UCRL·8289

Decay Schemes

D. STROMINGER
J. M. HOLLANDER

June 1958 · Berkeley, California

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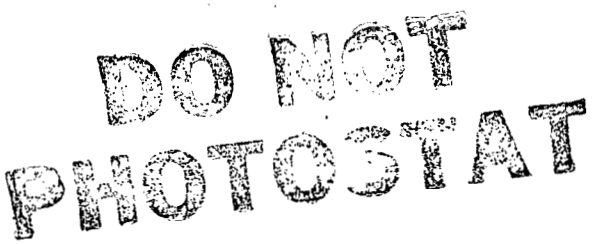

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DECAY SCHEMES

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The disintegration schemes presented here have been constructed from information contained in the Table of Isotopes, by Strominger, Hollander, and Seaborg, published as a supplement to the April, 1958, issue of the Reviews of Modern Physics.

They are arranged according to mass number so as to show more clearly than was possible in the Table of Isotopes the various isobaric and parent-daughter relationships encountered in alpha and beta decay. References to the original literature are not given here.

In these drawings, energies of excited states above the ground state are given in Mev to the right of the levels, and spin and parity assignments are indicated to the left. Directly measured spins are underlined, as 1/2+. If the spin is uniquely determined by other means, the quantum number is given without modification, as 3-. Probable spin values are indicated with parentheses, as (2+). This nomenclature does not apply to the parity assignments, which are heavily dependent upon theory.

The disintegration energy, or Q value, of a nuclear transformation is the mass difference (expressed in Mev) between the initial and final systems. For radioactive decay processes, Q equals the sum of the particle kinetic energy, nuclear recoil energy, and the energies of any gamma-transitions necessary to de-excite the final nucleus to its ground state. In β^+ decay the Q value is given as Q_{EC}, to avoid ambiguity associated with the addition of $2 m_o c^2$ to the positron energy. Alpha and beta disintegration energies are given as Q_α and Q_β respectively.

The percentage figures given in the drawings total 100 percent for the total decay of each nuclide. In some cases the symbol † is used to designate the relative branchings of one mode of decay to different final states of the daughter nucleus.

The half-lives of levels, when known, are given directly above the levels.

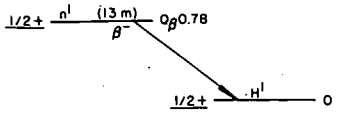
A double arrow drawn from the ground state to a higher level shows that

the higher level has been Coulomb excited.

We are indebted to Virginia Shirley and Eileen Doyle for their assistance in the preparation of the manuscript.

This work was performed under the auspices of the United States Atomic Energy Commission.

A=1



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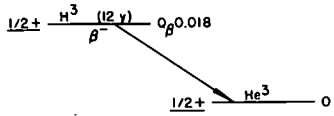

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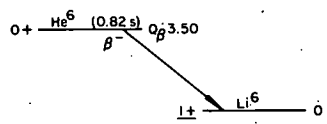

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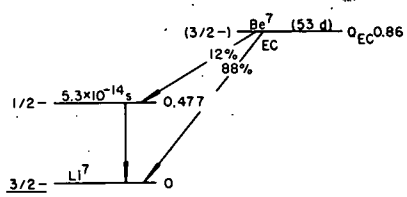

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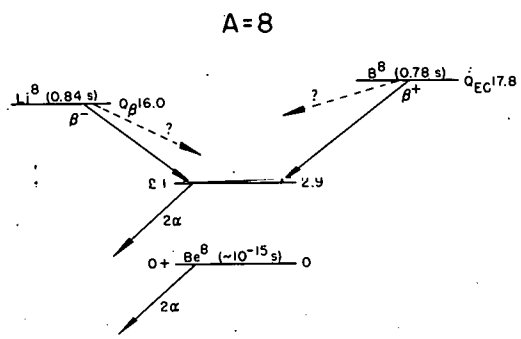

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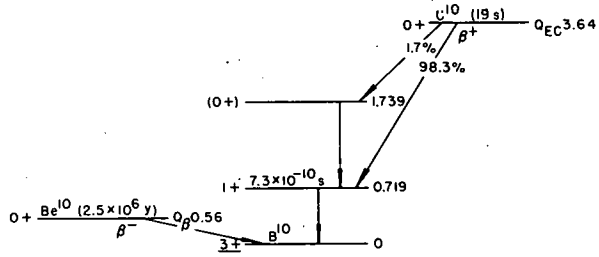

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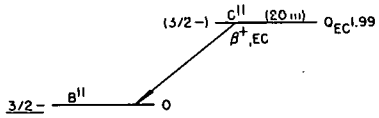

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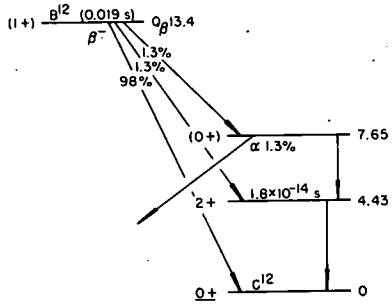

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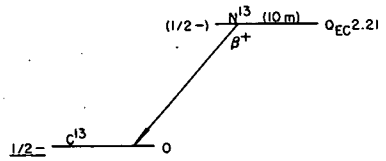

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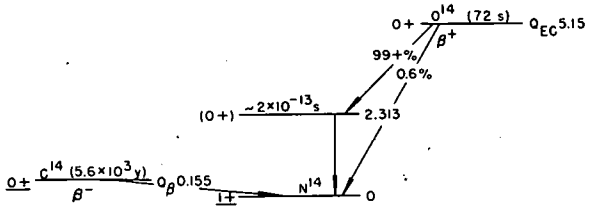

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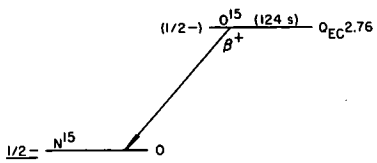

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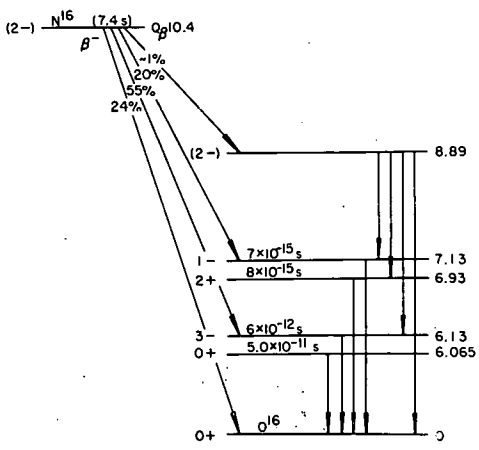

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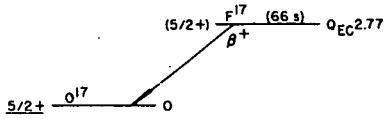

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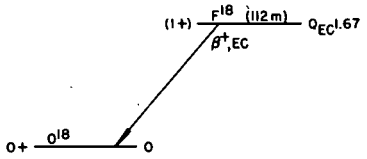

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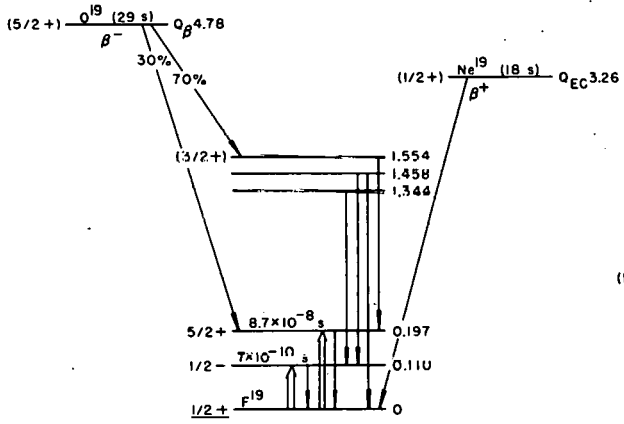

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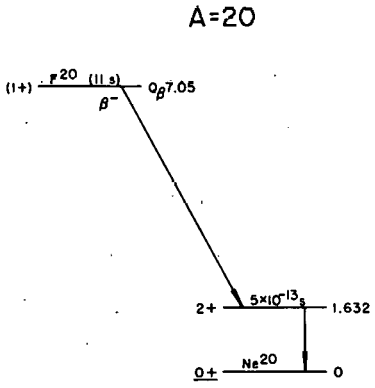

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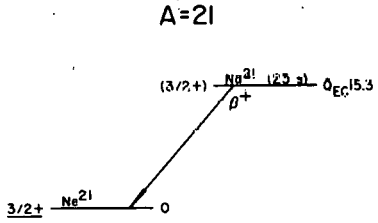

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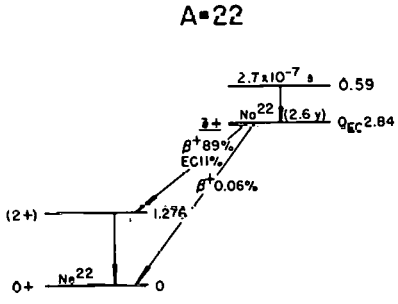

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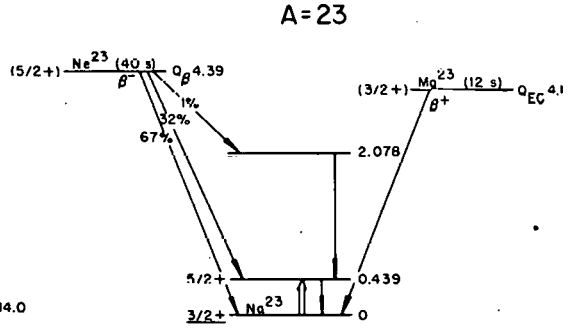

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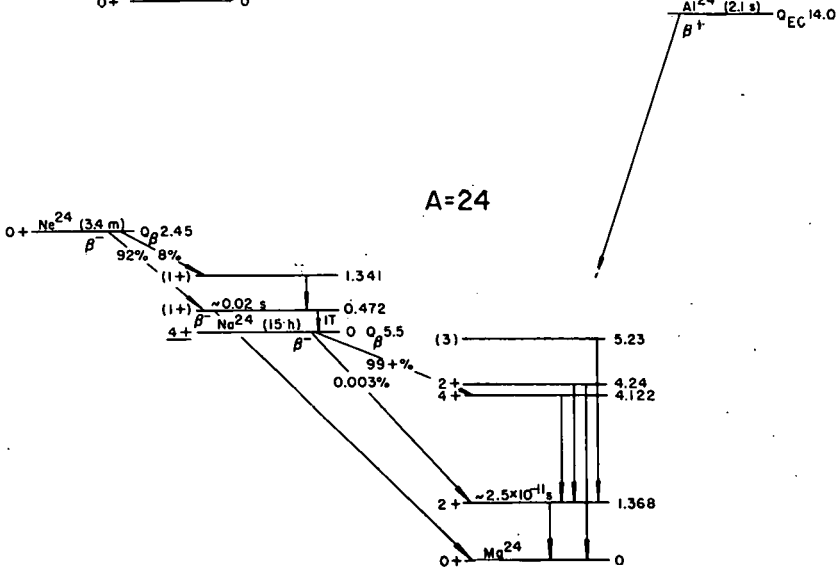

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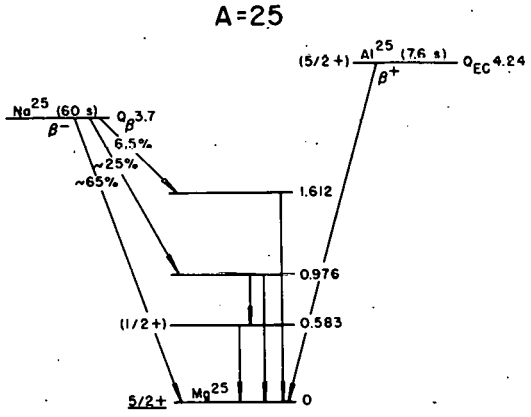
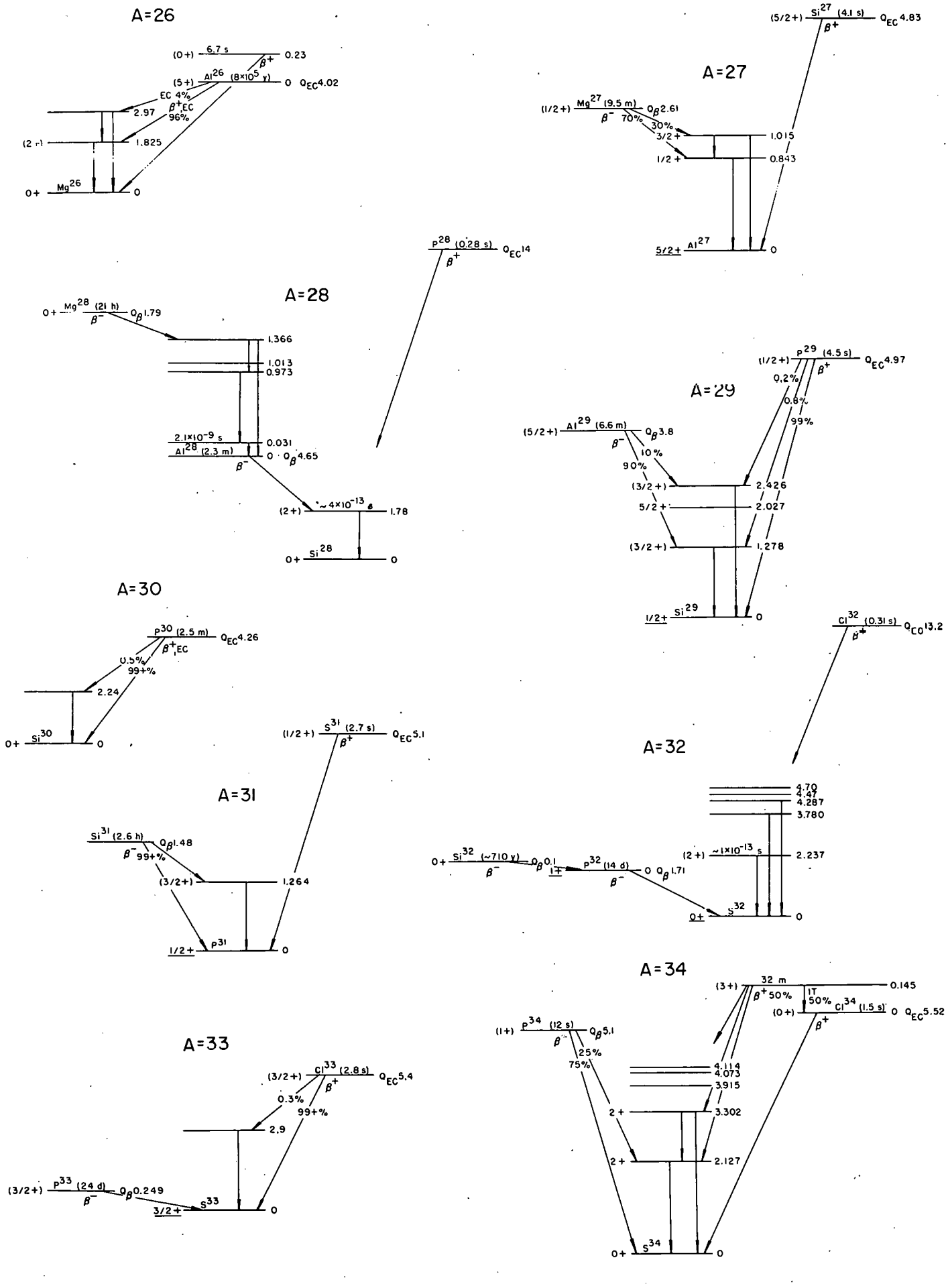
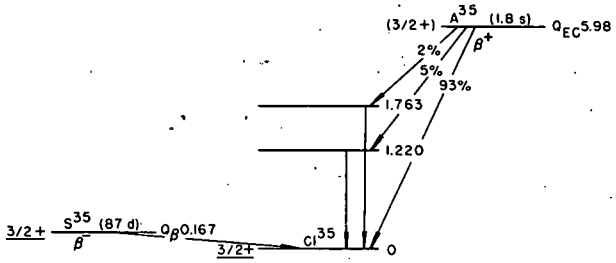



A=26
(0+) 6.7 s β+ 0.23
(5+) Al26 (8×10^5 y) 0 QEC4.02
EC 4%
β+EC 96%
2.97
(2 +) 1.825
0+ Mg26 0
A=27
(5/2+) Si27 (4.1 s) β+ QEC4.83
(1/2+) Mg27 (9.5 m) β− Qβ2.61
70%
30%
3/2+ 1.015
1/2+ 0.843
5/2+ Al27 0
A=28
P28 (0.28 s) β+ QEC14
0+ Mg28 (21 h) β− Qβ1.79
1.366
1.013
0.973
2.1×10−9 s
Al28 (2.3 m) 0.031
β− 0 Qβ4.65
(2+) ~4×10−13 s 1.78
0+ Si28 0
A=29
(1/2+) P29 (4.5 s) β+ QEC4.97
0.2%
0.8%
99%
(5/2+) Al29 (6.6 m) β− Qβ3.8
10%
90%
(3/2+) 2.426
5/2+ 2.027
(3/2+) 1.278
1/2+ Si29 0
A=30
P30 (2.5 m) β+EC QEC4.26
0.5%
99+%
2.24
0+ Si30 0
A=31
(1/2+) S31 (2.7 s) β+ QEC5.1
Si31 (2.6 h) β− 99+% Qβ1.48
(3/2+) 1.264
1/2+ P31 0
A=32
Cl32 (0.31 s) β+ QEC13.2
4.70
4.47
4.287
3.780
(2+) ~1×10−13 s 2.237
0+ Si32 (~710 y) β− Qβ0.1
1+ P32 (14 d) β− 0 Qβ1.71
0+ S32 0
A=33
(3/2+) Cl33 (2.8 s) β+ QEC5.4
0.3%
99+%
2.9
(3/2+) P33 (24 d) β− Qβ0.249
3/2+ S33 0
A=34
(3+) 32 m β+ 50% IT 50% 0.145
(0+) Cl34 (1.5 s) β+ 0 QEC5.52
(1+) P34 (12 s) β− Qβ5.1
25%
75%
4.114
4.073
3.915
2+ 3.302
2+ 2.127
0+ S34 0

A=35



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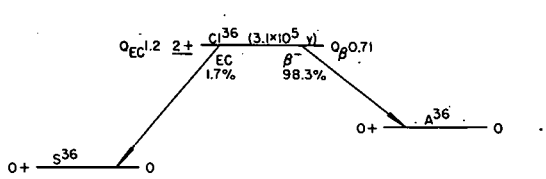

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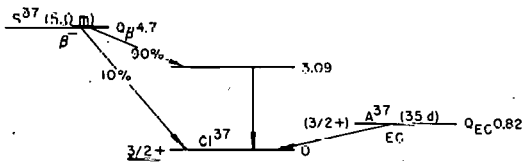

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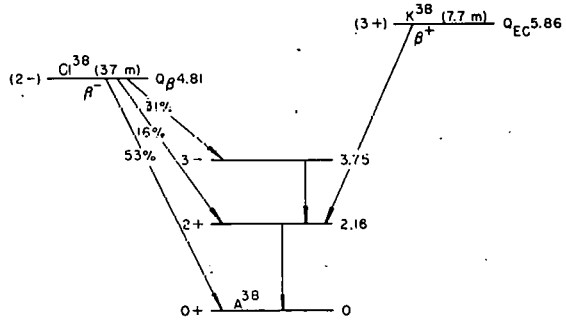

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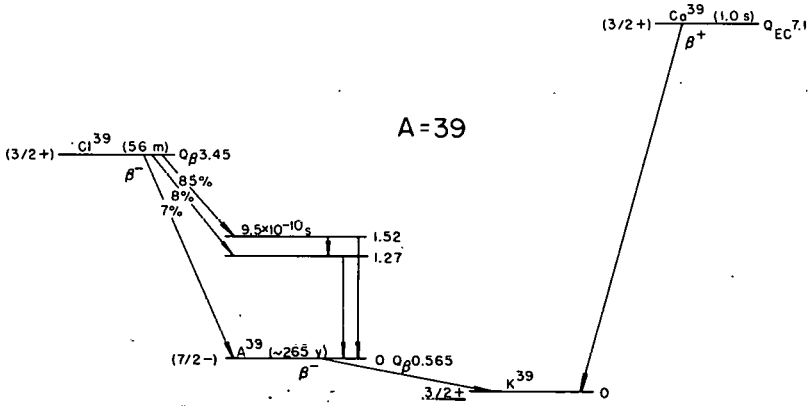

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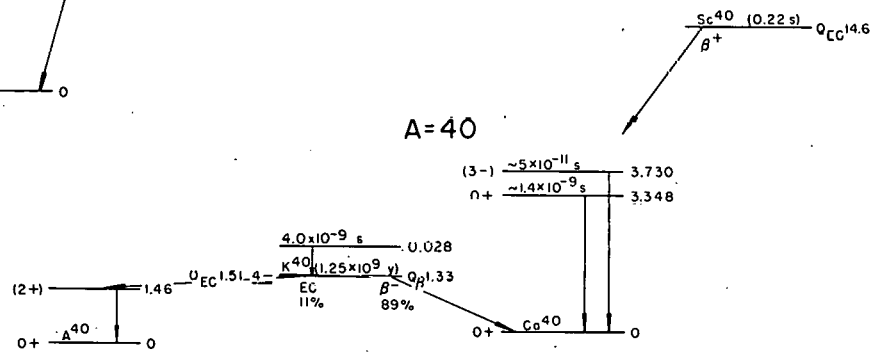

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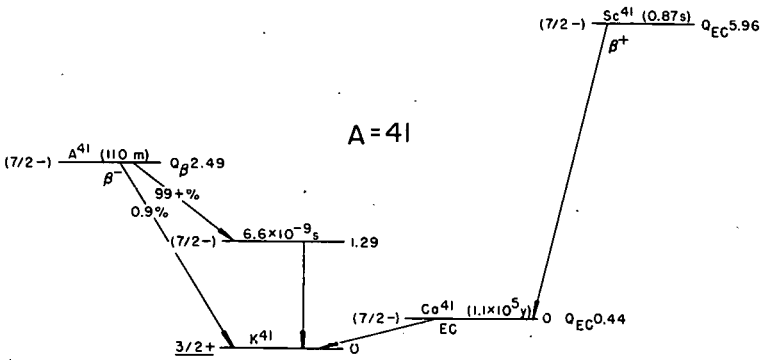

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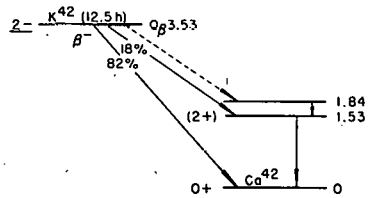

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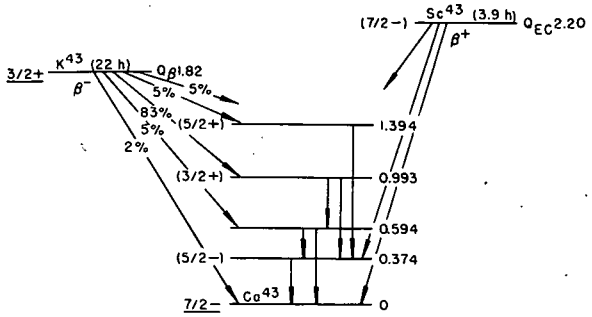

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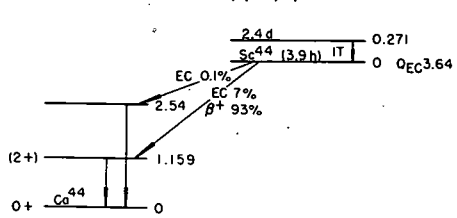

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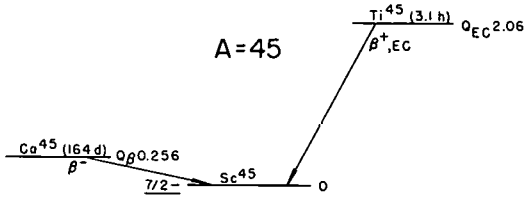

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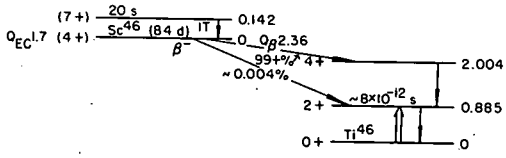

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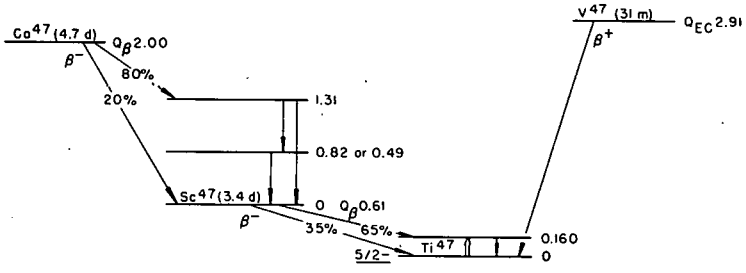

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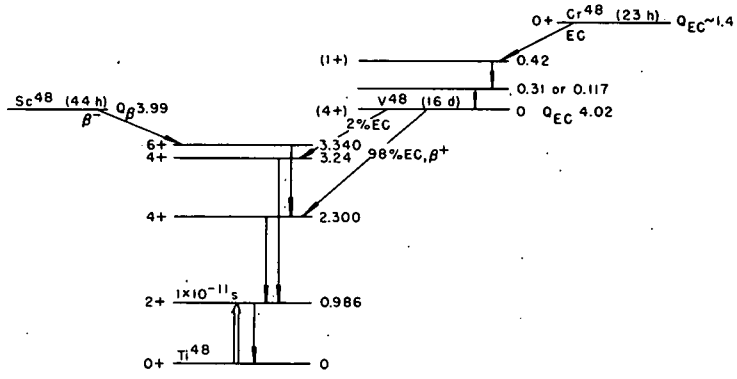

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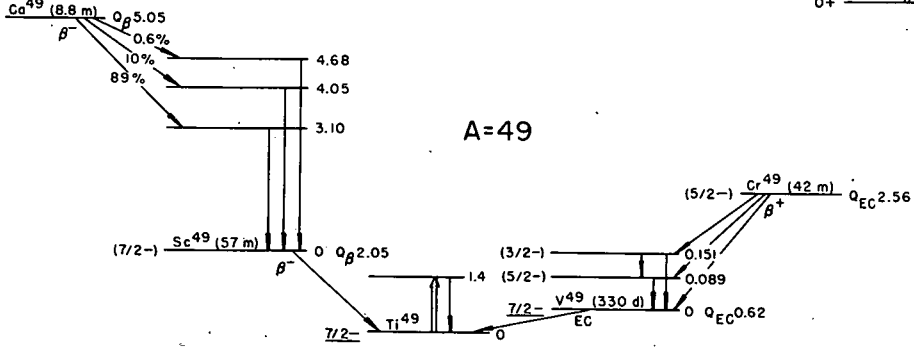

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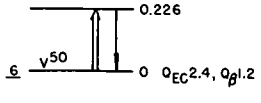
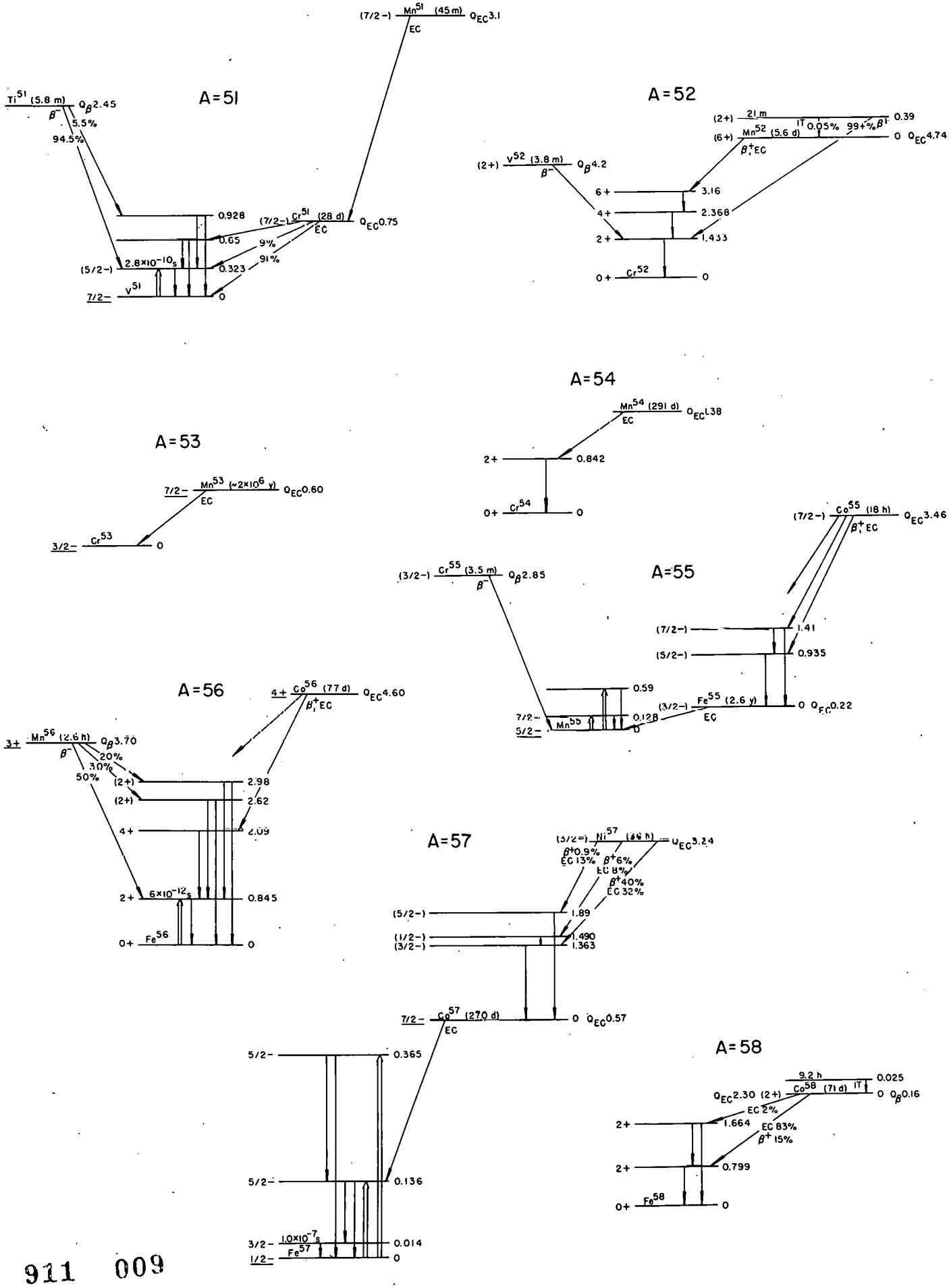
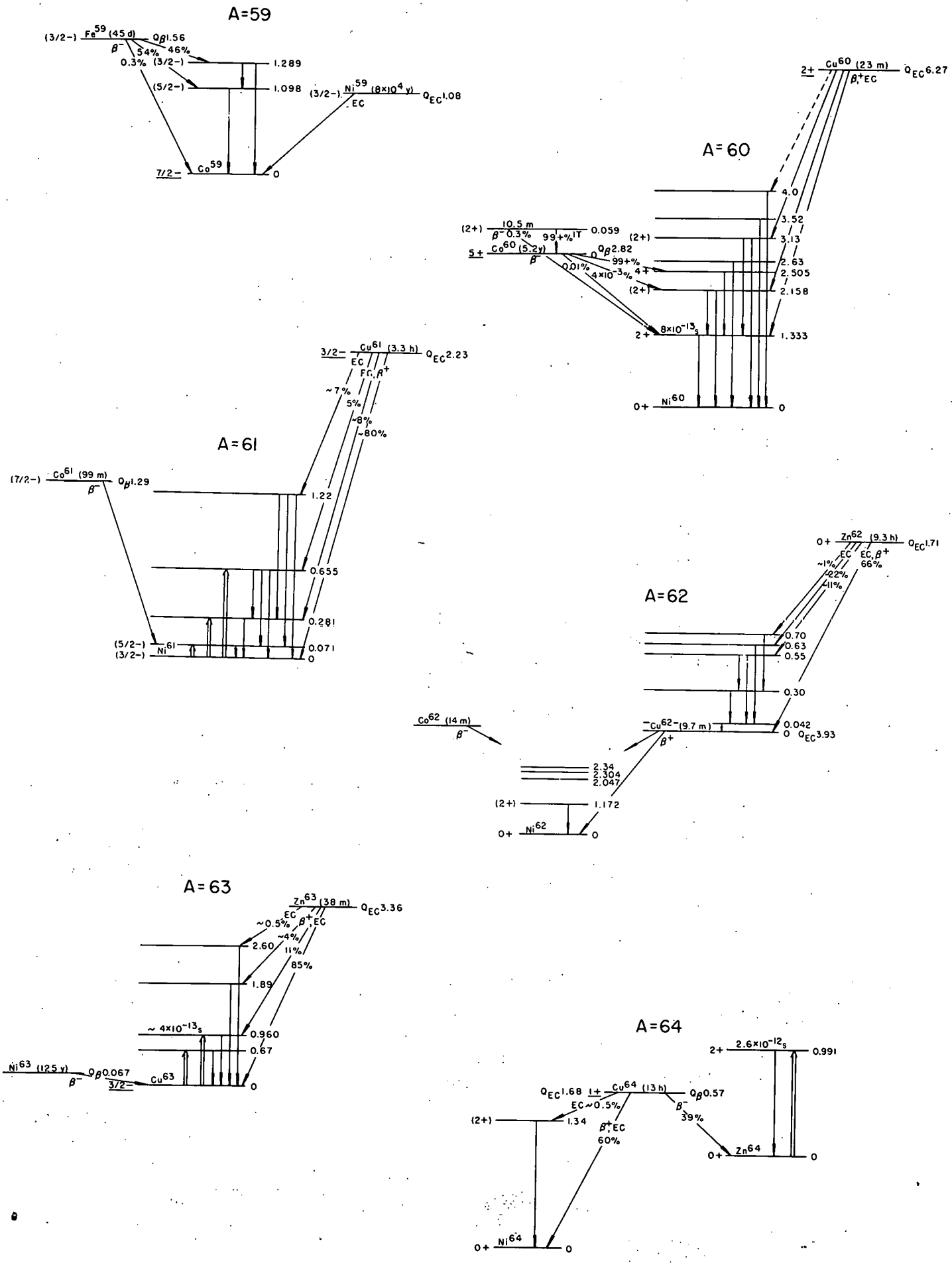
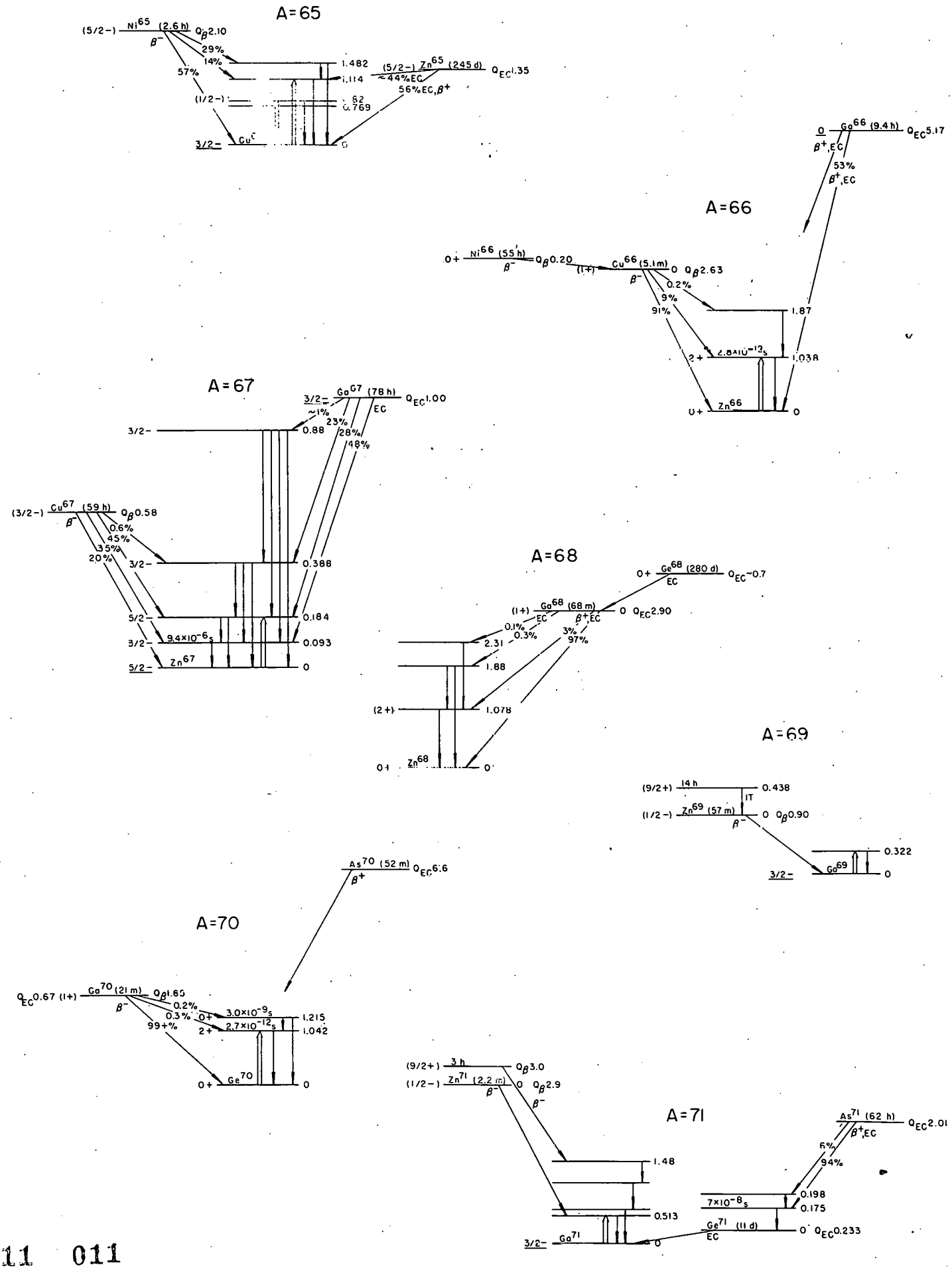
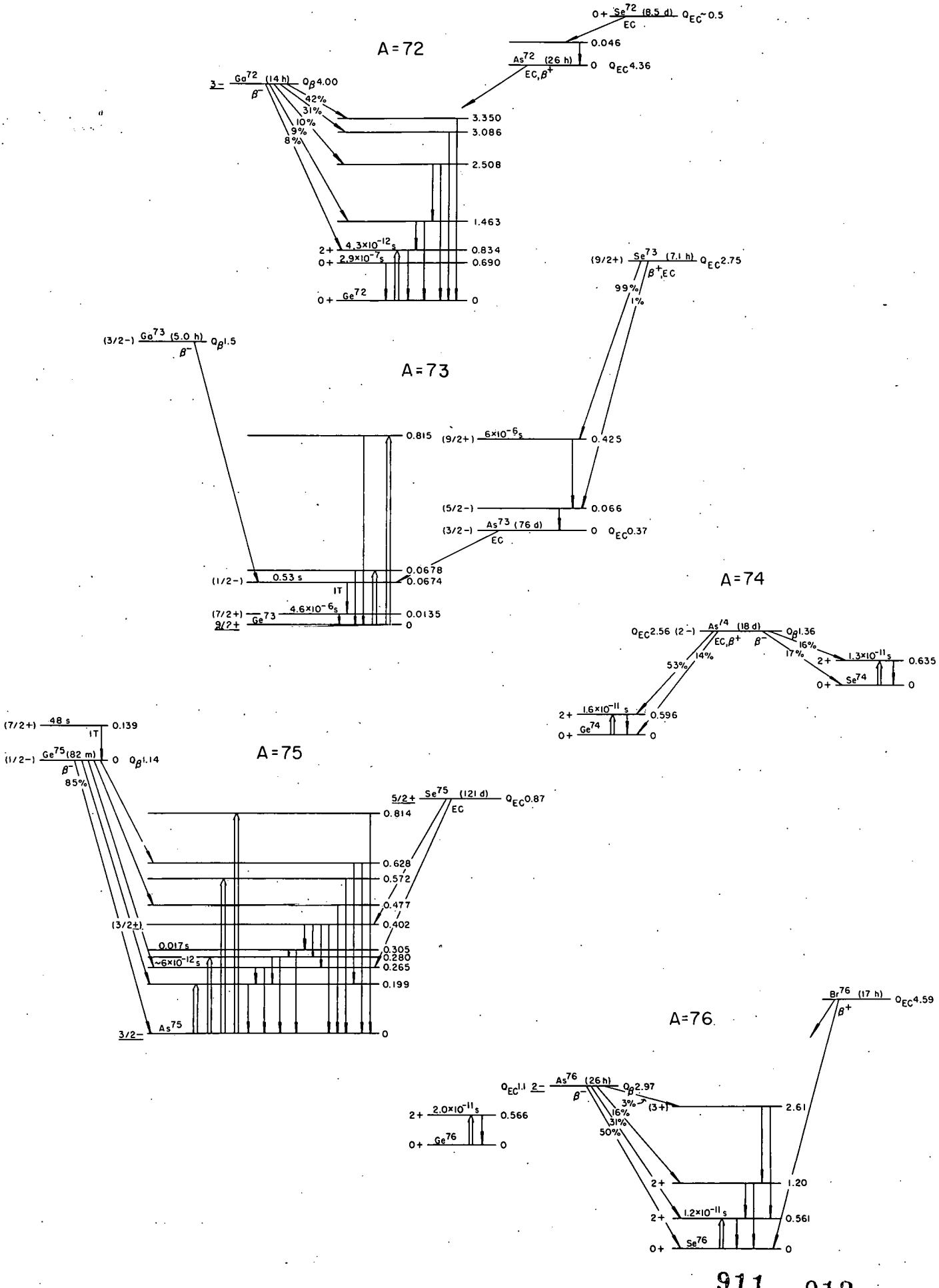


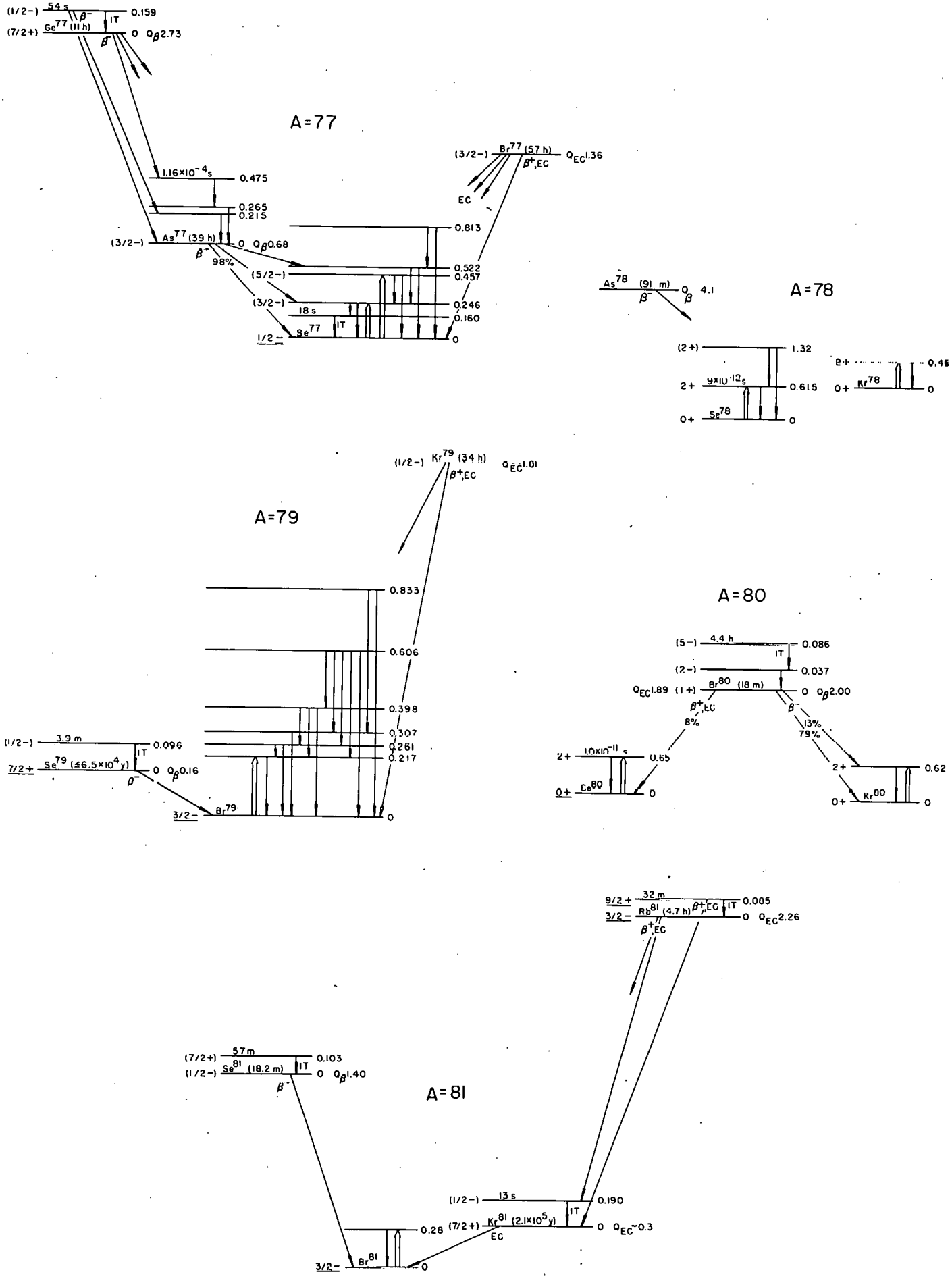

A=51
Ti51 (5.8 m) Qβ2.45
β−
5.5%
94.5%
(7/2−) Mn51 (45 m) QEC3.1
EC
0.928
(7/2−) Cr51 (28 d) QEC0.75
EC
0.65
9%
91%
(5/2−) 2.8×10−10s
0.323
7/2− V51
0
A=52
(2+) 21 m 0.39
IT 0.05% 99+%β−
(6+) Mn52 (5.6 d) 0 QEC4.74
β+,EC
(2+) V52 (3.8 m) Qβ4.2
β−
6+ 3.16
4+ 2.368
2+ 1.433
0+ Cr52 0
A=53
7/2− Mn53 (~2×10^6 y) QEC0.60
EC
3/2− Cr53 0
A=54
Mn54 (291 d) QEC1.38
EC
2+ 0.842
0+ Cr54 0
A=55
(7/2−) Co55 (18 h) QEC3.46
β+,EC
(3/2−) Cr55 (3.5 m) Qβ2.85
β−
(7/2−) 1.41
(5/2−) 0.935
0.59
7/2− 0.128
5/2− Mn55 0
(3/2−) Fe55 (2.6 y) 0 QEC0.22
EC
A=56
4+ Co56 (77 d) QEC4.60
β+,EC
3+ Mn56 (2.6 h) Qβ3.70
β−
20%
30%
50%
(2+) 2.98
(2+) 2.62
4+ 2.09
2+ 6×10−12s 0.845
0+ Fe56 0
A=57
(3/2−) Ni57 (36 h) QEC3.24
β+0.9%
EC 13%
β+6%
EC 8%
β+40%
EC 32%
(5/2−) 1.89
(1/2−) 1.490
(3/2−) 1.363
7/2− Co57 (270 d) 0 QEC0.57
EC
5/2− 0.365
5/2− 0.136
3/2− 1.0×10−7s 0.014
1/2− Fe57 0
A=58
9.2 h 0.025
QEC2.30 (2+) Co58 (71 d) IT 0 Qβ0.16
EC 2%
1.664
EC 83%
β+ 15%
2+ 0.799
0+ Fe58 0

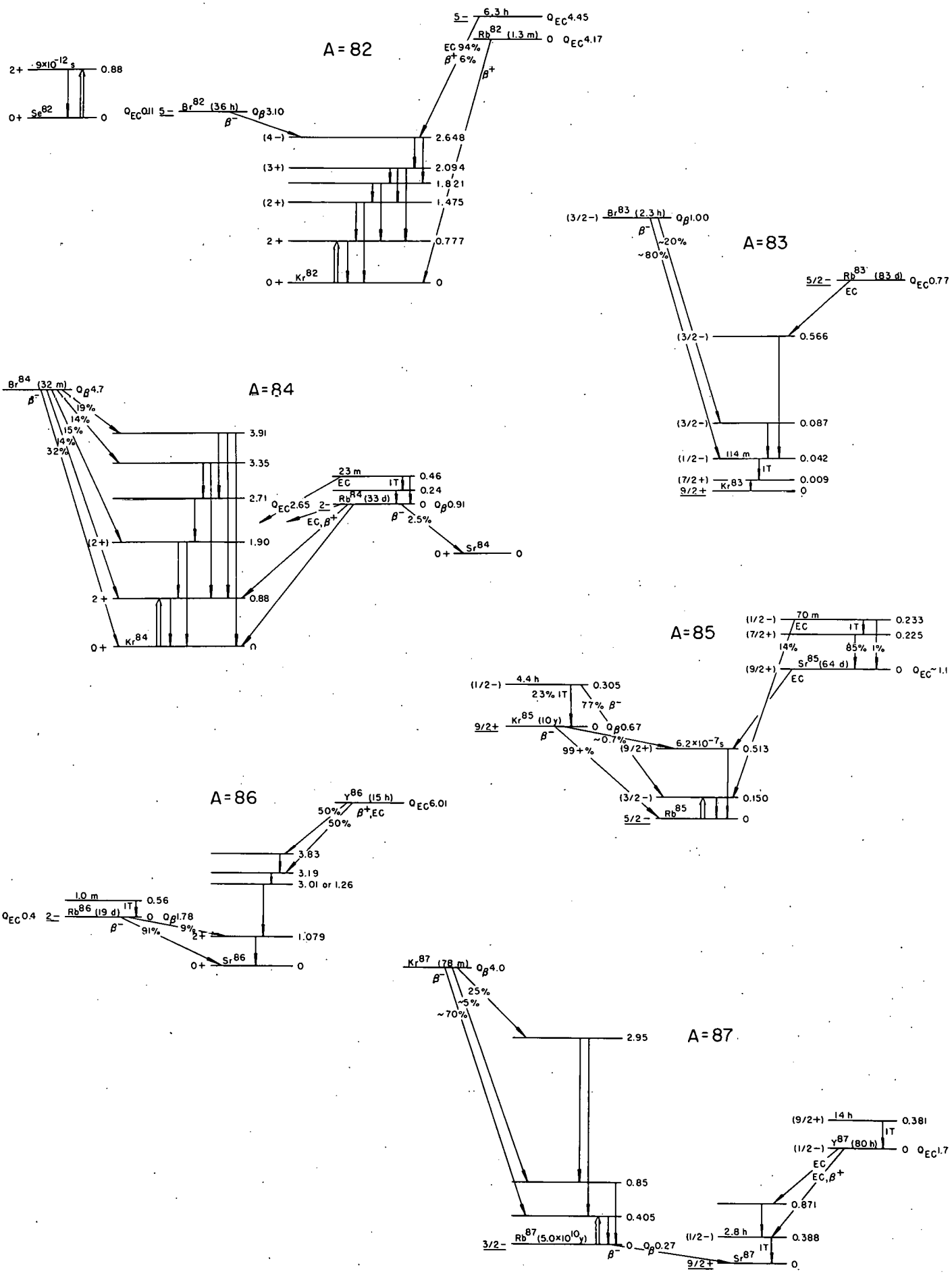

A=59
(3/2-) Fe59 (45 d) Qβ1.56
β-
54%
46%
0.3%
(3/2-)
1.289
(5/2-)
1.098
(3/2-) Ni59 (8x10^4 y) QEC1.08
EC
7/2- Co59
0
A=60
2+ Cu60 (23 m) QEC6.27
β+EC
4.0
3.52
(2+) 10.5 m
β- 0.3%
99+%IT
0.059
(2+)
3.13
5+ Co60 (5.2y)
Qβ2.82
β-
99+%
2.63
0.01%
4x10-3%
4+
2.505
(2+)
2.158
2+
8x10-13s
1.333
0+ Ni60
0
A=61
3/2- Cu61 (3.3 h) QEC2.23
EC
EC, β+
~7%
5%
~8%
~80%
(7/2-) Co61 (99 m) Qβ1.29
β-
1.22
0.655
0.281
(5/2-)
(3/2-) Ni61
0.071
0
A=62
0+ Zn62 (9.3 h) QEC1.71
EC
EC, β+
~1%
22%
11%
66%
0.70
0.63
0.55
0.30
Co62 (14 m)
β-
Cu62 (9.7 m)
0.042
0
QEC3.93
β+
2.34
2.304
2.047
(2+)
1.172
0+ Ni62
0
A=63
Zn63 (38 m) QEC3.36
EC
β+, EC
~0.5%
~4%
11%
85%
2.60
1.89
~ 4x10-13s
0.960
0.67
Ni63 (12.5 y) Qβ0.067
β-
3/2-
Cu63
0
A=64
2+ 2.6x10-12s
0.991
QEC1.68
1+ Cu64 (13 h)
Qβ0.57
EC~0.5%
β-
39%
(2+)
1.34
β+, EC
60%
0+ Zn64
0
0+ Ni64
0

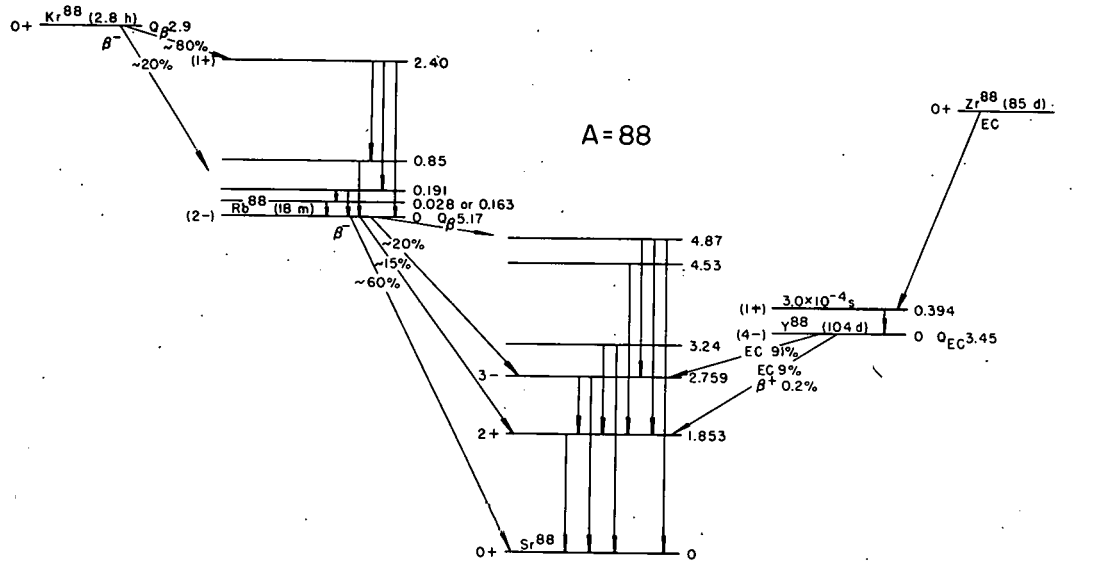

A=65
(5/2-) Ni65 (2.6 h) Qβ2.10
β-
29%
14%
57%
1.482
1.114
(5/2-) Zn65 (245 d) QEC1.35
≈44%EC
56%EC,β+
(1/2-)
82
0.769
3/2- Cu65
0
A=66
0+ Ni66 (55 h) Qβ0.20
β-
(1+) Cu66 (5.1m) 0 Qβ2.63
β-
0.2%
9%
91%
1.87
2+ 2.8x10-12s
1.038
0+ Zn66
0
0 Ga66 (9.4 h) QEC5.17
β+,EC
53%
β+,EC
A=67
3/2- Ga67 (78 h) QEC1.00
EC
~1%
23%
28%
48%
0.88
3/2-
(3/2-) Cu67 (59 h) Qβ0.58
β-
0.6%
45%
35%
20%
0.388
3/2-
5/2-
0.184
9.4x10-6s
3/2-
0.093
5/2- Zn67
0
A=68
0+ Ge68 (280 d) QEC~0.7
EC
(1+) Ga68 (68 m) 0 QEC2.90
EC
β+,EC
0.1%
0.3%
3%
97%
2.31
1.88
(2+)
1.078
0+ Zn68
0
A=69
(9/2+) 14 h
0.438
IT
(1/2-) Zn69 (57 m) 0 Qβ0.90
β-
0.322
3/2- Ga69
0
A=70
As70 (52 m) QEC6.6
β+
QEC0.67 (1+) Ga70 (21 m) Qβ1.65
β-
0.2%
0.3%
99+%
0+ 3.0x10-9s
1.215
2+ 2.7x10-12s
1.042
0+ Ge70
0
A=71
(9/2+) 3 h Qβ3.0
(1/2-) Zn71 (2.2 m) 0 Qβ2.9
β-
β-
1.48
0.513
3/2- Ga71
0
As71 (62 h) QEC2.01
β+,EC
6%
94%
0.198
7x10-8s
0.175
Ge71 (11 d)
EC
0 QEC0.233

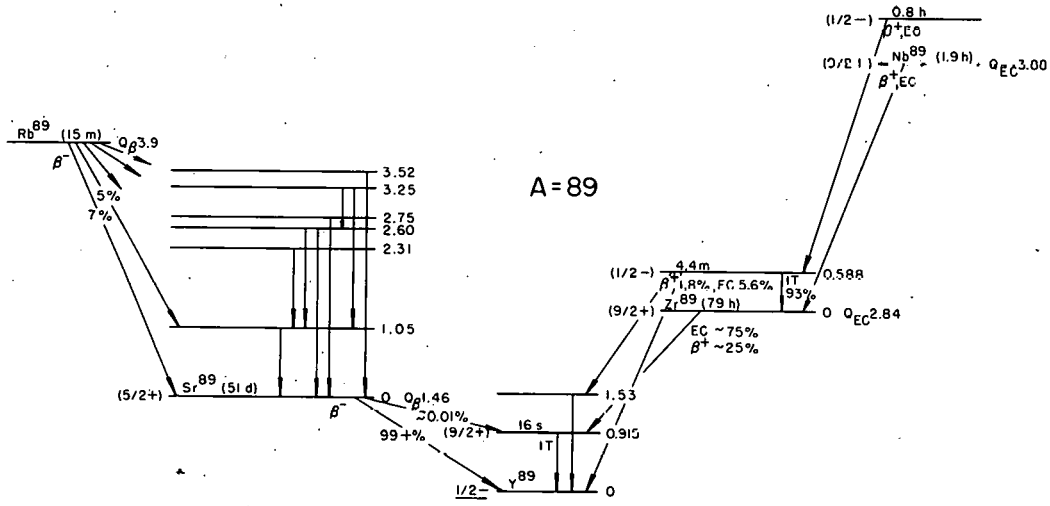
911 011

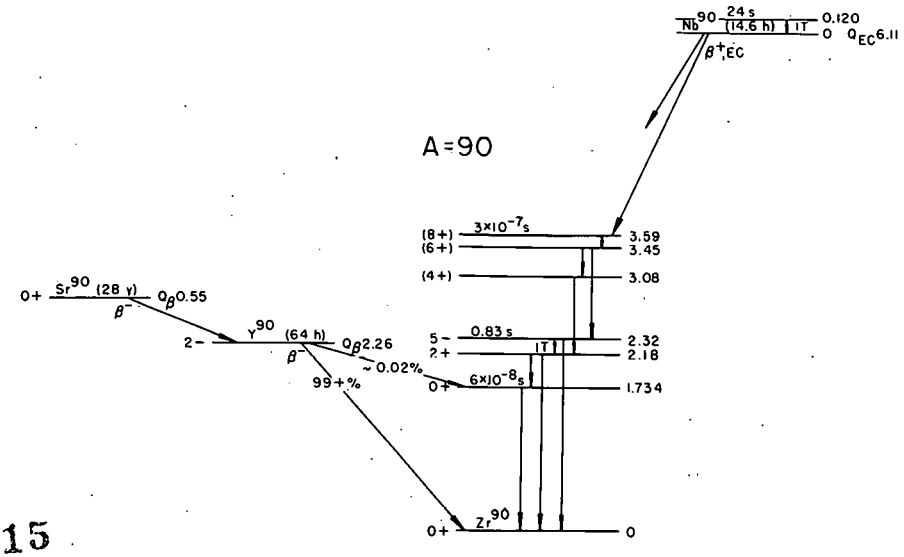

A=72
0+ Se72 (8.5 d) QEC~0.5
EC
0.046
As72 (26 h)
EC,β+
0 QEC4.36
3- Ga72 (14 h) Qβ4.00
β-
42%
31%
10%
9%
8%
3.350
3.086
2.508
1.463
2+ 4.3×10-12 s
0+ 2.9×10-7 s
0.834
0.690
0+ Ge72
0
A=73
(9/2+) Se73 (7.1 h) QEC2.75
β+,EC
99%
1%
(3/2-) Ga73 (5.0 h) Qβ1.5
β-
0.815
(9/2+) 6×10-6 s
0.425
(5/2-)
0.066
(3/2-) As73 (76 d)
EC
0 QEC0.37
0.0678
(1/2-) 0.53 s
IT
0.0674
(7/2+) Ge73 4.6×10-6 s
9/2+
0.0135
0
A=74
QEC2.56 (2-) As74 (18 d) Qβ1.36
EC,β+
β-
53%
14%
16%
17%
2+ 1.3×10-11 s
0.635
0+ Se74
0
2+ 1.6×10-11 s
0.596
0+ Ge74
0
A=75
(7/2+) 48 s
IT
0.139
(1/2-) Ge75 (82 m)
β-
85%
0 Qβ1.14
5/2+ Se75 (121 d) QEC0.87
EC
0.814
0.628
0.572
0.477
(3/2+)
0.402
0.017 s
~6×10-12 s
0.305
0.280
0.265
0.199
3/2- As75
0
A=76
Br76 (17 h) QEC4.59
β+
QEC1.1 2- As76 (26 h) Qβ2.97
β-
3%
(3+)
16%
31%
50%
2.61
2+
1.20
2+
1.2×10-11 s
0.561
0+ Se76
0
2+ 2.0×10-11 s
0.566
0+ Ge76
0

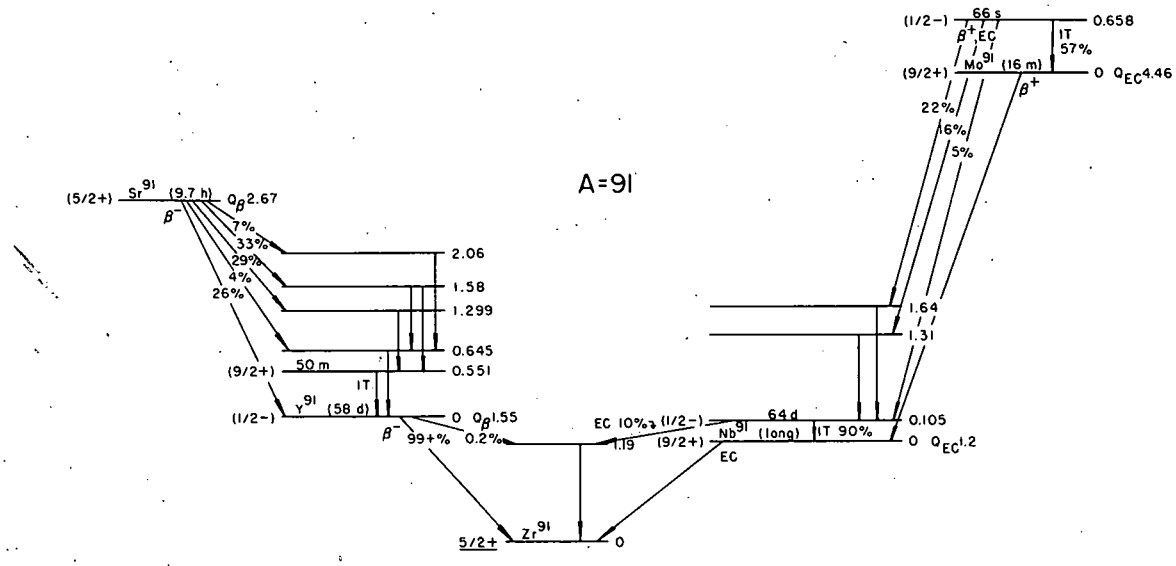

A=77
A=78
A=79
A=80
A=81
Ge77 (11 h)
As77 (39 h)
Se77
Br77 (57 h)
As78 (91 m)
Se78
Kr78
Kr79 (34 h)
Se79 (≤6.5×10⁴ y)
Br79
Br80 (18 m)
Se80
Kr80
Rb81 (4.7 h)
Se81 (18.2 m)
Kr81 (2.1×10⁵ y)
Br81

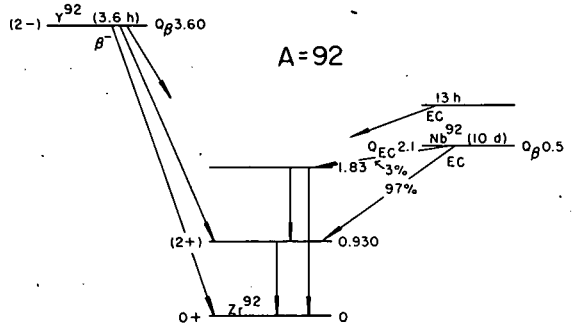

A = 82
A = 83
A = 84
A = 85
A = 86
A = 87
Se82
Br82 (36 h)
Kr82
Rb82 (1.3 m)
Br83 (2.3 h)
Rb83 (83 d)
Kr83
Br84 (32 m)
Rb84 (33 d)
Sr84
Kr84
Kr85 (10 y)
Rb85
Sr85 (64 d)
Y86 (15 h)
Rb86 (19 d)
Sr86
Kr87 (78 m)
Rb87 (5.0×10¹⁰ y)
Y87 (80 h)
Sr87

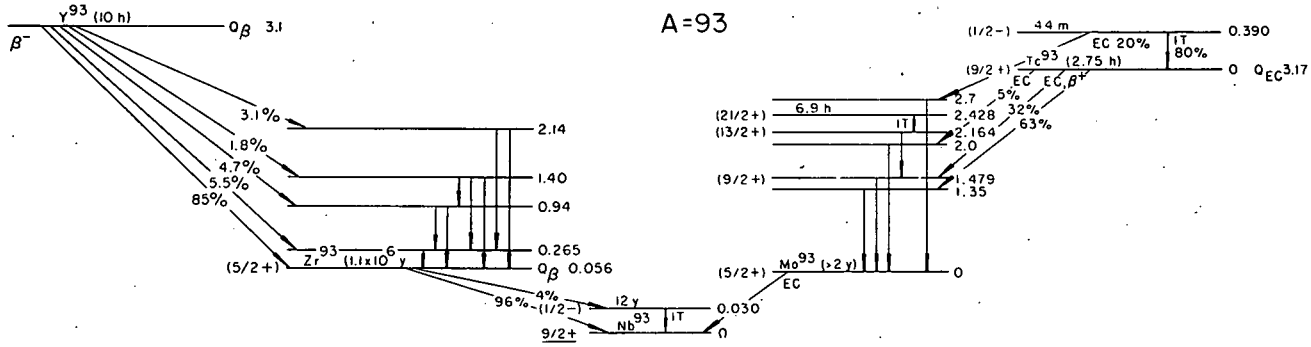

A=88
0+ Kr88 (2.8 h) Qβ2.9
β⁻
~20%
~80%
(1+)
2.40
0.85
0.191
0.028 or 0.163
(2−) Rb88 (18 m)
0 Qβ5.17
β⁻
~20%
~15%
~60%
4.87
4.53
3.24
3−
2.759
2+
1.853
0+ Sr88
0
0+ Zr88 (85 d)
EC
(1+) 3.0×10⁻⁴s
0.394
(4−) Y88 (104 d)
0 QEC3.45
EC 91%
EC 9%
β⁺ 0.2%

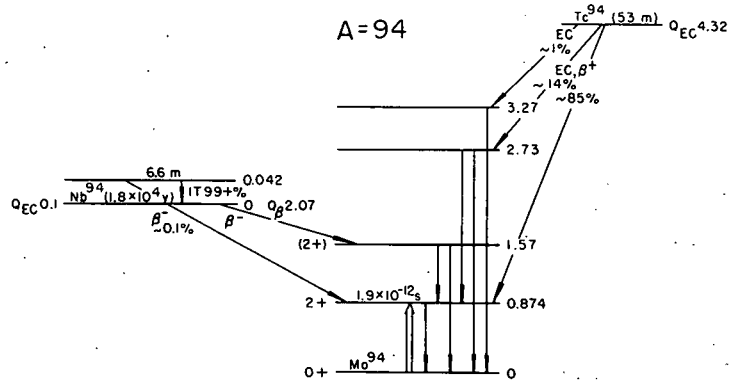

A=89
Rb89 (15 m) Qβ3.9
β⁻
5%
7%
3.52
3.25
2.75
2.60
2.31
1.05
(5/2+) Sr89 (51 d)
0 Qβ1.46
β⁻
~0.01%
99+%
(9/2+)
16 s
IT
0.915
1/2− Y89
0
(1/2−) 0.8 h
β⁺,EC
(9/2+) Nb89 (1.9 h), QEC3.00
β⁺,EC
(1/2−) 4.4m
β⁻ 1.8%, EC 5.6%
IT 93%
0.588
(9/2+) Zr89 (79 h)
0 QEC2.84
EC ~75%
β⁺ ~25%
1.53

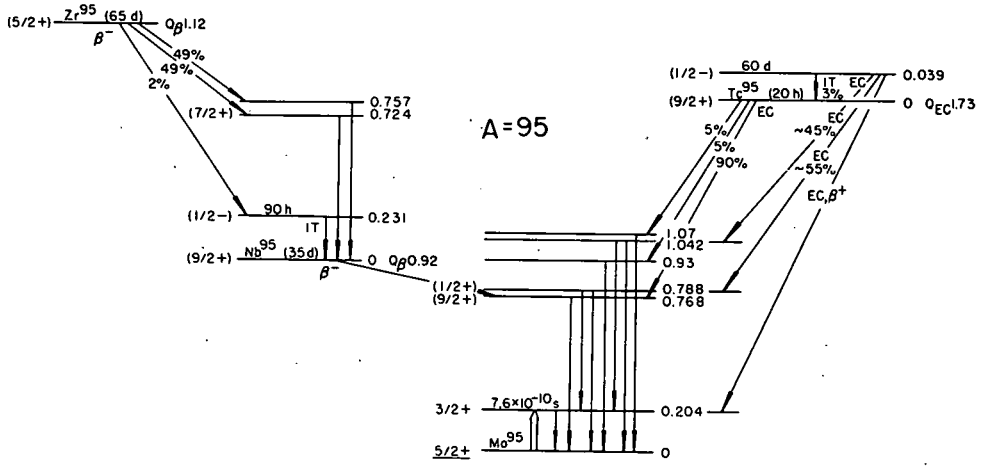

A=90
Nb90 24 s
(14.6 h) IT
0.120
0 QEC6.11
β⁺,EC
(8+) 3×10⁻⁷s
3.59
(6+)
3.45
(4+)
3.08
0+ Sr90 (28 y) Qβ0.55
β⁻
2− Y90 (64 h) Qβ2.26
β⁻
~0.02%
99+%
5−
0.83 s
IT
2.32
2+
2.18
0+ 6×10⁻⁸s
1.734
0+ Zr90
0


A=91
(1/2-) 66 s 0.658
β+ EC IT 57%
(9/2+) Mo91 (16 m) 0 QEC4.46
22%
16%
5%
β+
1.64
1.31
(5/2+) Sr91 (9.7 h) Qβ2.67
β-
7%
33%
29%
4%
26%
2.06
1.58
1.299
0.645
(9/2+) 50 m 0.551
IT
(1/2-) Y91 (58 d) 0 Qβ1.55
β- 99+% 0.2%
EC 10%
(1/2-) 64 d 0.105
1.19
(9/2+) Nb91 (long) IT 90%
0 QEC1.2
EC
5/2+ Zr91 0

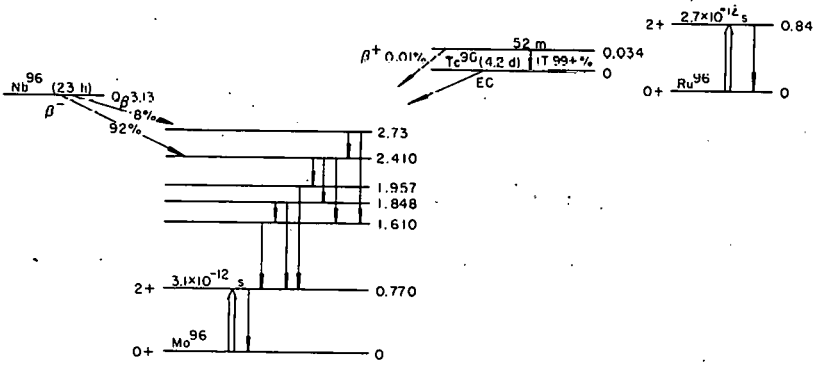

A=92
(2-) Y92 (3.6 h) Qβ3.60
β-
13 h
EC
QEC2.1 Nb92 (10 d) Qβ0.5
1.83
3%
97%
EC
(2+) 0.930
0+ Zr92 0

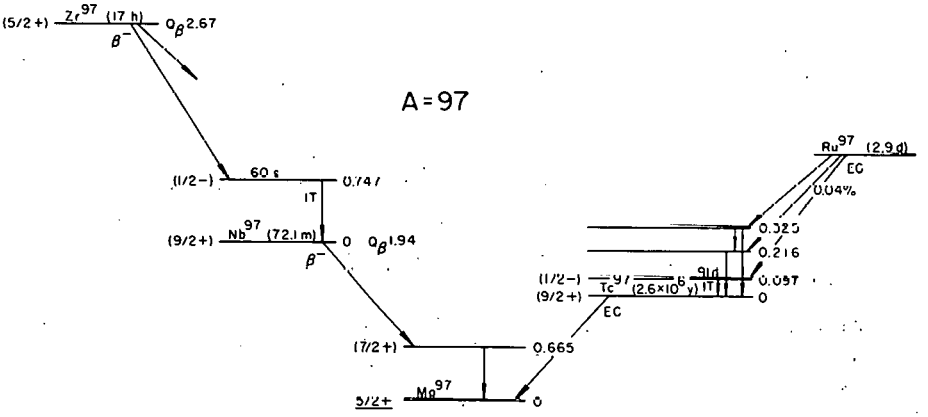

A=93
Y93 (10 h) Qβ 3.1
β-
3.1%
1.8%
4.7%
5.5%
85%
2.14
1.40
0.94
0.265
(5/2+) Zr93 (1.1x10^6 y) Qβ 0.056
4%
96%
12 y
(1/2-) Nb93 IT 0.030
9/2+ 0
(1/2-) 44 m 0.390
EC 20%
IT 80%
(9/2+) Tc93 (2.75 h) 0 QEC3.17
EC EC,β+
5%
32%
63%
2.7
(21/2+) 6.9 h 2,428
IT
(13/2+) 2,164
2.0
(9/2+) 1.479
1.35
(5/2+) Mo93 (>2 y) EC 0


A=94
Tc94 (53 m) QEC4.32
EC ~1%
EC,β+ ~14%
~85%
3.27
2.73
6.6 m 0.042
QEC0.1 Nb94 (1.8x10^4 y) IT 99+% 0 Qβ2.07
β+ ~0.1%
β-
(2+) 1.57
2+ 1.9x10^-12 s 0.874
0+ Mo94 0

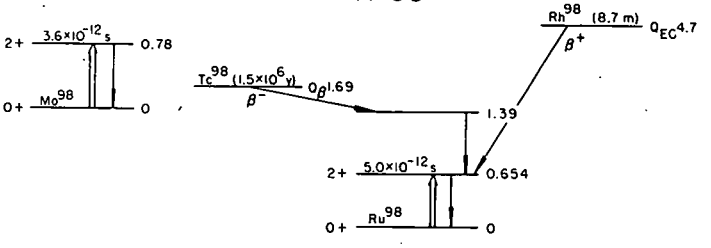


A=96

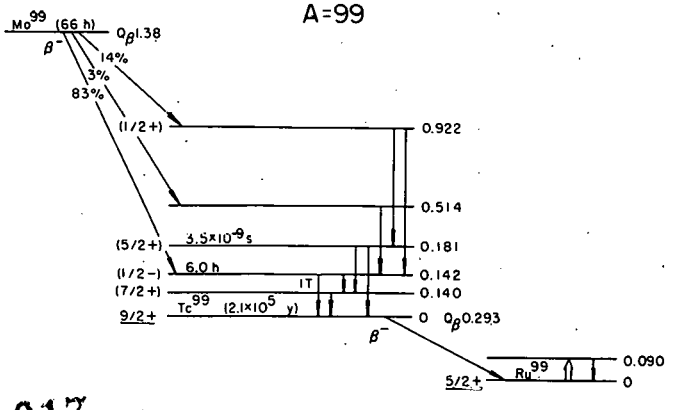


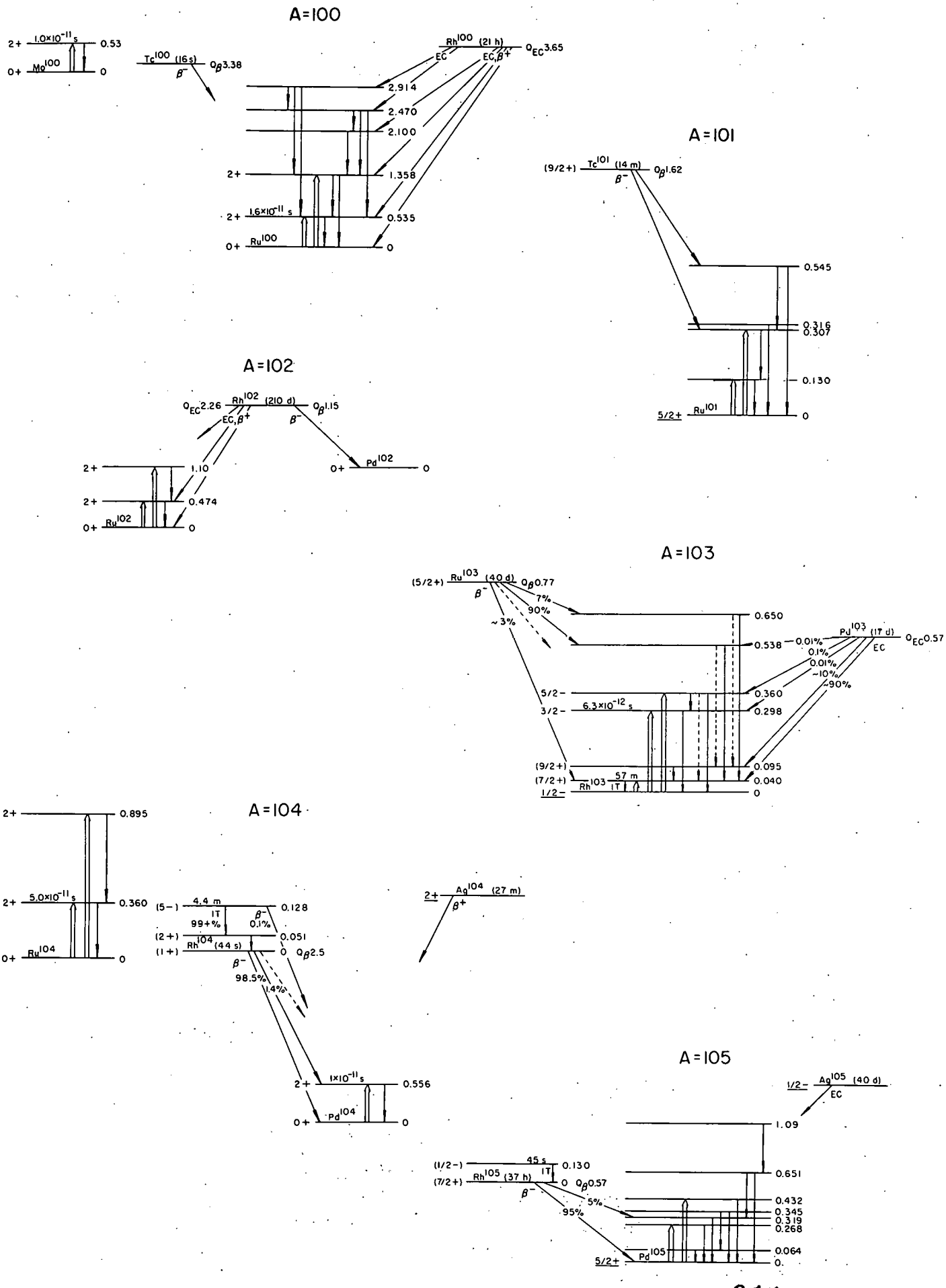


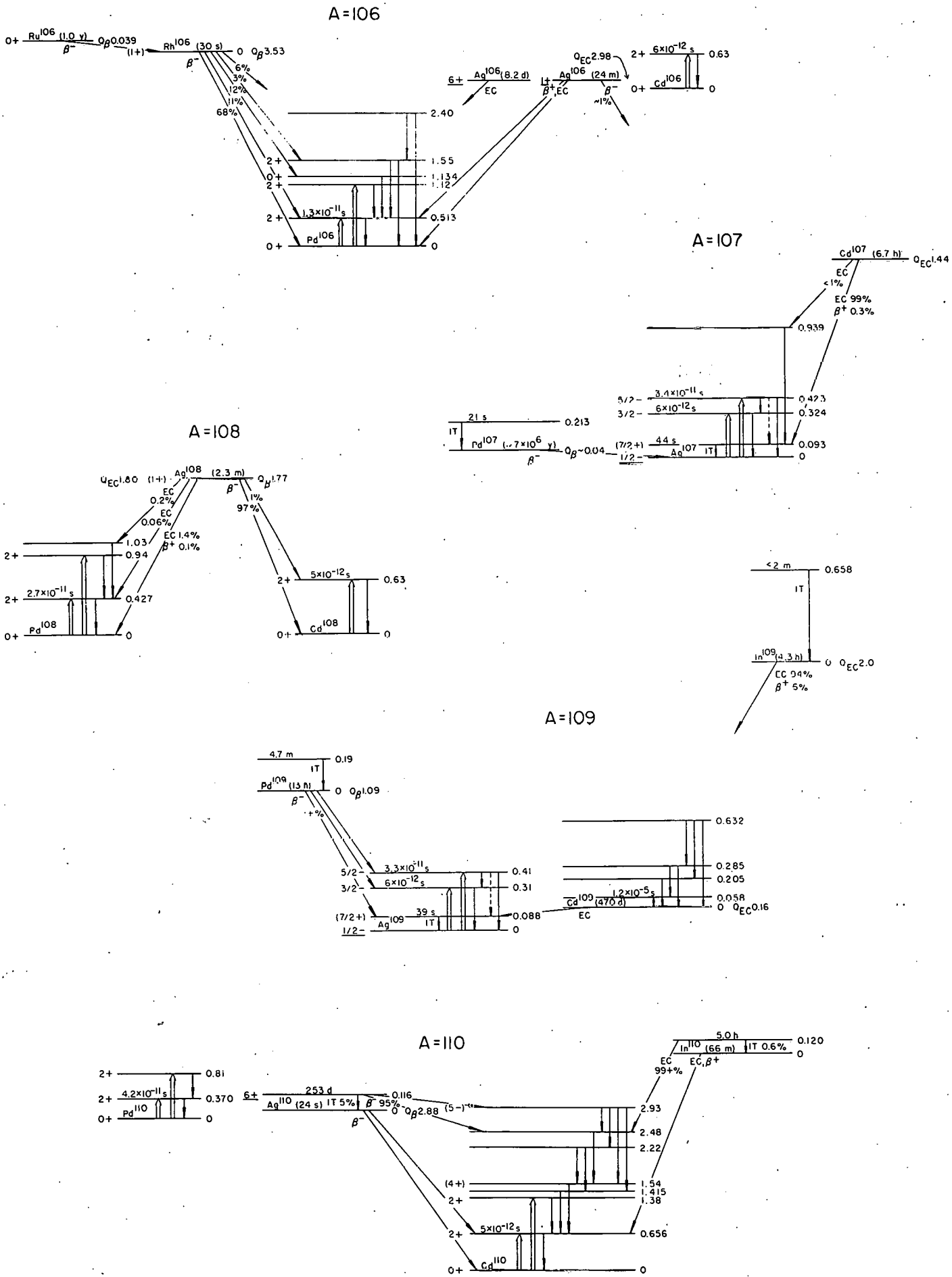
A=98

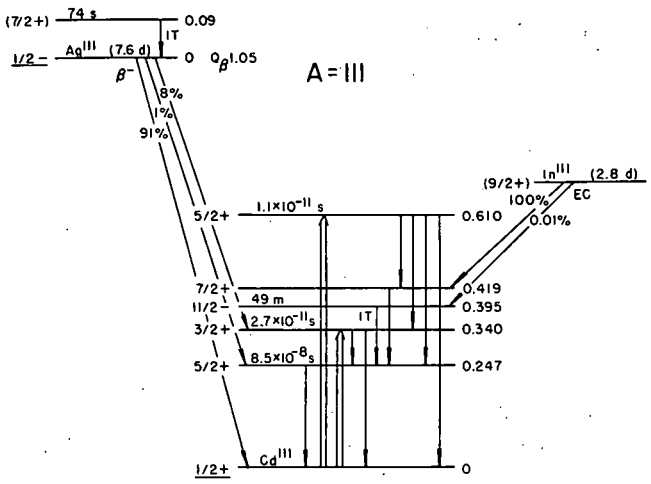


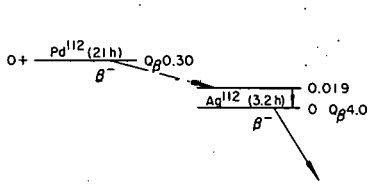
A=99

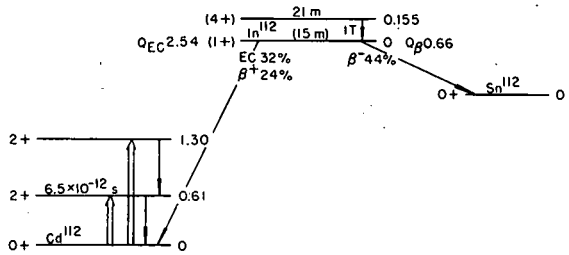


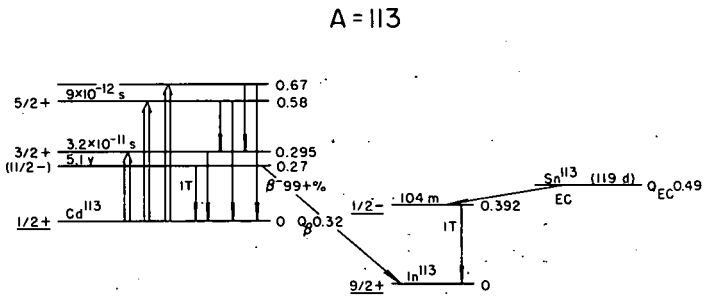

A=100
2+ 1.0×10⁻¹¹ s 0.53
0+ Mo100 0
Tc100 (16s) β⁻ Qβ3.38
Rh100 (21 h) EC EC,β⁺ QEC3.65
2.914
2.470
2.100
2+ 1.358
2+ 1.6×10⁻¹¹ s 0.535
0+ Ru100 0
A=101
(9/2+) Tc101 (14 m) β⁻ Qβ1.62
0.545
0.316
0.307
0.130
5/2+ Ru101 0
A=102
QEC2.26 Rh102 (210 d) Qβ1.15
EC,β⁺ β⁻
2+ 1.10
2+ 0.474
0+ Ru102 0
0+ Pd102 0
A=103
(5/2+) Ru103 (40 d) Qβ0.77
β⁻
7%
90%
~3%
0.650
0.538
Pd103 (17 d) QEC0.57
0.01%
0.1%
0.01%
~10%
~90%
EC
5/2− 0.360
3/2− 6.3×10⁻¹² s 0.298
(9/2+) 0.095
(7/2+) Rh103 57 m IT 0.040
1/2− 0
A=104
2+ 0.895
2+ 5.0×10⁻¹¹ s 0.360
0+ Ru104 0
(5−) 4.4 m IT 99+% β⁻ 0.1% 0.128
(2+) 0.051
(1+) Rh104 (44 s) 0 Qβ2.5
β⁻ 98.5% 1.4%
2+ Ag104 (27 m) β⁺
2+ 1×10⁻¹¹ s 0.556
0+ Pd104 0
A=105
1/2− Ag105 (40 d) EC
1.09
(1/2−) 45 s IT 0.130
(7/2+) Rh105 (37 h) 0 Qβ0.57
β⁻ 5% 95%
0.651
0.432
0.345
0.319
0.268
5/2+ Pd105 0.064
0.

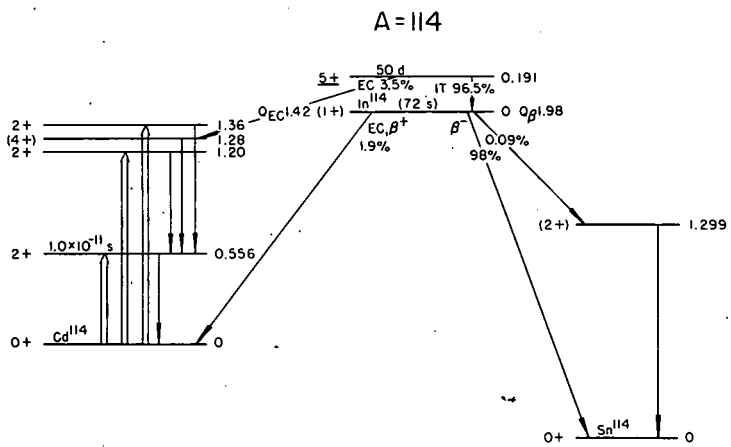

A=106
A=107
A=108
A=109
A=110
Ru106 (1.0 y)
Rh106 (30 s)
Ag106 (8.2 d)
Ag106 (24 m)
Cd106
Pd106
Cd107 (6.7 h)
Pd107 (~7×10^6 y)
Ag107
Ag108 (2.3 m)
Pd108
Cd108
In109 (4.3 h)
Pd109 (13 h)
Ag109
Cd109 (470 d)
Ag110 (24 s)
In110 (66 m)
Pd110
Cd110

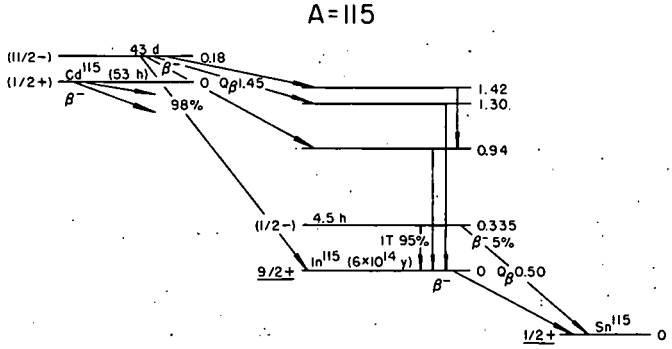

A = 111
(7/2+) 74 s
0.09
IT
1/2− Ag111 (7.6 d)
0 Qβ1.05
β−
8%
1%
91%
(9/2+) In111 (2.8 d)
100%
EC
0.01%
5/2+ 1.1×10−11 s
0.610
7/2+
49 m
0.419
11/2−
2.7×10−11 s
IT
0.395
3/2+
0.340
5/2+
8.5×10−8 s
0.247
1/2+ Cd111
0

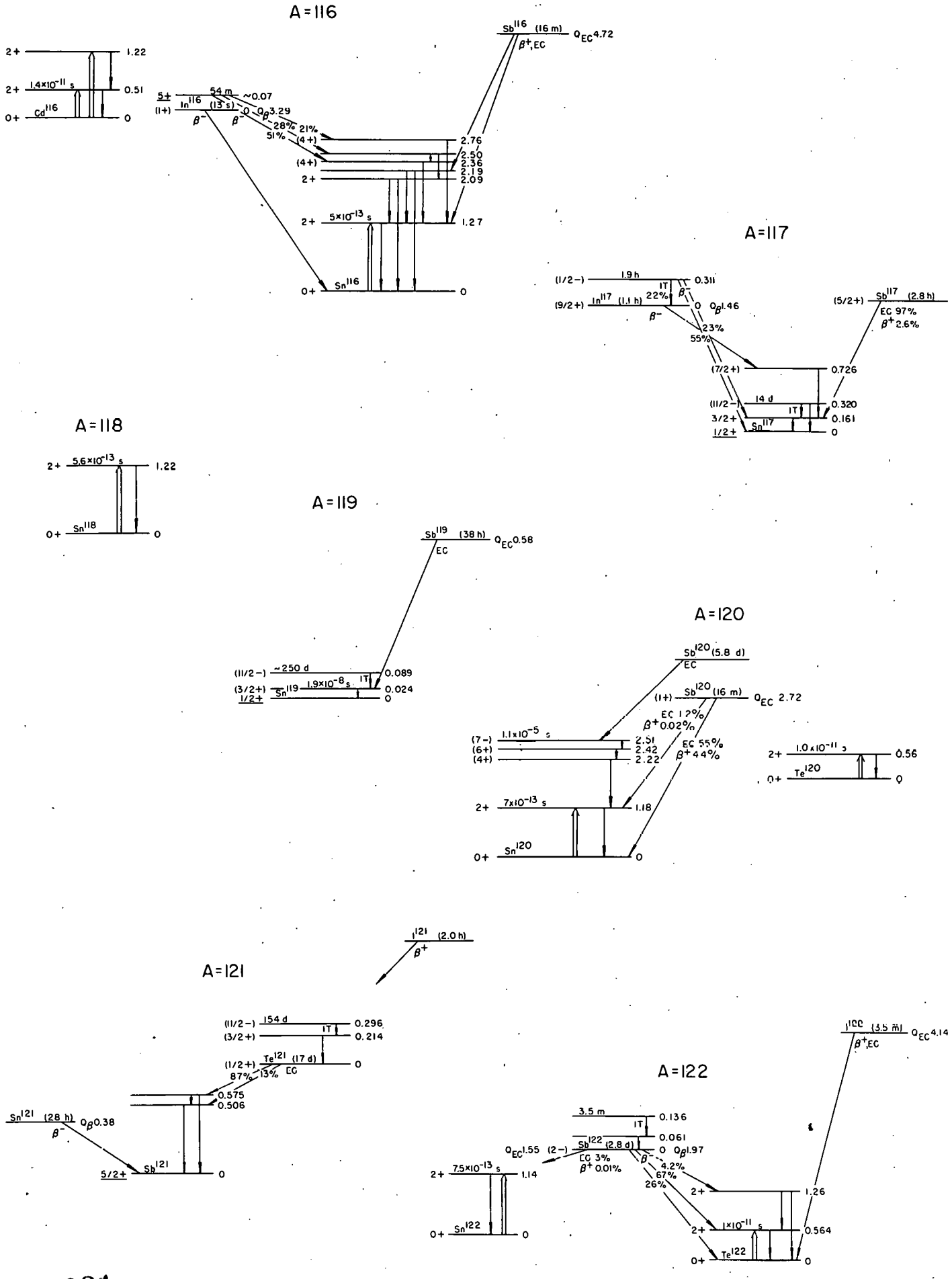

A = 112
0+ Pd112 (21 h)
Qβ0.30
β−
Ag112 (3.2 h)
0.019
0 Qβ4.0
β−


(4+) 21 m
0.155
In112 (15 m)
IT
QEC2.54 (1+)
0 Qβ0.66
EC 32%
β+24%
β−44%
0+ Sn112
0
2+
1.30
2+ 6.5×10−12 s
0.61
0+ Cd112
0

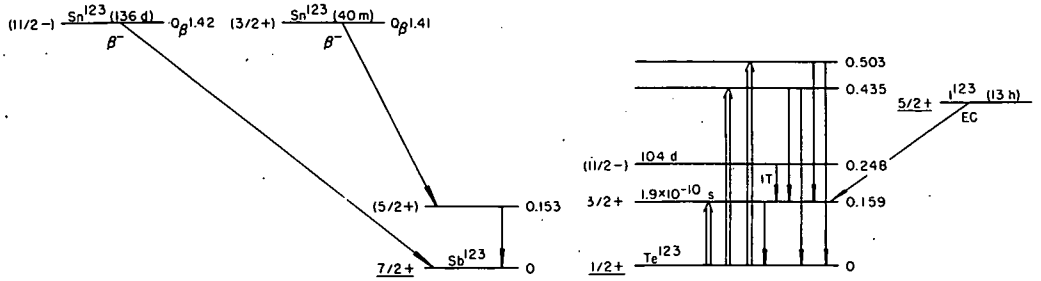

A = 113
5/2+ 9×10−12 s
0.67
0.58
3/2+ 3.2×10−11 s
(11/2−) 5.1 y
0.295
0.27
IT
β−99+%
1/2+ Cd113
0 Qβ0.32
1/2− 104 m
0.392
Sn113 (119 d)
QEC0.49
EC
IT
9/2+ In113
0


A = 114
5+ 50 d
EC 3.5%
0.191
IT 96.5%
In114 (72 s)
QEC1.42 (1+)
0 Qβ1.98
EC,β+
1.9%
β−
0.09%
98%
2+ 1.36
(4+) 1.28
2+ 1.20
2+ 1.0×10−11 s
0.556
0+ Cd114
0
(2+)
1.299
0+ Sn114
0

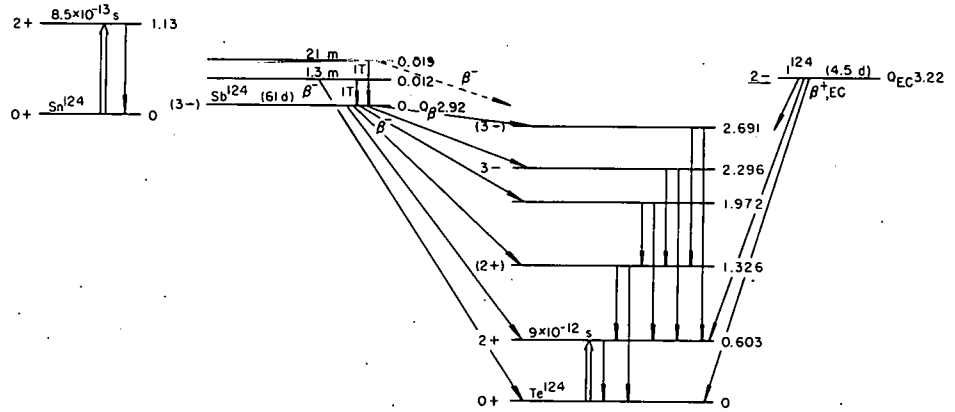

A = 115
(11/2−) 43 d
0.18
(1/2+) Cd115 (53 h)
β−
0 Qβ1.45
β−
98%
1.42
1.30
0.94
(1/2−) 4.5 h
0.335
IT 95%
β− 5%
9/2+ In115 (6×1014 y)
0 Qβ0.50
β−
1/2+ Sn115
0


A=116
A=117
A=118
A=119
A=120
A=121
A=122
Cd116
In116
Sn116
Sb116
In117
Sn117
Sb117
Sn118
Sn119
Sb119
Sn120
Sb120
Te120
Sn121
Sb121
Te121
I121
Sn122
Sb122
Te122
I122

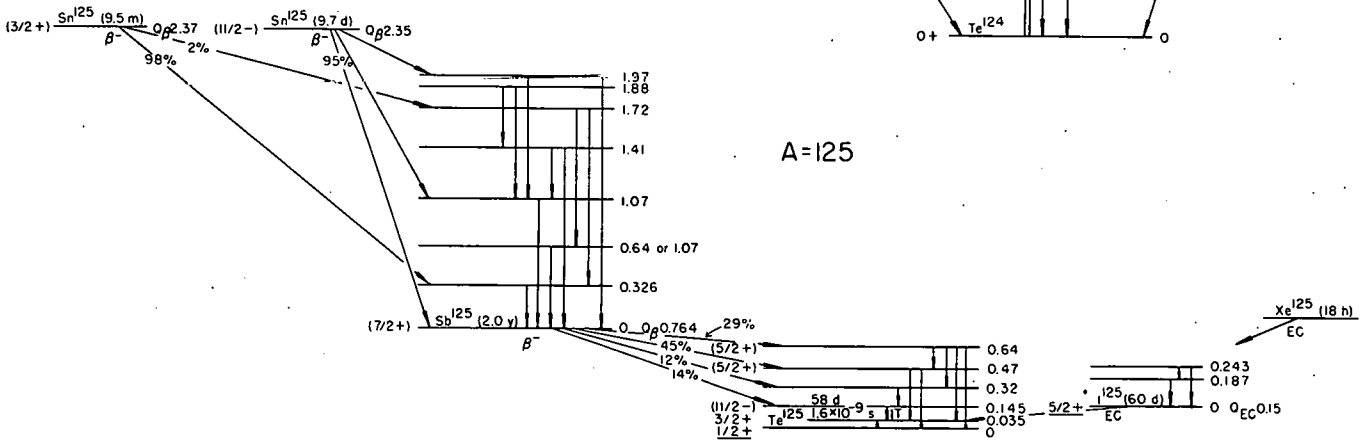
A=123



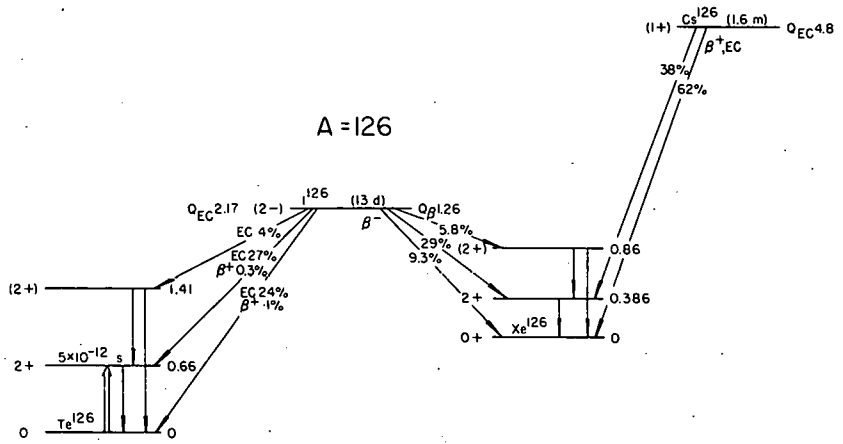
A=124

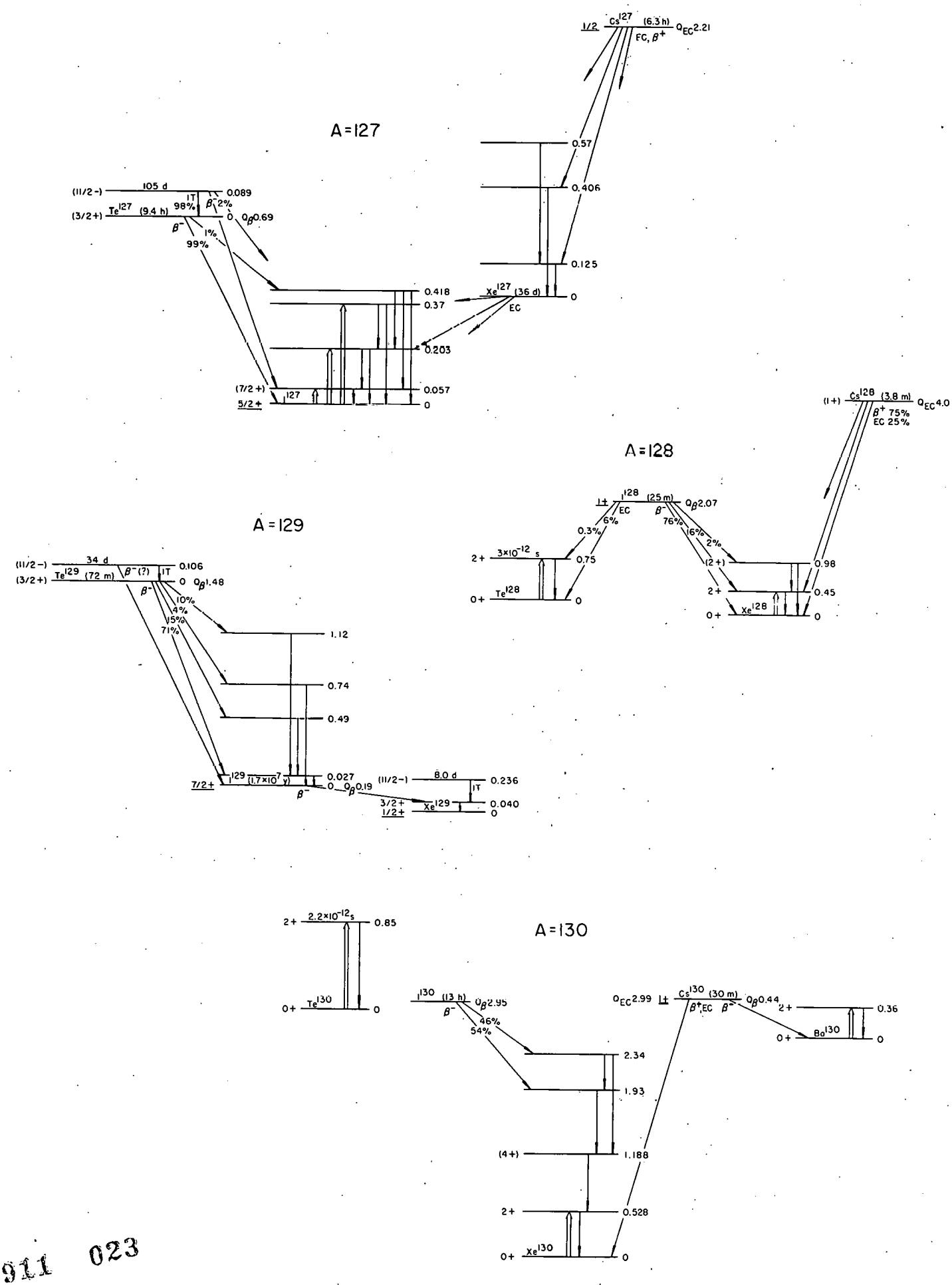


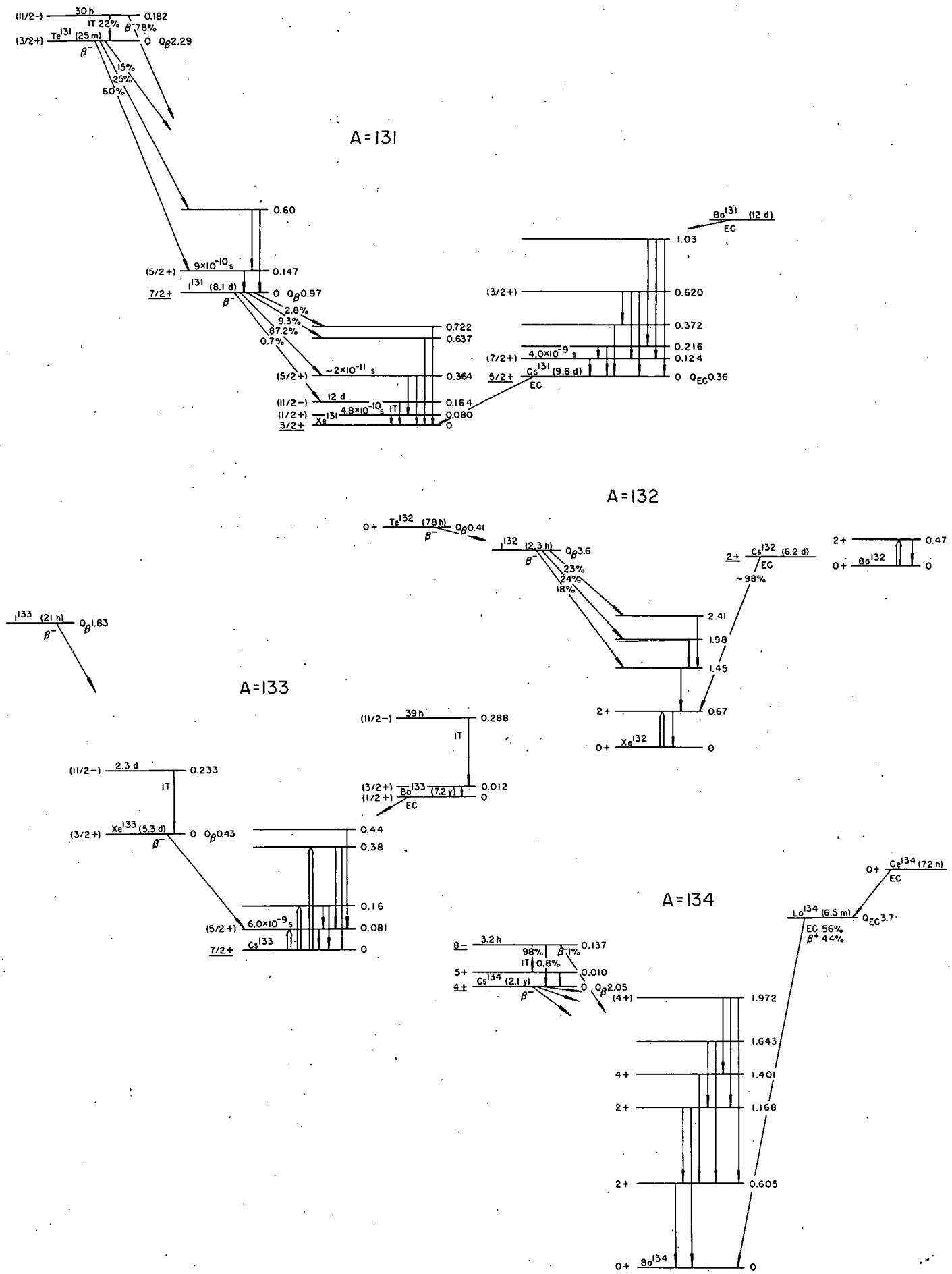
A=125

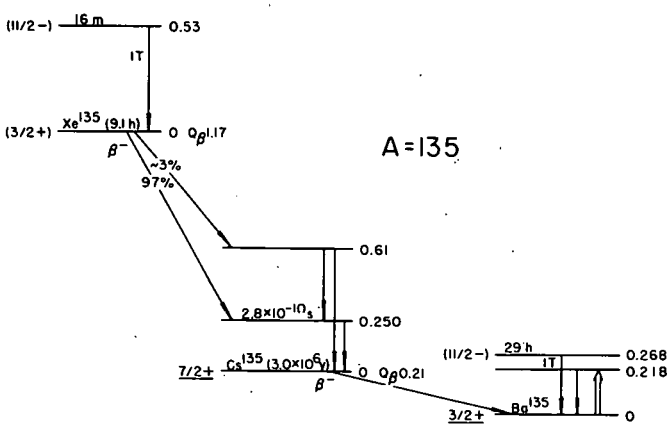


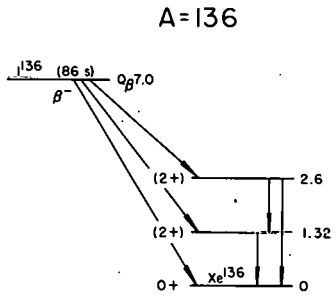
A=126

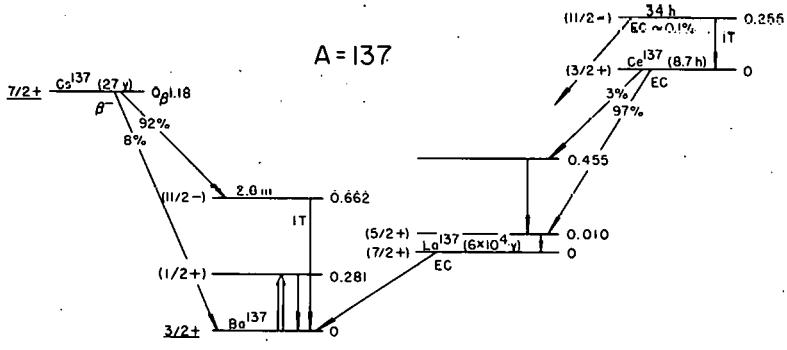


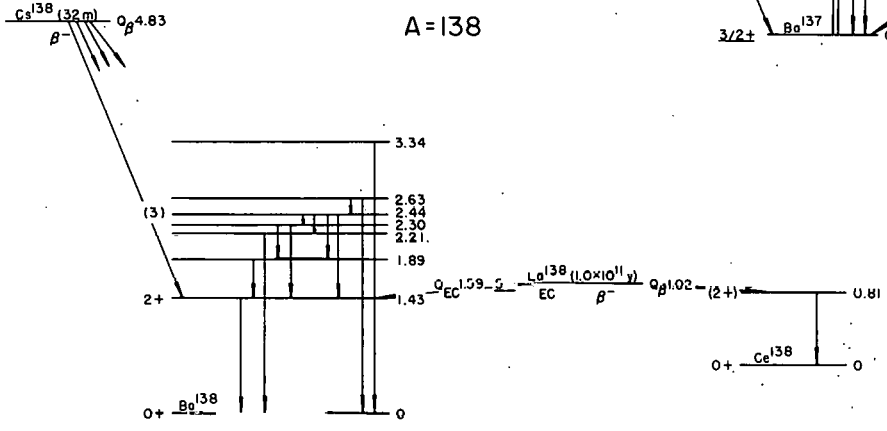

A=127
1/2 Cs127 (6.3 h) QEC2.21
EC, β+
0.57
0.406
0.125
0
Xe127 (36 d)
EC
(11/2-) 105 d 0.089
IT 98%
β- 2%
(3/2+) Te127 (9.4 h) 0 Qβ0.69
β- 1%
99%
0.418
0.37
0.203
(7/2+) 0.057
5/2+ 127 0
A=128
(1+) Cs128 (3.8 m) QEC4.0
β+ 75%
EC 25%
1+ I128 (25 m) Qβ2.07
EC 6%
β- 76%
0.3%
6%
2%
2+ 3x10-12 s 0.75
(2+) 0.98
0+ Te128 0
2+ 0.45
0+ Xe128 0
A=129
(11/2-) 34 d 0.106
(3/2+) Te129 (72 m) β-(?) IT 0 Qβ1.48
β- 10%
4%
15%
71%
1.12
0.74
0.49
7/2+ I129 (1.7x10^7 y) 0.027
0 Qβ0.19
β-
(11/2-) 8.0 d 0.236
IT
3/2+ 0.040
1/2+ Xe129 0
2+ 2.2x10-12s 0.85
0+ Te130 0
A=130
I130 (13 h) Qβ2.95
β- 46%
54%
2.34
1.93
(4+) 1.188
2+ 0.528
0+ Xe130 0
QEC2.99 1+ Cs130 (30 m) Qβ0.44
β+EC β-
2+ 0.36
0+ Ba130 0

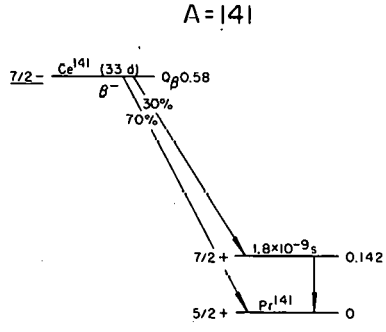

A=131
(11/2-) 30 h 0.182
IT 22% β⁻ 78%
(3/2+) Te131 (25 m) 0 Qβ2.29
β⁻
15%
25%
60%
0.60
(5/2+) 9x10⁻¹⁰ s 0.147
7/2+ I131 (8.1 d) 0 Qβ0.97
β⁻
2.8%
9.3%
87.2%
0.7%
0.722
0.637
(5/2+) ~2x10⁻¹¹ s 0.364
(11/2-) 12 d 0.164
(1/2+) Xe131 4.8x10⁻¹⁰ s IT 0.080
3/2+ 0
Ba131 (12 d)
EC
1.03
(3/2+) 0.620
0.372
(7/2+) 4.0x10⁻⁹ s 0.216
0.124
5/2+ Cs131 (9.6 d) 0 QEC0.36
EC
A=132
0+ Te132 (78 h) Qβ0.41
β⁻
I132 (2.3 h) Qβ3.6
β⁻
23%
24%
18%
2.41
1.98
1.45
2+ 0.67
0+ Xe132 0
2+ Cs132 (6.2 d)
EC
~98%
2+ 0.47
0+ Ba132 0
I133 (21 h) Qβ1.83
β⁻
A=133
(11/2-) 39 h 0.288
IT
(3/2+) Ba133 (7.2 y) 0.012
(1/2+) EC 0
(11/2-) 2.3 d 0.233
IT
(3/2+) Xe133 (5.3 d) 0 Qβ0.43
β⁻
0.44
0.38
0.16
(5/2+) 6.0x10⁻⁹ s 0.081
7/2+ Cs133 0
A=134
0+ Ce134 (72 h)
EC
La134 (6.5 m) QEC3.7
EC 56%
β+ 44%
8- 3.2 h 0.137
98% β⁻ 2%
IT 0.8% 0.010
5+ Cs134 (2.1 y) 0 Qβ2.05
4+ β⁻
(4+) 1.972
1.643
4+ 1.401
2+ 1.168
2+ 0.605
0+ Ba134 0

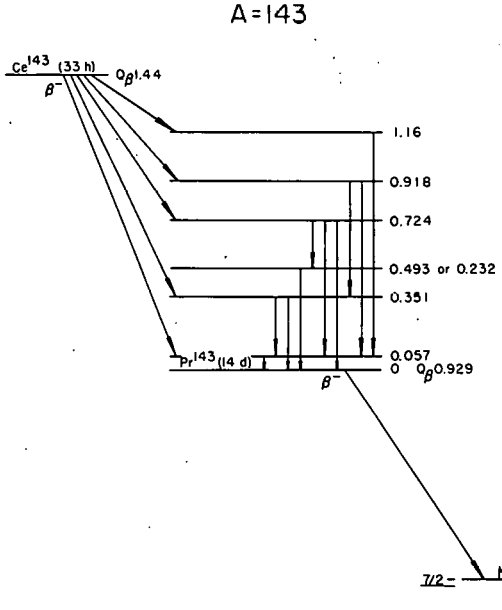

A=135
(11/2−) 16 m 0.53
IT
(3/2+) Xe135 (9.1 h) 0 Qβ1.17
β−
~3%
97%
0.61
2.8×10−10 s
0.250
7/2+ Cs135 (3.0×10^6 y) 0 Qβ0.21
β−
(11/2−) 29 h 0.268
IT 0.218
3/2+ Ba135 0

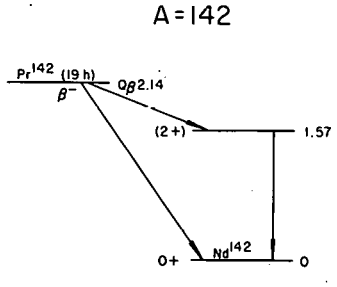

A=136
I136 (86 s) Qβ7.0
β−
(2+) 2.6
(2+) 1.32
0+ Xe136 0

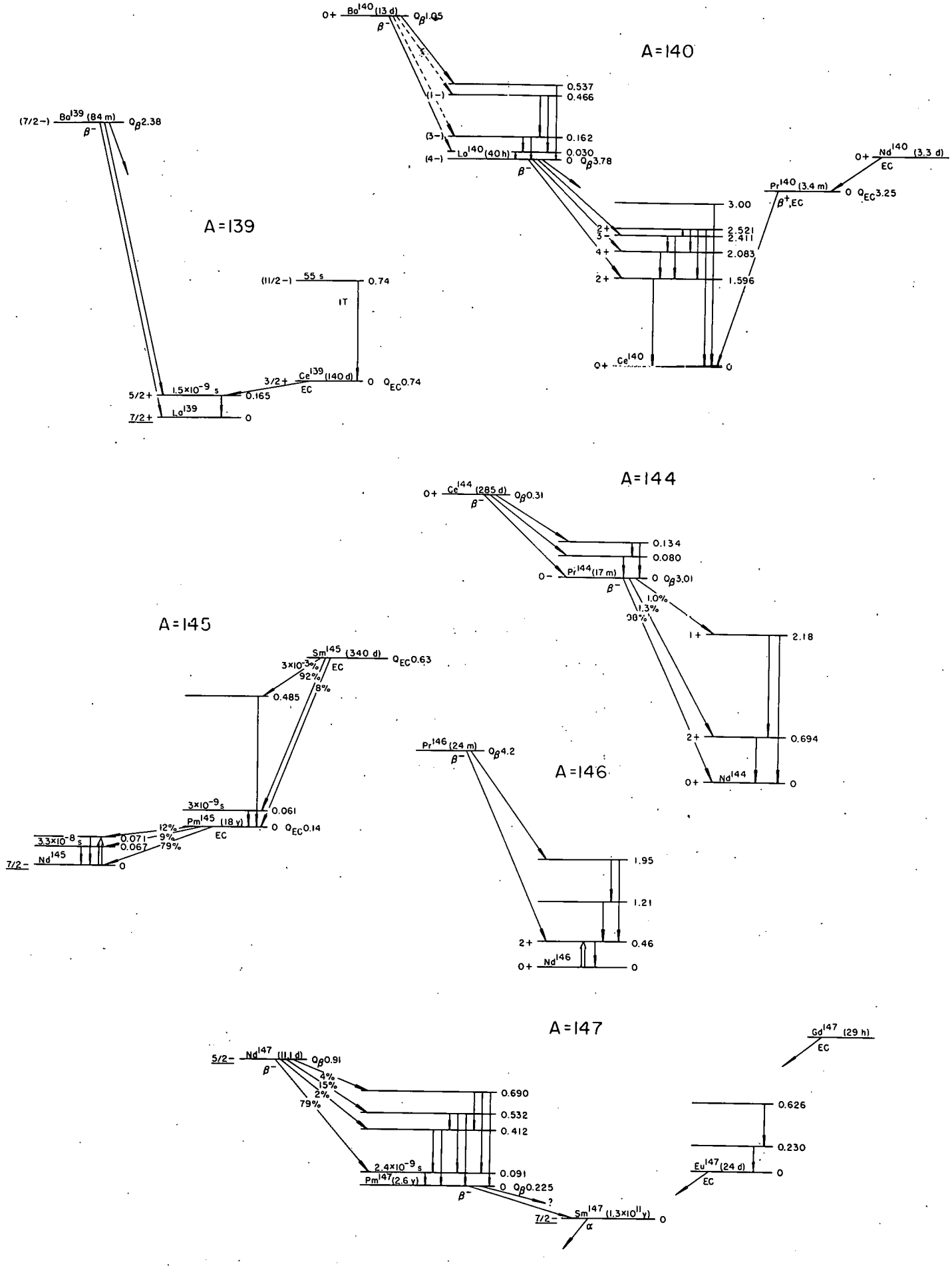

A=137
7/2+ Cs137 (27 y) Qβ1.18
β−
92%
8%
(11/2−) 2.6 m 0.662
IT
(1/2+) 0.281
3/2+ Ba137 0
(11/2−) 34 h 0.255
EC ~0.1%
IT
(3/2+) Ce137 (8.7 h) 0
EC
3%
97%
0.455
(5/2+) 0.010
(7/2+) La137 (6×10^4 y) 0
EC

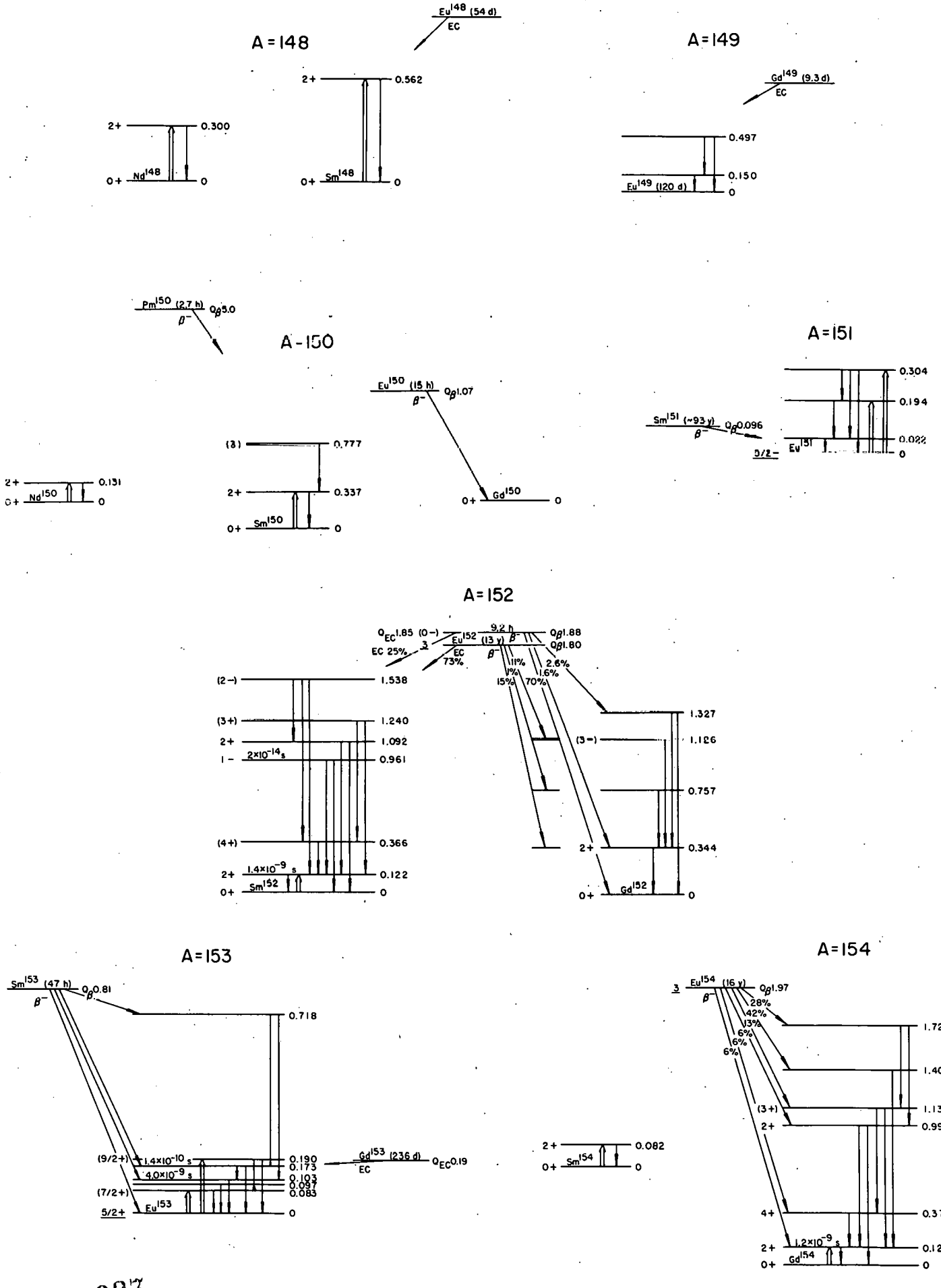

A=138
Cs138 (32 m) Qβ4.83
β−
3.34
(3) 2.63
2.44
2.30
2.21
1.89
2+ 1.43
0+ Ba138 0
QEC1.59 — γ — La138 (1.0×10^11 y)
EC
β−
Qβ1.02
(2+) 0.81
0+ Ce138 0

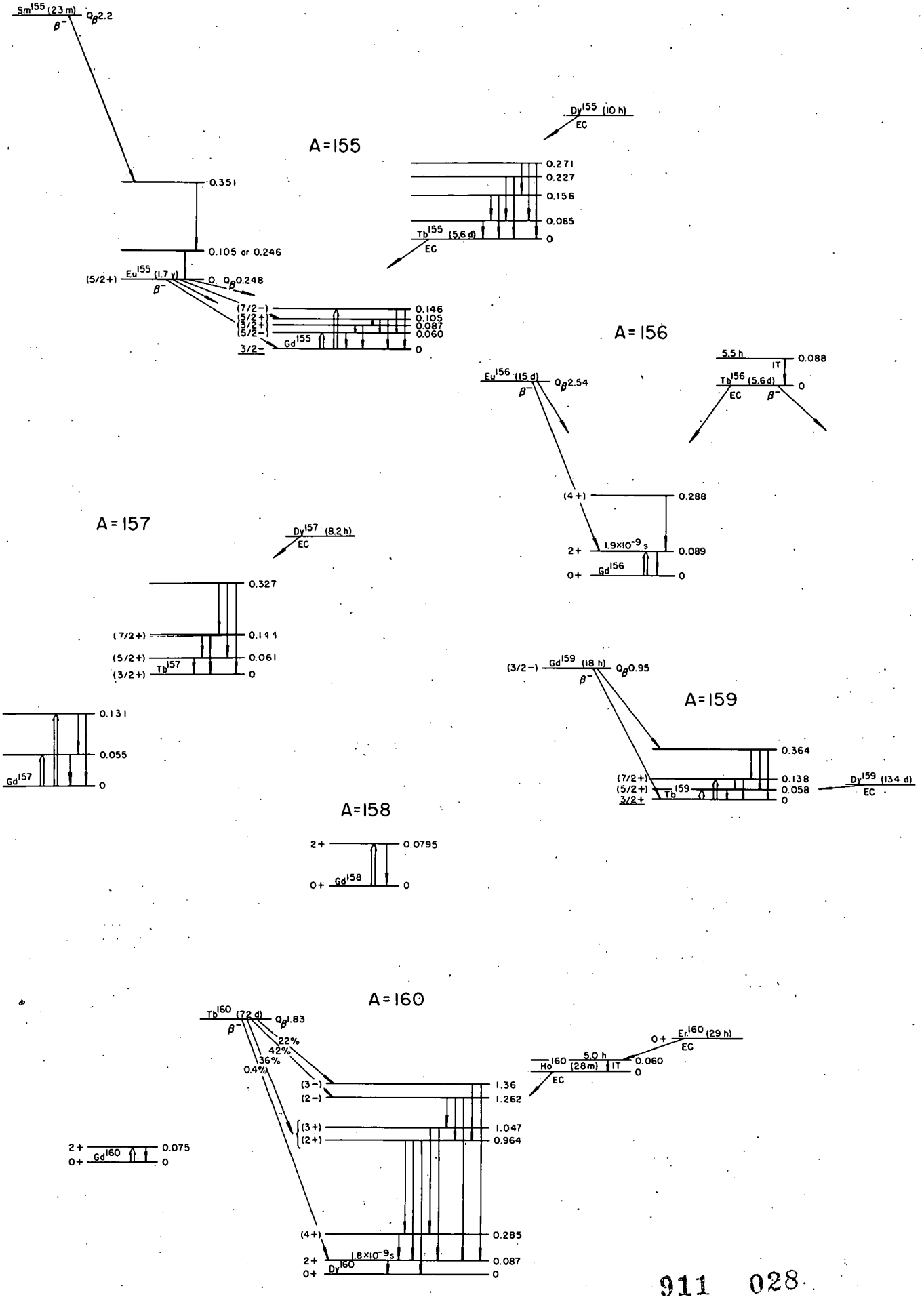

A=141
7/2− Ce141 (33 d) Qβ0.58
β−
30%
70%
7/2+ 1.8×10−9 s 0.142
5/2+ Pr141 0

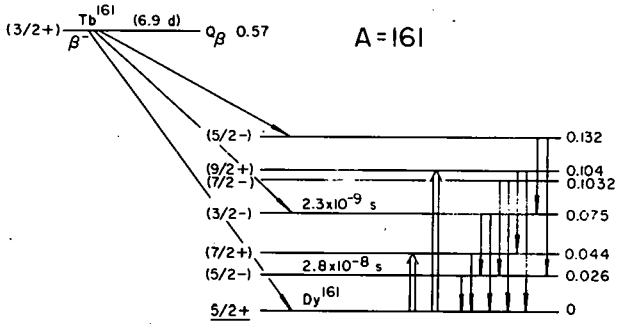

A=143
Ce143 (33 h) Qβ1.44
β−
1.16
0.918
0.724
0.493 or 0.232
0.351
0.057
Pr143 (14 d) 0 Qβ0.929
β−
7/2− Nd143 0

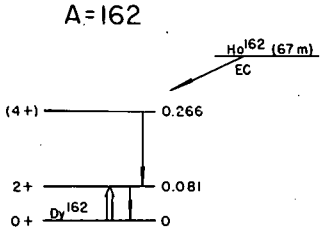

A=142
Pr142 (19 h) Qβ2.14
β−
(2+) 1.57
0+ Nd142 0


A=140
A=139
A=144
A=145
A=146
A=147
Ba140 (13 d)
La140 (40 h)
Ce140
Nd140 (3.3 d)
Pr140 (3.4 m)
Ba139 (84 m)
La139
Ce139 (140 d)
Ce144 (285 d)
Pr144 (17 m)
Nd144
Sm145 (340 d)
Pm145 (18 y)
Nd145
Pr146 (24 m)
Nd146
Nd147 (11.1 d)
Pm147 (2.6 y)
Sm147 (1.3×10¹¹ y)
Gd147 (29 h)
Eu147 (24 d)
EC
IT

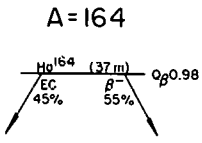

A=148
Eu148 (54 d)
EC
2+ 0.562
0+ Sm148 0
2+ 0.300
0+ Nd148 0
A=149
Gd149 (9.3 d)
EC
0.497
0.150
Eu149 (120 d) 0
A=150
Pm150 (2.7 h) Qβ5.0
β−
Eu150 (15 h) Qβ1.07
β−
(3) 0.777
2+ 0.337
0+ Sm150 0
2+ 0.131
0+ Nd150 0
0+ Gd150 0
A=151
Sm151 (~93 y) Qβ0.096
β−
5/2− Eu151
0.304
0.194
0.022
0
A=152
QEC1.85 (0−)
EC 25%
3
Eu152 9.2 h (13 y)
EC 73%
β−
Qβ1.88
Qβ1.80
11%
1%
15%
70%
2.6%
1.6%
(2−) 1.538
(3+) 1.240
2+ 1.092
1− 2×10−14 s 0.961
(4+) 0.366
2+ 1.4×10−9 s 0.122
0+ Sm152 0
1.327
(3−) 1.126
0.757
2+ 0.344
0+ Gd152 0
A=153
Sm153 (47 h) Qβ0.81
β−
0.718
(9/2+) 1.4×10−10 s 0.190
0.173
4.0×10−9 s 0.103
0.097
(7/2+) 0.083
5/2+ Eu153 0
Gd153 (236 d) QEC0.19
EC
A=154
3
Eu154 (16 y) Qβ1.97
β−
28%
42%
13%
6%
6%
6%
1.723
1.400
(3+) 1.130
2+ 0.998
4+ 0.371
2+ 1.2×10−9 s 0.123
0+ Gd154 0
2+ 0.082
0+ Sm154 0

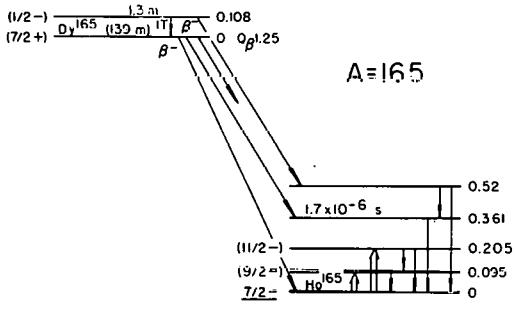

A=155
Sm155 (23 m)
β⁻
Qβ2.2
0.351
0.105 or 0.246
Eu155 (1.7 y)
(5/2+)
0
Qβ0.248
β⁻
(7/2−)
(5/2+)
(3/2−)
(5/2−)
3/2−
Gd155
0.146
0.105
0.087
0.060
0
Dy155 (10 h)
EC
0.271
0.227
0.156
0.065
Tb155 (5.6 d)
EC
0
A=156
Eu156 (15 d)
β⁻
Qβ2.54
5.5 h
IT
0.088
Tb156 (5.6 d)
EC
β⁻
0
(4+)
0.288
2+
1.9×10⁻⁹ s
0.089
0+
Gd156
0
A=157
Dy157 (8.2 h)
EC
0.327
(7/2+)
0.199
(5/2+)
0.061
(3/2+)
Tb157
0
(7/2−)
0.131
(5/2−)
0.055
3/2−
Gd157
0
A=158
2+
0.0795
0+
Gd158
0
A=159
(3/2−)
Gd159 (18 h)
β⁻
Qβ0.95
0.364
(7/2+)
0.138
(5/2+)
0.058
3/2+
Tb159
0
Dy159 (134 d)
EC
A=160
Tb160 (72 d)
β⁻
Qβ1.83
22%
42%
36%
0.4%
(3−)
(2−)
1.36
1.262
(3+)
(2+)
1.047
0.964
(4+)
0.285
2+
1.8×10⁻⁹ s
0.087
0+
Dy160
0
2+
0.075
0+
Gd160
0
0+
Er160 (29 h)
EC
Ho160
5.0 h
(28 m)
IT
0.060
0
EC

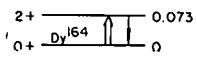

A=161
(3/2+) Tb161 (6.9 d) β- Qβ 0.57
(5/2-) 0.132
(9/2+) 0.104
(7/2-) 0.1032
2.3x10-9 s
(3/2-) 0.075
(7/2+) 0.044
2.8x10-8 s
(5/2-) 0.026
Dy161
5/2+ 0
(7/2-) Ho161 (2.5 h) EC

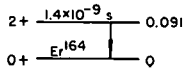

A=162
Ho162 (67 m) EC
(4+) 0.266
2+ 0.081
0+ Dy162 0

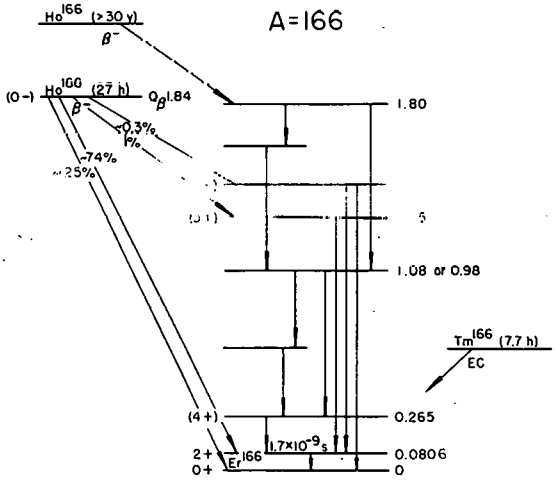

A=163
(9/2-) 0.170
(7/2-) 0.075
5/2- Dy163 0

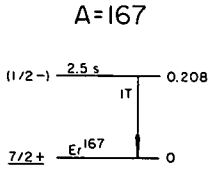

A=164
Ho164 (37 m) Qβ 0.98
EC 45%
β- 55%

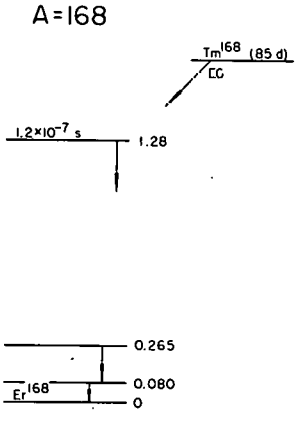

A=165
(1/2-) 1.3 m 0.108
(7/2+) Dy165 (139 m) IT β- 0 Qβ 1.25
β-
0.52
1.7x10-6 s
0.361
(11/2-) 0.205
(9/2-) 0.095
7/2- Ho165 0

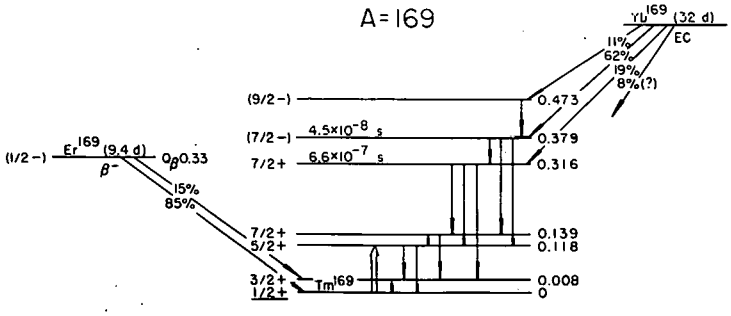

2+ 0.073
0+ Dy164 0

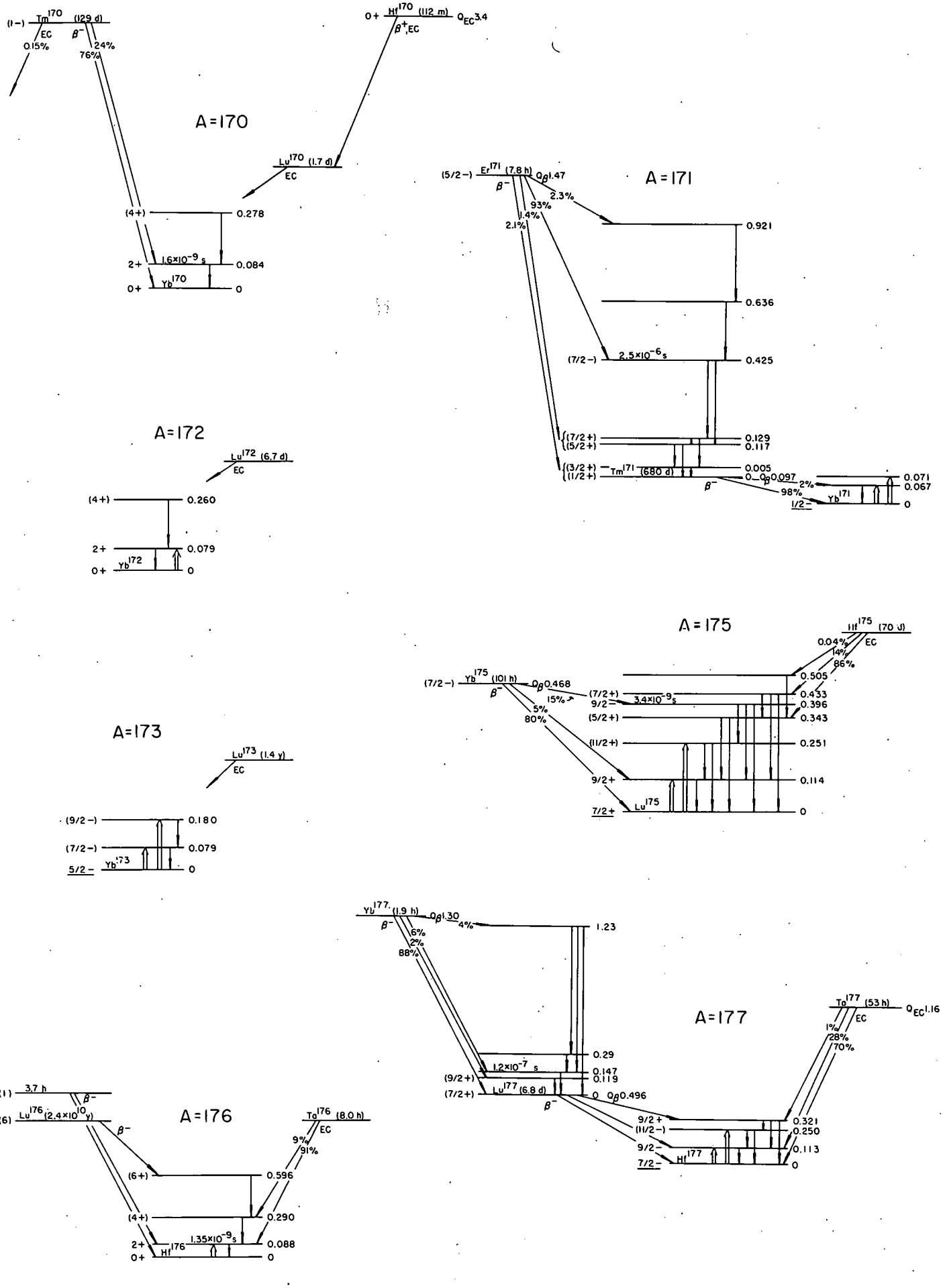

2+ 1.4x10-9 s 0.091
0+ Er164 0

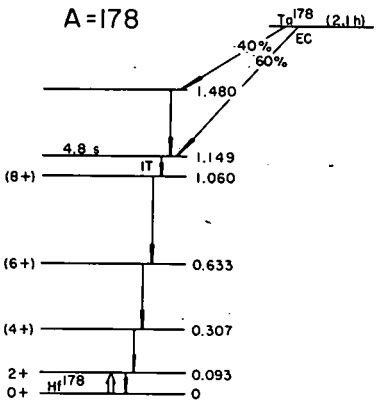

A=166
Ho166 (>30 y) β-
(0-) Ho160 (27 h) Qβ 1.84
β-
~0.3%
~74%
~25%
1.80
1.08 or 0.98
Tm166 (7.7 h) EC
(4+) 0.265
1.7x10-9 s
2+ Er166 0.0806
0+ 0

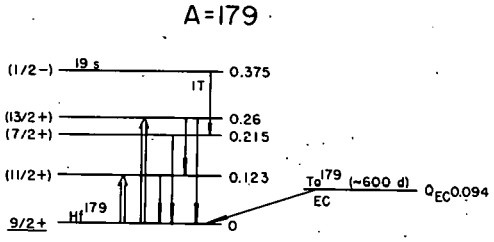

A=167
(1/2-) 2.5 s 0.208
IT
7/2+ Er167 0

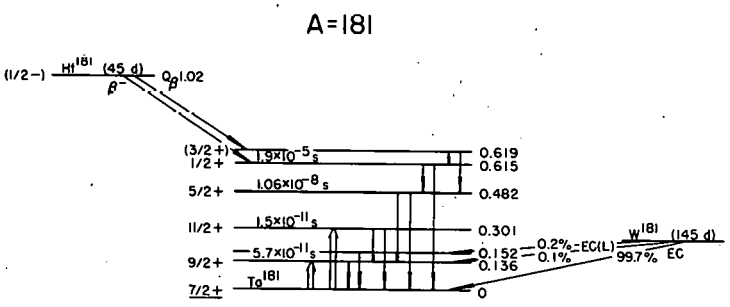

A=168
Tm168 (85 d) EC
1.2x10-7 s 1.28
(4+) 0.265
2+ 0.080
0+ Er168 0

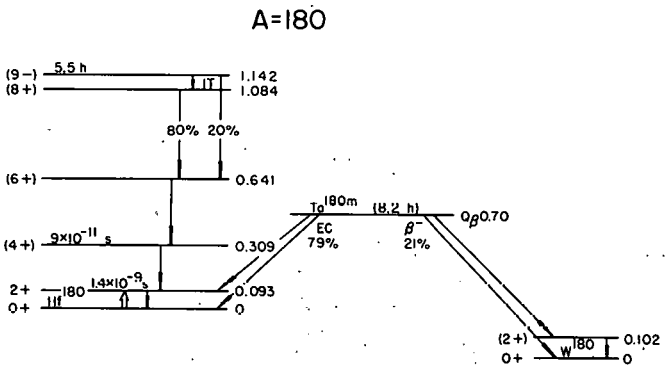

A=169
Yb169 (32 d) EC
11%
62%
19%
8%(?)
(9/2-) 0.473
(7/2-) 4.5x10-8 s 0.379
7/2+ 6.6x10-7 s 0.316
(1/2-) Er169 (9.4 d) Qβ 0.33
β-
15%
85%
7/2+ 0.139
5/2+ 0.118
3/2+ 0.008
1/2+ Tm169 0

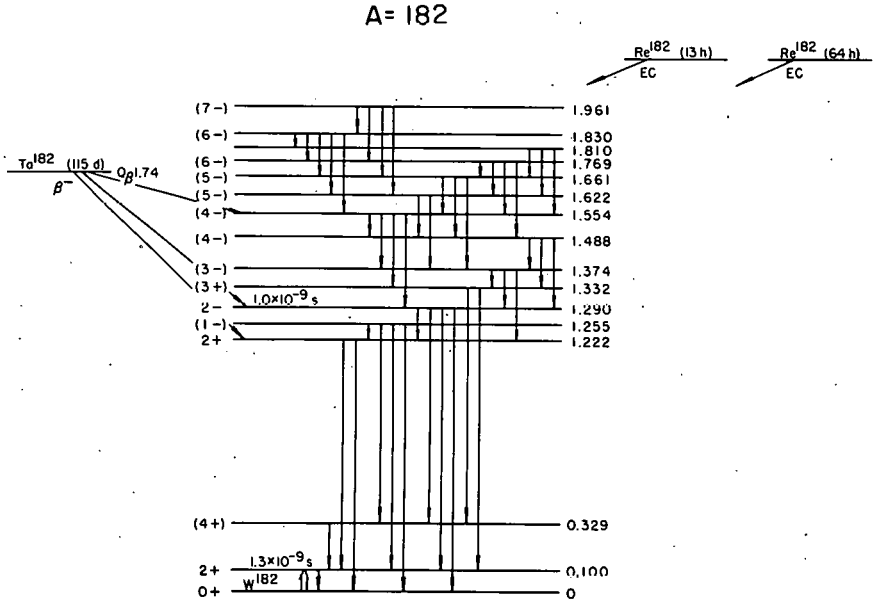

A=170
(1−) Tm170 (129 d)
EC
β−
0.15%
76%
24%
0+ Hf170 (112 m) QEC3.4
β+,EC
Lu170 (1.7 d)
EC
(4+) 0.278
2+ 1.6×10−9 s 0.084
0+ Yb170 0
A=171
(5/2−) Er171 (7.8 h) Qβ1.47
β−
93%
2.3%
1.4%
2.1%
0.921
0.636
(7/2−) 2.5×10−6 s 0.425
(7/2+) 0.129
(5/2+) 0.117
(3/2+) 0.005
(11/2+) Tm171 (680 d) 0 Qβ0.097
β−
2%
98%
0.071
0.067
Yb171
1/2− 0
A=172
Lu172 (6.7 d)
EC
(4+) 0.260
2+ 0.079
0+ Yb172 0
A=173
Lu173 (1.4 y)
EC
(9/2−) 0.180
(7/2−) 0.079
5/2− Yb173 0
A=175
Hf175 (70 d)
EC
0.04%
14%
86%
(7/2−) Yb175 (101 h) Qβ0.468
β−
15%
5%
80%
0.505
(7/2+)
9/2− 3.4×10−9 s 0.433
0.396
(5/2+) 0.343
(11/2+) 0.251
9/2+ 0.114
7/2+ Lu175 0
A=176
(1) 3.7 h
(6) Lu176 (2.4×10^10 y)
β−
β−
Ta176 (8.0 h)
EC
9%
91%
(6+) 0.596
(4+) 0.290
2+ 1.35×10−9 s 0.088
0+ Hf176 0
A=177
Yb177 (1.9 h) Qβ1.30
β−
6%
2%
88%
4%
1.23
0.29
1.2×10−7 s
(9/2+) 0.147
(7/2+) Lu177 (6.8 d) 0 Qβ0.496
β−
Ta177 (53 h) QEC1.16
EC
1%
28%
70%
9/2+ 0.321
(11/2−) 0.250
9/2− 0.113
7/2− Hf177 0

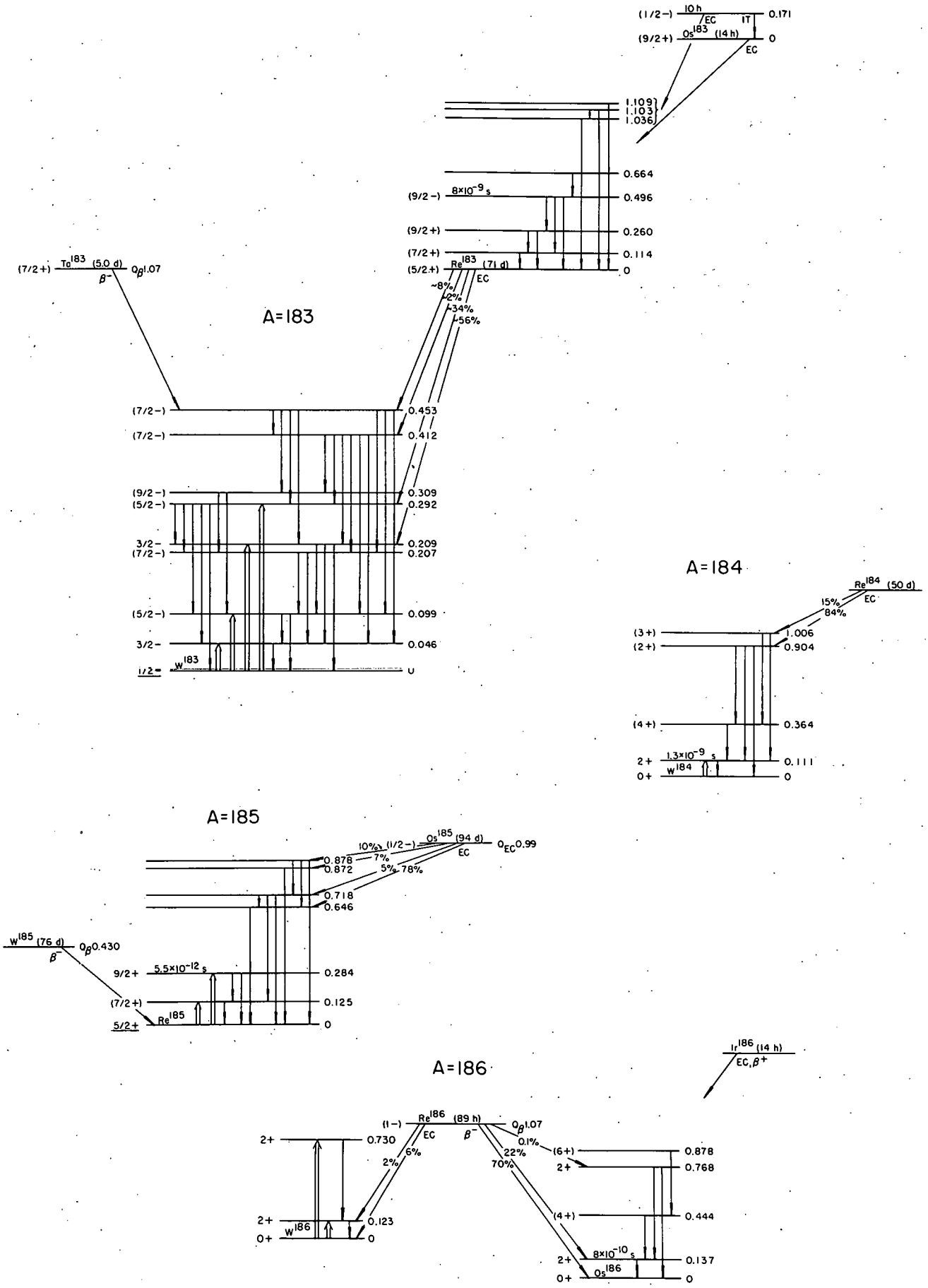

A=178
Ta178 (2.1 h)
EC
40%
60%
1.480
4.8 s
IT
1.149
(8+)
1.060
(6+)
0.633
(4+)
0.307
2+
0.093
0+
Hf178
0

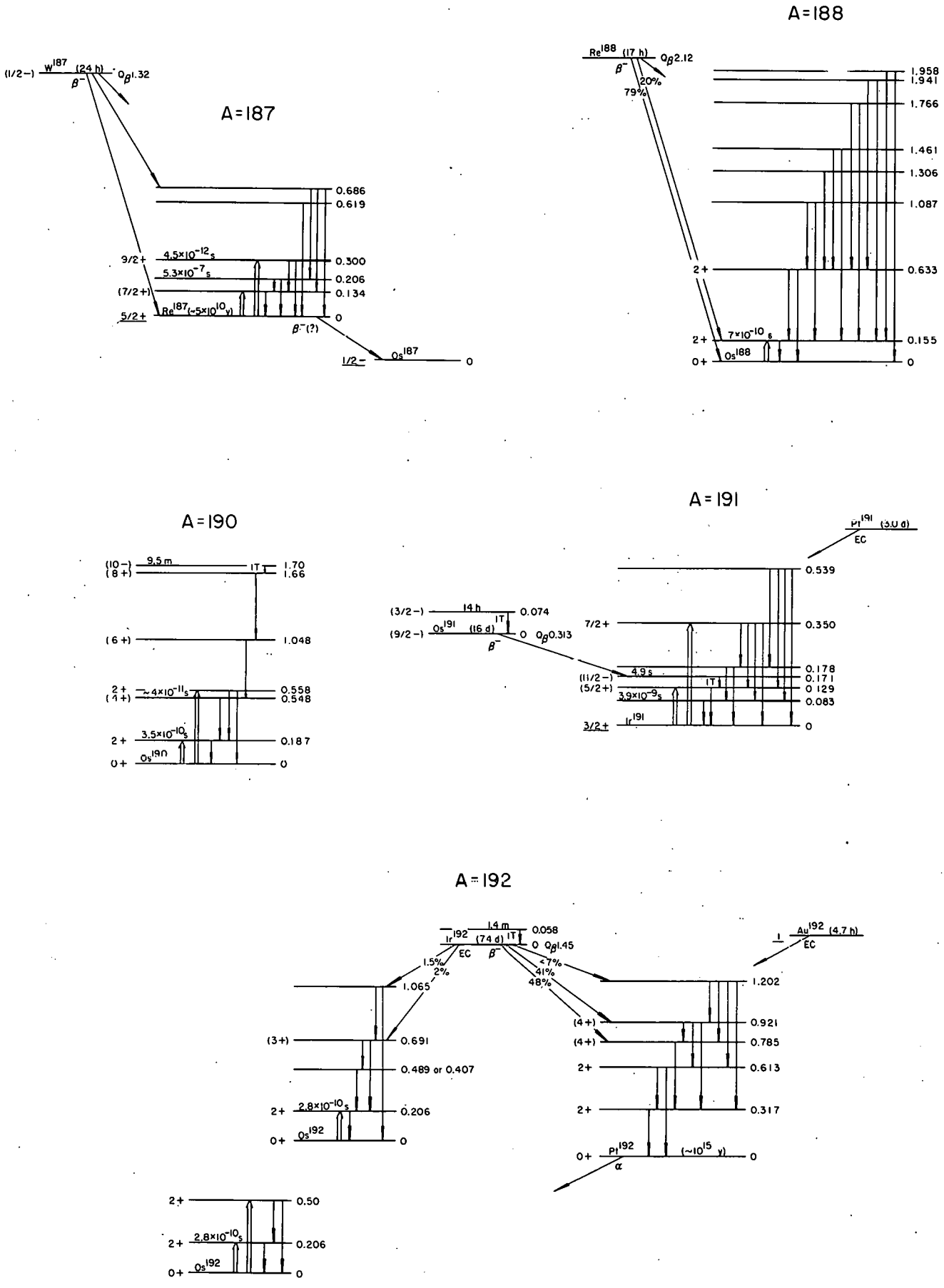

A=179
(1/2−)
19 s
0.375
IT
(13/2+)
0.26
(7/2+)
0.215
(11/2+)
0.123
Ta179 (~600 d)
EC
QEC0.094
9/2+
Hf179
0

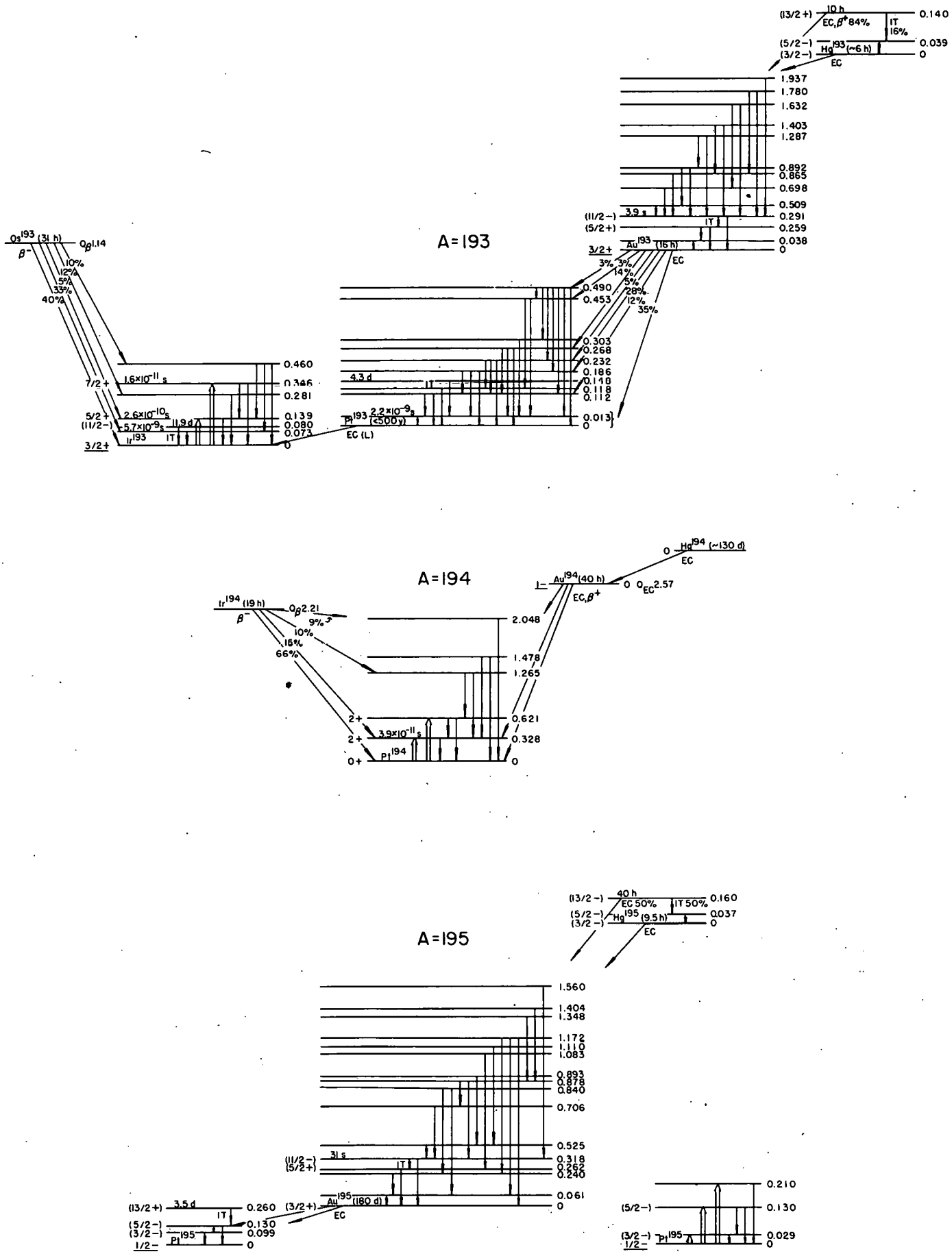

A=181
(1/2−)
Hf181 (45 d)
β−
Qβ1.02
(3/2+)
1.9×10−5 s
0.619
1/2+
0.615
5/2+
1.06×10−8 s
0.482
11/2+
1.5×10−11 s
0.301
9/2+
5.7×10−11 s
0.152
0.136
0.2%-EC(L)
0.1%
W181 (145 d)
99.7% EC
7/2+
Ta181
0


A=180
(9−)
5.5 h
1.142
(8+)
IT
1.084
80%
20%
(6+)
0.641
Ta180m (8.2 h)
EC
79%
β−
21%
Qβ0.70
(4+)
9×10−11 s
0.309
2+
1.4×10−9 s
0.093
0+
Hf180
0
(2+)
W180
0.102
0+
0

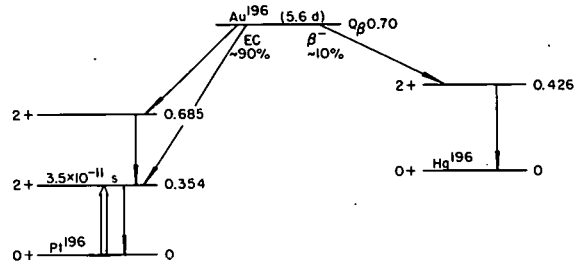

A= 182
Re182 (13 h)
EC
Re182 (64 h)
EC
(7−)
1.961
(6−)
1.830
1.810
(6−)
1.769
(5−)
1.661
(5−)
1.622
(4−)
1.554
(4−)
1.488
(3−)
1.374
(3+)
1.332
2−
1.290
(1−)
1.255
2+
1.222
Ta182 (115 d)
β−
Qβ1.74
1.0×10−9 s
(4+)
0.329
2+
1.3×10−9 s
0.100
0+
W182
0

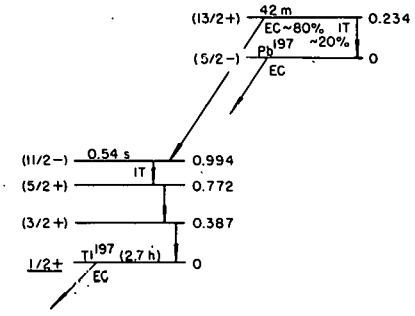

A=183
A=184
A=185
A=186
(1/2−) 10 h EC IT 0.171
(9/2+) Os183 (14 h) EC 0
1.109
1.103
1.036
0.664
(9/2−) 8×10−9 s 0.496
(9/2+) 0.260
(7/2+) 0.114
(5/2+) Re183 (71 d) EC 0
(7/2+) Tc183 (5.0 d) β− Qβ1.07
~8%
2%
34%
56%
(7/2−) 0.453
(7/2−) 0.412
(9/2−) 0.309
(5/2−) 0.292
3/2− 0.209
(7/2−) 0.207
(5/2−) 0.099
3/2− 0.046
1/2− W183 0
Re184 (50 d) EC
15%
84%
(3+) 1.006
(2+) 0.904
(4+) 0.364
2+ 1.3×10−9 s 0.111
0+ W184 0
10%
(1/2−) Os185 (94 d) EC QEC0.99
0.878
7%
0.872
5%
78%
0.718
0.646
W185 (76 d) β− Qβ0.430
9/2+ 5.5×10−12 s 0.284
(7/2+) 0.125
5/2+ Re185 0
Ir186 (14 h) EC,β+
(1−) Re186 (89 h) EC β− Qβ1.07
0.1%
2+ 0.730
6%
2%
22%
70%
(6+) 0.878
2+ 0.768
(4+) 0.444
2+ 0.123
0+ W186 0
8×10−10 s
2+ 0.137
0+ Os186 0


A=187
A=188
A=190
A=191
A=192
W187 (24 h)
Qβ1.32
β⁻
(1/2−)
0.686
0.619
9/2+
4.5×10⁻¹² s
5.3×10⁻⁷ s
0.300
0.206
(7/2+)
0.134
5/2+
Re187 (~5×10¹⁰ y)
0
β⁻(?)
1/2−
Os187
Re188 (17 h)
Qβ2.12
20%
79%
1.958
1.941
1.766
1.461
1.306
1.087
2+
0.633
7×10⁻¹⁰ s
0.155
0+
Os188
(10−)
(8+)
9.5 m
IT
1.70
1.66
(6+)
1.048
2+
(4+)
~4×10⁻¹¹ s
0.558
0.548
2+
3.5×10⁻¹⁰ s
0.187
0+
Os190
(3/2−)
14 h
0.074
(9/2−)
Os191
(16 d)
Qβ0.313
Pt191 (3.0 d)
EC
0.539
7/2+
0.350
4.9 s
0.178
(11/2−)
0.171
(5/2+)
3.9×10⁻⁹ s
0.129
0.083
3/2+
Ir191
Ir192
1.4 m
(74 d)
0.058
Qβ1.45
EC
β⁻
1.5%
2%
<7%
41%
48%
1.065
0.691
(3+)
0.489 or 0.407
2+
2.8×10⁻¹⁰ s
0.206
0+
Os192
Au192 (4.7 h)
1.202
(4+)
0.921
(4+)
0.785
2+
0.613
2+
0.317
0+
Pt192
(~10¹⁵ y)
α
2+
0.50
2+
2.8×10⁻¹⁰ s
0.206
0+
Os192

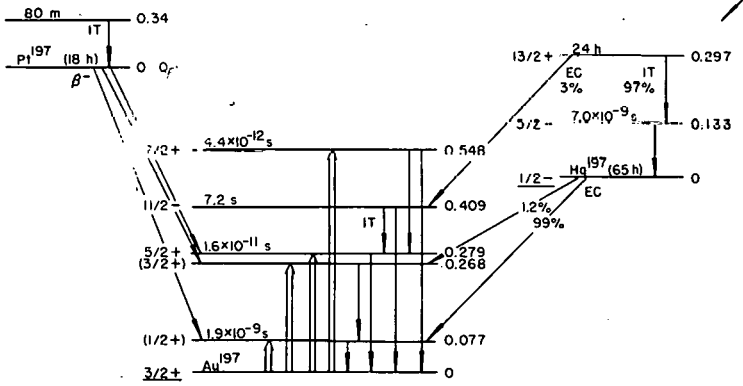

A=193
A=194
A=195
Os193 (31 h)
Qβ1.14
β−
10%
12%
5%
33%
40%
7/2+
1.6×10−11 s
0.460
0.346
0.281
5/2+
(11/2−)
2.6×10−10s
5.7×10−9s
11.9 d
0.139
0.080
0.073
Ir193
IT
3/2+
0
Pt193 2.2×10−9s (<500 y)
EC (L)
0.490
0.453
0.303
0.268
0.232
0.186
0.140
0.118
0.112
4.3 d
0.013
(13/2+)
10 h
EC,β+ 84%
IT 16%
0.140
(5/2−)
(3/2−)
Hg193 (~6 h)
0.039
EC
1.937
1.780
1.632
1.403
1.287
0.892
0.865
0.698
0.509
(11/2−)
3.9 s
0.291
(5/2+)
0.259
Au193 (16 h)
0.038
3/2+
3%
14%
5%
28%
12%
35%
Ir194 (19 h)
Qβ2.21
9%
10%
16%
66%
2.048
1.478
1.265
2+
0.621
3.9×10−11 s
0.328
0+
Pt194
0
Au194 (40 h)
EC,β+
EC2.57
Hg194 (~130 d)
(13/2−)
40 h
EC 50%
IT 50%
0.160
(5/2−)
(3/2−)
Hg195 (9.5 h)
0.037
1.560
1.404
1.348
1.172
1.110
1.083
0.893
0.878
0.840
0.706
0.525
(11/2−)
31 s
0.318
(5/2+)
0.262
0.240
Au195 (180 d)
0.061
(13/2+)
3.5 d
0.260
(5/2−)
0.130
(3/2−)
Pt195
0.099
1/2−
0.210
0.130
0.029

A=196

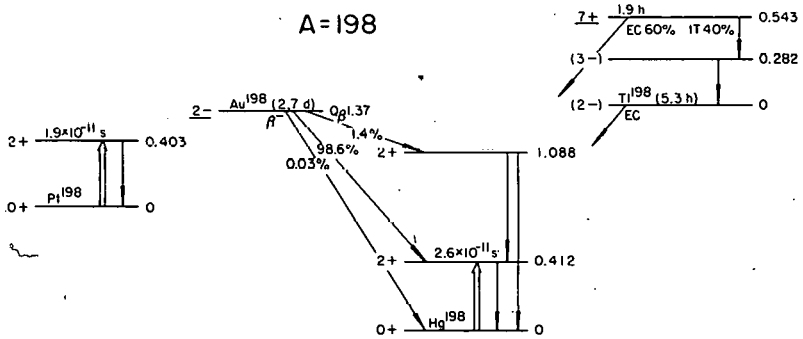




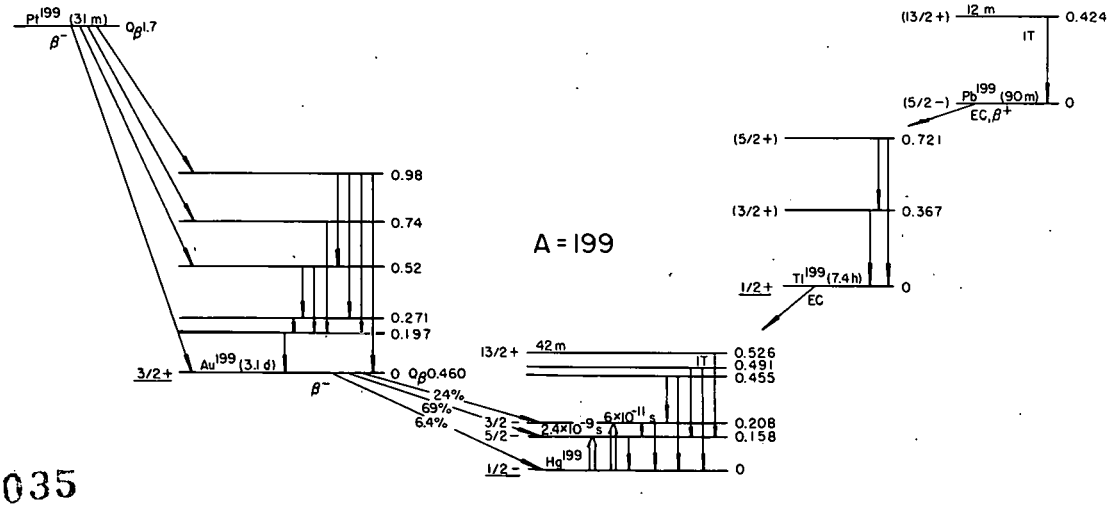
A=197

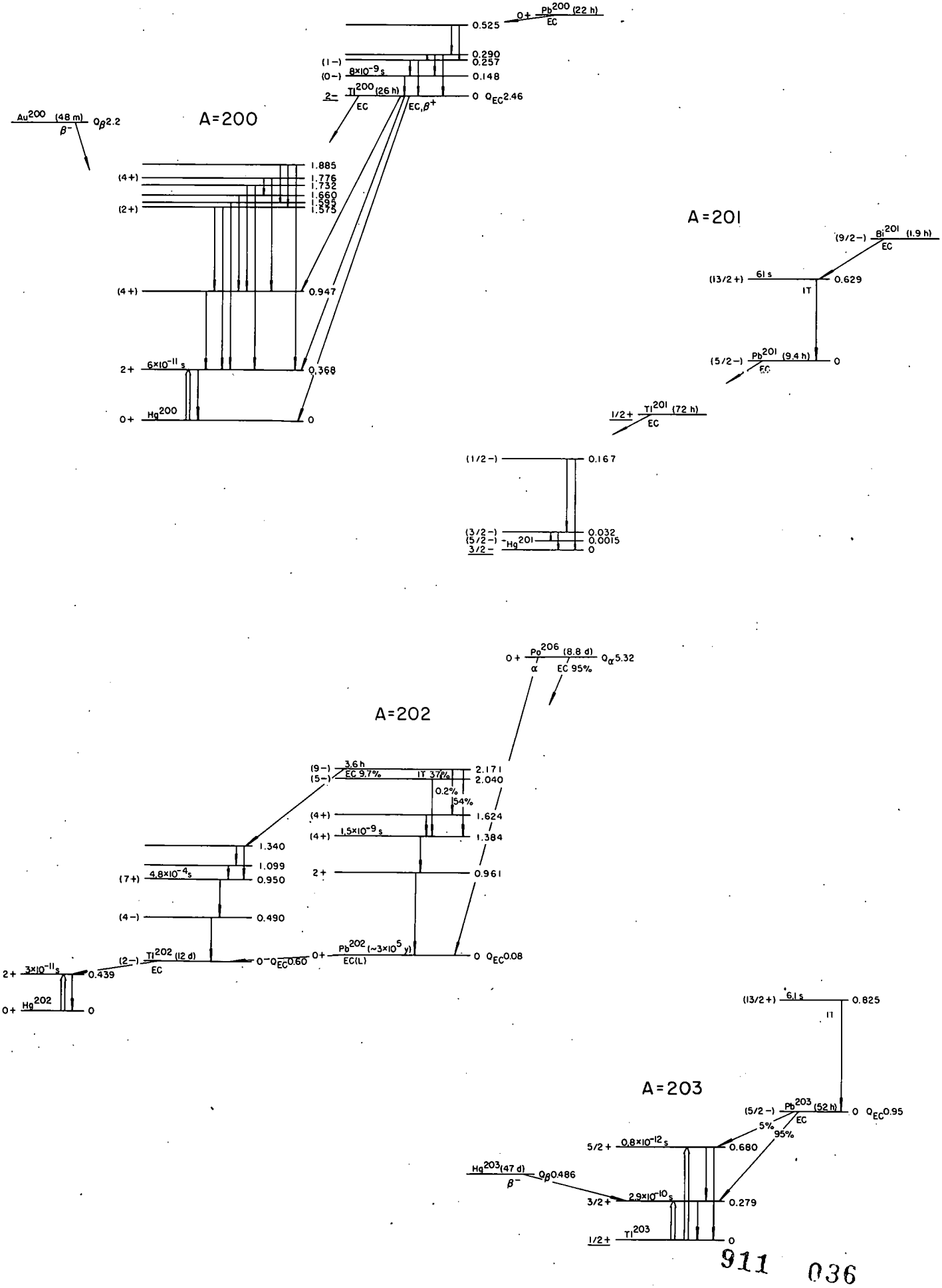


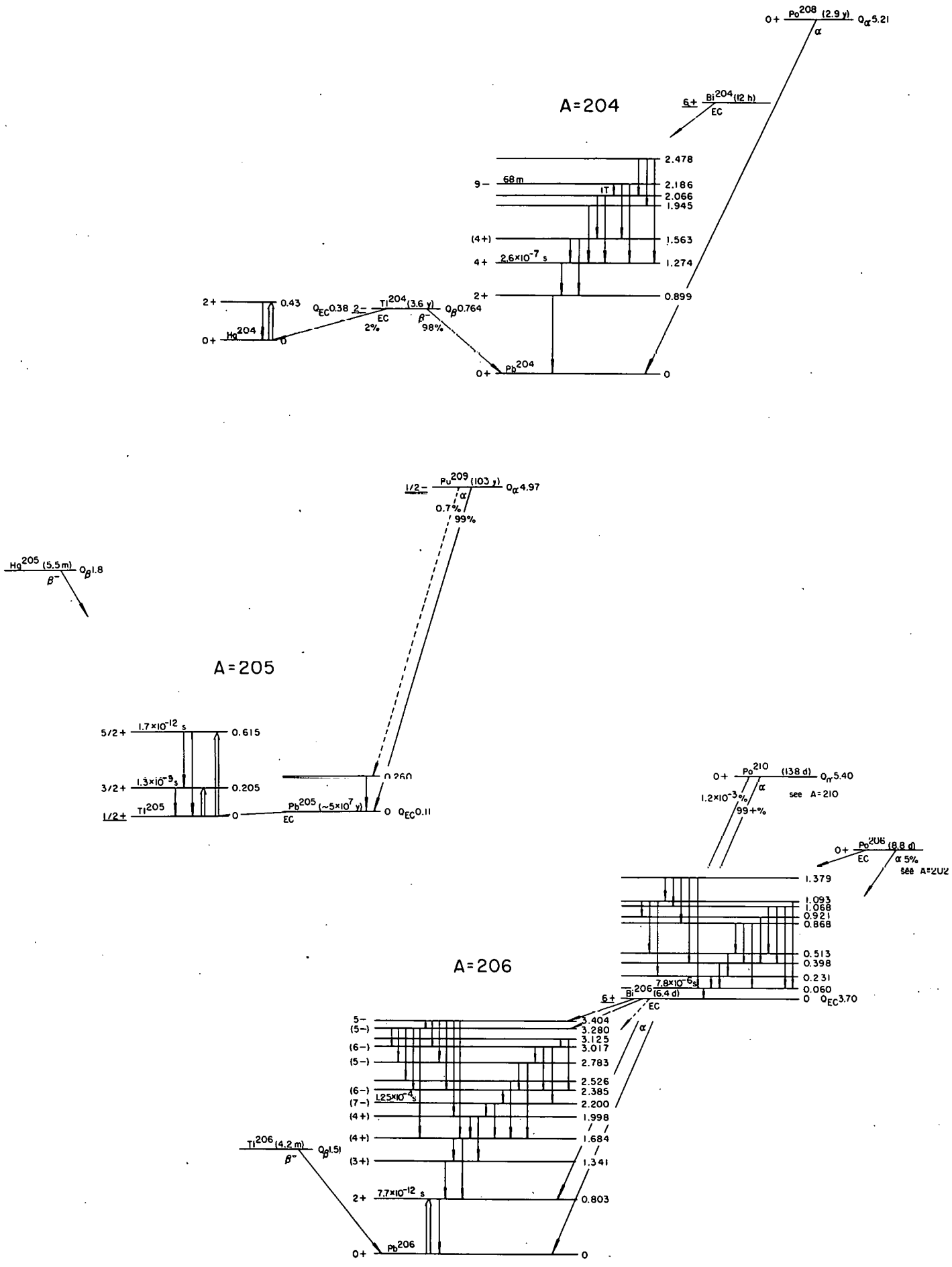
A=198



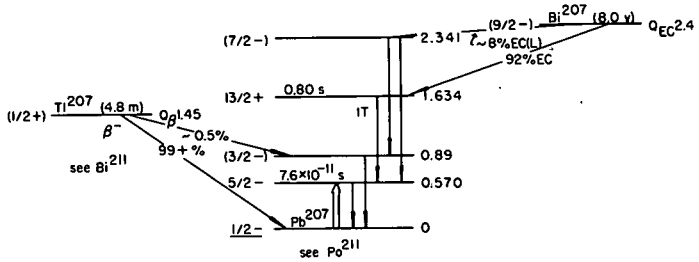
A=199

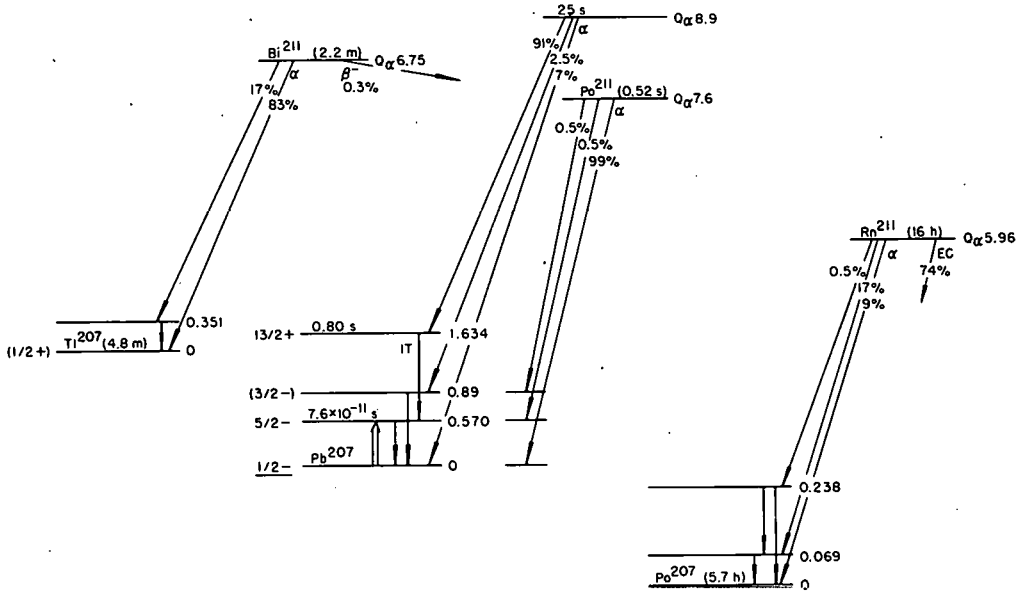


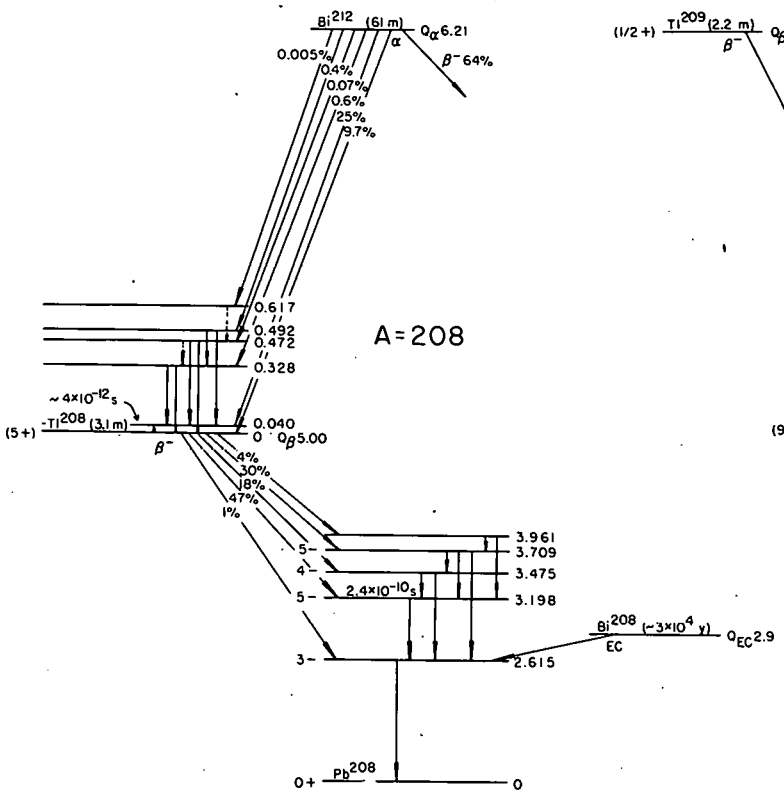

A=200
A=201
A=202
A=203
Au200 (48 m) β− Qβ2.2
Hg200
Tl200 (26 h) EC, β+ Qec2.46
Pb200 (22 h) EC
Bi201 (1.9 h) EC
Pb201 (9.4 h) EC
Tl201 (72 h) EC
Hg201
Po206 (8.8 d) α EC 95% Qα5.32
Tl202 (12 d) EC Qec0.60
Hg202
Pb202 (~3×10^5 y) EC(L) Qec0.08
Hg203 (47 d) β− Qβ0.486
Tl203
Pb203 (52 h) EC Qec0.95


A=204
A=205
A=206
Po208 (2.9 y) Qα5.21
Bi204 (12 h)
EC
2.478
68m
IT
2.186
2.066
1.945
1.563
2.6×10⁻⁷ s
1.274
0.899
0
Pb204
Tl204 (3.6 y)
EC 2%
β⁻ 98%
QEC0.38
Qβ0.764
0.43
Hg204
Pu209 (103 y) Qα4.97
α 0.7%
99%
Hg205 (5.5m) Qβ1.8
1.7×10⁻¹² s
0.615
1.3×10⁻³ s
0.205
Tl205
Pb205 (~5×10⁷ y)
EC
0.260
QEC0.11
Po210 (138 d) Qα5.40
see A=210
1.2×10⁻³%
99+%
Po206 (8.8 d)
EC
α 5%
see A=202
1.379
1.093
1.068
0.921
0.868
0.513
0.398
0.231
0.060
Bi206 (6.4 d)
7.8×10⁻⁶ s
QEC3.70
3.404
3.280
3.125
3.017
2.783
2.526
2.385
2.200
1.998
1.684
1.341
0.803
1.25×10⁻⁴ s
7.7×10⁻¹² s
Tl206 (4.2 m) Qβ1.51
Pb206

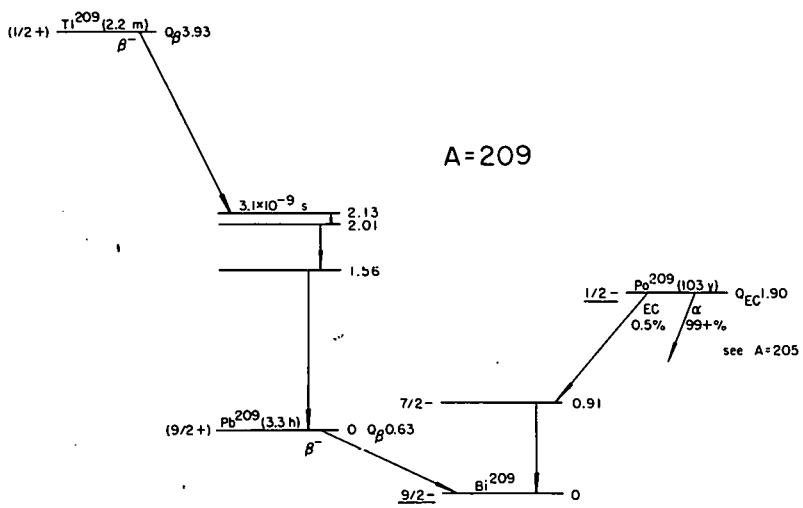
A=207



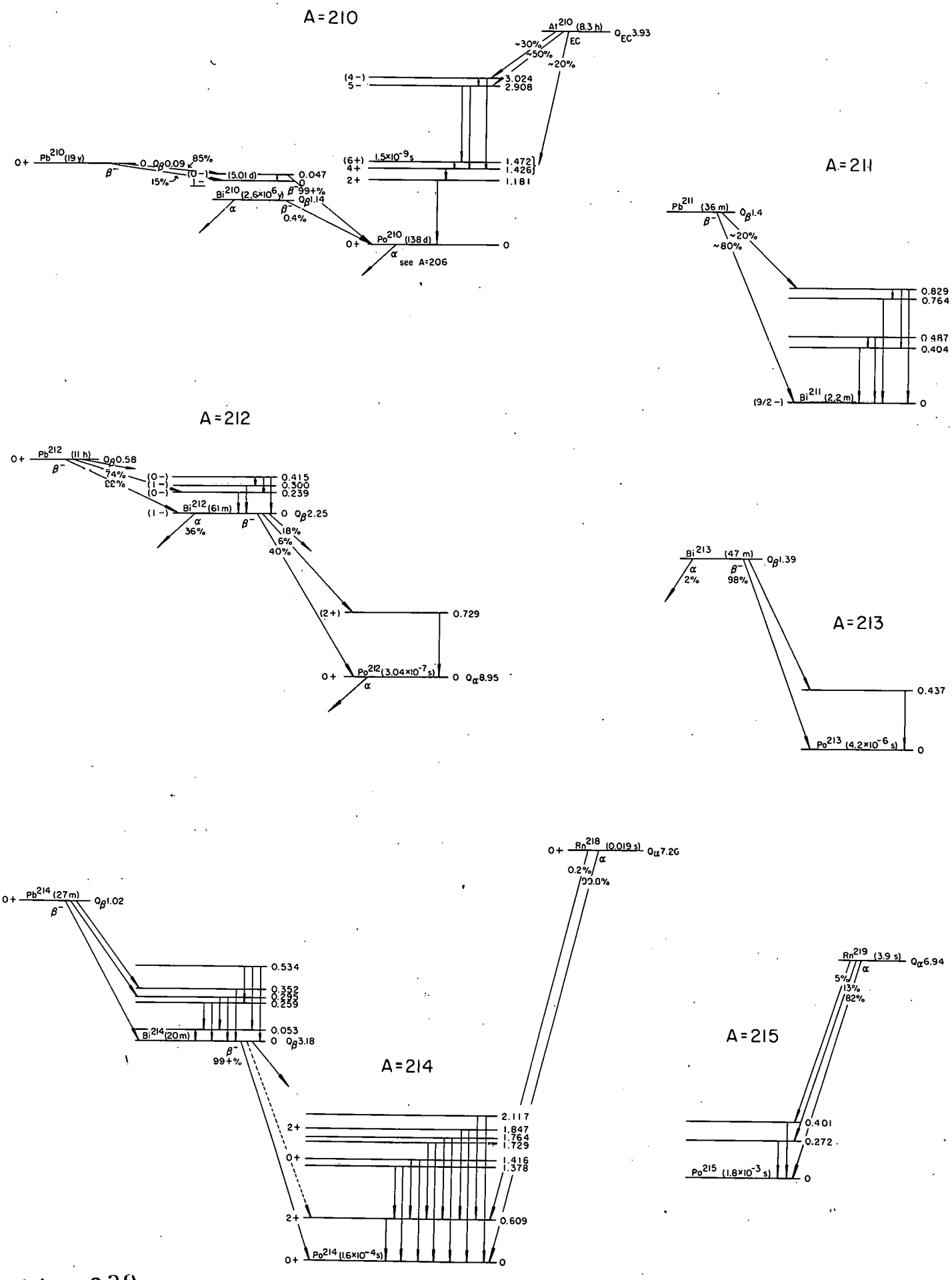


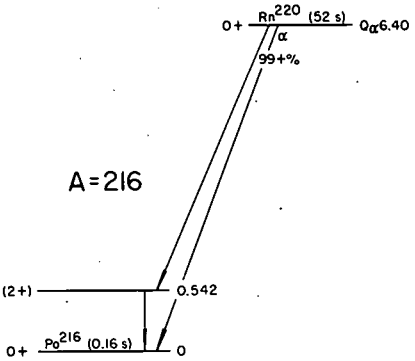


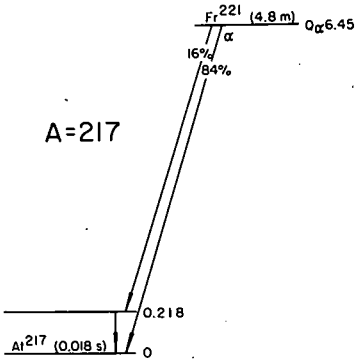
A=208



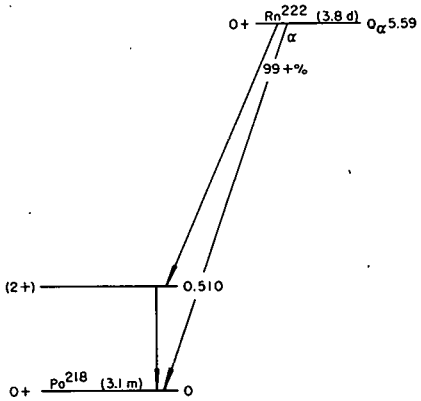
A=209

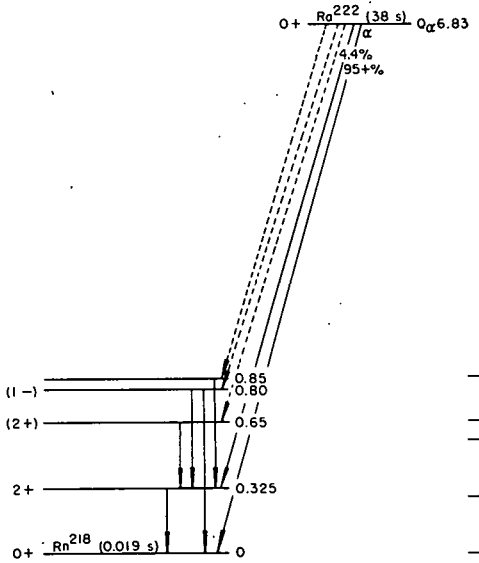

A=210
At210 (8.3 h)
EC
0EC3.93
~30%
~50%
~20%
(4-)
5-
3.024
2.908
(6+)
4+
2+
1.5×10-9s
1.472
1.426
1.181
0+ Pb210 (19 y)
β-
0 0β0.09
85%
15%
(0-)
1-
(5.01 d)
0.047
0
Bi210 (2.6×10^6 y)
α
β- 99+%
0β1.14
β- 0.4%
0+ Po210 (138 d)
0
α
see A=206
A=211
Pb211 (36 m)
β-
0β1.4
~20%
~80%
0.829
0.764
0.487
0.404
(9/2-) Bi211 (2.2 m)
0
A=212
0+ Pb212 (11 h)
β-
0β0.58
74%
22%
(0-)
(1-)
(0-)
0.415
0.300
0.239
(1-) Bi212 (61 m)
α
36%
β-
0 0β2.25
18%
6%
40%
(2+)
0.729
0+ Po212 (3.04×10-7 s)
0 0α8.95
α
Bi213 (47 m)
α
2%
β-
98%
0β1.39
A=213
0.437
Po213 (4.2×10-6 s)
0
0+ Rn218 (0.019 s)
α
0α7.26
0.2%
99.8%
0+ Pb214 (27 m)
β-
0β1.02
0.534
0.352
0.295
0.259
Bi214 (20 m)
0.053
0 0β3.18
β-
99+%
A=214
2.117
2+
1.847
1.764
1.729
0+
1.416
1.378
2+
0.609
0+ Po214 (1.6×10-4 s)
0
Rn219 (3.9 s)
α
0α6.94
5%
13%
82%
A=215
0.401
0.272
Po215 (1.8×10-3 s)
0

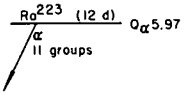

A=216
0+ Rn220 (52 s) Qα6.40
α
99+%
(2+) 0.542
0+ Po216 (0.16 s) 0


A=217
Fr221 (4.8 m) Qα6.45
α
16%
84%
0.218
At217 (0.018 s) 0

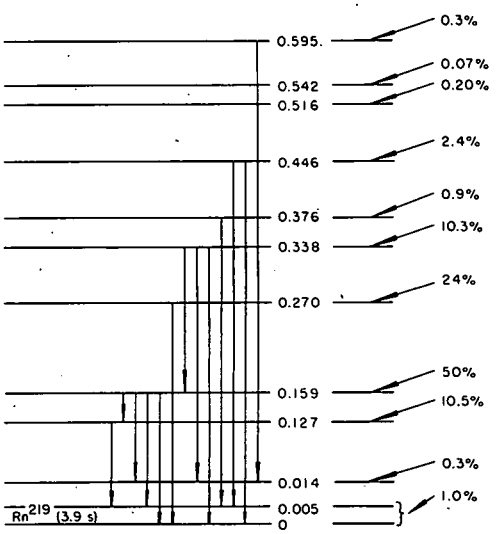
A=218

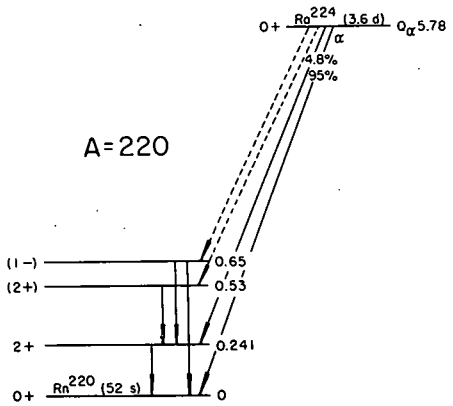

0+ Rn222 (3.8 d) Qα5.59
α
99+%
(2+) 0.510
0+ Po218 (3.1 m) 0


0+ Ra222 (38 s) Qα6.83
α
4.4%
95+%
(1−) 0.85
0.80
(2+) 0.65
2+ 0.325
0+ Rn218 (0.019 s) 0

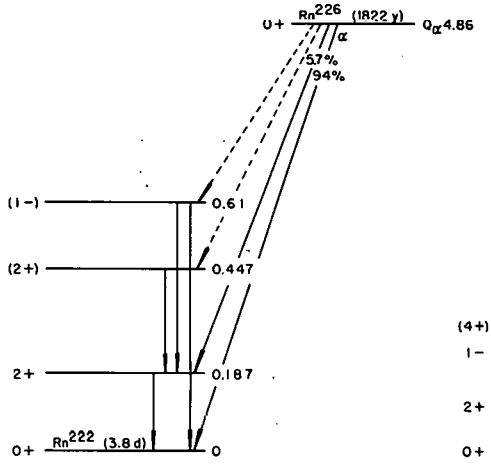

Ra223 (12 d) Qα5.97
α
11 groups

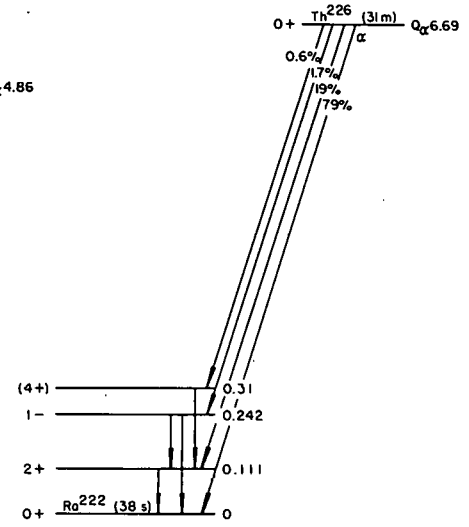
A=219

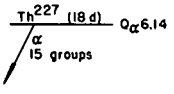

0.595 0.3%
0.542 0.07%
0.516 0.20%
0.446 2.4%
0.376 0.9%
0.338 10.3%
0.270 24%
0.159 50%
0.127 10.5%
0.014 0.3%
0.005 1.0%
0
Rn219 (3.9 s)


A=220
0+ Ra224 (3.6 d) Qα5.78
α
4.8%
95%
(1−) 0.65
(2+) 0.53
2+ 0.241
0+ Rn220 (52 s) 0

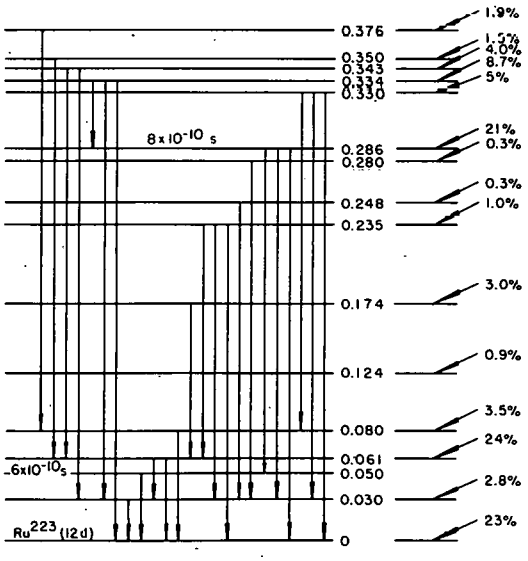
A=222



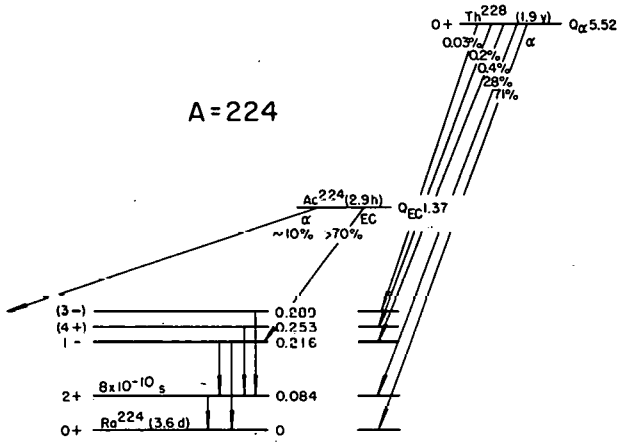




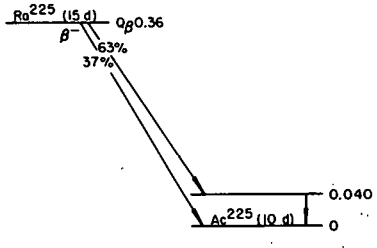
A=223



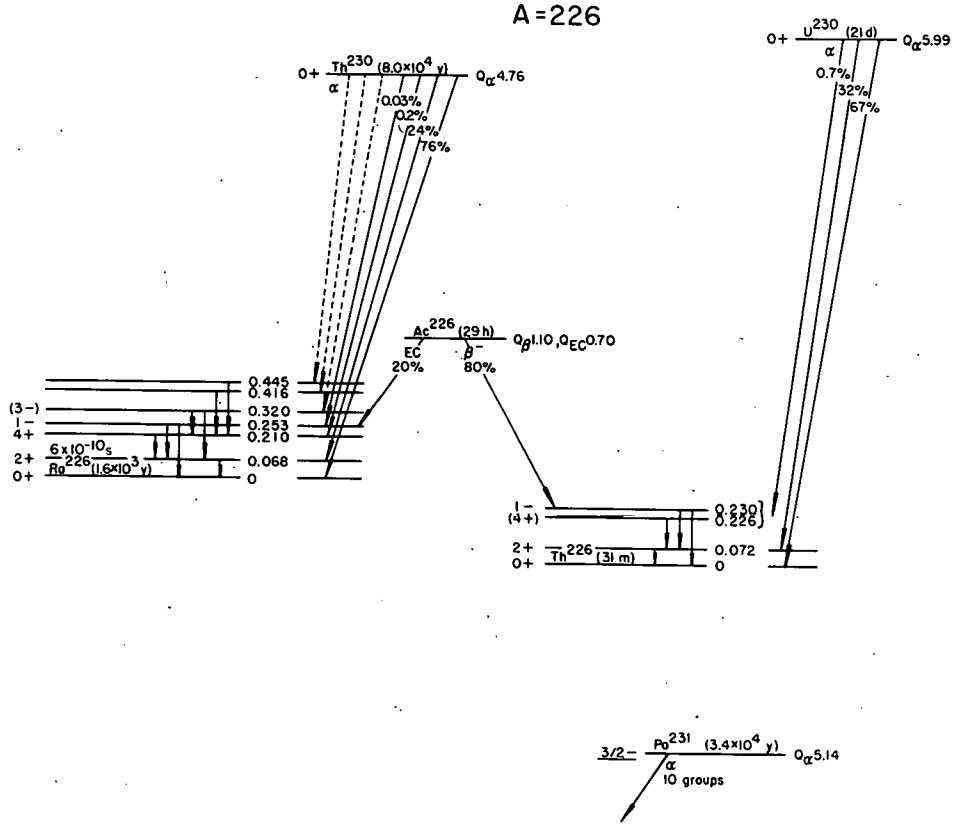
A=224



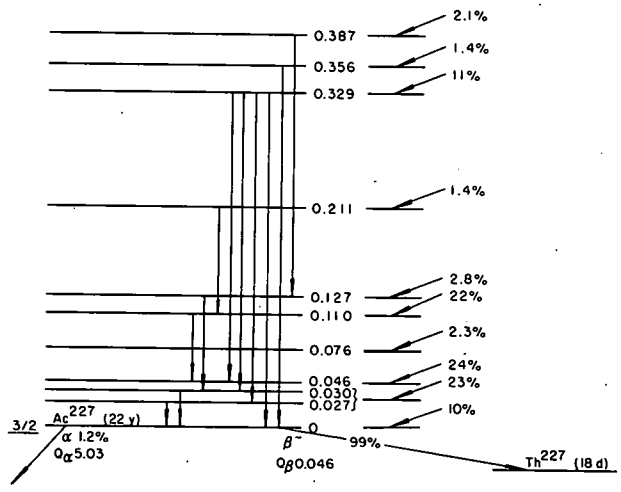
A=225

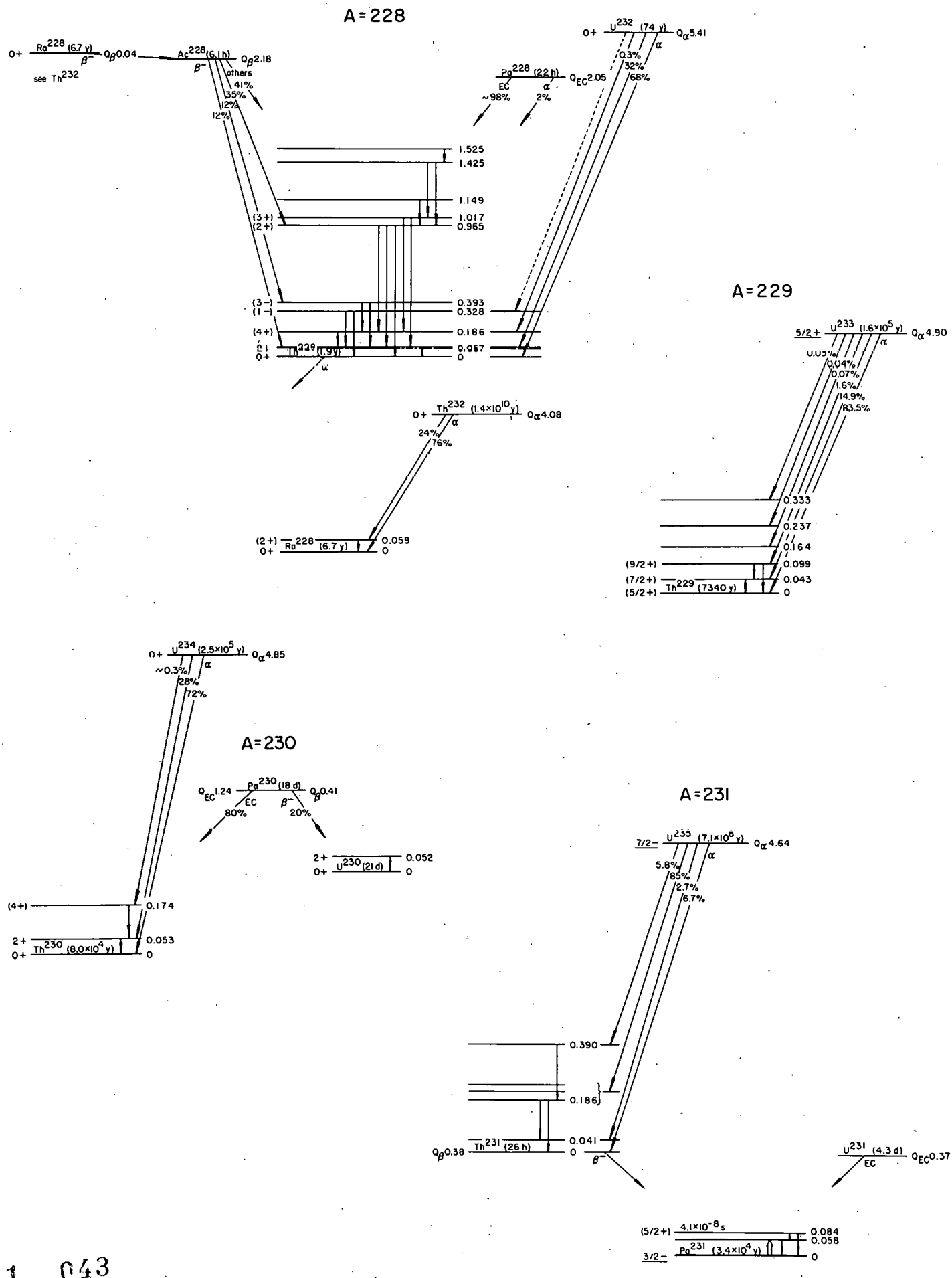


A=226

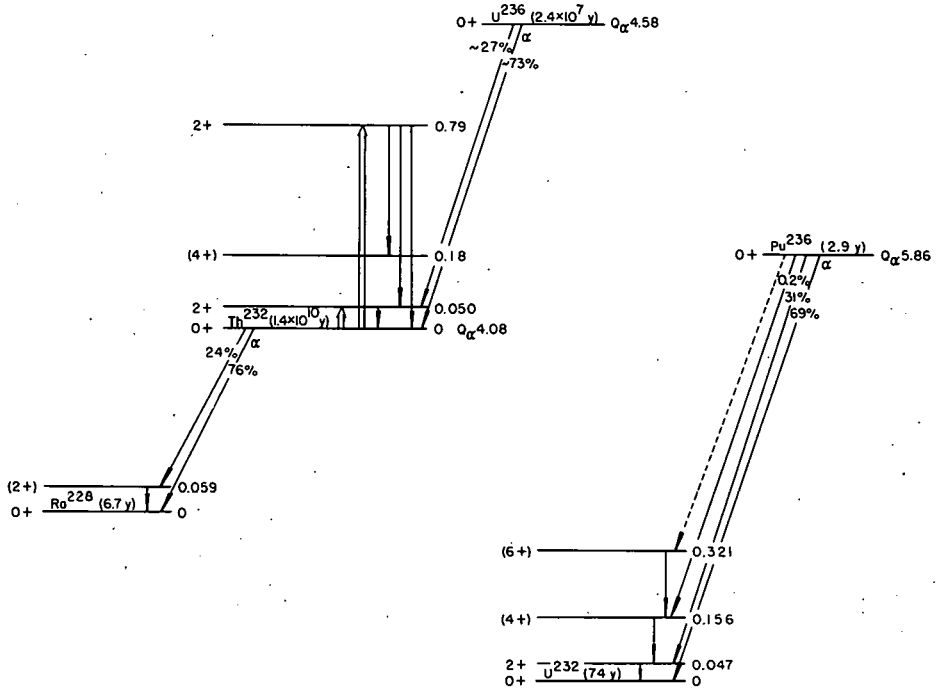

0+ Th230 (8.0×10^4 y) Qα4.76
α
0.03%
0.2%
24%
76%
0+ U230 (21 d) Qα5.99
α
0.7%
32%
67%
Ac226 (29 h) Qβ1.10, QEC0.70
EC 20%
β− 80%
0.445
0.416
(3−)
0.320
1−
0.253
4+
0.210
2+ 6×10^−10 s Ra226 (1.6×10^3 y)
0.068
0+
0
1−
(4+)
0.230
0.226
2+
0.072
0+ Th226 (31 m)
0
3/2− Pa231 (3.4×10^4 y) Qα5.14
α
10 groups

A=227

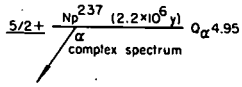

0.387
2.1%
0.356
1.4%
0.329
11%
0.211
1.4%
0.127
2.8%
0.110
22%
0.076
2.3%
0.046
24%
0.030
23%
0.027
10%
3/2 Ac227 (22 y)
α 1.2%
Qα5.03
0
β− 99%
Qβ0.046
Th227 (18 d)

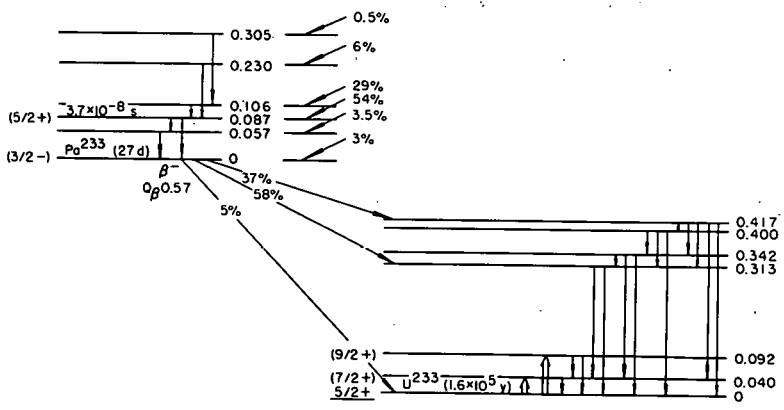

A=228
A=229
A=230
A=231
0+ Ra228 (6.7 y) Qβ0.04
β−
see Th232
Ac228 (6.1 h) Qβ2.18
β−
others
41%
35%
12%
12%
0+ U232 (74 y) Qα5.41
α
0.3%
32%
68%
Pa228 (22 h) QEC2.05
EC
~98%
α
2%
1.525
1.425
1.149
(3+) 1.017
(2+) 0.965
(3−) 0.393
(1−) 0.328
(4+) 0.186
2+ 0.057
0+ Th228 (1.9 y) 0
α
0+ Th232 (1.4×10^10 y) Qα4.08
α
24%
76%
(2+) 0.059
0+ Ra228 (6.7 y) 0
5/2+ U233 (1.6×10^5 y) Qα4.90
α
0.03%
0.04%
0.07%
1.6%
14.9%
83.5%
0.333
0.237
0.164
(9/2+) 0.099
(7/2+) 0.043
(5/2+) Th229 (7340 y) 0
0+ U234 (2.5×10^5 y) Qα4.85
α
~0.3%
28%
72%
(4+) 0.174
2+ 0.053
0+ Th230 (8.0×10^4 y) 0
QEC1.24 Pa230 (18 d) Qβ0.41
EC
β−
80%
20%
2+ 0.052
0+ U230 (21 d) 0
7/2− U235 (7.1×10^8 y) Qα4.64
α
5.8%
85%
2.7%
6.7%
0.390
0.186
0.041
Qβ0.38 Th231 (26 h) 0
β−
U231 (4.3 d) QEC0.37
EC
(5/2+) 4.1×10^−8 s 0.084
0.058
3/2− Pa231 (3.4×10^4 y) 0

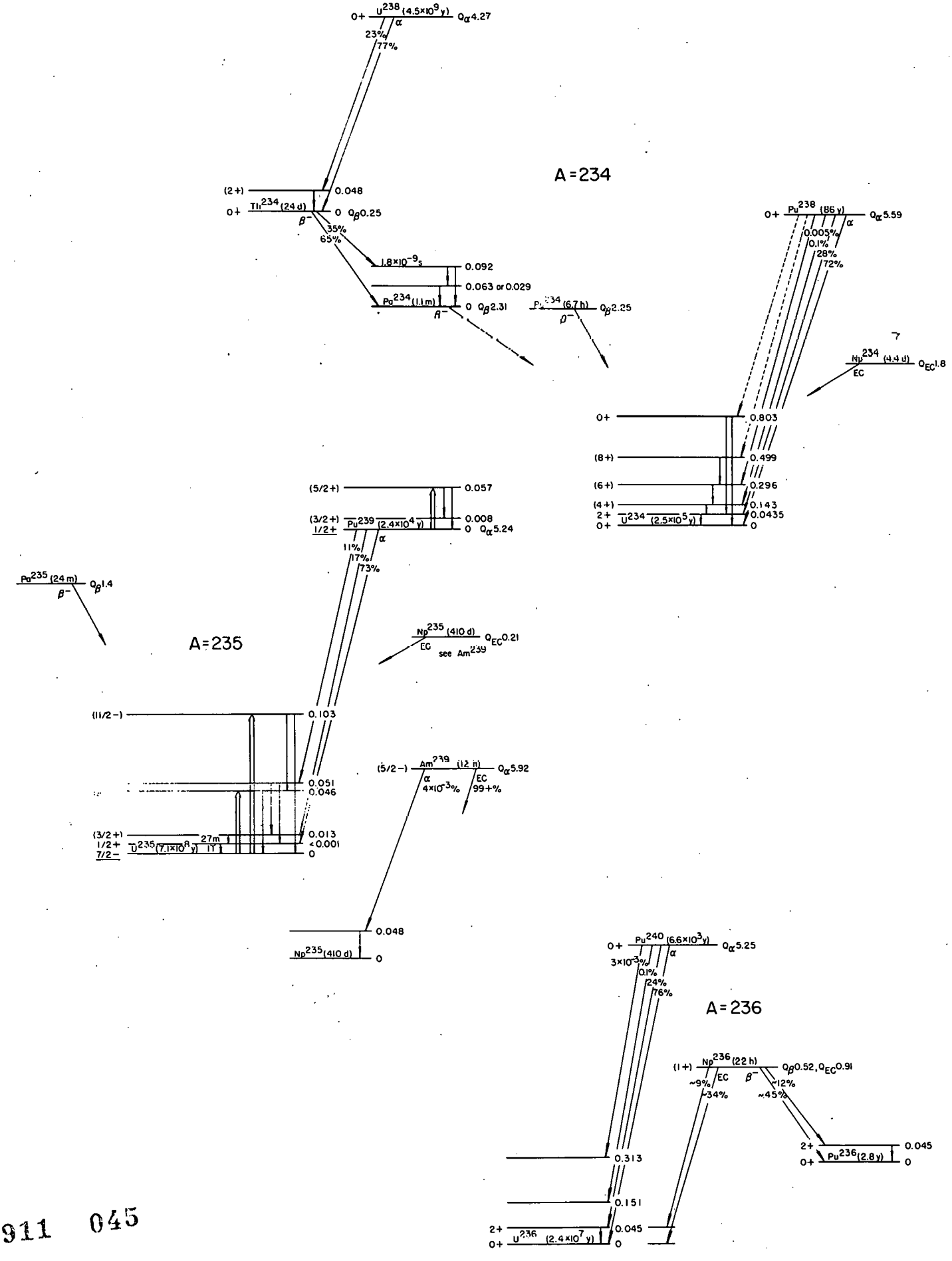
A=232

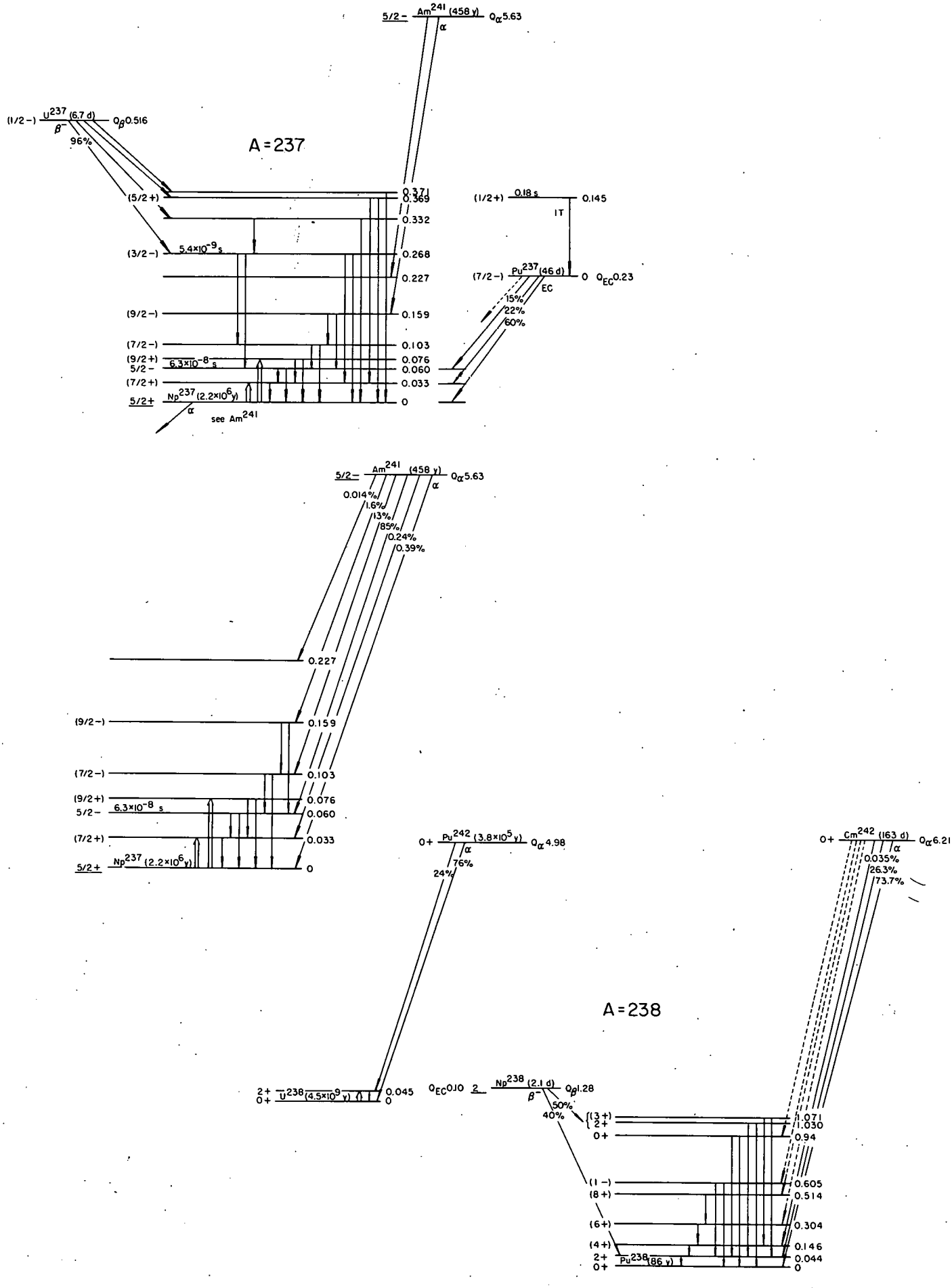

0+ U236 (2.4×10^7 y) Qα4.58
~27% α
~73%
2+ 0.79
(4+) 0.18
2+ 0.050
0+ Th232 (1.4×10^10 y) 0 Qα4.08
24% α
76%
(2+) 0.059
0+ Ra228 (6.7 y) 0
0+ Pu236 (2.9 y) Qα5.86
0.2% α
31%
69%
(6+) 0.321
(4+) 0.156
2+ 0.047
0+ U232 (74 y) 0

A=233

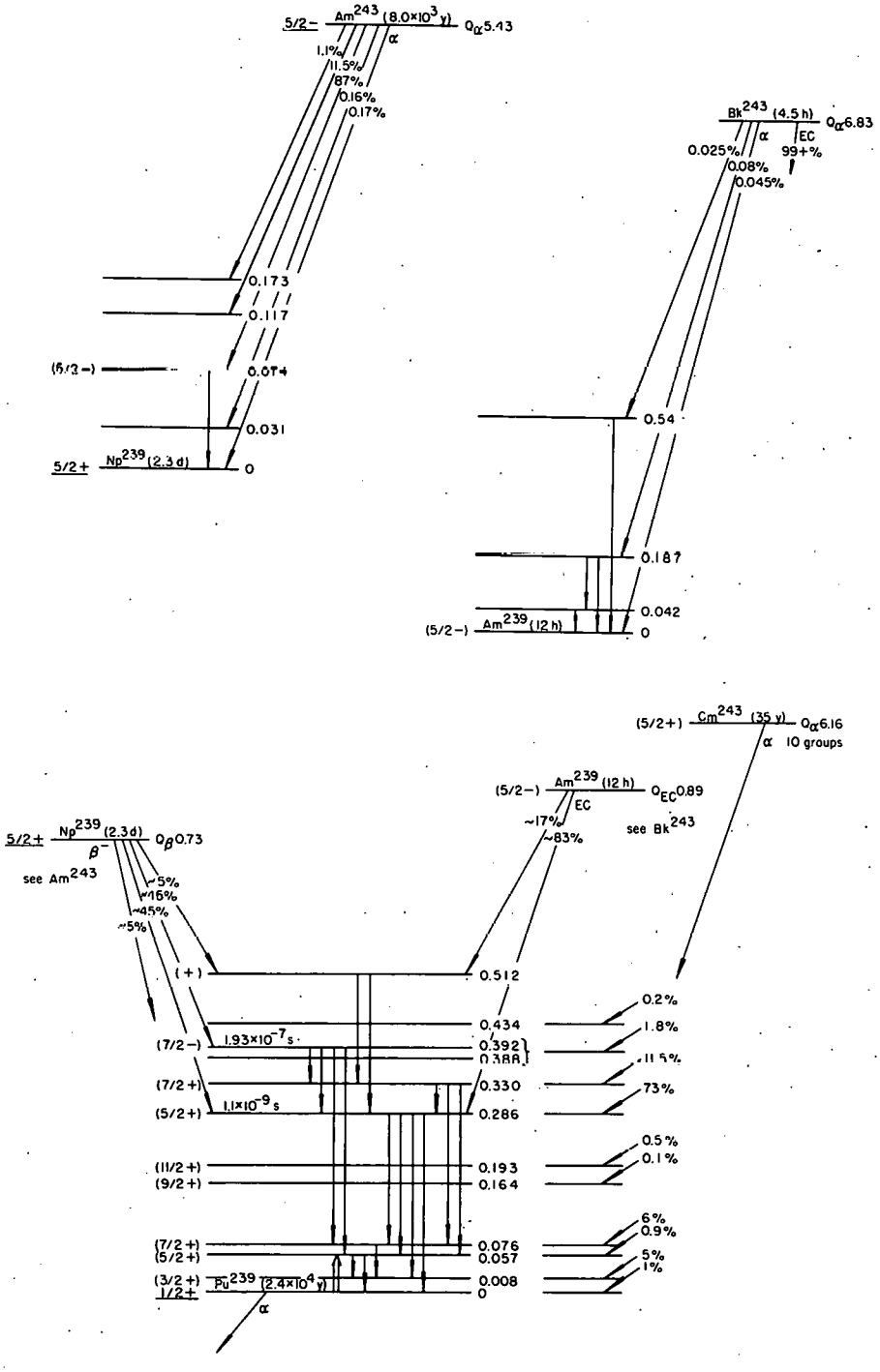

5/2+ Np237 (2.2×10^6 y) Qα4.95
α
complex spectrum

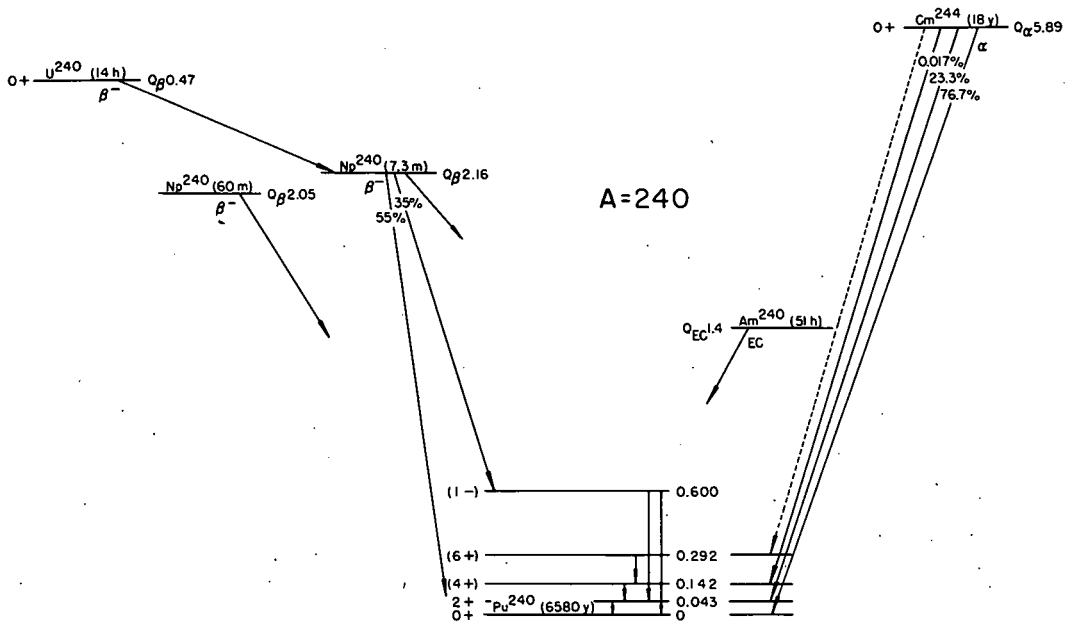

0.305 0.5%
0.230 6%
29%
54%
3.5%
3%
(5/2+) 3.7×10^-8 s 0.106
0.087
0.057
(3/2−) Pa233 (27 d) 0
β−
Qβ0.57
37%
58%
5%
0.417
0.400
0.342
0.313
(9/2+) 0.092
(7/2+) 0.040
5/2+ U233 (1.6×10^5 y) 0

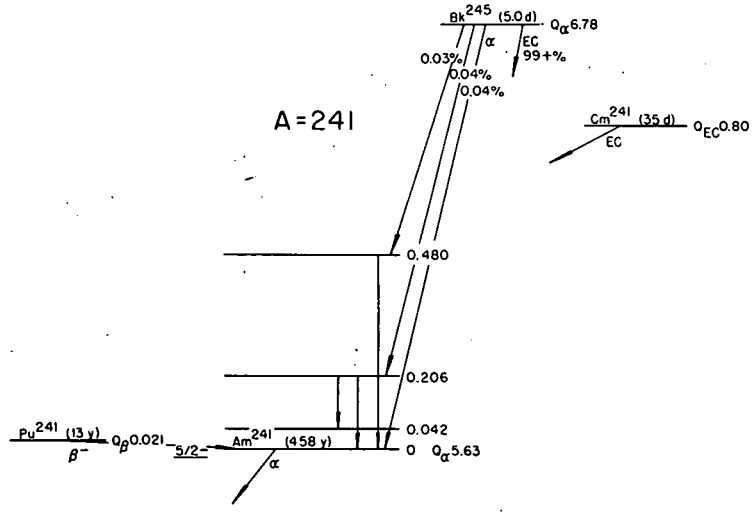

A=234
0+ U238 (4.5×10^9 y) Qα4.27
α
23%
77%
(2+) 0.048
0+ Th234 (24 d) 0 Qβ0.25
β−
35%
65%
1.8×10^−9 s
0.092
0.063 or 0.029
Pa234 (1.1 m) 0 Qβ2.31
β−
Pa234 (6.7 h) Qβ2.25
β−
0+ Pu238 (86 y) Qα5.59
α
0.005%
0.1%
28%
72%
Np234 (4.4 d) QEC1.8
EC
0+ 0.803
(8+) 0.499
(6+) 0.296
(4+) 0.143
2+ U234 (2.5×10^5 y) 0.0435
0+ 0
A=235
Pa235 (24 m) Qβ1.4
β−
(5/2+) 0.057
(3/2+) Pu239 (2.4×10^4 y) 0.008
1/2+ 0 Qα5.24
α
11%
17%
73%
Np235 (410 d) QEC0.21
EC
see Am239
(11/2−) 0.103
0.051
0.046
(3/2+) 0.013
1/2+ U235 (7.1×10^8 y) 27m 1Y <0.001
7/2− 0
(5/2−) Am239 (12 h) Qα5.92
α
4×10^−3%
EC
99+%
0.048
Np235 (410 d) 0
A=236
0+ Pu240 (6.6×10^3 y) Qα5.25
α
3×10^−3%
0.1%
24%
76%
(1+) Np236 (22 h) Qβ0.52, QEC0.91
EC
~9%
~34%
β−
~12%
~45%
0.313
0.151
2+ 0.045
0+ U236 (2.4×10^7 y) 0
2+ 0.045
0+ Pu236 (2.8 y) 0

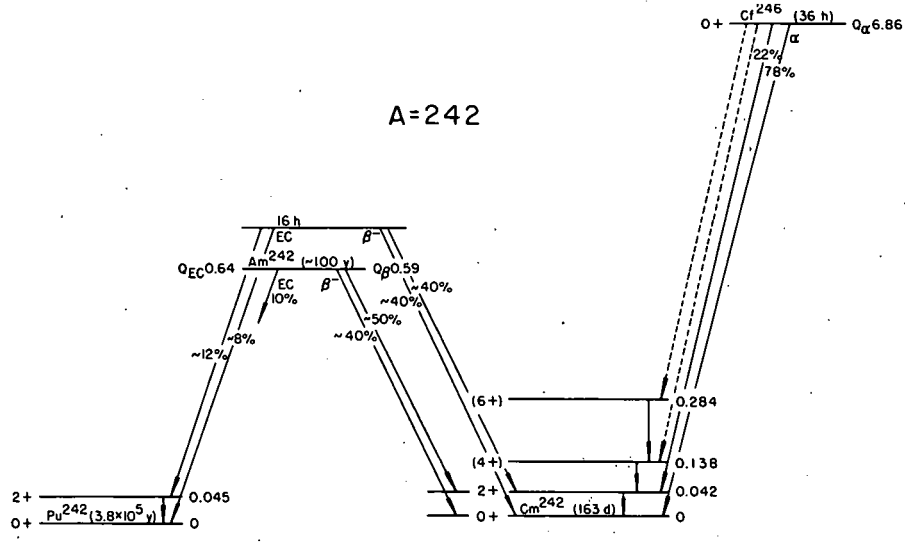

A = 237
5/2− Am241 (458 y) Qα5.63
α
(1/2−) U237 (6.7 d) Qβ0.516
β−
96%
(5/2+) 0.371
0.369
0.332
(3/2−) 5.4×10−9 s 0.268
0.227
(9/2−) 0.159
(7/2−) 0.103
(9/2+) 0.076
5/2− 6.3×10−8 s 0.060
(7/2+) 0.033
5/2+ Np237 (2.2×10⁶ y) 0
α
see Am241
(1/2+) 0.18 s 0.145
IT
(7/2−) Pu237 (46 d) 0 QEC0.23
EC
15%
22%
60%
5/2− Am241 (458 y) Qα5.63
α
0.014%
1.6%
13%
85%
0.24%
0.39%
0.227
(9/2−) 0.159
(7/2−) 0.103
(9/2+) 0.076
5/2− 6.3×10−8 s 0.060
(7/2+) 0.033
5/2+ Np237 (2.2×10⁶ y) 0
0+ Pu242 (3.8×10⁵ y) Qα4.98
α
76%
24%
2+ U238 (4.5×10⁹ y) 0.045
0+ 0
QEC0.10 2
Np238 (2.1 d) Qβ1.28
β−
50%
40%
A = 238
0+ Cm242 (163 d) Qα6.21
α
0.035%
26.3%
73.7%
(3+) 1.071
2+ 1.030
0+ 0.94
(1−) 0.605
(8+) 0.514
(6+) 0.304
(4+) 0.146
2+ 0.044
0+ Pu238 (86 y) 0

A = 239

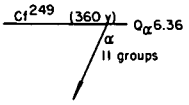

5/2− Am243 (8.0×10³ y) Qα5.43
α
1.1%
11.5%
87%
0.16%
0.17%
0.173
0.117
(5/2−)
0.074
0.031
5/2+ Np239 (2.3 d)
0
Bk243 (4.5 h) Qα6.83
α
EC
0.025%
0.08%
0.045%
99+%
0.54
0.187
0.042
(5/2−) Am239 (12 h)
0
(5/2+) Cm243 (35 y) Qα6.16
α 10 groups
(5/2−) Am239 (12 h) QEC0.89
EC
~17%
~83%
see Bk243
5/2+ Np239 (2.3 d) Qβ0.73
β−
see Am243
~5%
~16%
~45%
~5%
(+)
0.512
0.2%
0.434
1.8%
(7/2−)
1.93×10⁻⁷ s
0.392
0.388
11.5%
(7/2+)
0.330
73%
(5/2+)
1.1×10⁻⁹ s
0.286
0.5%
(11/2+)
0.193
0.1%
(9/2+)
0.164
6%
(7/2+)
0.076
0.9%
(5/2+)
0.057
5%
(3/2+)
1/2+
Pu239 (2.4×10⁴ y)
0.008
1%
0
α

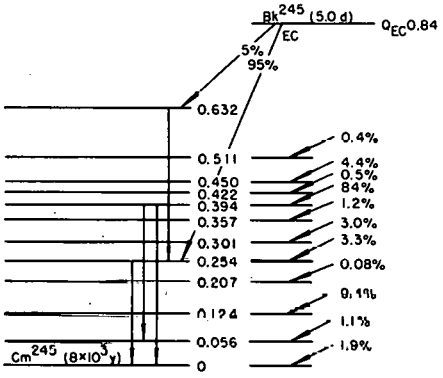

A=240
0+ U240 (14 h) Qβ0.47
β−
Np240 (60 m) Qβ2.05
β−
Np240 (7.3 m) Qβ2.16
β−
35%
55%
0+ Cm244 (18 y) Qα5.89
α
0.017%
23.3%
76.7%
QEC1.4 Am240 (51 h)
EC
(1 −) 0.600
(6+) 0.292
(4+) 0.142
2+ 0.043
0+ Pu240 (6580 y) 0


A=241
Bk245 (5.0 d) Qα6.78
α
EC
99+%
0.03%
0.04%
0.04%
Cm241 (35 d) QEC0.80
EC
0.480
0.206
Pu241 (13 y) Qβ0.021
β−
5/2−
Am241 (458 y)
0.042
0 Qα5.63
α

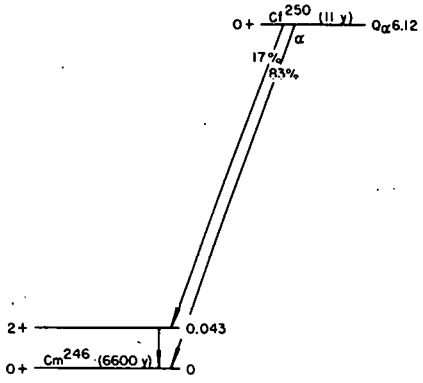

A=242
0+ Cf246 (36 h) Qα6.86
α
22%
78%
16 h
EC
β−
QEC0.64 Am242 (~100 y) Qβ0.59
EC
10%
β−
~12%
~8%
~50%
~40%
~40%
~40%
(6+) 0.284
(4+) 0.138
2+ 0.045
0+ Pu242 (3.8×10⁵ y) 0
2+ 0.042
0+ Cm242 (163 d) 0

A=245

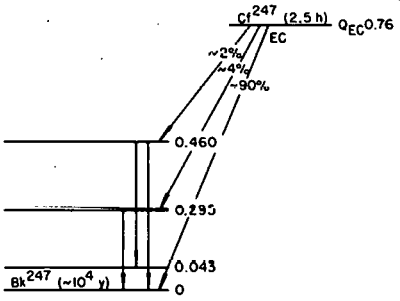




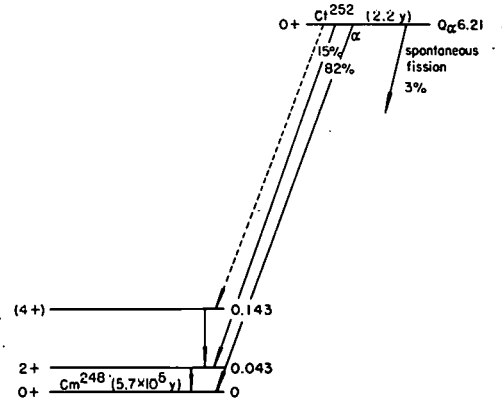
A=246



A=247



A=248



A=250