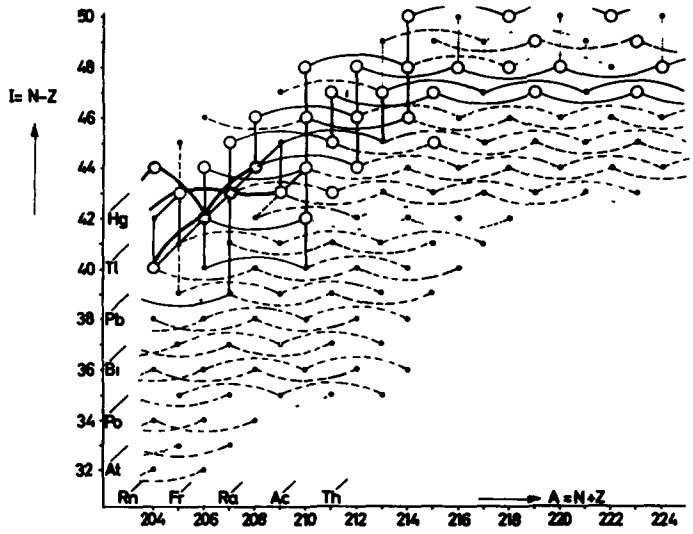
I= N-Z
50
48
46
44
42
40
38
36
34
32
Hg
Tl
Pb
Bi
Po
At
Rn
Fr
Ra
Ac
Th
204
206
208
210
212
214
216
218
220
222
224
A=N+Z

Fig. 2j

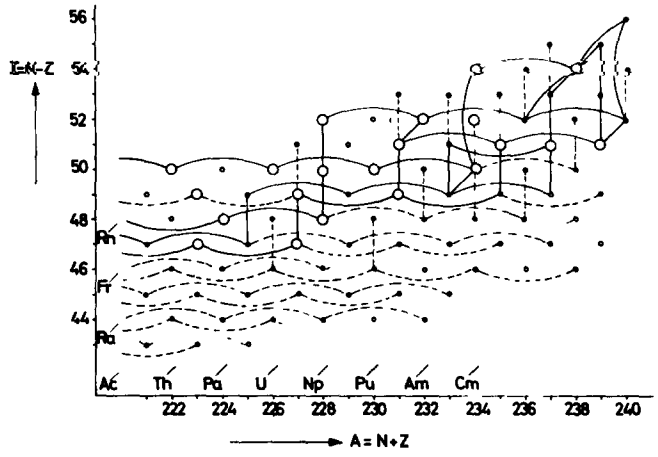
I=N-Z
56
54
52
50
48
46
44
Rn
Fr
Ra
Ac
Th
Pa
U
Np
Pu
Am
Cm
222
224
226
228
230
232
234
236
238
240
A=N+Z

Fig. 2k

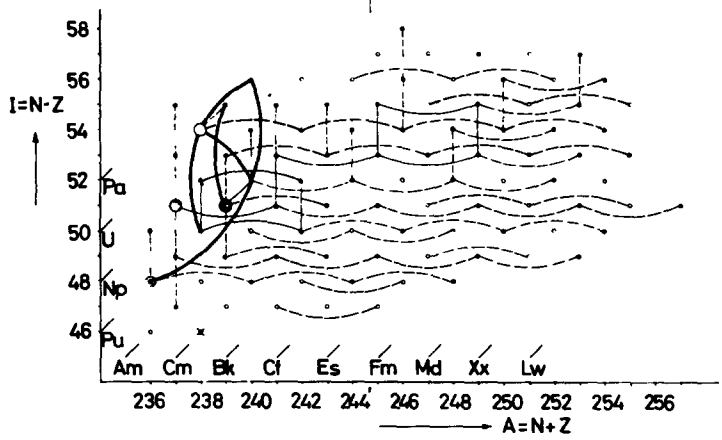
I=N-Z
58
56
54
52
50
48
46
Pa
U
Np
Pu
Am
Cm
Bk
Cf
Es
Fm
Md
Xx
Lw
236
238
240
242
244
246
248
250
252
254
256
A=N+Z

Fig. 2l

binations of protons and neutrons, alpha decay energies and reaction energies will appear in a separate paper [9].

We thank the "Deutsches Rechenzentrum" in Darmstadt for permission to use their excellent computer facilities. The help of Miss A. Anisimoff and Mr. C. Kurzeck during a large part of the calculations is very much appreciated. The work of one of us (A. H. W.) is part of a program of the Institute of Nuclear Physics Research (IKO), financially supported by the Foundation for Fundamental Research of Matter (FOM) of the Organization for Pure Scientific Research (ZWO).

References

1) L.A.König, J.H.E.Mattauch and A.H.Wapstra, Nuclear Physics 31 (1962) 18.
2) R.A.Damerow, R.R.Ries and W.H.Johnson Jr., Phys.Rev.132 (1963) 1662 and 1673
3) R.C.Barber et al., Can.J.Phys.40 (1962) 1496 and 42 (1964) 391; Bull. Am. Phys. Soc.8 (1963) 376 and private communication
4) V.A.Kravtsov, Nuclear Physics 41 (1963) 330
5) V.V.Dorokhov, Int.Conf.Nucl.Masses, Vienna, 1963
6) W.McLatchie et al., Bull.Am.Phys.Soc.9 (1964) 20
7) Rytz, private communication
8) J.H.E.Mattauch, W.Thiele and A.H.Wapstra, Nuclear Physics 67 (1965) 73
9) J.H.E.Mattauch, W.Thiele and A.H.Wapstra, Nuclear Physics 67 (1965) 32

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
1	0	1	1	N		8 071.44	0.10	8 665.20	0.10			782.45	0.07
-0	1	-1		H		7 288.99	0.08	7 825.19	0.08				
1	1	0	2	D		13 135.91	0.13	14 102.22	0.12	2 224.52	0.10		
2	1	1	3	T		14 949.95	0.21	16 049.71	0.21	8 481.92	0.20	18.61	0.02
1	2	-1		HE		14 931.34	0.21	16 029.73	0.21	7 718.08	0.17		
3	1	2	4	H	-N	28 220	1700	30 300	1830	3 280	1700	25 800	1700
2	2	0		HE		2 424.75	0.39	2 603.12	0.42	28 296.10	0.41		
4	1	3	5	H	+	29 450	1500	31 620	1610	10 120	1500	18 000	1500
3	2	1		HE		11 454	19	12 297	20	27 338	19	- 225	41
2	3	-1		LI		11 679	37	12 538	40	26 331	37		
4	2	2	6	HE	+	17 598.2	4.0	18 892.7	4.3	29 265.6	4.0	3 509.8	3.8
3	3	0		LI		14 088.4	1.1	15 124.7	1.2	31 992.9	1.2	-4 278	12
2	4	-2		BE	-	18 366	12	19 717	13	26 932	12		
4	3	1	7	LI		14 907.3	1.1	16 003.9	1.2	39 245.4	1.2	- 861.61	0.20
3	4	-1		BE		15 768.9	1.1	16 928.9	1.2	37 601.4	1.2		
6	2	4	8	HE	+	34 950	2000	37 520	2150	28 060	2000	14 000	2000
5	3	2		LI	-N	20 946.2	1.5	22 487.1	1.6	41 278.0	1.6	16 002.0	1.7
4	4	0		BE		4 944.2	0.8	5 307.9	0.9	56 497.5	0.9	-17 978.9	1.6
3	5	-2		B	-PP	22 923.1	1.5	24 609.3	1.6	37 736.2	1.6		
6	3	3	9	LI	-NN	24 965	20	26 802	22	45 330	20	13 615	20
5	4	1		BE		11 350.5	0.9	12 185.5	1.0	58 162.7	1.0	-1 668.1	0.9
4	5	-1		B	-	12 418.6	1.3	13 332.2	1.4	56 312.1	1.4		
6	4	2	10	BE		12 607.0	2.2	13 534.4	2.4	64 977.6	2.3	554.8	2.2
5	5	0		B		12 052.2	0.5	12 938.8	0.5	64 750.0	0.9	-3 606	13
4	6	-2		C	-	15 658	13	16 810	14	60 361	13		
7	4	3	11	BE	-NN	20 181	15	21 666	16	65 475	15	11 514	15
6	5	1		B		8 667.68	0.30	9 305.30	0.32	76 205.9	0.9	-1 980.7	1.1
5	6	-1		C	-	10 648.4	1.1	11 431.7	1.2	73 442.8	1.4		
7	5	2	12	B		13 370.2	1.3	14 353.7	1.4	79 574.8	1.6	13 370.2	1.3
6	6	0		C		0	0	0	0	92 162.6	0.9	-17 364	7
5	7	-2		N		17 364	7	18 641	8	74 617	7		
8	5	3	13	B	-NN	16 561.6	4.0	17 780.0	4.3	84 454.8	4.2	13 437.0	4.1
7	6	1		C		3 124.6	0.8	3 354.4	0.9	97 109.4	1.3	-2 220.6	0.8
6	7	-1		N		5 345.2	1.1	5 738.4	1.2	94 166.4	1.5		
8	6	2	14	C		3 019.82	0.30	3 241.97	0.32	105 285.6	1.0	156.10	0.26
7	7	0		N		2 863.73	0.16	3 074.39	0.17	104 659.3	1.0	-5 144.27	0.45
6	8	-2		O	-PP	8 008.00	0.42	8 597.09	0.45	98 732.5	1.1		
9	6	3	15	C	-N	9 873.2	0.9	10 599.5	0.9	106 503.6	1.4	9 772.9	1.2
8	7	1		N		100.4	0.8	107.7	0.9	115 494.1	1.3	-2 759.6	0.9
7	8	-1		O		2 859.9	1.2	3 070.3	1.3	111 952.1	1.6		
10	6	4	16	C	-NN	13 693	16	14 700	17	110 756	16	8 000	16
9	7	2		N		5 685.1	3.5	6 103.3	3.8	117 980.8	3.7	10 421.6	3.5
8	8	0		O		-4 736.55	0.26	-5 084.98	0.28	127 620.0	1.1	-15 640	12
7	9	-2		F	-PP	10 904	12	11 706	13	111 197	12		
10	7	3	17	N	+P	7 871	15	8 450	16	123 867	15	8 678	15
9	8	1		O		- 807.7	0.9	- 867.1	1.0	131 762.5	1.4	-2 759.5	1.0
8	9	-1		F		1 951.9	0.5	2 095.5	0.5	128 220.5	1.2		
10	8	2	18	O		- 782.43	0.33	- 839.98	0.36	139 808.7	1.3	-1 654.9	0.7
9	9	0		F		872.4	0.8	936.6	0.8	137 371.4	1.4	-4 446.9	4.7
8	10	-2		NE		5 319.3	4.7	5 711	5	132 142.1	4.8		
11	8	3	19	O		3 332.7	2.9	3 577.9	3.1	143 765.0	3.2	4 818.7	3.0
10	9	1		F		-1 486.0	0.8	-1 595.4	0.8	147 801.3	1.4	-3 238.1	1.4
9	10	-1		NE	-	1 752.0	1.6	1 880.9	1.7	143 780.8	2.0		
12	8	4	20	O	-NN	3 799	8	4 079	9	151 370	8	3 811	10
11	9	2		F		-11.9	4.7	-13	5	154 398.6	4.9	7 029.6	4.7
10	10	0		NE		-7 041.5	0.5	-7 559.5	0.5	160 645.8	1.3	-15 320	300
9	11	-2		NA	-	8 280	300	8 880	320	144 550	300		
12	9	3	21	F		-46	7	-49	8	162 504	7	5 684	7
11	10	1		NE		-5 729.9	1.5	-6 151.4	1.6	167 405.6	2.0	-3 545	8
10	11	-1		NA		-2 185	8	-2 345	9	163 878	8		
12	10	2	22	NE		-8 024.9	0.6	-8 615.3	0.6	177 772.1	1.5	-2 842.8	2.7
11	11	0		NA		-5 182.2	2.7	-5 563.4	2.9	174 146.9	3.0	-5 640	80
10	12	-2		MG	-PP	- 140	80	- 150	90	168 320	80		
13	10	3	23	NE		-5 148.3	3.4	-5 527.1	3.6	182 966.9	3.7	4 380.0	3.7
12	11	1		NA		-9 528.3	1.9	-10 229.3	2.0	186 564.5	2.4	-4 055.9	2.2
11	12	-1		MG		-5 472.4	2.9	-5 875.0	3.1	181 726.1	3.3		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
14	10	4	24	NE		-5 949	10	-6 387	10	191 839	10	2 469	10
13	11	2		NA		-8 418.4	3.2	-9 037.7	3.5	193 526.0	3.6	5 514.9	3.3
12	12	0		MG		-13 933.3	1.7	-14 958.3	1.9	198 258.4	2.5	-14 030	90
11	13	-2		AL	-	100	90	100	100	183 450	90		
14	11	3	25	NA		-9 356	9	-10 045	9	202 535	9	3 834	9
13	12	1		MG		-13 190.7	1.9	-14 161.0	2.0	205 587.3	2.6	-4 259	6
12	13	-1		AL	-P	-8 931	6	-9 588	7	200 545	7		
15	11	4	26	NA	+	-7 690	300	-8 260	320	208 940	300	8 520	300
14	12	2		MG		-16 214.2	1.8	-17 407.0	2.0	216 682.2	2.6	-4 003.4	2.0
13	13	0		AL		-12 210.8	2.3	-13 109.1	2.4	211 896.4	2.9	-5 078	13
12	14	-2		SI		-7 132	13	-7 657	14	206 036	13		
15	12	3	27	MG		-14 582.6	3.8	-15 655.3	4.0	223 122.1	4.2	2 613.5	3.9
14	13	1		AL		-17 196.1	1.8	-18 461.1	1.9	224 953.1	2.6	-4 810.1	1.8
13	14	-1		SI		-12 386.0	2.6	-13 297.2	2.8	219 360.5	3.2		
16	12	4	28	MG		-15 020	6	-16 125	6	231 631	6	1 835.7	4.7
15	13	2		AL		-16 855.4	3.7	-18 095.3	4.0	232 683.8	4.2	4 634.5	4.2
14	14	0		SI		-21 489.9	2.8	-23 070.8	3.0	236 535.9	3.4	-13 830	280
13	15	-2		P	-	-7 660	280	-8 220	300	221 920	280		
16	13	3	29	AL		-18 218	6	-19 558	7	242 118	7	3 676	7
15	14	1		SI		-21 893.6	3.7	-23 504.2	4.0	245 011.1	4.2	-4 948	6
14	15	-1		P		-16 945	6	-18 192	6	239 280	6		
17	13	4	30	AL	+	-17 150	250	-18 410	270	249 120	250	7 290	250
16	14	2		SI		-24 439.4	3.7	-26 237.2	4.0	255 628.3	4.3	-4 242	8
15	15	0		P		-20 197	7	-21 683	8	250 603	8	-6 107	26
14	16	-2		S	-	-14 090	27	-15 127	29	243 714	27		
17	14	3	31	SI		-22 962	5	-24 651	6	262 222	6	1 476	5
16	15	1		P		-24 437.6	1.4	-26 235.3	1.5	262 915.5	2.5	-5 445	11
15	16	-1		S		-18 992	11	-20 389	12	256 588	11		
18	14	4	32	SI	+	-24 200	50	-25 980	50	271 530	50	100	50
17	15	2		P		-24 302.7	2.1	-26 090.5	2.3	270 852.0	3.0	1 710.0	1.9
16	16	0		S		-26 012.7	0.9	-27 926.3	0.9	271 779.6	2.3	-13 200	380
15	17	-2		CL	-	-12 810	380	-13 760	410	257 800	380		
18	15	3	33	P	+	-26 334.6	3.4	-28 271.8	3.7	280 955.3	4.3	248.0	2.0
17	16	1		S		-26 582.6	2.8	-28 538.1	3.0	280 420.9	3.8	-5 569	12
16	17	-1		CL	-P	-21 014	12	-22 560	13	274 870	12		
19	15	4	34	P	+	-24 830	200	-26 660	210	287 530	200	5 100	200
18	16	2		S		-29 933.5	2.7	-32 135.4	2.9	291 843.2	3.8	-5 482.3	4.9
17	17	0		CL	-	-24 451	6	-26 250	6	285 578	6	-6 400	1000
16	18	-2		AR	-	-18 050	1000	-19 380	1070	278 400	1000		
19	16	3	35	S		-28 847.1	1.2	-30 969.2	1.3	298 828.3	2.9	167.40	0.20
18	17	1		CL		-29 014.5	1.2	-31 148.9	1.3	298 213.2	2.9	-5 964	16
17	18	-1		AR	-	-23 051	16	-24 746	18	291 467	17		
20	16	4	36	S	M	-30 655	8	-32 910	9	308 707	9	-1 135	9
19	17	2		CL		-29 519.6	4.1	-31 691.1	4.4	306 789.7	4.9	712.0	3.6
18	18	0		AR		-30 231.6	2.3	-32 455.5	2.4	306 719.2	3.5	-13 500	1000
17	19	-2		K	-	-18 730	1000	-19 960	1070	292 440	1000		
21	16	5	37	S		-27 000	70	-28 990	80	313 130	70	4 760	70
20	17	3		CL		-31 764.8	1.1	-34 101.5	1.1	317 106.3	3.0	- 813.8	0.7
19	18	1		AR		-30 950.9	1.3	-33 227.8	1.3	315 510.1	3.1	-6 141	45
18	19	-1		K		-24 810	45	-26 635	48	308 587	45		
22	16	6	38	S	+	-26 800	150	-28 770	160	321 000	150	3 600	150
21	17	4		CL	-N	-29 803	8	-31 995	9	323 216	9	4 915	8
20	18	2		AR		-34 718.2	2.5	-37 272.2	2.7	327 348.8	3.7	-5 933	10
19	19	0		K		-28 786	10	-30 903	11	320 634	10	-7 100	1000
18	20	-2		CA	-	-21 690	1000	-23 280	1070	312 750	1000		
22	17	5	39	CL		-29 800	18	-31 992	20	331 284	19	3 438	18
21	18	3		AR		-33 238	6	-35 683	6	333 948	6	565	5
20	19	1		K		-33 803.3	2.6	-36 289.9	2.8	333 722.8	3.8	-6 503	23
19	20	-1		CA	-	-27 300	23	-29 309	25	326 437	23		
23	17	6	40	CL	+	-27 500	500	-29 600	500	337 100	500	7 500	500
22	18	4		AR		-35 038.3	0.8	-37 615.8	0.8	343 811.7	2.7	-1 584.9	1.0
21	19	2		K		-33 533.3	1.2	-36 000.2	1.3	341 524.3	2.9	1 314.3	3.4
20	20	0		CA		-34 847.6	3.2	-37 411.1	3.5	342 056.2	4.3	-13 950	200
19	21	-2		SC	-	-20 900	200	-22 430	210	327 320	200		
23	18	5	41	AR		-33 067.4	4.9	-35 500	5	349 912	6	2 485	6
22	19	3		K		-35 552.4	3.5	-38 167.7	3.8	351 614.8	4.5	- 412	8
21	20	1		CA		-35 140	8	-37 725	8	350 420	8	-6 495	11
20	21	-1		SC	-P	-28 645	10	-30 753	10	343 143	10		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
24	18	6	42	AR	-NN	-34 420	40	-36 952	43	359 337	40	598	41
23	19	4		K		-35 018	10	-37 594	11	359 152	11	3 521	11
22	20	2		CA		-38 539.7	3.5	-41 374.8	3.8	361 891.1	4.6	-6 399	12
21	21	0		SC		-32 141	12	-34 505	13	354 710	12	-8 763	19
20	22	-2		TI	-PP	-23 378	15	-25 097	16	345 164	16		
24	19	5	43	K	+	-36 579	11	-39 270	12	368 784	11	1 817	10
23	20	3		CA		-38 395.9	3.9	-41 220.4	4.2	369 818.8	4.8	-2 222	7
22	21	1		SC	-	-36 174	8	-38 835	9	366 815	9	-6 830	150
21	22	-1		TI	-	-29 348	150	-31 508	160	359 200	150		
25	19	6	44	K	+	-35 360	200	-37 960	210	375 640	200	6 100	200
24	20	4		CA		-41 459.6	4.1	-44 509.5	4.4	380 954	5	-3 646.9	4.5
23	21	2		SC		-37 813	6	-40 594	6	376 525	6	- 155	11
22	22	0		TI	-	-37 658	12	-40 428	13	375 587	13		
26	19	7	45	K	+	-36 630	200	-39 320	210	384 980	200	4 180	200
25	20	5		CA		-40 [illegible]	[illegible]	-43 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	21	3		SC		-41 [illegible]	[illegible]	-44 [illegible]	[illegible]	[illegible]	[illegible]	-2 [illegible]	[illegible]
23	22	1		TI	-	-39 002.0	4.8	-41 871	5	385 303	6		
27	19	8	46	K	+	-35 340	1000	-37 940	1070	391 760	1000	7 800	1000
26	20	6		CA	M	-43 [illegible]	[illegible]	-46 [illegible]	[illegible]	[illegible]	[illegible]	-1 [illegible]	[illegible]
25	21	4		SC		-41 [illegible]	[illegible]	-44 [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
24	22	2		TI		-44 [illegible]	[illegible]	-47 [illegible]	[illegible]	[illegible]	[illegible]	-1 [illegible]	[illegible]
23	23	0		V	-	-37 060	9	-39 786	10	390 350	9		
28	19	9	47	K	+	-36 250	300	-38 910	320	400 740	300	6 100	300
27	20	7		CA	+	-42 347	6	-45 462	6	406 056	7	[illegible]	5
26	21	5		SC		-44 326.3	3.2	-47 587.1	3.4	407 252.5	4.6	[illegible]	[illegible]
25	22	3		TI		-44 926.6	2.5	-48 231.5	2.7	407 878.3	4.2	-2 936	8
24	23	1		V	-	-42 310	8	-45 101	9	403 372	9		
28	20	8	48	CA		-44 216	9	-47 469	10	415 936	10	188	12
27	21	6		SC	+	-44 505	7	-47 779	8	415 503	8	3 978	7
26	22	4		TI		-48 483.1	2.0	-52 049.7	2.1	418 698.3	3.9	-4 013.1	2.8
25	23	2		V		-44 470.9	3.4	-47 741.3	3.6	413 902.7	4.8	-1 480	280
24	24	0		CR	-	-43 070	200	-46 240	210	411 720	200		
29	20	9	49	CA	-N	-41 288	11	-44 325	12	421 140	12	5 261	11
28	21	7		SC		-46 549	5	-49 974	6	425 619	6	2 008.2	4.8
27	22	5		TI		-48 557.7	2.0	-52 129.7	2.1	426 844.3	4.1	- 687.5	4.8
26	23	3		V	-	-47 950.2	4.5	-51 477.5	4.8	425 454	6	-2 560	10
25	24	1		CR	-	-45 390	11	-48 729	12	422 112	11		
29	21	8	50	SC	+	-44 960	200	-48 270	210	432 100	200	6 470	200
28	22	6		TI		-51 430.7	3.3	-55 214.1	3.5	437 789	5	-2 214.9	4.3
27	23	4		V		-49 215.8	3.2	-52 836.2	3.5	434 791.3	4.9	1 033.3	4.7
26	24	2		CR		-50 249.0	3.5	-53 945.5	3.7	435 042	5	-7 601	27
25	25	0		MN	-	-42 648	27	-45 785	29	426 659	27		
29	22	7	51	TI		-49 738	6	-53 397	7	444 168	7	2 461	6
28	23	5		V		-52 198.9	2.4	-56 038.8	2.5	445 845.8	4.4	- 751.7	1.1
27	24	3		CR		-51 447.2	2.6	-55 231.8	2.7	444 311.8	4.5	-3 190	50
26	25	1		MN	-	-48 260	50	-51 810	50	440 340	50		
30	22	8	52	TI	+	-49 540	1000	-53 180	1070	452 040	1000	1 900	1000
29	23	6		V	-N	-51 436	5	-55 220	5	453 155	6	3 974	6
28	24	4		CR		-55 410.7	3.0	-59 486.9	3.2	456 347	5	-4 708	5
27	25	2		MN		-50 702	6	-54 432	6	450 856	7	-2 374	12
26	26	0		FE	-	-48 328	13	-51 883	14	447 699	14		
30	23	7	53	V	+	-52 180	1000	-56 020	1070	461 970	1000	3 100	1000
29	24	5		CR		-55 280.7	3.0	-59 347.3	3.2	464 288	5	- 598	6
28	25	3		MN		-54 682	7	-58 705	7	462 907	8	-3 984	45
27	26	1		FE		-50 698	45	-54 428	48	458 141	45		
31	23	8	54	V	+	-49 630	1000	-53 280	1070	467 490	1000	7 300	1000
30	24	6		CR		-56 930.5	3.8	-61 118.5	4.0	474 009	6	-1 378.8	4.4
29	25	4		MN		-55 552	5	-59 638	6	471 848	7	694	7
28	26	2		FE		-56 245.5	4.6	-60 383	5	471 760	6	-8 251.6	4.6
27	27	0		CO	-	-47 994	7	-51 525	7	462 726	8		
31	24	7	55	CR	-N	-55 113	7	-59 167	7	480 263	8	2 592	7
30	25	5		MN		-57 704.8	3.3	-61 949.7	3.5	482 073	5	- 231.3	1.3
29	26	3		FE		-57 473.5	3.5	-61 701.4	3.7	481 059	5	-3 460	10
28	27	1		CO	-	-54 014	11	-57 987	11	476 817	11		
32	24	8	56	CR	+	-55 290	150	-59 360	160	488 520	150	1 610	150
31	25	6		MN		-56 903.8	4.3	-61 089.8	4.6	489 343	6	3 701.6	4.9
30	26	4		FE		-60 605.4	4.0	-65 063.7	4.3	492 262	6	-4 574	7
29	27	2		CO		-56 031	8	-60 153	8	486 905	9	-2 113	17
28	28	0		NI		-53 918	15	-57 884	16	484 010	16		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
32	25	7	57	MN	+	-57 480	300	-61 700	320	497 990	300	2 700	300
31	26	5		FE		-60 175.5	4.2	-64 602.2	4.5	499 904	6	- 836.6	2.5
30	27	3		CO	-	-59 338.9	4.9	-63 704	5	498 285	7	-3 235	15
29	28	1		NI	-	-56 104	16	-60 231	17	494 267	16		
33	25	8	58	MN	+	-55 650	1000	-59 740	1070	504 230	1000	6 500	1000
32	26	6		FE		-62 146.5	4.8	-66 718	5	509 946	7	-2 309.0	3.0
31	27	4		CO	-	-59 838	6	-64 239	6	506 855	7	390	7
30	28	2		NI		-60 228	5	-64 658	5	506 462	7	-8 569	5
29	29	0		CU	-	-51 659	7	-55 459	8	497 111	8		
33	26	7	59	FE		-60 659.9	4.3	-65 122.2	4.6	516 531	6	1 572.8	2.8
32	27	5		CO		-62 232.7	3.6	-66 810.7	3.8	517 321	6	-1 073.9	2.1
31	28	3		NI		-61 158.7	4.1	-65 657.7	4.3	515 465	6	-4 800	20
30	29	1		CU	-P	-56 359	21	-60 504	22	509 882	21		
34	26	8	60	FE	+	-61 511	30	-66 036	33	525 454	31	140	30
33	27	6		CO		-61 651.3	4.5	-66 186.6	4.8	524 812	6	2 819.3	1.9
32	28	4		NI		-64 470.7	4.6	-69 213	5	526 848	7	-6 125	7
31	29	2		CU	-	-58 346	8	-62 638	9	519 941	10		
35	26	9	61	FE	+	-59 130	1000	-63 480	1070	531 140	1000	3 800	1000
34	27	7		CO	+	-62 930	40	-67 560	43	534 162	41	1 290	40
33	28	5		NI		-64 220	6	-68 944	7	534 669	8	-2 236.4	3.0
32	29	3		CU	-	-61 984	7	-66 543	7	531 651	8	-5 400	200
31	30	1		ZN	-	-56 580	200	-60 750	210	525 470	200		
35	27	8	62	CO	+	-61 528	40	-66 054	43	540 831	41	5 220	40
34	28	6		NI		-66 748	5	-71 658	5	545 269	7	-3 935	9
33	29	4		CU	-	-62 813	10	-67 434	11	540 552	11	-1 690	8
32	30	2		ZN	-	-61 123	13	-65 620	14	538 079	14		
36	27	9	63	CO	+	-61 920	200	-66 470	210	549 290	200	3 600	200
35	28	7		NI		-65 516	5	-70 336	5	552 108	7	66.8	0.5
34	29	5		CU		-65 583.1	4.9	-70 408	5	551 393	7	-3 365.9	2.6
33	30	3		ZN	-	-62 217	6	-66 794	6	547 244	7	-5 500	1000
32	31	1		GA	-	-56 720	1000	-60 890	1070	540 960	1000		
36	28	8	64	NI		-67 106	5	-72 042	6	561 769	7	-1 678.2	2.0
35	29	6		CU		-65 427.6	4.8	-70 241	5	559 309	7	572.7	2.0
34	30	4		ZN		-66 000.3	4.6	-70 855	5	559 099	7	-7 072	30
33	31	2		GA	-	-58 928	30	-63 263	33	551 244	31		
37	28	9	65	NI		-65 137	8	-69 928	8	567 872	9	2 130	8
36	29	7		CU		-67 266	5	-72 214	6	569 219	7	-1 349.3	0.7
35	30	5		ZN		-65 917	5	-70 766	6	567 087	7	-3 259	15
34	31	3		GA	-	-62 658	16	-67 267	17	563 045	17	-6 400	1000
33	32	1		GE	-	-56 260	1000	-60 400	1070	555 860	1000		
38	28	10	66	NI	+	-66 055	31	-70 915	33	576 862	32	200	30
37	29	8		CU		-66 255	9	-71 129	9	576 279	10	2 626	9
36	30	6		ZN		-68 881	6	-73 948	6	578 123	8	-5 175.0	3.0
35	31	4		GA	-	-63 706	6	-68 393	7	572 165	8	-2 970	150
34	32	2		GE	-	-60 740	150	-65 200	160	568 410	150		
38	29	9	67	CU	+	-67 291	12	-72 241	13	585 386	13	572	8
37	30	7		ZN		-67 863	10	-72 855	10	585 175	11	- 997.6	3.5
36	31	5		GA	-	-66 865	10	-71 784	11	583 395	11	-4 400	100
35	32	3		GE	-	-62 460	100	-67 060	110	578 210	100		
39	29	10	68	CU	+	-65 410	60	-70 230	60	591 580	60	4 580	60
38	30	8		ZN		-69 994	5	-75 143	6	595 378	8	-2 919.8	3.0
37	31	6		GA	-	-67 074	6	-72 008	7	591 676	8	- 500	1000
36	32	4		GE	-	-66 570	1000	-71 470	1070	590 390	1000		
39	30	9	69	ZN	+	-68 425	6	-73 459	7	601 881	8	901	5
38	31	7		GA	M	-69 326.2	3.4	-74 426.0	3.7	602 000	6	-2 225.5	2.4
37	32	5		GE	-	-67 100.7	4.2	-72 036.8	4.5	598 992	7	-3 900	300
36	33	3		AS	-	-63 200	300	-67 850	320	594 310	300		
40	30	10	70	ZN		-69 550	6	-74 666	6	611 077	8	- 653.0	1.8
39	31	8		GA		-68 897	6	-73 965	6	609 642	8	1 661	6
38	32	6		GE		-70 558.0	1.7	-75 748.5	1.8	610 520	6	-6 236	30
37	33	4		AS	-	-64 322	30	-69 054	32	603 502	31		
41	30	11	71	ZN	+	-67 520	50	-72 490	50	617 120	50	2 610	50
40	31	9		GA		-70 134.7	4.3	-75 294.0	4.6	618 951	7	- 233.0	3.0
39	32	7		GE	-	-69 902	5	-75 044	6	617 935	8	-2 009	7
38	33	5		AS	-	-67 893	9	-72 887	9	615 144	10	-4 400	300
37	34	3		SE	-	-63 490	300	-68 160	320	609 960	300		
42	30	12	72	ZN		-68 144	9	-73 157	10	625 814	11	439	6
41	31	10		GA		-68 583	7	-73 628	7	625 471	9	3 996	7
40	32	8		GE		-72 579.1	1.6	-77 918.2	1.7	628 684	6	-4 360	10
39	33	6		AS	-	-68 219	10	-73 237	11	623 542	12	- 600	1000
38	34	4		SE	-	-67 620	1000	-72 590	1070	622 160	1000		

N	Z	N-Z	A	EL	O	MASS EXCESS (MEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
42	31	11	73	GA	+	-69 743	40	-74 874	43	634 702	40	1 550	40
41	32	9		GE		-71 293.0	1.8	-76 537.5	1.8	635 470	6	- 372	30
40	33	7		AS	-	-70 921	30	-76 139	32	634 316	31	-2 750	10
39	34	5		SE	-	-68 171	32	-73 186	34	630 783	32	-4 700	1000
38	35	3		BR	-	-63 470	1000	-68 140	1070	625 300	1000		
43	31	12	74	GA	+	-67 820	50	-72 810	50	640 850	50	5 600	50
42	32	10		GE		-73 418.5	1.6	-78 819.4	1.7	645 667	6	-2 563.5	3.6
41	33	8		AS		-70 855.0	3.9	-76 067.3	4.1	642 321	7	1 357	6
40	34	6		SE		-72 212.2	4.8	-77 524	5	642 895	7	-6 800	1000
39	35	4		BR	-	-65 410	1000	-70 220	1070	635 310	1000	-3 100	1000
38	36	2		KR	-	-62 310	1410	-66 900	1520	631 430	1410		
43	32	11	75	GE		-71 833	19	-77 117	20	652 152	20	1 198	18
42	33	9		AS		-73 031.2	3.7	-78 403.6	3.9	652 568	7	- 864.8	1.7
41	34	7		SE	-	-72 166.3	4.1	-77 475.1	4.3	650 921	7	-2 722	20
40	35	5		BR	-	-69 444	20	-74 553	22	647 416	21	-5 100	1000
39	36	3		KR	-	-64 340	1000	-69 080	1070	641 530	1000		
44	32	12	76	GE		-73 209.3	1.9	-78 594.8	2.0	661 600	6	- 924	12
43	33	10		AS		-72 286	12	-77 603	12	659 894	13	2 972	10
42	34	8		SE		-75 257	7	-80 793	7	662 083	9	-4 630	60
41	35	6		BR	-	-70 630	60	-75 820	60	656 670	60	-1 200	1000
40	36	4		KR	-	-69 430	1000	-74 530	1080	654 690	1000		
45	32	13	77	GE	+	-71 170	50	-76 400	50	667 630	50	2 750	50
44	33	11		AS	+	-73 917	10	-79 354	11	669 597	12	684	9
43	34	9		SE		-74 601	5	-80 089	5	669 498	8	-1 364.6	2.8
42	35	7		BR	-	-73 236	6	-78 624	6	667 351	8	-2 890	80
41	36	5		KR	-	-70 350	80	-75 520	90	663 680	80		
45	33	12	78	AS	+	-72 750	200	-78 100	210	676 500	200	4 270	200
44	34	10		SE		-77 020.5	2.5	-82 686.3	2.6	679 989	7	-3 573	5
43	35	8		BR	-	-73 447	6	-78 850	6	675 634	8	696	7
42	36	6		KR	M	-74 143	5	-79 597	5	675 547	8		
46	33	13	79	AS	+	-73 690	60	-79 110	60	685 510	60	2 230	60
45	34	11		SE		-75 920.8	4.4	-81 505.7	4.7	686 961	8	153.9	4.1
44	35	9		BR		-76 074.7	3.1	-81 670.9	3.3	686 333	7	-1 620	5
43	36	7		KR	-	-74 455	6	-79 932	6	683 930	8		
47	33	14	80	AS	+	-71 750	200	-77 030	210	691 650	200	6 000	200
46	34	12		SE		-77 753.0	2.7	-83 472.7	2.9	696 865	7	-1 870.8	2.2
45	35	10		BR		-75 882.2	3.4	-81 464.3	3.6	694 212	7	2 008	6
44	36	8		KR		-77 891	6	-83 620	6	695 437	8	-5 100	600
43	37	6		RB	-	-72 800	600	-78 100	600	689 600	600		
47	34	13	81	SE	-N	-76 396	7	-82 016	7	703 579	9	1 576	8
46	35	11		BR		-77 972	5	-83 708	5	704 373	8	- 300	100
45	36	9		KR	-N	-77 670	100	-83 390	110	703 290	100	-2 240	30
44	37	7		RB	-	-75 430	100	-80 980	110	700 270	100		
48	34	14	82	SE	M	-77 586	6	-83 293	7	712 840	9	-88	8
47	35	12		BR	+	-77 497	5	-83 198	5	711 970	8	3 092.0	2.0
46	36	10		KR		-80 589.4	4.7	-86 518	5	714 279	8	-4 170	30
45	37	8		RB	-	-76 419	30	-82 041	33	709 327	31	- 400	1000
44	38	6		SR	-	-76 020	1000	-81 610	1070	708 140	1000		
48	35	13	83	BR	+	-79 019	16	-84 832	17	721 562	17	966	15
47	36	11		KR		-79 984.7	4.4	-85 868.6	4.8	721 746	8	- 600	1000
46	37	9		RB	-	-79 420	1000	-85 270	1070	720 400	1000	-2 300	1000
45	38	7		SR	-	-77 120	1410	-82 800	1520	717 320	1410		
49	35	14	84	BR	+	-77 730	50	-83 450	50	728 350	50	4 700	50
48	36	12		KR		-82 432.6	3.3	-88 496.6	3.5	732 265	7	-2 680.1	2.9
47	37	10		RB		-79 752.5	4.3	-85 619.3	4.6	728 803	8	886	5
46	38	8		SR		-80 638.0	3.7	-86 569.9	3.9	728 906	7	-6 300	100
45	39	6		Y	-	-74 340	100	-79 810	110	721 820	100		
50	35	15	85	BR	+	-78 680	100	-84 470	110	737 370	100	2 800	100
49	36	13		KR		-81 483	6	-87 477	7	739 387	9	674	6
48	37	11		RB		-82 156	5	-88 200	5	739 278	8	-1 108	30
47	38	9		SR	-	-81 049	30	-87 011	33	737 388	31	-3 260	10
46	39	7		Y	-	-77 789	32	-83 511	34	733 346	33		
51	35	16	86	BR	+	-76 200	500	-81 800	500	742 900	500	7 100	500
50	36	14		KR	M	-83 259.3	4.0	-89 384.1	4.2	749 235	8	- 537	8
49	37	12		RB	+	-82 722	7	-88 807	7	747 915	10	1 777	5
48	38	10		SR		-84 499.1	4.8	-90 715	5	748 910	8	-5 273	16
47	39	8		Y	-	-79 226	17	-85 054	18	742 854	18	-1 200	1000
46	40	6		ZR	-	-78 030	1000	-83 770	1070	740 870	1000		
51	36	15	87	KR	-N	-80 698	9	-86 635	10	754 745	11	3 892	9
50	37	13		RB		-84 590.8	3.1	-90 813.5	3.3	757 855	7	274.1	2.7
49	38	11		SR		-84 864.9	3.3	-91 107.8	3.5	757 347	8	-1 720	200
48	39	9		Y	-	-83 150	200	-89 260	210	754 850	200	-3 500	20
47	40	7		ZR	-	-79 650	200	-85 510	220	750 560	200		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
52	36	16	88	KR	+	-79 850	220	-85 730	240	761 970	220	2 800	200
51	37	14		RB		-82 650	90	-88 730	100	763 990	90	5 240	90
50	38	12		SR		-87 894	6	-94 359	6	768 447	9	-3 620.8	4.4
49	39	10		Y		-84 273	7	-90 472	8	764 044	10	- 500	1000
48	40	8		ZR	-	-83 770	1000	-89 940	1070	762 760	1000	-7 200	1000
47	41	6		NB	-	-76 570	1410	-82 210	1520	754 780	1410		
53	36	17	89	KR	+	-77 700	500	-83 400	500	767 900	500	4 600	500
52	37	15		RB	+	-82 300	50	-88 350	50	771 700	50	3 920	50
51	38	13		SR		-86 215	7	-92 558	7	774 840	10	1 462.8	4.9
50	39	11		Y		-87 678.3	4.5	-94 128.1	4.8	775 521	8	-2 833.5	3.2
49	40	9		ZR	-	-84 845	5	-91 086	6	771 905	9	-3 880	90
48	41	7		NB	-	-80 960	90	-86 920	100	767 240	90		
54	36	18	90	KR	+	-74 780	100	-80 280	110	773 040	100	4 560	20
53	37	16		RB	+	-79 340	100	-85 180	110	776 820	100	6 590	100
52	38	14		SR	+	-85 932	8	-92 253	9	782 628	11	544.0	4.0
51	39	12		Y		-86 476	7	-92 837	8	782 390	10	2 294	7
50	40	10		ZR		-88 770.2	3.9	-95 300.4	4.1	783 902	8	-6 110	10
49	41	8		NB	-	-82 660	11	-88 741	11	777 009	13	-2 500	100
48	42	6		MO	-	-80 160	100	-86 060	110	773 730	100		
54	37	17	91	RB	+	-78 180	1000	-83 930	1070	783 730	1000	5 500	1000
53	38	15		SR	+	-83 683	15	-89 839	16	788 451	17	2 670	10
52	39	13		Y	+	-86 353	11	-92 705	12	790 338	13	1 540	10
51	40	11		ZR		-87 892.8	4.8	-94 358	5	791 096	9	-1 140	60
50	41	9		NB	+	-86 750	60	-93 140	70	789 180	60	-4 460	30
49	42	7		MO	+N	-82 290	50	-88 350	60	783 930	50		
55	37	18	92	RB	+	-75 320	1000	-80 860	1080	788 940	1000	7 600	1000
54	38	16		SR	+	-82 920	70	-89 020	80	795 760	70	1 920	70
53	39	14		Y	+	-84 834	20	-91 074	22	796 890	22	3 628	20
52	40	12		ZR		-88 461.7	3.3	-94 969.1	3.5	799 736	8	-2 031	10
51	41	10		NB		-86 431	9	-92 789	10	796 922	12	374	10
50	42	8		MO		-86 804.3	3.2	-93 189.9	3.4	796 514	8	-8 060	140
49	43	6		TC	-	-78 750	140	-84 540	150	787 670	140		
55	38	17	93	SR	+	-79 450	100	-85 290	110	800 360	100	4 800	100
54	39	15		Y	+	-84 250	21	-90 448	22	804 378	22	2 890	20
53	40	13		ZR		-87 140	5	-93 550	5	806 486	9	63.4	2.0
52	41	11		NB		-87 203.5	4.7	-93 618	5	805 767	9	- 418	14
51	42	9		MO		-86 785	13	-93 170	14	804 566	15	-3 186	13
50	43	7		TC	-	-83 599	19	-89 749	20	800 598	20		
56	38	18	94	SR	+	-78 820	220	-84 620	240	807 800	220	3 450	100
55	39	16		Y	+	-82 270	200	-88 320	210	810 470	200	5 000	200
54	40	14		ZR		-87 267.0	3.4	-93 686.6	3.7	814 684	8	- 922	15
53	41	12		NB		-86 346	14	-92 697	15	812 980	16	2 061	15
52	42	10		MO		-88 496.5	2.7	-94 909.9	2.9	814 259	8	-4 260	6
51	43	8		TC	-	-84 146	7	-90 337	7	809 216	10		
56	39	17	95	Y	+	-81 460	1000	-87 460	1070	817 730	1000	4 200	1000
55	40	15		ZR		-85 663.1	4.9	-91 965	5	821 152	9	1 121.0	3.9
54	41	13		NB		-86 784.1	3.1	-93 168.2	3.3	821 490	8	924.7	0.7
53	42	11		MO		-87 708.9	3.0	-94 161.0	3.2	821 633	8	-1 659	21
52	43	9		TC	-	-86 050	21	-92 380	23	819 191	23	-2 032	30
51	44	7		RU	-	-84 018	37	-90 199	40	816 377	38		
57	39	18	96	Y	+	-78 530	1000	-84 310	1070	822 870	1000	6 900	1000
56	40	16		ZR		-85 429.8	4.7	-91 714	5	828 990	9	214	26
55	41	14		NB	+	-85 644	25	-91 944	27	828 422	26	3 150	25
54	42	12		MO		-88 794.2	2.5	-95 326.2	2.6	830 789	8	-2 940	50
53	43	10		TC	-	-85 860	50	-92 170	50	827 070	50	210	50
52	44	8		RU	M	-86 071	5	-92 402	6	826 501	9		
57	40	17	97	ZR		-82 934	22	-89 034	23	834 565	23	2 673	22
56	41	15		NB		-85 606	7	-91 904	8	836 455	11	1 933	7
55	42	13		MO		-87 538.9	2.7	-93 978.5	2.9	837 606	8	- 300	1000
54	43	11		TC	-	-87 240	1000	-93 660	1070	836 520	1000	-1 200	1000
53	44	9		RU	-	-86 040	1410	-92 370	1520	834 540	1410	-3 490	20
52	45	7		RH	-	-82 550	1410	-88 620	1520	830 270	1410		
58	40	18	98	ZR	+	-82 010	1410	-88 040	1520	841 710	1410	1 500	1000
57	41	16		NB	+	-83 510	1000	-89 650	1070	842 430	1000	4 600	1000
56	42	14		MO		-88 109.7	2.7	-94 591.2	2.8	846 248	8	-1 590	200
55	43	12		TC	+	-86 520	200	-92 890	210	843 880	200	1 700	200
54	44	10		RU		-88 221.5	4.1	-94 711.3	4.4	844 795	9	-4 200	300
53	45	8		RH	-	-84 020	300	-90 200	320	839 810	300		
58	41	17	99	NB	+	-82 860	1000	-88 950	1070	849 850	1000	3 100	1000
57	42	15		MO		-85 957	9	-92 280	10	852 166	12	1 370	8
56	43	13		TC		-87 327	5	-93 751	6	852 754	9	292.1	3.9
55	44	11		RU		-87 619.0	4.0	-94 064.5	4.3	852 264	9	-2 100	20
54	45	9		RH	-	-85 519	20	-91 810	22	849 381	22	-3 800	200
53	46	7		PD	-	-81 720	200	-87 730	220	844 800	200		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
59	41	18	100	NB	+	-80 090	1000	-85 980	1070	855 150	1000	6 100	1000
58	42	16		MO		-86 185.3	3.5	-92 525.3	3.7	860 466	9	- 340	60
57	43	14		TC	+	-85 850	60	-92 160	60	859 350	60	3 370	60
56	44	12		RU		-89 218.7	4.8	-95 782	5	861 935	9	-3 640	20
55	45	10		RH	-	-85 579	21	-91 874	22	857 512	22	- 600	1000
54	46	8		PD	-	-84 980	1000	-91 230	1070	856 130	1000		
59	42	17	101	MO		-83 504	19	-89 647	20	865 857	20	2 819	27
58	43	15		TC		-86 324	25	-92 674	27	867 893	26	1 630	25
57	44	13		RU		-87 953.2	3.1	-94 423.2	3.3	868 741	8	- 560	18
56	45	11		RH	+NN	-87 393	18	-93 822	19	867 398	19	-1 760	50
55	46	9		PD	-	-85 630	50	-91 930	60	864 860	50		
60	42	18	102	MO	+	-83 600	1410	-89 750	1520	874 020	1410	1 000	1000
59	43	16		TC	+	-84 600	1000	-90 820	1070	874 240	1000	4 500	1000
58	44	14		RU		-89 097.9	4.4	-95 652.2	4.7	877 957	9	-2 324	7
57	45	12		RH		-86 774	8	-93 158	9	874 851	12	1 149	6
56	46	10		PD		-87 923	10	-94 391	11	875 217	13	-5 300	1000
55	47	8		AG	-	-82 620	1000	-88 700	1070	869 130	1000		
60	43	17	103	TC	+	-84 920	100	-91 170	110	882 640	100	2 350	100
59	44	15		RU		-87 274	19	-93 694	21	884 204	21	740	19
58	45	13		RH		-88 014.4	4.5	-94 489.0	4.8	884 162	9	- 555	20
57	46	11		PD		-87 460	20	-93 893	22	882 825	22	-2 590	100
56	47	9		AG	-	-84 870	100	-91 110	110	879 450	100		
61	43	18	104	TC	+	-82 240	100	-88 290	110	888 020	100	5 850	100
60	44	16		RU	M	-88 089.9	4.8	-94 570	5	893 092	9	-1 145	8
59	45	14		RH		-86 945	6	-93 341	7	891 164	10	2 466	12
58	46	12		PD		-89 411	11	-95 989	11	892 848	13	-4 270	10
57	47	10		AG	-	-85 141	15	-91 404	16	887 796	17	-1 200	1000
56	48	8		CD	-	-83 940	1000	-90 129	1070	885 810	1000		
62	43	19	105	TC	+	-82 590	200	-88 670	220	896 450	200	3 400	200
61	44	17		RU	+	-85 995	16	-92 321	17	899 068	18	1 871	10
60	45	15		RH	+	-87 866	12	-94 329	13	900 156	14	565.0	3.0
59	46	13		PD		-88 431	12	-94 936	12	899 939	14	-1 300	1000
58	47	11		AG	-	-87 130	1000	-93 540	1070	897 860	1000	-2 800	1000
57	48	9		CD	-	-84 330	1410	-90 530	1520	894 270	1410		
62	44	18	106	RU	+	-86 328	11	-92 678	12	907 472	14	39.40	0.30
61	45	16		RH	+	-86 367	11	-92 721	12	906 729	14	3 540	10
60	46	14		PD		-89 907	6	-96 521	6	909 487	10	-2 964	7
59	47	12		AG		-86 943	9	-93 339	9	905 740	12	185	9
58	48	10		CD	M	-87 128.1	3.9	-93 537.4	4.1	905 143	9	-6 500	300
57	49	8		IN	-	-80 630	300	-86 560	320	897 860	300		
63	44	19	107	RU	+	-83 710	300	-89 870	320	912 920	300	3 150	300
62	45	17		RH	+	-86 858	40	-93 247	43	915 292	41	1 510	40
61	46	15		PD		-88 367.9	4.3	-94 868.4	4.6	916 019	9	35.0	1.0
60	47	13		AG		-88 402.8	4.2	-94 906.0	4.5	915 272	9	-1 417.0	4.0
59	48	11		CD	-	-86 986	6	-93 385	6	913 072	10	-3 490	150
58	49	9		IN	-	-83 500	150	-89 640	160	908 800	150		
64	44	20	108	RU	+	-83 700	600	-89 900	700	921 000	600	1 320	100
63	45	18		RH	+	-85 000	600	-91 300	600	921 500	600	4 500	600
62	46	16		PD		-89 524	8	-96 109	8	925 246	11	-1 917	10
61	47	14		AG		-87 607	8	-94 051	8	922 547	11	1 642	9
60	48	12		CD		-89 248.1	4.2	-95 813.4	4.4	923 406	9	-5 150	80
59	49	10		IN	-	-84 100	80	-90 280	90	917 470	80		
64	45	19	109	RH	+	-85 100	1000	-91 360	1070	929 680	1000	2 500	1000
63	46	17		PD		-87 602	5	-94 046	5	931 396	10	1 115.3	2.0
62	47	15		AG		-88 717.4	4.8	-95 244	5	931 729	10	- 159.5	4.0
61	48	13		CD		-88 558	6	-95 072	7	930 787	10	-2 020	10
60	49	11		IN	-	-86 538	12	-92 904	13	927 985	14		
65	45	20	110	RH	+	-82 800	500	-88 900	500	935 500	500	5 500	500
64	46	18		PD	M	-88 338	13	-94 836	14	940 204	15	- 868	14
63	47	16		AG		-87 470	7	-93 905	7	938 553	11	2 872	7
62	48	14		CD		-90 342.4	3.5	-96 988.2	3.8	940 643	9	-3 930	40
61	49	12		IN	-	-86 412	40	-92 769	43	935 931	41		
65	46	19	111	PD	+	-86 010	50	-92 330	50	945 940	50	2 190	50
64	47	17		AG	+	-88 196	11	-94 684	11	947 351	14	1 050	10
63	48	15		CD		-89 246.4	3.6	-95 811.6	3.8	947 618	9	-1 090	200
62	49	13		IN	-PP	-88 160	200	-94 640	210	945 750	200	-2 520	30
61	50	11		SN	-	-85 640	200	-91 940	220	942 440	200		
66	46	20	112	PD	+	-86 268	31	-92 614	33	954 276	32	300	20
65	47	18		AG	+	-86 568	23	-92 936	25	953 794	25	4 007	23
64	48	16		CD		-90 574.6	3.0	-97 237.5	3.2	957 018	9	-2 591	9
63	49	14		IN		-87 984	9	-94 456	10	953 645	13	660	6
62	50	12		SN		-88 644	9	-95 165	10	953 523	12		

N	Z	N-Z	A	EL	D	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
66	47	19	113	AG	+	-87 041	40	-93 444	43	962 339	41	2 000	40
65	48	17		CD		-89 041.3	3.4	-95 591.5	3.6	963 556	9	297	8
64	49	15		IN		-89 339	8	-95 911	9	963 071	12	-1 023	19
63	50	13		SN		-88 316	17	-94 813	18	961 266	19	-4 470	40
62	51	11		SB	-	-83 846	43	-90 014	47	956 014	44		
67	47	20	114	AG	+	-85 420	400	-91 700	430	968 790	400	4 660	400
66	48	18		CD		-90 017.8	2.9	-96 639.7	3.0	972 604	9	-1 438	9
65	49	16		IN		-88 579	8	-95 095	9	970 383	12	1 985.9	2.6
64	50	14		SN		-90 565	8	-97 227	9	971 587	12	-6 280	200
63	51	12		SB	-	-84 290	200	-90 490	210	964 520	200		
68	47	21	115	AG	+	-84 830	170	-91 070	180	976 270	170	3 260	170
67	48	19		CD		-88 089	9	-94 569	10	978 747	13	1 452	8
66	49	17		IN		-89 542	8	-96 129	8	979 417	12	489	9
65	50	15		SN		-90 031	7	-96 654	7	979 124	11	-3 030	20
64	51	13		SB	-	-87 001	21	-93 401	23	975 311	23		
69	47	22	116	AG	+	-82 610	1000	-88 690	1070	982 120	1000	6 100	1000
68	48	20		CD		-88 712.3	3.1	-95 238.2	3.3	987 442	10	- 517	24
67	49	18		IN		-88 195	24	-94 683	26	986 142	26	3 327	24
66	50	16		SN		-91 522.7	4.4	-98 255.4	4.7	988 687	10	-4 550	50
65	51	14		SB	-	-86 970	50	-93 370	50	983 350	50	-1 560	100
64	52	12		TE	-	-85 410	110	-91 700	120	981 010	110		
69	48	21	117	CD		-86 405	14	-92 761	15	993 205	16	2 520	14
68	49	19		IN		-88 925	10	-95 466	10	994 943	13	1 468	9
67	50	17		SN		-90 392.4	3.2	-97 041.9	3.4	995 628	10	-1 820	30
66	51	15		SB	-	-88 572	30	-95 088	32	993 026	32	-3 560	50
65	52	13		TE	-	-85 070	60	-91 330	60	988 740	60		
70	48	22	118	CD	+	-86 650	1080	-93 030	1160	1 001 520	1080	800	1000
69	49	20		IN	+	-87 450	400	-93 890	430	1 001 540	400	4 200	400
68	50	18		SN		-91 652.0	3.8	-98 394.2	4.1	1 004 959	10	-3 696	6
67	51	16		SB	-	-87 956	7	-94 426	8	1 000 481	12	- 300	1000
66	52	14		TE	-	-87 660	1000	-94 100	1070	999 400	1000		
71	48	23	119	CD	+	-84 070	320	-90 260	350	1 007 020	320	3 500	300
70	49	21		IN	+	-87 570	120	-94 010	130	1 009 730	120	2 490	120
69	50	19		SN		-90 061.6	3.1	-96 686.7	3.3	1 011 440	10	- 579	20
68	51	17		SB	-	-89 483	20	-96 065	22	1 010 079	22	-2 294.6	2.6
67	52	15		TE	-	-87 189	20	-93 602	22	1 007 002	22		
71	49	22	120	IN	+	-85 700	1000	-92 000	1070	1 015 930	1000	5 400	1000
70	50	20		SN		-91 100.2	3.4	-97 801.8	3.6	1 020 550	10	-2 686	7
69	51	18		SB		-88 415	7	-94 919	8	1 017 082	12	986	15
68	52	16		TE	M	-89 400	13	-95 977	14	1 017 285	16	-5 400	1000
67	53	14		I	-	-84 000	1000	-90 180	1070	1 011 100	1000		
72	49	23	121	IN	+	-85 610	1000	-91 910	1070	1 023 910	1000	3 600	1000
71	50	21		SN		-89 210	6	-95 773	6	1 026 732	11	383	5
70	51	19		SB		-89 593.2	2.6	-96 183.9	2.8	1 026 332	10	-1 288	45
69	52	17		TE	-	-88 305	45	-94 801	48	1 024 262	46	-2 360	50
68	53	15		I	-	-85 950	70	-92 270	70	1 021 120	70	-3 790	100
67	54	13		XE	-	-82 160	120	-88 200	130	1 016 550	120		
73	49	24	122	IN	+	-83 200	800	-89 400	900	1 029 600	800	6 700	800
72	50	22		SN		-89 942.5	4.1	-96 558.9	4.4	1 035 536	10	-1 623	7
71	51	20		SB		-88 320	6	-94 817	7	1 033 130	12	1 971.7	3.9
70	52	18		TE		-90 291	6	-96 934	6	1 034 320	11	-4 140	40
69	53	16		I	-	-86 151	40	-92 489	43	1 029 397	41		
74	49	25	123	IN	+	-83 300	1000	-89 430	1070	1 037 750	1000	4 500	1000
73	50	23		SN		-87 803	10	-94 262	11	1 041 467	14	1 421	10
72	51	21		SB		-89 223.8	3.1	-95 787.3	3.3	1 042 106	10	-60	6
71	52	19		TE		-89 163	6	-95 723	6	1 041 263	11	-1 400	1000
70	53	17		I	-	-87 810	1000	-94 270	1070	1 039 130	1000	-2 800	100
69	54	15		XE	-	-85 010	1010	-91 270	1080	1 035 550	1010		
75	49	26	124	IN	+	-80 900	500	-86 800	500	1 043 400	500	7 400	500
74	50	24		SN		-88 237.0	4.9	-94 728	5	1 049 973	11	- 653	8
73	51	22		SB	+	-87 584	6	-94 027	6	1 048 538	11	2 916.0	3.0
72	52	20		TE		-90 500	5	-97 158	6	1 050 671	11	-3 170	30
71	53	18		I	-	-87 330	30	-93 754	33	1 046 719	32	120	140
70	54	16		XE	M	-87 450	140	-93 880	150	1 046 050	140		
75	50	25	125	SN		-85 933	12	-92 254	13	1 055 740	15	2 342	9
74	51	23		SB		-88 275	8	-94 768	9	1 057 299	13	758	6
73	52	21		TE		-89 032	6	-95 582	6	1 057 275	11	- 148.9	1.0
72	53	19		I	-	-88 883	6	-95 422	6	1 056 343	11	-1 900	1000
71	54	17		XE	-	-86 980	1000	-93 380	1070	1 053 660	1000	-3 070	20
70	55	15		CS	-	-83 910	1000	-90 090	1070	1 049 810	1000		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
76	50	26	126	SN	+	-86 030	1010	-92 360	1090	1 063 910	1010	300	1000
75	51	24		SB	+	-86 330	150	-92 680	160	1 063 420	150	3 730	150
74	52	22		TE		-90 053	5	-96 678	5	1 066 367	11	-2 150.1	4.9
73	53	20		I		-87 903	7	-94 369	7	1 063 434	12	1 251	5
72	54	18		XE		-89 154	8	-95 712	9	1 063 903	13	-4 800	400
71	55	16		CS	-	-84 350	400	-90 560	430	1 058 320	400		
77	50	27	127	SN	+	-83 600	1000	-89 740	1070	1 069 550	1000	3 100	1000
76	51	25		SB	+	-86 695	31	-93 073	33	1 071 863	33	1 600	30
75	52	23		TE	+	-88 295	8	-94 791	9	1 072 681	13	689	7
74	53	21		I		-88 984.3	4.0	-95 530.2	4.3	1 072 587	11	-1 700	350
73	54	19		XE	-	-88 280	350	-94 780	380	1 071 100	350	-2 100	60
72	55	17		CS	-	-86 180	360	-92 520	380	1 068 220	360	-3 600	1000
71	56	15		BA	-	-82 580	1060	-88 660	1140	1 063 840	1060		
78	50	28	128	SN	+	-83 400	210	-89 530	230	1 077 420	210	1 300	150
77	51	26		SB	+	-84 700	150	-90 930	160	1 077 940	150	4 280	150
76	52	24		TE		-88 978	5	-95 524	6	1 081 435	11	-1 269	8
75	53	22		I		-87 710	8	-94 162	9	1 079 384	13	2 141	8
74	54	20		XE		-89 850	5	-96 466	6	1 080 742	11	-3 930	30
73	55	18		CS	-	-85 920	30	-92 241	33	1 076 029	32	- 700	1000
72	56	16		BA	-	-85 220	1000	-91 490	1070	1 074 550	1000		
78	51	27	129	SB	+	-84 520	1000	-90 740	1070	1 085 830	1000	2 500	1000
77	52	25		TE	+	-87 023	9	-93 425	9	1 087 551	13	1 480	5
76	53	23		I	+	-88 503	7	-95 013	7	1 088 249	12	189	5
75	54	21		XE		-88 692.0	4.7	-95 216	5	1 087 655	11	-1 100	1000
74	55	19		CS	-	-87 590	1000	-94 040	1070	1 085 770	1000	-2 450	20
73	56	17		BA	-	-85 140	1000	-91 410	1070	1 082 540	1000	-4 000	1000
72	57	15		LA	-	-81 140	1410	-87 110	1520	1 077 760	1410		
79	51	28	130	SB	+	-81 940	1000	-87 960	1070	1 091 320	1000	5 400	1000
78	52	26		TE		-87 337	6	-93 762	6	1 095 937	12	- 407	31
77	53	24		I	+	-86 930	30	-93 324	33	1 094 747	32	2 950	30
76	54	22		XE		-89 880	5	-96 491	6	1 096 914	12	-2 991	20
75	55	20		CS		-86 889	21	-93 280	22	1 093 141	23	442.0	4.0
74	56	18		BA		-87 331	21	-93 755	23	1 092 800	23	-5 600	1000
73	57	16		LA	-	-81 730	1000	-87 740	1070	1 086 420	1000		
79	52	27	131	TE	+	-85 161	20	-91 425	22	1 101 832	23	2 280	20
78	53	25		I	+	-87 440.6	4.0	-93 872.9	4.3	1 103 329	11	970.4	0.6
77	54	23		XE		-88 411.0	4.0	-94 914.7	4.2	1 103 517	11	- 355	6
76	55	21		CS	-	-88 056	7	-94 534	8	1 102 380	13	-1 164	15
75	56	19		BA	-	-86 892	17	-93 284	18	1 100 433	20	-2 960	50
74	57	17		LA	-	-83 930	50	-90 110	60	1 096 690	50	-5 220	300
73	58	15		CE	-	-78 710	300	-84 500	330	1 090 690	300		
80	52	28	132	TE	+	-85 209	16	-91 477	18	1 109 951	19	505	15
79	53	26		I	+	-85 714	7	-92 019	7	1 109 674	12	3 558	5
78	54	24		XE		-89 271.9	4.4	-95 839.0	4.7	1 112 450	11	-2 079	25
77	55	22		CS		-87 193	25	-93 607	27	1 109 588	27	1 180	280
76	56	20		BA	M	-88 380	280	-94 880	300	1 109 990	280	-4 820	100
75	57	18		LA	-	-83 560	300	-89 700	320	1 104 390	300	-1 200	1000
74	58	16		CE	-	-82 360	1040	-88 410	1120	1 102 400	1040		
80	53	27	133	I	+	-85 930	60	-92 250	70	1 117 960	60	1 800	50
79	54	25		XE	+	-87 732	36	-94 185	39	1 118 981	38	428.0	4.0
78	55	23		CS		-88 160	36	-94 645	38	1 118 626	37	- 488	5
77	56	21		BA	-	-87 672	36	-94 121	39	1 117 356	38	-2 200	200
76	57	19		LA	-	-85 470	200	-91 760	220	1 114 370	200	-2 800	1000
75	58	17		CE	-	-82 670	1020	-88 750	1100	1 110 790	1020		
81	53	28	134	I	+	-83 970	60	-90 150	60	1 124 070	60	4 150	60
80	54	26		XE	M	-88 120.5	4.6	-94 602.9	4.9	1 127 441	12	-1 328	39
79	55	24		CS		-86 793	39	-93 177	41	1 125 331	40	2 059.0	2.0
78	56	22		BA		-88 852	39	-95 388	41	1 126 607	40	-3 770	50
77	57	20		LA	-	-85 080	60	-91 340	70	1 122 050	60	- 140	60
76	58	18		CE	-	-84 940	90	-91 190	90	1 121 130	90		
82	53	29	135	I	+	-83 810	1000	-89 980	1080	1 131 980	1000	2 800	1000
81	54	27		XE	+	-86 610	100	-92 980	110	1 134 000	100	1 160	10
80	55	25		CS	+	-87 770	100	-94 230	110	1 134 380	100	210	5
79	56	23		BA		-87 980	100	-94 450	110	1 133 810	100	-1 300	1000
78	57	21		LA	-	-86 730	1000	-93 110	1080	1 131 780	1000	-2 100	1000
77	58	19		CE	-	-84 630	1420	-90 860	1520	1 128 890	1420		
83	53	30	136	I	+	-79 420	100	-85 260	110	1 135 670	100	7 000	100
82	54	28		XE	M	-86 422	6	-92 779	6	1 141 885	12	- 110	80
81	55	26		CS	+	-86 310	80	-92 660	90	1 140 990	80	2 830	20
80	56	24		BA		-89 140	80	-95 700	80	1 143 040	80	-2 870	70
79	57	22		LA	-	-86 270	100	-92 620	110	1 139 390	110	280	480
78	58	20		CE	M	-86 550	470	-92 900	500	1 138 880	470		

N	Z	N-Z	A	EL	Q	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
83	54	29	137	XE	+	-82 810	100	-88 900	110	1 146 340	100	4 040	70
82	55	27		CS	+	-86 850	70	-93 230	80	1 149 600	70	1 176.0	2.0
81	56	25		BA		-88 020	70	-94 500	80	1 149 990	70	- 500	1000
80	57	23		LA	-	-87 520	1000	-93 960	1080	1 148 710	1000	-1 200	1000
79	58	21		CE	-	-86 320	1420	-92 670	1520	1 146 730	1420	-2 820	100
78	59	19		PR	-	-83 500	1420	-89 640	1520	1 143 120	1420		
84	54	30	138	XE	+	-80 290	1020	-86 190	1100	1 151 890	1020	2 800	200
83	55	28		CS	+	-83 090	1000	-89 200	1080	1 153 910	1000	5 400	1000
82	56	26		BA		-88 490	50	-95 000	60	1 158 530	60	-1 782	33
81	57	24		LA		-86 710	50	-93 090	60	1 155 970	50	1 015	15
80	58	22		CE		-87 720	50	-94 170	60	1 156 200	60	-4 320	100
79	59	20		PR	-	-83 400	110	-89 540	120	1 151 100	110		
85	54	31	139	XE	+	-76 530	360	-82 160	390	1 156 210	360	4 600	200
84	55	29		CS	+	-81 130	300	-87 100	330	1 160 030	310	4 000	300
83	56	27		BA		-85 130	50	-91 400	60	1 163 250	60	2 294	31
82	57	25		LA		-87 428	49	-93 860	50	1 164 760	50	- 270	6
81	58	23		CE		-87 158	49	-93 570	50	1 163 710	50	-2 000	100
80	59	21		PR	-	-85 160	110	-91 420	120	1 160 920	110	-2 800	1000
79	60	19		ND	-	-82 360	1010	-88 420	1080	1 157 340	1010		
85	55	30	140	CS	+	-77 210	1000	-82 890	1070	1 164 170	1000	6 100	1000
84	56	28		BA	+	-83 307	21	-89 435	23	1 169 491	24	1 050	10
83	57	26		LA		-84 357	19	-90 562	20	1 169 758	22	3 769	5
82	58	24		CE		-88 125	18	-94 608	19	1 172 745	21	-3 367	20
81	59	22		PR		-84 758	25	-90 993	27	1 168 595	27	- 300	1000
80	60	20		ND	-	-84 460	1000	-90 670	1070	1 167 510	1000		
85	56	29	141	BA	+	-80 060	110	-85 950	110	1 174 320	110	3 000	100
84	57	27		LA	+	-83 062	35	-89 172	37	1 176 535	36	2 430	30
83	58	25		CE		-85 492	17	-91 781	19	1 178 182	21	580.9	4.9
82	59	23		PR		-86 072	17	-92 404	18	1 177 981	20	-1 800	10
81	60	21		ND	-	-84 272	20	-90 472	21	1 175 398	23	-3 620	200
80	61	19		PM	-	-80 650	200	-86 590	220	1 171 000	200		
86	56	30	142	BA	+	-77 920	110	-83 650	120	1 180 250	120	2 200	100
85	57	28		LA	+	-80 120	60	-86 020	60	1 181 670	60	4 510	30
84	58	26		CE		-84 631	47	-90 860	50	1 185 393	48	- 778	46
83	59	24		PR		-83 854	16	-90 022	17	1 183 833	19	2 156	7
82	60	22		ND		-86 010	14	-92 337	16	1 185 207	18	-4 800	300
81	61	20		PM	-	-81 210	300	-87 180	320	1 179 620	300		
86	57	29	143	LA	+	-78 370	80	-84 130	90	1 187 980	80	3 300	80
85	58	27		CE		-81 665	18	-87 673	19	1 190 499	21	1 440	10
84	59	25		PR		-83 106	15	-89 219	16	1 191 157	19	933	5
83	60	23		ND		-84 039	14	-90 221	15	1 191 307	18	-1 130	310
82	61	21		PM	+	-82 910	310	-89 010	330	1 189 400	310	-3 320	300
81	62	19		SM	+N	-79 590	80	-85 450	90	1 185 300	80		
87	57	30	144	LA	+	-74 890	1000	-80 400	1070	1 192 580	1000	5 600	1000
86	58	28		CE	+	-80 488	18	-86 409	19	1 197 393	21	320	10
85	59	26		PR	+	-80 808	15	-86 752	16	1 196 930	18	2 989.0	4.0
84	60	24		ND		-83 797	14	-89 961	15	1 199 137	18	-2 300	1000
83	61	22		PM	-	-81 500	1000	-87 490	1070	1 196 050	1000	480	1000
82	62	20		SM		-81 980	14	-88 011	15	1 195 755	18		
87	58	29	145	CE	+	-77 060	1000	-82 730	1070	1 202 040	1000	2 600	1000
86	59	27		PR	+	-79 664	17	-85 524	19	1 203 858	21	1 805	10
85	60	25		ND		-81 469	14	-87 462	15	1 204 881	18	- 143	9
84	61	23		PM		-81 326	16	-87 309	18	1 203 955	20	- 654	11
83	62	21		SM		-80 672	17	-86 606	18	1 202 519	20	-2 790	50
82	63	19		EU	-	-77 880	50	-83 610	60	1 198 950	50		
88	58	30	146	CE	+	-75 760	220	-81 330	240	1 208 810	220	1 000	100
87	59	28		PR	+	-76 760	200	-82 410	220	1 209 020	200	4 200	200
86	60	26		ND		-80 959	14	-86 914	15	1 212 442	18	-1 440	23
85	61	24		PM	+	-79 518	26	-85 368	28	1 210 219	29	1 528	15
84	62	22		SM		-81 046	22	-87 008	23	1 210 964	25	-3 862	27
83	63	20		EU		-77 184	34	-82 862	37	1 206 320	36	-1 100	1000
82	64	18		GD	-	-76 080	1000	-81 680	1070	1 204 440	1000		
88	59	29	147	PR	+	-75 630	1000	-81 200	1070	1 215 970	1000	2 500	1000
87	60	27		ND	+	-78 175	17	-83 926	19	1 217 729	21	900	10
86	61	25		PM	+	-79 075	14	-84 892	15	1 217 847	18	225.0	3.0
85	62	23		SM		-79 300	14	-85 133	15	1 217 290	18	-1 860	310
84	63	21		EU	-A	-77 500	310	-83 200	330	1 214 700	310	-2 200	1000
83	64	19		GD	-	-75 300	1050	-80 830	1120	1 211 720	1050		
89	59	30	148	PR	+	-72 730	1000	-78 090	1070	1 221 140	1000	4 700	1000
88	60	28		ND		-77 435	14	-83 131	15	1 225 061	18	- 514	21
87	61	26		PM	+	-76 921	24	-82 579	26	1 223 764	27	2 458	20
86	62	24		SM		-79 371	14	-85 209	15	1 225 432	18	-3 090	50
85	63	22		EU	-	-76 280	50	-81 890	60	1 221 560	50	10	50
84	64	20		GD	-A	-76 287	17	-81 899	19	1 220 783	21	-5 620	300
83	65	18		TB	-	-70 670	300	-75 870	320	1 214 380	300		

N	Z	N-Z	A	EL	D	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
89	60	29	149	ND		-74 405	17	-79 878	18	1 230 102	21	1 669	10
88	61	27		PM		-76 074	14	-81 670	15	1 230 989	18	1 071.0	2.0
87	62	25		SM		-77 145	14	-82 820	14	1 231 278	18	- 800	1000
86	63	23		EU	-	-76 390	1000	-82 000	1070	1 229 740	1000	-1 220	1010
85	64	21		GD	-A	-75 170	150	-80 700	160	1 227 730	150	-3 770	160
84	65	19		TB	-A	-71 400	50	-76 650	60	1 223 180	50		
90	60	30	150	ND		-73 666	14	-79 085	15	1 237 435	18	-40	60
89	61	28		PM	+	-73 630	60	-79 040	70	1 236 610	60	3 430	60
88	62	26		SM		-77 056	13	-82 724	14	1 239 260	18	-2 248	18
87	63	24		EU		-74 807	22	-80 311	24	1 236 229	25	1 010.4	4.0
86	64	22		GD		-75 818	22	-81 395	24	1 236 457	25	-4 791	29
85	65	20		TB		-71 927	35	-76 252	38	1 230 884	37	-1 710	1000
84	66	18		DY	-A	-69 310	1000	-74 410	1070	1 228 390	1000		
91	60	31	151	ND	+	-71 000	100	-76 230	110	1 242 840	100	2 400	100
90	61	29		PM	+	-73 403	21	-78 802	22	1 244 460	24	1 191	7
89	62	27		SM		-74 594	20	-80 081	21	1 244 869	23	75.9	0.6
88	63	25		EU		-74 670	20	-80 162	21	1 244 162	23	- 400	1000
87	64	23		GD	-	-74 270	1000	-79 730	1070	1 242 980	1000	-2 690	1050
86	65	21		TB	-A	-71 580	310	-76 850	330	1 239 510	310	-2 880	1000
85	66	19		DY	-A	-68 700	1050	-73 750	1120	1 235 850	1050		
91	61	30	152	PM	+	-71 250	1000	-76 490	1070	1 250 370	1000	3 500	1000
90	62	28		SM		-74 746	14	-80 244	15	1 253 093	18	-1 856.8	3.0
89	63	26		EU		-72 889	14	-78 251	15	1 250 453	18	1 821	6
88	64	24		GD		-74 710	15	-80 206	16	1 251 492	19	-4 180	150
87	65	22		TB	-	-70 530	150	-75 720	160	1 246 530	150	- 420	150
86	66	20		DY	-A	-70 113	26	-75 271	28	1 245 330	29	-6 370	300
85	67	18		HO	-A	-63 750	300	-68 440	330	1 238 180	300		
92	61	31	153	PM	+	-70 760	100	-75 970	110	1 257 960	100	1 800	100
91	62	29		SM		-72 560	16	-77 898	17	1 258 978	20	801.0	4.9
90	63	27		EU		-73 361	16	-78 758	18	1 258 997	20	- 243.0	3.0
89	64	25		GD	-	-73 118	17	-78 497	18	1 257 971	21	-1 900	1000
88	65	23		TB	-	-71 270	1000	-76 510	1070	1 255 340	1000	-2 100	1010
87	66	21		DY	-A	-69 170	150	-74 260	160	1 252 460	150	-4 220	160
86	67	19		HO	-A	-64 950	60	-69 730	60	1 247 460	60		
92	62	30	154	SM		-72 393	14	-77 718	15	1 266 882	19	- 718	17
91	63	28		EU	+	-71 675	19	-76 947	20	1 265 382	23	1 978	5
90	64	26		GD		-73 653	18	-79 071	20	1 266 577	22	-3 400	1000
89	65	24		TB	-	-70 250	1000	-75 420	1070	1 262 400	1000	210	1000
88	66	22		DY	-A	-70 460	50	-75 650	60	1 261 820	60	-5 500	1000
87	67	20		HO	-	-64 960	1000	-69 740	1080	1 255 540	1000	-2 330	1420
86	68	18		ER	-A	-62 630	1000	-67 240	1070	1 252 420	1000		
93	62	31	155	SM		-70 140	17	-75 299	18	1 272 701	21	1 650	13
92	63	29		EU		-71 789	17	-77 070	19	1 273 568	21	247.6	3.0
91	64	27		GD		-72 037	17	-77 336	18	1 273 033	21	- 900	1000
90	65	25		TB	-	-71 140	1000	-76 370	1070	1 271 350	1000	-2 099	6
89	66	23		DY	-	-69 040	1000	-74 120	1070	1 268 470	1000		
94	62	32	156	SM	+	-69 331	28	-74 431	30	1 279 963	31	715	15
93	63	30		EU	+	-70 046	24	-75 198	25	1 279 896	27	2 447	16
92	64	28		GD		-72 493	17	-77 825	19	1 281 560	21	-2 400	1000
91	65	26		TB	-	-70 090	1000	-75 250	1070	1 278 380	1000	760	1010
90	66	24		DY		-70 860	170	-76 070	180	1 278 360	170		
94	63	31	157	EU	+	-69 500	50	-74 610	60	1 287 420	50	1 270	50
93	64	29		GD		-70 769	17	-75 975	19	1 287 908	21	-60	10
92	65	27		TB	-	-70 709	20	-75 910	22	1 287 065	24	-1 100	1000
91	66	25		DY	-	-69 610	1000	-74 730	1070	1 285 180	1000		
95	63	32	158	EU	+	-67 130	200	-72 060	220	1 293 120	200	3 500	200
94	64	30		GD		-70 627	17	-75 822	19	1 295 837	21	-1 198	25
93	65	28		TB		-69 428	27	-74 536	29	1 293 857	29	946	10
92	66	26		DY		-70 374	28	-75 551	30	1 294 020	31	-4 044	5
91	67	24		HO	-	-66 330	29	-71 210	31	1 289 193	31		
96	63	33	159	EU	+	-66 290	200	-71 160	220	1 300 350	200	2 300	200
95	64	31		GD		-68 586	25	-73 632	27	1 301 868	28	947	7
94	65	29		TB		-69 534	24	-74 649	26	1 302 033	27	- 380	20
93	66	27		DY	-	-69 154	32	-74 241	34	1 300 871	34	-1 800	1000
92	67	25		HO	-	-67 350	1000	-72 310	1070	1 298 290	1000		
97	63	34	160	EU	+	-64 300	500	-69 000	500	1 306 400	500	3 600	500
96	64	32		GD		-67 891	19	-72 885	20	1 309 244	23	-29	28
95	65	30		TB		-67 862	23	-72 854	25	1 308 433	27	1 810	18
94	66	28		DY		-69 673	19	-74 798	21	1 309 461	23	-3 300	50
93	67	26		HO	-	-66 370	50	-71 260	60	1 305 380	50		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
97	64	33	161	GD	+	-65 460	70	-70 280	80	1 314 890	70	2 000	70
96	65	31		TB	+	-67 465	19	-72 428	21	1 316 107	23	584	6
95	66	29		DY		-68 049	18	-73 055	20	1 315 909	22	- 800	1000
94	67	27		HO	-	-67 250	1000	-72 200	1070	1 314 330	1000	-2 000	50
93	68	25		ER	-	-65 250	1000	-70 050	1080	1 311 540	1000	-3 520	100
92	69	23		TM	-	-61 730	1010	-66 270	1080	1 307 240	1010		
98	64	34	162	GD	+	-64 380	1410	-69 120	1520	1 321 880	1410	1 000	1000
97	65	32		TB	+	-65 380	1000	-70 190	1070	1 322 100	1000	2 800	1000
96	66	30		DY		-68 182	18	-73 197	19	1 324 113	22	-2 160	30
95	67	28		HO	-	-66 022	35	-70 878	38	1 321 170	37	350	90
94	68	26		ER		-66 370	90	-71 260	90	1 320 740	90	-4 890	100
93	69	24		TM	-	-61 480	130	-66 010	140	1 315 070	130		
98	65	33	163	TB	+	-64 680	50	-69 440	60	1 329 470	50	1 680	50
97	66	31		DY		-66 363	18	-71 245	19	1 330 366	22	-10	10
96	67	29		HO	-	-66 353	21	-71 234	22	1 329 574	24	-1 210	6
95	68	27		ER	-	-65 143	21	-69 935	23	1 327 581	25	-2 270	30
94	69	25		TM	-	-62 873	37	-67 498	40	1 324 529	39		
99	65	34	164	TB	+	-62 150	1000	-66 720	1070	1 335 010	1000	3 800	1000
98	66	32		DY		-65 949	18	-70 800	19	1 338 023	22	-1 109	37
97	67	30		HO		-64 840	38	-69 610	41	1 336 132	40	1 027	28
96	68	28		ER		-65 867	40	-70 713	43	1 336 377	42	-3 962	20
95	69	26		TM	-	-61 905	45	-66 459	48	1 331 632	46		
99	66	33	165	DY		-63 512	19	-68 184	20	1 343 658	23	1 299	10
98	67	31		HO		-64 811	20	-69 579	21	1 344 175	24	- 371	6
97	68	29		ER	-	-64 440	21	-69 181	22	1 343 021	24	-1 600	1000
96	69	27		TM	-	-62 840	1000	-67 460	1070	1 340 640	1000	-2 700	1000
95	70	25		YB	-	-60 140	1410	-64 560	1520	1 337 160	1410		
100	66	34	166	DY	+	-62 589	28	-67 193	30	1 350 806	31	482	5
99	67	32		HO	+	-63 071	28	-67 711	30	1 350 506	31	1 847	5
98	68	30		ER		-64 918	27	-69 693	29	1 351 570	30	-2 980	50
97	69	28		TM	-	-61 940	60	-66 490	60	1 347 810	60	- 320	80
96	70	26		YB	-	-61 620	100	-66 150	110	1 346 700	100		
100	67	33	167	HO	+	-62 280	100	-66 870	110	1 357 790	100	1 000	100
99	68	31		ER		-63 285	27	-67 940	29	1 358 008	30	- 900	1000
98	69	29		TM	-	-62 380	1000	-66 970	1070	1 356 330	1000	-1 960	20
97	70	27		YB	-	-60 420	1000	-64 870	1070	1 353 580	1000	-3 040	90
96	71	25		LU	-	-57 380	1000	-61 610	1080	1 349 760	1000		
101	67	34	168	HO	+	-59 680	100	-64 070	110	1 363 260	110	3 300	100
100	68	32		ER		-62 983	30	-67 617	32	1 365 779	32	-1 718	37
99	69	30		TM	+N	-61 266	47	-65 770	50	1 363 279	49	70	160
98	70	28		YB		-61 330	150	-65 840	160	1 362 560	150	-4 600	1000
97	71	26		LU	-	-56 730	1010	-60 910	1090	1 357 180	1010		
102	67	35	169	HO	+	-58 810	100	-63 140	110	1 370 460	110	2 100	100
101	68	33		ER		-60 909	32	-65 390	34	1 371 776	34	340.0	2.0
100	69	31		TM		-61 249	32	-65 755	34	1 371 334	34	-1 200	1000
99	70	29		YB	-	-60 050	1000	-64 470	1070	1 369 350	1000	-2 260	50
98	71	27		LU	-	-57 790	1000	-62 040	1080	1 366 310	1000		
103	67	36	170	HO	+	-55 820	120	-59 930	130	1 375 540	120	4 200	100
102	68	34		ER		-60 020	70	-64 440	70	1 378 960	70	- 460	70
101	69	32		TM	+	-59 560	60	-63 940	60	1 377 720	60	967.0	3.0
100	70	30		YB		-60 530	60	-64 980	60	1 377 900	60	-3 551	20
99	71	28		LU	-	-56 980	60	-61 170	70	1 373 570	60		
103	68	35	171	ER		-57 630	70	-61 870	70	1 384 640	70	1 490.1	2.0
102	69	33		TM		-59 120	70	-63 470	70	1 385 350	70	98.1	2.0
101	70	31		YB		-59 220	70	-63 570	70	1 384 660	70	-1 600	1000
100	71	29		LU	-	-57 620	1000	-61 860	1080	1 382 280	1000		
104	68	36	172	ER	+	-56 510	70	-60 670	80	1 391 590	70	891	10
103	69	34		TM	+	-57 400	70	-61 620	80	1 391 700	70	1 880	20
102	70	32		YB		-59 280	70	-63 640	70	1 392 800	70	-2 700	1000
101	71	30		LU	-	-56 580	1000	-60 740	1080	1 389 320	1000		
104	69	35	173	TM	+	-56 370	70	-60 520	80	1 398 740	70	1 320	30
103	70	33		YB		-57 690	60	-61 940	70	1 399 280	70	- 690	30
102	71	31		LU	-	-57 000	70	-61 200	80	1 397 810	70		
105	69	36	174	TM	+	-54 060	120	-58 030	120	1 404 500	120	3 000	100
104	70	34		YB		-57 060	60	-61 260	60	1 406 720	60	-1 500	90
103	71	32		LU	+N	-55 560	70	-59 650	70	1 404 440	70	-10	90
102	72	30		HF		-55 550	70	-59 640	70	1 403 640	70		
106	69	37	175	TM	+	-52 320	1000	-56 170	1080	1 410 840	1000	2 500	1000
105	70	35		YB	+	-54 820	50	-58 860	60	1 412 550	50	467.0	3.0
104	71	33		LU		-55 290	50	-59 360	60	1 412 240	50	- 900	1000
103	72	31		HF	-	-54 390	1000	-58 390	1080	1 410 560	1000		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
107	69	38	176	TM	+	-49 190	120	-52 810	130	1 415 770	120	4 200	100
106	70	36		YB		-53 390	70	-57 320	70	1 419 190	70	20	80
105	71	34		LU		-53 410	50	-57 340	60	1 418 430	60	1 017	20
104	72	32		HF		-54 430	50	-58 430	60	1 418 660	50		
107	70	37	177	YB	+	-50 850	90	-54 590	90	1 424 720	90	1 380	50
106	71	35		LU	+	-52 230	70	-56 070	80	1 425 320	70	497.0	2.0
105	72	33		HF		-52 720	70	-56 600	80	1 425 030	70	-1 166	6
104	73	31		TA	-	-51 560	70	-55 350	80	1 423 080	70		
108	70	38	178	YB	+	-49 020	1000	-52 630	1080	1 430 970	1000	1 000	1000
107	71	36		LU	+	-50 020	90	-53 700	90	1 431 180	90	2 250	50
106	72	34		HF		-52 270	70	-56 120	80	1 432 650	70	-1 910	100
105	73	32		TA	-	-50 360	120	-54 070	130	1 429 960	120		
108	71	37	179	LU	+	-48 930	90	-52 530	100	1 438 160	90	1 340	40
107	72	35		HF		-50 270	80	-53 970	90	1 438 720	80	- 115	5
106	73	33		TA	-	-50 150	80	-53 840	90	1 437 820	80		
109	71	38	180	LU	+	-46 230	140	-49 630	150	1 443 540	140	3 300	100
108	72	36		HF		-49 530	90	-53 180	100	1 446 050	90	- 670	100
107	73	34		TA	+N	-48 862	45	-52 456	48	1 444 602	47	503	36
106	74	32		W		-49 365	49	-53 000	50	1 444 320	50		
109	72	37	181	HF	+	-47 407	39	-50 895	42	1 452 001	42	1 023.0	4.0
108	73	35		TA		-48 430	39	-51 993	42	1 452 242	42	- 190	20
107	74	33		W	-	-48 240	44	-51 789	47	1 451 269	46		
110	72	38	182	HF	+	-45 920	200	-49 300	220	1 458 580	200	500	200
109	73	36		TA		-46 418	39	-49 833	42	1 458 301	41	1 738	8
108	74	34		W		-48 156	38	-51 699	41	1 459 257	41	-2 860	20
107	75	32		RE	-	-45 296	43	-48 628	47	1 455 614	46		
111	72	39	183	HF	+	-43 000	200	-46 170	220	1 463 740	200	2 200	200
110	73	37		TA	+	-45 204	40	-48 530	43	1 465 159	42	1 068	10
109	74	35		W		-46 272	38	-49 676	41	1 465 444	41	- 900	1000
108	75	33		RE	-	-45 400	1000	-48 740	1070	1 463 790	1000		
111	73	38	184	TA	+	-42 870	50	-46 020	50	1 470 900	50	2 750	30
110	74	36		W		-45 619	40	-48 975	43	1 472 863	42	-1 630	1000
109	75	34		RE	+	-43 990	1000	-47 220	1080	1 470 450	1000	0	1000
108	76	32		OS		-44 010	70	-47 250	70	1 469 690	70		
112	73	39	185	TA	+	-41 400	60	-44 440	70	1 477 490	70	1 900	50
111	74	37		W		-43 296	40	-46 481	43	1 478 611	43	428.6	2.0
110	75	35		RE		-43 725	40	-46 941	43	1 478 257	43	- 982.0	4.0
109	76	33		OS	-	-42 743	40	-45 887	43	1 476 493	43		
113	73	40	186	TA	+	-38 740	300	-41 590	330	1 482 910	300	3 700	300
112	74	38		W		-42 438	42	-45 560	45	1 485 824	44	- 540	60
111	75	36		RE		-41 900	70	-44 980	70	1 484 500	70	1 071.0	1.0
110	76	34		OS		-42 970	70	-46 130	70	1 484 790	70	-3 831	20
109	77	32		IR	-	-39 140	70	-42 010	80	1 480 170	70		
113	74	39	187	W		-39 827	42	-42 756	45	1 491 284	44	1 314	10
112	75	37		RE		-41 140	41	-44 167	44	1 491 815	44	1.20	0.10
111	76	35		OS		-41 141	41	-44 168	44	1 491 034	44	-1 600	1000
11.	77	33		IR	-	-39 530	1000	-42 440	1070	1 488 640	1000		
114	74	40	188	W	+	-38 362	45	-41 184	48	1 497 891	47	431	5
113	75	38		RE	+	-38 793	44	-41 647	47	1 497 540	47	2 116.0	2.0
112	76	36		OS		-40 909	44	-43 919	47	1 498 873	47	-2 832	10
111	77	34		IR		-38 077	45	-40 878	49	1 495 259	48	- 509	49
110	78	32		PT		-37 570	70	-40 330	70	1 493 970	70		
114	75	39	189	RE	+	-37 840	90	-40 630	90	1 504 660	90	1 000	20
113	76	37		OS		-38 840	80	-41 700	90	1 504 880	90	- 600	1000
112	77	35		IR	-	-38 270	1000	-41 090	1080	1 503 530	1000	-1 580	1000
111	78	33		PT	-	-36 690	1420	-39 390	1520	1 501 160	1420		
115	75	40	190	RE	+	-35 440	410	-38 040	440	1 510 330	410	3 100	400
114	76	38		OS		-38 540	70	-41 370	80	1 512 640	80	-2 050	150
113	77	36		IR	-	-36 490	170	-39 170	180	1 509 810	170	810	180
112	78	34		PT	-A	-37 300	70	-40 050	70	1 509 840	70	-4 400	1000
111	79	32		AU	-	-32 870	1000	-35 290	1080	1 504 630	1000		
115	76	39	191	OS	+	-36 360	60	-39 030	60	1 518 530	60	310.0	3.0
114	77	37		IR		-36 670	60	-39 360	60	1 518 060	60	- 800	1000
113	78	35		PT	-	-35 910	1000	-38 550	1080	1 516 520	1000	-1 950	1000
112	79	33		AU	-	-33 960	1420	-36 450	1520	1 513 790	1420		
116	76	40	192	OS		-35 910	50	-38 550	60	1 526 160	60	-1 170	80
115	77	38		IR		-34 740	60	-37 300	60	1 524 210	60	1 453	5
114	78	36		PT		-36 190	60	-38 850	60	1 524 880	60	-3 240	50
113	79	34		AU	-	-32 950	70	-35 380	80	1 520 860	80	-1 400	1000
112	80	32		HG	-	-31 520	1000	-33 840	1080	1 518 640	1000		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
117	76	41	193	OS	+	-33 322	33	-35 773	35	1 531 643	36	1 132	5
116	77	39		IR		-34 454	32	-36 988	35	1 531 993	36	-45	15
115	78	37		PT		-34 409	29	-36 940	31	1 531 165	33	-1 100	1000
114	79	35		AU	-	-33 310	1000	-35 760	1070	1 529 280	1000	-2 340	30
113	80	33		HG	-	-30 970	1000	-33 250	1070	1 526 160	1000		
118	76	42	194	OS	+	-32 388	23	-34 771	25	1 538 781	28	97.0	2.0
117	77	40		IR	+	-32 485	23	-34 875	25	1 538 096	28	2 236	10
116	78	38		PT		-34 721	21	-37 275	23	1 539 549	26	-2 509	15
115	79	36		AU	-	-32 212	26	-34 582	28	1 536 258	30	- 400	1000
114	80	34		HG	-	-31 860	1000	-34 210	1070	1 535 130	1000	-5 400	1000
113	81	32		TL	-	-26 480	1410	-28 430	1520	1 528 960	1410		
119	76	43	195	OS	+	-29 800	500	-32 000	500	1 544 200	500	2 000	500
118	77	41		IR	+	-31 780	100	-34 110	110	1 545 460	100	1 000	100
117	78	39		PT		-32 776	17	-35 187	18	1 545 675	23	- 221.0	2.0
116	79	37		AU	-	-32 555	17	-34 949	19	1 544 672	23	-1 500	1000
115	80	35		HG	-	-31 090	1000	-33 380	1070	1 542 430	1000	-3 000	150
114	81	33		TL	-	-28 090	1010	-30 160	1090	1 538 650	1010		
119	77	42	196	IR	+	-29 570	1000	-31 750	1070	1 551 330	1000	3 100	1000
118	78	40		PT		-32 633	14	-35 033	15	1 553 604	21	-1 479	9
117	79	38		AU		-31 154	13	-33 445	14	1 551 342	20	684.2	4.0
116	80	36		HG		-31 838	13	-34 180	14	1 551 244	20	-4 600	150
115	81	34		TL	-	-27 240	150	-29 240	160	1 545 860	150	-2 800	1000
114	82	32		PB	-	-24 410	1010	-26 200	1090	1 542 250	1010		
120	77	43	197	IR	+	-28 420	200	-30 510	220	1 558 240	200	2 000	200
119	78	41		PT		-30 415	12	-32 653	13	1 559 458	20	751	9
118	79	39		AU		-31 166	9	-33 459	10	1 559 426	18	- 763	40
117	80	37		HG	-	-30 403	41	-32 640	44	1 557 881	44	-2 200	150
116	81	35		TL	-	-28 200	160	-30 280	170	1 554 900	160	-4 100	1000
115	82	33		PB	-	-24 130	1010	-25 910	1090	1 550 050	1010		
121	77	44	198	IR	+	-25 510	300	-27 380	320	1 563 400	300	4 400	300
120	78	42		PT		-29 905	22	-32 105	23	1 567 019	27	- 313	21
119	79	40		AU		-29 592	6	-31 769	7	1 565 923	17	1 374.1	1.0
118	80	38		HG		-30 966	6	-33 244	7	1 566 515	17	-3 460	80
117	81	36		TL	-	-27 510	80	-29 530	90	1 562 270	80	-1 800	1000
116	82	34		PB	-	-25 700	1000	-27 590	1080	1 559 680	1000	-7 400	1000
115	83	32		BI	-	-18 290	1420	-19 630	1520	1 551 490	1420		
121	78	43	199	PT		-27 484	27	-29 420	29	1 572 589	31	1 683	27
120	79	41		AU		-29 088	12	-31 227	13	1 573 490	20	460	10
119	80	39		HG		-29 547	7	-31 721	7	1 573 168	17	-1 100	300
118	81	37		TL	-	-28 450	300	-30 540	320	1 571 290	300	-3 200	1000
117	82	35		PB	-	-25 280	1040	-27 140	1120	1 567 330	1040	-5 200	1450
116	83	33		BI	-A	-20 080	1010	-21 560	1090	1 561 350	1010		
122	78	44	200	PT	+	-26 610	1000	-28 570	1080	1 579 870	1000	700	1000
121	79	42		AU	+	-27 290	90	-29 300	100	1 579 770	90	2 210	90
120	80	40		HG		-29 503	6	-31 673	6	1 581 194	17	-2 454.0	4.0
119	81	38		TL	-	-27 049	7	-29 038	8	1 577 958	17	- 900	1000
118	82	36		PB	-	-26 110	1000	-28 030	1070	1 576 240	1000	-6 490	1000
117	83	34		BI	-	-19 620	1410	-21 060	1520	1 568 960	1410	-3 620	1740
116	84	32		PO	-A	-16 000	1010	-17 180	1090	1 564 570	1010		
123	78	45	201	PT	+	-23 500	110	-25 230	120	1 584 830	110	2 660	50
122	79	43		AU	+	-26 160	100	-28 080	110	1 586 700	100	1 500	100
121	80	41		HG		-27 658	7	-29 692	7	1 587 421	17	- 410	60
120	81	39		TL	-	-27 250	60	-29 250	60	1 586 230	60	-2 000	1000
119	82	37		PB	-	-25 280	1000	-27 140	1080	1 583 480	1000	-4 200	1000
118	83	35		BI	-	-21 080	1420	-22 630	1520	1 578 490	1420	-5 260	1740
117	84	33		PO	-A	-15 820	1010	-16 980	1090	1 572 450	1010		
123	79	44	202	AU	+	-24 110	1000	-25 880	1070	1 592 720	1000	3 200	1000
122	80	42		HG		-27 346	6	-29 358	7	1 595 181	17	-1 218	22
121	81	40		TL	-	-26 128	23	-28 050	25	1 593 180	28	-50	30
120	82	38		PB	-	-26 078	38	-27 997	40	1 592 348	41	-5 500	1000
119	83	36		BI	-	-20 610	1000	-22 120	1070	1 586 100	1000	-3 030	1420
118	84	34		PO	-A	-17 580	1000	-18 870	1080	1 582 280	1000	-8 070	1000
117	85	32		AT	-A	-9 530	1420	-10 200	1520	1 573 420	1420		
124	79	45	203	AU	+	-23 160	1000	-24 870	1070	1 599 850	1000	2 100	1000
123	80	43		HG	+	-25 262	7	-27 120	8	1 601 168	18	491.0	1.0
122	81	41		TL		-25 753	7	-27 647	8	1 600 876	18	- 816	10
121	82	39		PB		-24 936	12	-26 771	13	1 599 278	20	-3 190	50
120	83	37		BI	-	-21 750	50	-23 350	60	1 595 310	50	-4 480	1050
119	84	35		PO	-A	-17 260	1040	-18 530	1120	1 590 040	1040	-5 820	1460
118	85	33		AT	-A	-11 440	1010	-12 290	1090	1 583 440	1010		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
124	80	44	204	HG		-24 689	6	-26 505	7	1 608 666	17	- 345	7
123	81	42		TL		-24 344	8	-26 135	8	1 607 539	18	764.9	2.0
122	82	40		PB		-25 109	8	-26 956	8	1 607 522	18	-4 400	1000
121	83	38		BI	-	-20 670	1000	-22 190	1070	1 602 300	1000	-2 470	1410
120	84	36		PO	-A	-18 200	1000	-19 540	1070	1 599 050	1000	-7 080	1000
119	85	34		AT	-A	-11 120	1410	-11 940	1520	1 591 190	1410	-3 950	1740
118	86	32		RN	-A	-7 170	1010	-7 700	1090	1 586 450	1010		
125	80	45	205	HG	+	-22 160	100	-23 790	110	1 614 210	100	1 650	100
124	81	43		TL		-23 807	8	-25 558	8	1 615 073	18	-35	8
123	82	41		PB		-23 772	9	-25 520	9	1 614 256	18	-2 704	8
122	83	39		BI	-	-21 068	12	-22 618	13	1 610 769	20	-3 550	1000
121	84	37		PO	-A	-17 510	1000	-18 800	1080	1 606 430	1000	-4 880	1000
120	85	35		AT	-A	-12 630	1420	-13 560	1520	1 600 770	1420	-5 700	2010
119	86	33		RN	-A	-6 930	1420	-7 440	1530	1 594 290	1420		
126	80	46	206	HG	+A	-20 946	21	-22 487	23	1 621 067	27	1 312	21
125	81	44		TL		-22 259	8	-23 896	8	1 621 597	18	1 523.8	4.8
124	82	42		PB		-23 783	6	-25 532	7	1 622 338	17	-3 652	26
123	83	40		BI		-20 131	26	-21 611	28	1 617 904	31	-1 803	46
122	84	38		PO	-A	-18 328	39	-19 676	41	1 615 318	42	-6 020	1000
121	85	36		AT	-A	-12 300	1000	-13 210	1070	1 608 510	1000	-3 530	1420
120	86	34		RN	-A	-8 770	1000	-9 420	1080	1 604 200	1000	-8 620	1000
119	87	32		FR	-A	- 150	1420	- 160	1520	1 594 790	1420		
126	81	45	207	TL		-21 005	10	-22 550	11	1 628 414	19	1 441	8
125	82	43		PB		-22 446	7	-24 097	7	1 629 073	18	-2 361.0	2.0
124	83	41		BI		-20 085	7	-21 562	8	1 625 929	18	-2 906	8
123	84	39		PO		-17 178	10	-18 442	11	1 622 240	19	-3 730	50
122	85	37		AT	-A	-13 450	50	-14 440	60	1 617 730	50	-4 840	1050
121	86	35		RN	-A	-8 610	1050	-9 240	1120	1 612 100	1050	-6 500	1460
120	87	33		FR	-A	-2 110	1010	-2 270	1090	1 604 830	1010		
127	81	46	208	TL		-16 754	8	-17 987	9	1 632 235	18	4 995.1	4.4
126	82	44		PB		-21 750	7	-23 350	7	1 636 448	18	-2 869	7
125	83	42		BI	+N	-18 880	9	-20 269	9	1 632 796	19	-1 409	11
124	84	40		PO	-A	-17 472	11	-18 757	12	1 630 605	20	-5 000	1000
123	85	38		AT	-A	-12 470	1000	-13 390	1080	1 624 830	1000	-2 970	1420
122	86	36		RN	-A	-9 510	1000	-10 210	1070	1 621 080	1000	-7 590	1000
121	87	34		FR	-A	-1 910	1410	-2 050	1520	1 612 700	1410		
128	81	47	209	TL	+A	-13 697	35	-14 704	37	1 637 249	38	3 925	33
127	82	45		PB		-17 622	11	-18 918	11	1 640 391	20	641	8
126	83	43		BI		-18 262	7	-19 606	8	1 640 250	18	-1 892	11
125	84	41		PO	-A	-16 370	12	-17 574	13	1 637 575	20	-3 485	12
124	85	39		AT	-A	-12 885	13	-13 833	13	1 633 307	21	-3 960	1000
123	86	37		RN	-A	-8 930	1000	-9 580	1080	1 628 570	1000	-5 500	1000
122	87	35		FR	-A	-3 430	1420	-3 680	1520	1 622 280	1420		
129	81	48	210	TL		-9 264	27	-9 946	29	1 640 888	32	5 465	26
128	82	46		PB		-14 730	7	-15 813	7	1 645 571	18	61.0	1.0
127	83	44		BI		-14 791	7	-15 879	7	1 644 849	18	1 159.7	1.9
126	84	42		PO		-15 950	6	-17 124	7	1 645 227	18	-3 875	26
125	85	40		AT		-12 075	26	-12 964	28	1 640 569	31	-2 332	46
124	86	38		RN	-A	-9 743	39	-10 460	42	1 637 454	42	-6 550	1000
123	87	36		FR	-A	-3 200	1000	-3 430	1070	1 630 120	1000		
129	82	47	211	PB		-10 486	21	-11 258	22	1 649 399	27	1 344	19
128	83	45		BI		-11 830	10	-12 700	11	1 649 960	20	599	8
127	84	43		PO	-A	-12 429	7	-13 343	8	1 649 777	18	- 750.0	4.1
126	85	41		AT	-A	-11 679	8	-12 538	8	1 648 244	18	-2 891	9
125	86	39		RN	-A	-8 787	11	-9 434	11	1 644 570	20	-4 440	60
124	87	37		FR	-A	-4 350	60	-4 670	60	1 639 350	60	-5 230	1450
123	88	35		RA	-A	890	1450	950	1550	1 633 330	1450		
130	82	48	212	PB		-7 541	12	-8 095	13	1 654 525	21	583	10
129	83	46		BI		-8 124	8	-8 721	9	1 654 325	19	2 247.3	4.5
128	84	44		PO		-10 371	7	-11 134	7	1 655 790	18	-1 730	21
127	85	42		AT	-A	-8 641	22	-9 276	23	1 653 277	27	15	23
126	86	40		RN	-A	-8 656	12	-9 293	13	1 652 510	21	-5 150	1000
125	87	38		FR	-A	-3 510	1000	-3 770	1080	1 646 580	1000	-3 470	1420
124	88	36		RA	-A	-40	1000	-50	1070	1 642 330	1000		
131	82	49	213	PB	+	-3 450	1000	-3 710	1070	1 658 510	1000	1 800	1000
130	83	47		BI		-5 294	17	-5 683	19	1 659 567	24	1 390	10
129	84	45		PO		-6 683	15	-7 175	16	1 660 174	22	- 230	200
128	85	43		AT	-A	-6 460	200	-6 930	210	1 659 170	200	- 810	200
127	86	41		RN	-A	-5 652	23	-6 068	25	1 657 578	29	-2 098	25
126	87	39		FR	-A	-3 554	16	-3 816	17	1 654 698	23	-3 950	1000
125	88	37		RA	-A	390	1000	420	1080	1 649 970	1000	-6 180	1000
124	89	35		AC	-A	6 570	1420	7 050	1520	1 643 010	1420		

N	Z	N-Z	A	EL	C	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
132	82	50	214	PB		- 218	24	- 234	26	1 663 345	29	1 006	32
131	83	48		BI		-1 224	27	-1 314	29	1 663 568	32	3 246	26
130	84	46		PO		-4 470	7	-4 799	7	1 666 032	18	-1 060	50
129	85	44		AT	-A	-3 410	50	-3 660	50	1 664 190	50	900	1000
128	86	42		RN	-A	-4 310	1000	-4 620	1070	1 664 300	1000	-3 380	1000
127	87	40		FR	-A	- 930	33	- 999	36	1 660 145	37	- 930	60
126	88	38		RA	-A	-5	49	-10	50	1 658 440	50	-6 620	1000
125	89	36		AC	-A	6 610	1000	7 100	1080	1 651 040	1000		
132	83	49	215	BI	+A	1 700	100	1 830	100	1 668 710	100	2 240	90
131	84	47		PO		- 537	21	- 577	22	1 670 171	27	708	28
130	85	45		AT	-A	-1 245	23	-1 337	24	1 670 096	28	-20	100
129	86	43		RN	-A	-1 220	100	-1 310	110	1 669 290	100	-1 560	100
128	87	41		FR	-A	332	31	356	33	1 666 954	35	-2 197	37
127	88	39		RA	-A	2 529	23	2 715	24	1 663 974	28		
133	83	50	216	BI	+	5 900	1000	6 330	1070	1 672 590	1000	4 100	1000
132	84	48		PO		1 790	12	1 922	13	1 675 915	21	- 456	32
131	85	46		AT	-A	2 246	31	2 411	33	1 674 676	35	1 992	32
130	86	44		RN	-A	254	12	272	13	1 675 886	21	-2 830	1000
129	87	42		FR	-A	3 080	1000	3 310	1070	1 672 270	1000	- 170	1000
128	88	40		RA	-A	3 251	32	3 490	35	1 671 324	37		
133	84	49	217	PO	-A	5 640	1000	6 060	1070	1 680 140	1000	1 310	1000
132	85	47		AT		4 329	18	4 648	19	1 680 664	25	700	32
131	86	45		RN	-A	3 629	33	3 896	36	1 680 582	37	- 800	280
130	87	43		FR	-A	4 430	280	4 750	300	1 679 000	280	-1 520	290
129	88	41		RA	-A	5 949	38	6 386	41	1 676 698	42		
134	84	50	218	PO		8 318	24	8 930	26	1 685 530	30	301	32
133	85	48		AT	-A	8 017	27	8 607	29	1 685 048	32	2 798	28
132	86	46		RN	-A	5 219	12	5 603	13	1 687 064	21	-1 800	70
131	87	44		FR	-A	7 020	70	7 540	80	1 684 480	70	340	1420
130	88	42		RA	-A	6 680	1410	7 170	1520	1 684 040	1410		
134	85	49	219	AT	+A	10 520	80	11 290	90	1 690 620	80	1 690	80
133	86	47		RN		8 832	21	9 481	22	1 691 523	27	209	34
132	87	45		FR	-A	8 622	30	9 257	32	1 690 950	35	- 740	140
131	88	43		RA	-A	9 360	140	10 050	150	1 689 430	140		
135	85	50	220	AT	+	14 320	1000	15 370	1070	1 694 890	1000	3 700	1000
134	86	48		RN		10 620	13	11 401	14	1 697 806	22	- 872	44
133	87	46		FR	-A	11 492	43	12 337	46	1 696 151	47	1 218	45
132	88	44		RA	-A	10 274	16	11 029	17	1 696 587	23		
135	86	49	221	RN	-A	14 190	1410	15 230	1520	1 702 310	1410	970	1410
134	87	47		FR		13 211	18	14 183	19	1 702 504	25	271	33
133	88	45		RA	-A	12 940	35	13 892	37	1 701 992	39	-1 660	300
132	89	43		AC	-A	14 600	300	15 680	320	1 699 550	300		
136	86	50	222	RN		16 329	24	17 531	26	1 708 239	30	-90	1000
135	87	48		FR	-A	16 420	1000	17 630	1070	1 707 360	1000	2 100	1000
134	88	46		RA	-A	14 322	16	15 376	17	1 708 681	24	-2 220	90
133	89	44		AC	-A	16 540	90	17 760	90	1 705 680	90		
136	87	49	223	FR	+A	18 383	21	19 736	22	1 713 474	27	1 150.3	3.7
135	88	47		RA		17 233	21	18 501	22	1 713 842	27	- 599	35
134	89	45		AC	-A	17 832	31	19 144	33	1 712 461	35	-1 650	180
133	90	43		TH	-A	19 490	170	20 920	190	1 710 020	170		
137	87	50	224	FR	+	21 970	1000	23 590	1070	1 717 960	1000	3 100	1000
136	88	48		RA		18 832	13	20 218	14	1 720 314	22	-1 370	50
135	89	46		AC	-A	20 200	50	21 690	60	1 718 160	60	200	50
134	90	44		TH	-A	20 005	19	21 477	20	1 717 576	26		
137	88	49	225	RA		21 916	20	23 528	22	1 725 302	27	350	10
136	89	47		AC		21 566	18	23 153	19	1 724 869	25	- 721	35
135	90	45		TH	-A	22 288	36	23 927	39	1 723 365	40	-2 150	1040
134	91	43		PA	-A	24 440	1040	26 230	1120	1 720 430	1040		
138	88	50	226	RA		23 623	24	25 360	26	1 731 667	30	- 740	100
137	89	48		AC	+	24 370	100	26 160	110	1 730 140	100	1 170	100
136	90	46		TH	-A	23 195	19	24 901	20	1 730 529	26	-2 710	100
135	91	44		PA	-A	25 990	100	27 810	110	1 727 040	100		
139	88	51	227	RA	+	27 161	29	29 159	31	1 736 200	34	1 310	20
138	89	49		AC		25 851	21	27 753	22	1 736 727	27	43.9	2.6
137	90	47		TH		25 807	21	27 706	22	1 735 989	27	-1 030	35
136	91	45		PA	-A	26 837	31	28 811	33	1 734 177	36		
140	88	52	228	RA		29 005	20	31 139	21	1 742 427	27	55.3	3.0
139	89	50		AC		28 950	20	31 080	21	1 741 700	27	2 170	17
138	90	48		TH		26 780	13	28 750	14	1 743 087	22	-2 100	50
137	91	46		PA	-A	28 880	50	31 010	60	1 740 200	60	- 350	60
136	92	44		U	-A	29 236	21	31 387	23	1 739 067	28		

N	Z	N-Z	A	EL	O	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
140	89	51	229	AC	+	30 550	1000	32 800	1070	1 748 170	1000	1 100	1000
139	90	49		TH		29 483	21	31 652	23	1 748 455	28	- 345	12
138	91	47		PA	-A	29 828	19	32 022	20	1 747 328	26	-1 358	37
137	92	45		U	-A	31 187	38	33 481	40	1 745 188	42		
141	89	52	230	AC	+	33 730	1000	36 210	1070	1 753 060	1000	2 900	1000
140	90	50		TH		30 820	23	33 087	25	1 755 190	30	-1 254	29
139	91	48		PA	+	32 074	19	34 433	21	1 753 154	27	462.0	2.0
138	92	46		U	-A	31 612	19	33 937	21	1 752 834	26	-3 490	1010
137	93	44		NP	-A	35 100	1010	37 680	1080	1 748 560	1010		
142	89	53	231	AC	+	35 900	100	38 550	110	1 758 960	100	2 100	100
141	90	51		TH		33 804	21	36 291	22	1 760 277	28	385.7	3.0
140	91	49		PA		33 419	21	35 877	22	1 759 881	28	- 360	50
139	92	47		U	-A	33 780	50	36 270	60	1 758 730	60	-1 880	80
138	93	45		NP	-A	35 660	60	38 280	60	1 756 070	60		
142	90	52	232	TH		35 512	20	38 124	21	1 766 641	27	- 454	27
141	91	50		PA	+	35 966	24	38 612	26	1 765 405	30	1 345	20
140	92	48		U	-A	34 621	13	37 168	14	1 765 967	23	-2 510	1000
139	93	46		NP	-A	37 130	1000	39 860	1080	1 762 680	1000	-1 230	1000
138	94	44		PU	-A	38 360	50	41 180	60	1 760 660	60		
143	90	53	233	TH	+	38 628	21	41 469	23	1 771 597	28	1 245.0	3.0
142	91	51		PA		37 383	21	40 132	23	1 772 060	28	569.0	3.0
141	92	49		U		36 814	21	39 522	23	1 771 846	28	-1 070	50
140	93	47		NP	-A	37 880	50	40 670	60	1 769 990	60	-2 140	70
139	94	45		PU	-A	40 027	43	42 972	46	1 767 068	46		
144	90	54	234	TH		40 596	22	43 583	23	1 777 700	29	265	18
143	91	52		PA	+	40 332	28	43 298	30	1 777 182	33	2 230	15
142	92	50		U		38 102	23	40 904	25	1 778 630	30	-1 820	100
141	93	48		NP	-	39 920	100	42 860	110	1 776 030	100	- 430	100
140	94	46		PU	-A	40 347	22	43 315	23	1 774 820	29		
144	91	53	235	PA	+	42 310	100	45 420	110	1 783 280	100	1 400	100
143	92	51		U		40 906	21	43 915	22	1 783 897	28	- 125	7
142	93	49		NP		41 031	21	44 049	23	1 782 989	28	-1 130	50
141	94	47		PU	-A	42 160	60	45 270	60	1 781 070	60		
145	91	54	236	PA	+	45 860	100	49 230	110	1 787 800	100	3 350	100
144	92	52		U		42 510	20	45 637	21	1 790 364	27	- 919	20
143	93	50		NP	+	43 429	16	46 624	17	1 788 663	24	515	7
142	94	48		PU	-A	42 914	14	46 071	15	1 788 395	23	-2 900	1000
141	95	46		AM	-	45 790	1000	49 160	1070	1 784 730	1000		
146	91	55	237	PA	+	47 580	50	51 080	60	1 794 150	60	2 300	50
145	92	53		U		45 277	22	48 608	23	1 795 668	29	513.9	3.0
144	93	51		NP		44 763	21	48 056	23	1 795 400	29	- 226	19
143	94	49		PU		44 989	28	48 298	30	1 794 392	34	-1 440	70
142	95	47		AM	-A	46 430	70	49 840	80	1 792 170	80		
146	92	54	238	U		47 291	21	50 770	23	1 801 726	29	- 117	15
145	93	52		NP	+	47 408	25	50 896	27	1 800 826	32	1 290	10
144	94	50		PU	-A	46 118	23	49 511	25	1 801 334	30	-2 260	1000
143	95	48		AM	-A	48 380	1010	51 940	1080	1 798 290	1010	-1 030	1010
142	96	46		CM	-A	49 401	37	53 036	40	1 796 486	42		
147	92	55	239	U		50 579	22	54 300	23	1 806 510	29	1 282	10
146	93	53		NP		49 297	21	52 924	22	1 807 009	28	723.8	3.0
145	94	51		PU		48 573	21	52 146	22	1 806 950	28	- 810	21
144	95	49		AM	-A	49 383	29	53 016	31	1 805 358	35	-1 730	1000
143	96	47		CM	-A	51 120	1000	54 880	1080	1 802 840	1000		
148	92	56	240	U		52 716	25	56 594	27	1 812 455	32	480	60
147	93	54		NP	+	52 240	60	56 080	70	1 812 150	70	2 050	60
146	94	52		PU		50 190	20	53 882	21	1 813 416	28	-1 300	1000
145	95	50		AM	-	51 490	1000	55 280	1070	1 811 330	1000	- 250	1000
144	96	48		CM	-A	51 739	17	55 545	18	1 810 302	26		
148	93	55	241	NP	+	54 210	100	58 200	110	1 818 250	100	1 360	100
147	94	53		PU		52 849	21	56 737	22	1 818 829	28	20.80	0.20
146	95	51		AM		52 828	21	56 714	22	1 818 067	28	- 771	20
145	96	49		CM	-A	53 599	29	57 542	31	1 816 514	35	-2 400	1000
144	97	47		BK	-	55 980	1000	60 100	1070	1 813 350	1000		
149	93	56	242	NP	+	57 600	1000	61 840	1070	1 822 930	1000	2 900	1000
148	94	54		PU	-A	54 701	23	58 725	24	1 825 048	30	- 724	14
147	95	52		AM		55 425	25	59 502	27	1 823 542	31	665	8
146	96	50		CM		54 760	24	58 788	25	1 823 424	30	-2 800	1000
145	97	48		BK	-	57 568	1000	61 790	1070	1 819 840	1000		
149	94	55	243	PU	+	57 725	37	61 972	40	1 830 095	42	564	30
148	95	53		AM	-A	57 162	22	61 367	23	1 829 876	29	-4	8
147	96	51		CM	-A	57 165	20	61 370	22	1 829 090	28	-1 485	23
146	97	49		BK	-A	58 651	31	62 965	33	1 826 822	36	-2 180	1000
145	98	47		CF	-	60 830	1000	65 310	1070	1 823 860	1000		

N	Z	N-Z	A	EL	D	MASS EXCESS (KEV)		MASS EXCESS (MICRO-U)		BINDING ENERGY (KEV)		BETA-DECAY ENERGY (KEV)	
150	94	56	244	PU	+	59 710	1000	64 100	1070	1 836 190	1000	- 200	1000
149	95	54		AM	+	59 946	20	64 355	22	1 835 164	28	1 429.0	2.0
148	96	52		CM	-A	58 517	20	62 821	21	1 835 810	28	-2 190	1000
147	97	50		BK	-A	60 700	1000	65 170	1070	1 832 840	1000	- 750	1000
146	98	48		CF	-A	61 449	26	65 969	28	1 831 313	33		
151	94	57	245	PU	+	63 180	1000	67 830	1070	1 840 780	1000	1 480	1000
150	95	55		AM		61 794	22	66 340	23	1 841 387	29	902.7	4.8
149	96	53		CM		60 892	21	65 371	23	1 841 507	29	- 839	21
148	97	51		BK	-A	61 731	29	66 272	31	1 839 885	35	-1 521	35
147	98	49		CF	-A	63 252	35	67 905	38	1 837 582	40	-2 940	1000
146	99	47		ES	-A	66 190	1000	71 060	1080	1 833 860	1000		
152	94	58	246	PU	+	65 290	60	70 090	70	1 846 750	70	400	30
151	95	56		AM	+	64 890	60	69 660	60	1 846 370	60	2 290	50
150	96	54		CM	-A	62 598	23	67 202	25	1 847 872	30	-1 460	1000
149	97	52		BK	-A	64 060	1000	68 770	1070	1 845 630	1000	10	1000
148	98	50		CF	-A	64 054	26	68 766	28	1 844 851	32	-3 410	1000
147	99	48		ES	-A	67 460	1000	72 430	1080	1 840 668	1000		
152	95	57	247	AM	+	67 150	1410	72 090	1520	1 852 170	1410	1 760	1000
151	96	55		CM	-A	65 460	1000	70 280	1070	1 853 080	1000	20	1000
150	97	53		BK	-A	65 440	50	70 260	60	1 852 320	60	- 760	1000
149	98	51		CF	-A	66 200	1000	71 070	1070	1 850 780	1000	-2 340	1410
148	99	49		ES	-A	68 540	1000	73 580	1070	1 847 660	1000		
152	96	56	248	CM	-A	67 270	1000	72 220	1070	1 859 340	1000	- 690	1000
151	97	54		BK	+	67 960	60	72 960	70	1 857 870	60	650	50
150	98	52		CF	-A	67 310	36	72 262	39	1 857 738	41	-2 810	1000
149	99	50		ES	-A	70 120	1000	75 280	1070	1 854 150	1000	-1 690	1000
148	100	48		FM	-A	71 809	33	77 092	35	1 851 674	38		
153	96	57	249	CM	+	70 610	100	75 810	110	1 864 070	100	860	100
152	97	55		BK		69 752	23	74 883	24	1 864 150	30	125.4	2.0
151	98	53		CF		69 627	23	74 749	24	1 863 493	30	-1 486	37
150	99	51		ES	-A	71 033	41	76 258	45	1 861 304	46	-2 680	300
149	100	49		FM	-A	73 720	300	79 140	320	1 857 840	300		
153	97	56	250	BK	+	72 910	60	78 270	60	1 869 060	60	1 760	50
152	98	54		CF	-A	71 150	24	76 384	26	1 870 041	31	-2 070	1410
151	99	52		ES	-A	73 220	1410	78 610	1520	1 867 180	1410	- 810	1420
150	100	50		FM	-A	74 040	60	79 490	60	1 865 590	60		
154	97	57	251	BK	+	75 270	1410	80 810	1520	1 874 780	1410	1 440	1000
153	98	55		CF	-A	73 830	1000	79 260	1070	1 875 430	1000	- 630	1000
152	99	53		ES	-A	74 460	60	79 930	70	1 874 020	70	-1 170	1000
151	100	51		FM	-A	75 620	1000	81 190	1080	1 872 070	1000	-3 200	1730
150	101	49		MD	-A	78 820	1410	84 620	1520	1 868 090	1410		
154	98	56	252	CF	-A	75 910	1000	81 500	1070	1 881 420	1000	-1 230	1000
153	99	54		ES	-A	77 140	70	82 810	70	1 879 410	70	230	60
152	100	52		FM	-A	76 905	41	82 562	44	1 878 864	46	-3 320	1410
151	101	50		MD	-A	80 220	1410	86 120	1520	1 874 760	1410		
155	98	57	253	CF	+	79 190	60	85 020	60	1 886 210	60	270	50
154	99	55		ES	-A	78 924	23	84 730	25	1 885 699	31	- 187	40
153	100	53		FM	-A	79 110	46	84 930	49	1 884 738	50	-1 880	1000
152	101	51		MD	-A	80 990	1000	86 940	1070	1 882 070	1000	-4 090	1050
151	102	49		XX	-A	85 080	320	91 340	340	1 877 190	320		
155	99	56	254	ES	-A	81 870	60	87 900	60	1 890 820	60	980	50
154	100	54		FM	-A	80 889	24	86 839	26	1 891 023	32	-2 450	1730
153	101	52		MD	-A	83 340	1730	89 470	1860	1 887 790	1730	-1 550	1760
152	102	50		XX	-A	84 890	310	91 140	330	1 885 458	310		
155	100	55	255	FM	-A	83 500	1000	89 640	1070	1 896 490	1000	- 850	1000
154	101	53		MD	-A	84 340	80	90 550	90	1 894 860	80	-2 040	1510
153	102	51		XX	-A	86 380	1000	92 730	1080	1 892 040	1000		
154	103	51	257	LW	-A	92 160	1000	98 940	1070	1 901 620	1000		

63AB/A Abdumalikova et al., Phys. Letters 5 (1963) 359
64AB/A Abdumalikova et al., Akad. Nauk SSSR (1964)
64AG/A Ageev et al., Akad. Nauk SSSR (1964)
63AL/A Alburger, Phys. Rev. 132 (1963) 328
59AN/A Antonova et al., Zh. Eksperim. i Teor. Fiz. 37 (1959) 667
62AR/A Argan et al., Phys. Rev. Letters 9 (1962) 405
61AS/A Asaro and Perlman, UCRL-9524 (1961)
64AS/A Asaro et al., Phys. Rev. 133 (1964) B291
62BA/A Bartis, Phys. Rev. 132 (1963) 1763
62BA/B Bashkova et al., Zh. Eksperim. i Teor. Fiz. 42 (1962) 416
62BA/D Basu and Patro, Nucl. Phys. 33 (1962) 347
63BA/A Basu and Patro, Nucl. Phys. 46 (1963) 59
63BA/E Badalov et al., Zh. Eksperim. i Teor. Fiz. 44 (1963) 35
64BA/A Basina, Akad. Nauk SSSR (1964) 53
64BA/C Bakhru and Mukherjee, Nucl. Phys. 52 (1964) 125
50BE/A Bell and Cassidy, Phys. Rev. 77 (1950) 301
57BE/A Bernstein and Lewis, Phys. Rev. 107 (1957) 737
64BE/A Bertelsen et al., Nucl. Phys. 50 (1964) 657
63BH/A Bhat and Pool, Phys. Rev. 127 (1962) 1704
63BI/A Bisgard et al., Nucl. Phys. 41 (1963) 21
64BI/A Birukov, Akad. Nauk SSSR (1964)
64BJ/A Bjerregaard et al., Nucl. Phys. 51 (1964) 641
53BL/A Bleuler et al., Phys. Rev. 90 (1953) 460
62BL/A Blok et al., Physica 28 (1962) 993
60BO/A Bondelid et al., Phys. Rev. 120 (1960) 887
61BO/A Bolotin and Schwarzschild, Phys. Rev. 124 (1961) 213
63BO/A Born et al., Physica 29 (1963) 277
63BO/B Bondelid, personal communication
59BR Bromley et al., Can. J. Phys. 37 (1959) 1514
61BU/A Butler and Bondelid, Phys. Rev. Letters 6 (1961) 81
61BU/A Burson and Helmer, Phys. Rev. 123 (1961) 978
63CA/A Carlson, Phys. Rev. 132 (1963) 2239
60CH/A Chukhladze et al., Zh. Eksperim. i Teor. Fiz. 11 (1960) 974
63CH/A Chilosi and Wapstra, personal communication
64CH/A Chromov et al., Akad. Nauk SSSR (1964)
64CO/A Cohen et al., personal communication
63CR/A Crasemann et al., Phys. Rev. 132 (1963) 1681
63DA/A Daniels and Hoffman, Bull. Am. Phys. Soc. 8 (1963) 482
63DA/B Da Silva and Gordon, personal communication
63DO/A Dostrovsky et al., Phys. Rev. 132 (1963) 2600
58DU/A Dunning et al., Phys. Rev. 110 (1958) 1076
64DU/A Dubois and Maripuu, Phys. Letters 8 (1964) 349
62DZ/A Dzhelepov et al., Nucl. Phys. 30 (1962) 126
63DZ/A Dzelepov et al., Akad. Nauk SSSR (1963) Decay scheme
64ER/A Erskine, Bull. Am. Phys. Soc. 9 (1964) 80
64ER/A Erkine, personal communication
61EV/A Everling et al., Nucl. Phys. 25 (1961) 177
61EV/B Everling et al., Nucl. Phys. 25 (1961) 177
61EV/C Everling et al., Nucl. Phys. 25 (1961) 177
62EW/A Ewan et al., Nucl. Phys. 29 (1962) 153
62FI/A Fiebiger, Bull. Am. Phys. Soc. 7 (1962) 11
60FL/A Flerov et al., Zh. Eksperim. i Teor. Fiz. 38 (1960) 82
63FR/A Frick et al., Phys. Rev. 132 (1963) 2169
63FR/B Freeman et al., Conf. Vienna 1963
64FR/A Freeman et al., Phys. Letters 8 (1964) 123
64FR/B Freeman et al., personal communication
61GH/A Ghiorso et al., Phys. Rev. Letters 6 (1961) 473
61GH/B Ghiorso et al., Phys. Rev. Letters 6 (1961) 473
60GL/A Glass et al., J. Inorg. Nucl. Chem. 13 (1960) 181
63GL/A Glass and Peterson, Phys. Rev. 130 (1963) 292
60GO/A Goetze, Z. Physik 158 (1960) 347
62GO/A Gove and Okelley, Bull. Am. Phys. Soc. 7 (1962) 352

63GO/A Gopinathan et al., Nuovo Cimento 30 (1963) 14
64GO/A Gopinathan and Joshi, Phys. Rev. 134 (1964) B297
61GR/A Groshev, personal communication, Copenhagen discussions 196
62GR/A Griffioen and MacFarlane, Bull. Am. Phys. Soc. 7 (1962) 541, UCRL-10023
63GR/A Groshev et al., Nucl. Phys. 43 (1963) 669
63GR/B Groshev et al., personal communication
63GR/C Griffioen and MacFarlane, Phys. Rev. 133 (1964) B1504
64GR/A Groshev et al., Akad. Nauk SSSR (1964)
64GR/B Gromov et al., personal communication
61GU/A Guttmann et al., Bull. Am. Phys. Soc. 6 (1961) 429
64HA/A Hamilton et al., personal communication
61HO/A Holm et al., Phys. Rev. 122 (1961) 1261
63HO/A Holm et al., Phys. Letters 6 (1963) 324
63HO/B Hoogenboom, personal communication
63HO/C Hoff et al., J. Inorg. Nucl. Chem. 25 (1963) 1303
63HO/D Hoot et al., Bull. Am. Phys. Soc. 8 (1963) 598
64HO/A Hovestadt and Armbruster, Bull. Am. Phys. Soc. 9 (1964) 180
64HO/A Hovestadt, Bull. Am. Phys. Soc. 9 (1964) 180
51HU/A Huizenga et al., Phys. Rev. 82 (1951) 561
64IS/A Isoya, Phys. Rev. 130 (1963) 234
62JA/A Janecke, Bull. Am. Phys. Soc 7 (1962) 302
63JA/A Janecke, Phys. Letters 6 (1963) 69
63JA/B Jasinski et al., Proc. Conf. Warshaw 1963
63JO/A Johnson, Nucl. Phys. 41 (1963) 167
63JO/B Joshi et al., Phys. Letters 4 (1963) 354
64JO/A Johnson et al., Bull. Am. Phys. Soc. 9 (1964) 485
60KA/A Karliamin, J. Nucl. Energy A13 (1960) 78
63KA/A Karras and Kantele, Phys. Letters 6 (1963) 98
64KA/A Kavanagh, Phys. Rev. 133 (1964) B1502
59KE/A Ketelle and Brosi, Phys Rev 116 (1959) 98
64KE/A Kenefick and Sheline, Phys. Rev. 133 (1964) B25
63KI/A Kienle et al , Z. Physik 176 (1963) 226
60KN/A Knowles, Proc. Conf. Kingston (1960) 576
62KN/A Knowles, Can. J. Phys 40 (1962) 257
63KN/A Knoll et al., Phys. Rev 131 (1963) 331
59KO/A Kolesnikov and Krylova, Zh. Eksperim. i Teor Fiz. 37 (1959) 550
60KO/A Komar et al., Zh. Eksperim. i Teor. Fiz 11 (1960) 1038
61KO/A Kuroyanagi et al., J. Phys. Soc. Japan 16 (1961) 2363
63KR/A Van Krugten et al., personal communication
64KU/A Kuroyanagi, Nucl. Phys. 50 (1964) 417
64KU/B Kuroyanagi et al., Nucl. Phys. 50 (1964) 417
64KU/B Kuan and Risser, Bull Am Phys. Soc. 9 (1964) 67
60LA/A Langer and Smith, Phys. Rev. 119 (1960) 1308
63LA/A Langer et al., Phys. Rev. 132 (1963) 2616
63LE/A Lewin et al., personal communication
64LA/A Langer et al., Phys. Rev. 133 (1964) B1145
64LE/A Leutz and Ziegler, Nucl. Phys. 50 (1964) 648
60LU/A Luhrs and Mayer-Boricke, Z. Naturforsch. 15 (1960) 939
61MA/A MacFarlane and Kohman, Phys. Rev. 121 (1961) 1758
62MA/A Martin et al., Phys. Rev. 125 (1962) 942
63MA/A Marion, Conf. Vienna 1963
63MA/B MacFarlane, Bull. Am. Phys. Soc 8 (1963) 524
63MA/C MacFarlane and Griffioen, Phys. Rev. 131 (1963) 2176
64MA/A MacFarlane, personal communication
63ME/A Megli and Thwaites, Nucl Phys. 46 (1963) 233
63MI/A Middleton and Allen, Conf. Vienna 1963
63MI/B Miller et al , Bull. Am. Phys. Soc. 8 (1963) 599
63MI/C Miyano and Kuroyanagi, Nucl. Phys. 49 (1963) 315
64MI/A Middleton and Pullen, Nucl. Phys. 51 (1964) 50
63MO/A Montague et al., Bull. Am Phys. Soc. 8 (1963) 115
63MO/B Monaro et al., personal communication
64MO/A Moore et al., Bull. Am Phys. Soc. 9 (1964) 107

62NA/A Naumann et al., Bull. Am. Phys. Soc. 7 (1962) 34
62NE/A Nelson et al., Phys. Rev. 129 (1963) 1723
63NE/A Nefkens, Phys. Rev. Letters 10 (1963) 55
63NE/B Nefkens, Phys. Rev. Letters 10 (1963) 243
63NI/A Nielsen, personal communication
59NO/A Novikova et al., Zh. Eksperim. i Teor. Fiz. 37 (1959) 925
62NU/A Nurmia et al., Phys. Rev. 127 (1962) 943
63NU/A Nurmia, personal communication 1963
64OB/A Oberski et al., personal communication
63OK/A Okano and Nishimura, J. Phys. Soc Japan 18 (1963) 1563
64ON/A Onega, Bull. Am. Phys. Soc. 9 (1964) 18
64OR/A Orth, Bull. Am. Phys. Soc. 9 (1964) 498
62PA/A Patro and Basu, Phys. Rev. 127 (1962) 1260
63PA/A Pasternak and Sonnino, Nucl. Phys. 45 (1963) 336
64PA/A Parker et al., Bull. Am. Phys Soc. 9 (1964) 32
60PE/A Perelygin, Zh. Esperim. i Teor. Fiz. 37 (1959) 1558
63PE/A Persson, Phys. Letters 6 (1963) 347
58PH/A Phillips et al., Phys Rev. Letters 1 (1958) 215
63PH/A Phillips et al., Conf. Vienna 1963
59PO/A Porter, Phys. Rev. 115 (1959) 450
61PR/A Preston et al., Phys Rev. 121 (1961) 1741
64PR/A Preston et al., Can. J. Phys. 42 (1964) 321
55RA/A Rasmussen et al., Phys. Rev. 98 (1955) 1258, 89 (1953) 33
62RI/A Riehs and Warhanek, Nucl. Phys. 44 (1963) 164
63RI/A Riehs and Warhanek, Nucl. Phys. 44 (1963) 164
63RI/B Ries et al., Conf. Vienna 1963
61RU/A Ruiz, UCRL-9511 (1961)
61RY/A Rytz et al., HPA 34 (61) 819
63RY/A Rytz et al., Nucl. Phys. 43 (1963) 229
63RY/A Ryde et al., Arkiv Fysik 23 (1963) 209
63RY/B Ryde et al., Arkiv Fysik 23 (1963) 209
64SA/A Salgo, Nucl. Phys. 53 (1964) 457
62SC/A Schweizer and Richardson, Nucl Phys. 33 (1962) 47
63SC/A Schima et al., Phys. Rev. 132 (1963) 2650
64SC/A Schima et al., Bull Am. Phys. Soc 9 (1964) 297
61SE/A Seelmann-Eggebert et al , Chart of the nuclides (1961)
62SH/A Shelton and Sheline, Bull. Am. Phys. Soc. 7 (1962) 317
64SH/A Sheline et al., Phys. Letters 8 (1964) 121
64SI/A Siivola, Nucl. Phys. 52 (1964) 449
64SI/B Siivola, personal communication
60SK/A Skytte Jensen et al., Nucl. Phys. 19 (1960) 654
64SP/A Sperduto and Buechner, personal communication
60TA/A Takahashi and Morinaga, Nucl. Phys. 15 (1960) 664
63TH/A Thosar et al., Nucl. Phys. 41 (1963) 380
64TH/A Thorne et al., Bull. Am. Phys. Soc. 9 (1964) 107
55TI/A Titterton, Progr. Nucl. Phys. 4 (1955) 31
59VA/A Vandenbosch et al., Phys. Rev. 115 (1959) 115
62VA/A Vandenbosch and Day, Nucl. Phys. 30 (1962) 177
63VA/A Van Lieshout et al., personal communication
63VA/B Vandenbosch et al., Nucl. Phys. 41 (1963) 482
64VA/A Van der Leun and Mouton, Physica 30 (1964) 333
64VE/A Verheul et al., Physica 30 (1964) 877
63VI/A Vingiani and Enpt, personal communication
64VI/A Vingiani and Endt, personal communication
62WA/A Wapstra et al , personal communication
62WA/B Walen et al., Nucl. Phys. 35 (1962) 232
63WH/A Whaling and Fisher, Phys Rev. 133 (1964) B1502
64WI/A Williams and Naumann, Bull. Am Phys. Soc 9 (1964) 18
63WO/A Wolzak and Morinaga, Radiochim. Acta 1 (1963) 225
63WO/A Wortman and Langer, Phys. Rev. 131 (1963) 325
63YO/A Yoshizawa et al., Nucl Phys. 46 (1963) 78