$^{94m}_{43}\mathrm{Tc}_{51}$

1 Decay Scheme

Tc-94m (half-life of 51.9 (10) min) undergoes 100% EC/positron decay (Q(EC) of 4332(5) keV) to various excited nuclear levels and the ground state of Mo-94.

Le technétium 94 métastable se désintègre à 100 % par capture électronique et bêta plus vers des niveaux excités et le niveau fondamental du molybdène 94.

2 Nuclear Data

$T_{1/2}(^{94m}\mathrm{Tc}) : 51{,}9 \quad (10) \quad \mathrm{min}$
$Q^{+}(^{94m}\mathrm{Tc}) : 4332 \quad (5) \quad \mathrm{keV}$

2.1 Electron Capture Transitions

	Energy (keV)	Probability (%)	Nature	lg ft	P_K	P_L	P_M
$\epsilon_{0,27}$	440 (5)	0,212 (13)	(allowed)	5,6	0,8620 (15)	0,1121 (12)	0,0220 (4)
$\epsilon_{0,26}$	539 (5)	0,169 (20)	(allowed)	5,9	0,8639 (15)	0,1106 (11)	0,0216 (4)
$\epsilon_{0,25}$	798 (5)	0,106 (3)	(allowed)	6,4	0,8664 (15)	0,1086 (11)	0,0212 (4)
$\epsilon_{0,24}$	820 (5)	0,121 (10)	(allowed)	6,4	0,8666 (15)	0,1085 (11)	0,0212 (4)
$\epsilon_{0,23}$	884 (5)	0,118 (19)	(allowed)	6,4	0,8669 (14)	0,1082 (11)	0,0211 (4)
$\epsilon_{0,22}$	931 (5)	0,36 (4)	(allowed)	6	0,8672 (14)	0,1080 (11)	0,0211 (4)
$\epsilon_{0,20}$	1000 (5)	0,234 (20)	(allowed)	6,3	0,8675 (14)	0,1078 (11)	0,0210 (4)
$\epsilon_{0,18}$	1169 (5)	0,058 (17)	(allowed)	7	0,8681 (14)	0,1073 (11)	0,0209 (4)
$\epsilon_{0,17}$	1203 (5)	1,63 (9)	(allowed)	5,57	0,8682 (14)	0,1072 (11)	0,0209 (4)
$\epsilon_{0,16}$	1367 (5)	0,093 (14)	(allowed)	6,9	0,8686 (14)	0,1069 (11)	0,0208 (4)
$\epsilon_{0,13}$	1462 (5)	0,15 (3)	(allowed)	6,8	0,8688 (14)	0,1067 (11)	0,0208 (4)
$\epsilon_{0,11}$	1592 (5)	10,1 (4)	(allowed)	5,03	0,8690 (14)	0,1066 (11)	0,0207 (4)
$\epsilon_{0,7}$	1939 (5)	4,0 (2)	(allowed)	5,6	0,8694 (14)	0,1062 (11)	0,0207 (4)
$\epsilon_{0,5}$	2265 (5)	0,34 (5)	(allowed)	6,8	0,8697 (14)	0,1060 (11)	0,0206 (4)
$\epsilon_{0,4}$	2468 (5)	0,39 (9)	(allowed)	6,82	0,8699 (14)	0,1059 (11)	0,0206 (4)
$\epsilon_{0,1}$	3461 (5)	12,8 (1)	(allowed)	5,61	0,8704 (14)	0,1055 (11)	0,0205 (4)

2.2 β^+ Transitions

	Energy (keV)	Probability (%)	Nature	lg ft
$\beta^+_{0,16}$	345 (5)	0,00058 (9)	(allowed)	6,9
$\beta^+_{0,13}$	440 (5)	0,0024 (5)	(allowed)	6,8
$\beta^+_{0,11}$	570 (5)	0,427 (21)	(allowed)	5,03
$\beta^+_{0,7}$	917 (5)	0,91 (6)	(allowed)	5,6
$\beta^+_{0,5}$	1243 (5)	0,22 (3)	(allowed)	6,8
$\beta^+_{0,4}$	1446 (5)	0,41 (10)	(allowed)	6,82
$\beta^+_{0,1}$	2439 (5)	67,2 (4)	(allowed)	5,61

2.3 Gamma Transitions and Internal Conversion Coefficients

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K (10^{-2})	α_L (10^{-3})	α_M (10^{-4})	α_T (10^{-2})	α_π (10^{-6})
$\gamma_{7,5}$(Mo)	325,67 (9)	0,027 (2)	M1+50%E2	1,28 (8)	1,56 (11)	2,80 (19)	1,47 (9)	
$\gamma_{18,12}$(Mo)	358,3 (3)	0,0084 (7)	M1+10,9%E2	0,80 (4)	0,93 (5)	1,67 (8)	0,92 (4)	
$\gamma_{7,4}$(Mo)	528,71 (8)	0,032 (2)	M1+50%E2	0,325 (8)	0,378 (11)	0,676 (19)	0,371 (9)	
$\gamma_{11,5}$(Mo)	672,56 (9)	0,17 (3)	M1+50%E2	0,176 (3)	0,201 (4)	0,359 (7)	0,200 (3)	
$\gamma_{2,1}$(Mo)	702,66 (4)	0,18 (2)	E2	0,1608 (23)	0,187 (3)	0,334 (5)	0,183 (3)	
$\gamma_{13,5}$(Mo)	802,55 (10)	0,0246 (14)	M1+50%E2	0,1146 (16)	0,1301 (19)	0,232 (4)	0,1303 (19)	
$\gamma_{3,1}$(Mo)	870,55 (22)	0,26 (3)	E2	0,0940 (14)	0,1075 (15)	0,192 (3)	0,1070 (15)	
$\gamma_{1,0}$(Mo)	871,098 (16)	94,04 (21)	E2	0,0939 (14)	0,1073 (15)	0,192 (3)	0,1068 (15)	
$\gamma_{11,4}$(Mo)	875,60 (9)	1,0 (3)	M1+1,0%E2	0,0945 (14)	0,1056 (15)	0,189 (3)	0,1072 (15)	
$\gamma_{16,5}$(Mo)	898,06 (9)	0,0098 (5)	M1+80%E2	0,0877 (13)	0,0996 (14)	0,1778 (25)	0,0997 (15)	
$\gamma_{4,1}$(Mo)	993,21 (5)	2,21 (18)	M1+80%E2	0,0696 (13)	0,0786 (13)	0,1403 (22)	0,0791 (15)	
$\gamma_{11,3}$(Mo)	998,26 (17)	0,24 (2)	M1	0,071 (1)	0,0792 (11)	0,1413 (20)	0,0806 (12)	
$\gamma_{13,4}$(Mo)	1005,59 (9)	0,09 (3)	M1+0,25%E2	0,0699 (10)	0,0779 (11)	0,139 (2)	0,0793 (12)	
$\gamma_{17,5}$(Mo)	1061,31 (9)	0,016 (2)	M1+24,5%E2	0,0616 (10)	0,0688 (10)	0,1227 (18)	0,0699 (11)	
$\gamma_{16,4}$(Mo)	1101,10 (8)	0,042 (14)	M1+0,80%E2	0,0576 (8)	0,0640 (9)	0,1142 (16)	0,0653 (10)	0,492 (8)
$\gamma_{5,1}$(Mo)	1196,25 (6)	0,71 (7)	M1+2,20%E2	0,0483 (7)	0,0536 (8)	0,0957 (14)	0,0553 (8)	5,77 (9)
$\gamma_{17,4}$(Mo)	1264,35 (9)	0,22 (2)	M1+0,64%E2	0,0431 (6)	0,0478 (7)	0,0852 (12)	0,0503 (7)	15,16 (22)
$\gamma_{16,2}$(Mo)	1391,65 (7)	0,0267 (10)	M1+0,64%E2	0,0353 (5)	0,0391 (6)	0,0698 (10)	0,0441 (7)	40,4 (6)
$\gamma_{26,7}$(Mo)	1399,85 (16)	0,041 (3)	M1+E2					
$\gamma_{20,4}$(Mo)	1467,43 (18)	0,072 (5)	M1+8,3%E2	0,0316 (15)	0,0350 (15)	0,062 (3)	0,0419 (9)	61 (10)
$\gamma_{27,7}$(Mo)	1499,14 (9)	0,067 (11)	M1+E2					
$\gamma_{7,1}$(Mo)	1521,92 (6)	4,48 (28)	M1+1,42%E2	0,0295 (5)	0,0326 (5)	0,0581 (9)	0,0411 (6)	77,6 (11)
$\gamma_{22,4}$(Mo)	1536,52 (18)	0,014 (3)						
$\gamma_{25,4}$(Mo)	1670,01 (10)	0,037 (2)	M1+2,20%E2	0,0245 (4)	0,0270 (4)	0,0481 (7)	0,0410 (6)	132 (3)
$\gamma_{20,2}$(Mo)	1757,98 (17)	0,15 (2)	M1+1,0%E2	0,0221 (3)	0,0244 (4)	0,0435 (6)	0,0418 (6)	167,7 (24)
$\gamma_{24,3}$(Mo)	1770,21 (21)	0,025 (6)	(M1+E2)					
$\gamma_{27,5}$(Mo)	1824,81 (9)	0,023 (1)	(M1+E2)					
$\gamma_{4,0}$(Mo)	1864,31 (5)	0,23 (3)	E2	0,0189 (3)	0,0209 (3)	0,0372 (6)	0,0455 (7)	241 (4)
$\gamma_{11,1}$(Mo)	1868,81 (7)	5,49 (28)	M1+1,42%E2	0,0196 (3)	0,0216 (3)	0,0385 (6)	0,0438 (7)	215 (3)
$\gamma_{26,4}$(Mo)	1928,56 (16)	0,075 (19)	M1+E2					
$\gamma_{13,1}$(Mo)	1998,80 (8)	0,0123 (6)	M1+62,8%E2	0,0168 (3)	0,0186 (3)	0,0331 (6)	0,0484 (10)	293 (9)
$\gamma_{27,4}$(Mo)	2027,85 (9)	0,021 (4)	(M1+E2)					
$\gamma_{5,0}$(Mo)	2067,35 (6)	0,11 (1)	E2	0,01562 (22)	0,01722 (25)	0,0307 (5)	0,0515 (8)	338 (5)
$\gamma_{16,1}$(Mo)	2094,31 (6)	0,0156 (6)	M1+54,8%E2	0,0155 (3)	0,0171 (4)	0,0304 (6)	0,0512 (14)	336 (15)
$\gamma_{17,1}$(Mo)	2257,56 (7)	0,057 (5)	M1+35,4%E2	0,01356 (20)	0,01491 (22)	0,0266 (4)	0,0561 (9)	407 (8)
$\gamma_{18,1}$(Mo)	2292,19 (19)	0,050 (17)	M1+2,8%E2	0,01330 (19)	0,01461 (21)	0,0260 (4)	0,0562 (8)	411 (6)
$\gamma_{7,0}$(Mo)	2393,02 (6)	0,50 (4)	E2	0,01203 (17)	0,01322 (19)	0,0235 (4)	0,0633 (9)	496 (7)
$\gamma_{20,1}$(Mo)	2460,64 (17)	0,011 (2)	(M1+E2)					
$\gamma_{22,1}$(Mo)	2529,73 (17)	0,34 (4)						

	Energy (keV)	$P_{\gamma+ce}$ (%)	Multipolarity	α_K (10^{-2})	α_L (10^{-3})	α_M (10^{-4})	α_T (10^{-2})	α_π (10^{-6})
$\gamma_{23,1}$(Mo)	2576,5 (4)	0,11 (2)	M1+78,3%E2	0,01061 (15)	0,01164 (17)	0,0207 (3)	0,0694 (12)	574 (11)
$\gamma_{24,1}$(Mo)	2640,76 (14)	0,033 (4)	(M1+E2)					
$\gamma_{25,1}$(Mo)	2663,22 (9)	0,066 (2)	M1+8,3%E2	0,01009 (15)	0,01106 (16)	0,0197 (3)	0,0699 (11)	585 (10)
$\gamma_{11,0}$(Mo)	2739,91 (7)	3,53 (20)	M1	0,00959 (14)	0,01051 (15)	0,0187 (3)	0,0725 (11)	616 (9)
$\gamma_{13,0}$(Mo)	2869,90 (8)	0,016 (2)	E2	0,00881 (13)	0,00964 (14)	0,01717 (24)	0,0816 (12)	717 (10)
$\gamma_{27,1}$(Mo)	3021,06 (7)	0,087 (14)	(M1+E2)					
$\gamma_{17,0}$(Mo)	3128,66 (7)	1,34 (9)	M1	0,00758 (11)	0,00829 (12)	0,01476 (21)	0,0871 (13)	785 (11)
$\gamma_{22,0}$(Mo)	3400,83 (17)	0,005 (2)						
$\gamma_{23,0}$(Mo)	3447,6 (4)	0,006 (1)						
$\gamma_{24,0}$(Mo)	3511,86 (14)	0,063 (7)	(M1+E2)					
$\gamma_{25,0}$(Mo)	3534,32 (9)	0,0034 (4)	E2	0,00625 (9)	0,00682 (10)	0,01215 (17)	0,1065 (15)	994 (14)
$\gamma_{26,0}$(Mo)	3792,87 (15)	0,052 (5)	E2	0,00559 (8)	0,00609 (9)	0,01084 (16)	0,1149 (16)	1086 (16)
$\gamma_{27,0}$(Mo)	3892,16 (7)	0,014 (2)						

3 Atomic Data

3.1 Mo

ω_K : 0,767 (4)
$\bar{\omega}_L$: 0,0381 (9)
n_{KL} : 1,029 (4)

3.1.1 X Radiations

		Energy (keV)	Relative probability
X_K			
	$K\alpha_2$	17,3745	52,4
	$K\alpha_1$	17,47954	100
	$K\beta_3$	19,5904	26,3
	$K\beta_1$	19,6085	
	$K\beta''_5$	19,774	
	$K\beta_2$	19,9653	4,04
	$K\beta_4$	19,998	
X_L			
	$L\ell$	2,016	
	$L\alpha$	2,29 - 2,293	
	$L\eta$	2,12	
	$L\beta$	2,395 - 2,518	
	$L\gamma$	2,623 - 2,831	

3.1.2 Auger Electrons

	Energy (keV)	Relative probability
Auger K		
KLL	14,172 - 14,855	100
KLX	16,592 - 17,478	39,8
KXY	18,990 - 19,996	3,94
Auger L	1,48 - 2,25	682

4 Electron and Positron Emissions

		Energy (keV)	Electrons (per 100 disint.)
e_{AL}	(Mo)	1,48 - 2,25	29,8 (4)
e_{AK}	(Mo)		
	KLL	14,172 - 14,855	6,28 (15)
	KLX	16,592 - 17,478	
	KXY	18,990 - 19,996	
$\beta^+_{0,1}$	max:	2439 (5)	67,2 (4)
	avg:	1094,4 (24)	
$\beta^+_{0,4}$	max:	1446 (5)	0,41 (10)
	avg:	639,6 (23)	
$\beta^+_{0,5}$	max:	1243 (5)	0,22 (3)
	avg:	548,7 (23)	
$\beta^+_{0,7}$	max:	917 (5)	0,91 (6)
	avg:	404,8 (22)	
$\beta^+_{0,11}$	max:	570 (5)	0,427 (21)
	avg:	254,3 (22)	
$\beta^+_{0,13}$	max:	440 (5)	0,0024 (5)
	avg:	198,5 (22)	
$\beta^+_{0,16}$	max:	345 (5)	0,00058 (9)
	avg:	157,5 (22)	

5 Photon Emissions

5.1 X-Ray Emissions

		Energy (keV)	Photons (per 100 disint.)	
XL	(Mo)	2,016 - 2,831	1,198 (22)	
XKα_2	(Mo)	17,3745	5,93 (11)	Kα
XKα_1	(Mo)	17,47954	11,31 (19)	
XKβ_3	(Mo)	19,5904	2,97 (6)	K$'\beta_1$
XKβ_1	(Mo)	19,6085		
XKβ_5''	(Mo)	19,774		
XKβ_2	(Mo)	19,9653	0,457 (18)	K$'\beta_2$
XKβ_4	(Mo)	19,998		

5.2 Gamma Emissions

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{7,5}$(Mo)	325,67 (9)	0,027 (2)
$\gamma_{18,12}$(Mo)	358,3 (3)	0,0084 (7)
$\gamma^{\pm}$	511	138 (1)
$\gamma_{7,4}$(Mo)	528,71 (8)	0,032 (2)
$\gamma_{11,5}$(Mo)	672,56 (9)	0,17 (3)
$\gamma_{2,1}$(Mo)	702,66 (4)	0,18 (2)
$\gamma_{13,5}$(Mo)	802,55 (10)	0,0246 (14)
$\gamma_{3,1}$(Mo)	870,55 (22)	0,26 (3)
$\gamma_{1,0}$(Mo)	871,094 (16)	94,04 (21)
$\gamma_{11,4}$(Mo)	875,60 (9)	1,0 (3)
$\gamma_{16,5}$(Mo)	898,06 (9)	0,0098 (5)
$\gamma_{4,1}$(Mo)	993,20 (5)	2,21 (18)
$\gamma_{11,3}$(Mo)	998,25 (17)	0,24 (2)
$\gamma_{13,4}$(Mo)	1005,58 (9)	0,09 (3)
$\gamma_{(-1,-2)}$(Mo)	1022	0,027 (14)
$\gamma_{(-1,1)}$(Mo)	1037,2 (3)	0,044 (14)
$\gamma_{17,5}$(Mo)	1061,30 (9)	0,016 (2)
$\gamma_{16,4}$(Mo)	1101,09 (8)	0,042 (14)
$\gamma_{5,1}$(Mo)	1196,24 (6)	0,71 (7)
$\gamma_{17,4}$(Mo)	1264,34 (9)	0,22 (2)
$\gamma_{(-1,2)}$(Mo)	1357,4 (15)	0,19 (8)
$\gamma_{16,2}$(Mo)	1391,64 (7)	0,0267 (10)
$\gamma_{26,7}$(Mo)	1399,84 (16)	0,041 (3)
$\gamma_{20,4}$(Mo)	1467,42 (18)	0,072 (5)
$\gamma_{27,7}$(Mo)	1499,13 (9)	0,067 (11)
$\gamma_{7,1}$(Mo)	1521,91 (6)	4,48 (28)

	Energy (keV)	Photons (per 100 disint.)
$\gamma_{22,4}$(Mo)	1536,51 (18)	0,014 (3)
$\gamma_{25,4}$(Mo)	1669,99 (10)	0,037 (2)
$\gamma_{20,2}$(Mo)	1757,96 (17)	0,15 (2)
$\gamma_{24,3}$(Mo)	1770,19 (21)	0,025 (6)
$\gamma_{27,5}$(Mo)	1824,79 (9)	0,023 (1)
$\gamma_{4,0}$(Mo)	1864,29 (5)	0,23 (3)
$\gamma_{11,1}$(Mo)	1868,79 (7)	5,49 (28)
$\gamma_{26,4}$(Mo)	1928,54 (16)	0,075 (19)
$\gamma_{13,1}$(Mo)	1998,78 (8)	0,0123 (6)
$\gamma_{27,4}$(Mo)	2027,83 (9)	0,021 (4)
$\gamma_{5,0}$(Mo)	2067,33 (6)	0,11 (1)
$\gamma_{16,1}$(Mo)	2094,28 (6)	0,0156 (6)
$\gamma_{17,1}$(Mo)	2257,53 (7)	0,057 (5)
$\gamma_{18,1}$(Mo)	2292,16 (19)	0,050 (17)
$\gamma_{7,0}$(Mo)	2392,99 (6)	0,50 (4)
$\gamma_{20,1}$(Mo)	2460,61 (17)	0,011 (2)
$\gamma_{22,1}$(Mo)	2529,69 (17)	0,34 (4)
$\gamma_{23,1}$(Mo)	2576,5 (4)	0,11 (2)
$\gamma_{24,1}$(Mo)	2640,72 (14)	0,033 (4)
$\gamma_{25,1}$(Mo)	2663,18 (9)	0,066 (2)
$\gamma_{11,0}$(Mo)	2739,87 (7)	3,53 (20)
$\gamma_{13,0}$(Mo)	2869,85 (8)	0,016 (2)
$\gamma_{27,1}$(Mo)	3021,01 (7)	0,087 (14)
$\gamma_{(-1,3)}$(Mo)	3065,6 (3)	0,011 (4)
$\gamma_{(-1,4)}$(Mo)	3085,8 (3)	0,016 (4)
$\gamma_{17,0}$(Mo)	3128,60 (7)	1,34 (9)
$\gamma_{22,0}$(Mo)	3400,76 (17)	0,005 (2)
$\gamma_{23,0}$(Mo)	3447,5 (4)	0,006 (1)
$\gamma_{24,0}$(Mo)	3511,79 (14)	0,063 (7)
$\gamma_{25,0}$(Mo)	3534,25 (9)	0,0034 (4)
$\gamma_{(-1,5)}$(Mo)	3640,6 (3)	0,007 (2)
$\gamma_{26,0}$(Mo)	3792,79 (15)	0,052 (5)
$\gamma_{27,0}$(Mo)	3892,07 (7)	0,014 (2)
$\gamma_{(-1,6)}$(Mo)	4136,2 (3)	0,007 (1)

6 Main Production Modes

$\left\{ \begin{array}{l} \mathrm{Mo-94(p,n)Tc-94m} \\ \text{Possible impurities: Tc} - 94 \text{ ground state.} \end{array} \right.$

$\left\{ \begin{array}{l} \mathrm{Mo-94(d,2n)Tc-94m} \\ \text{Possible impurities: Tc} - 94 \text{ ground state.} \end{array} \right.$

$\mathrm{Mo-92}(\alpha,2n)\mathrm{Ru-94(EC)Tc-94m}$

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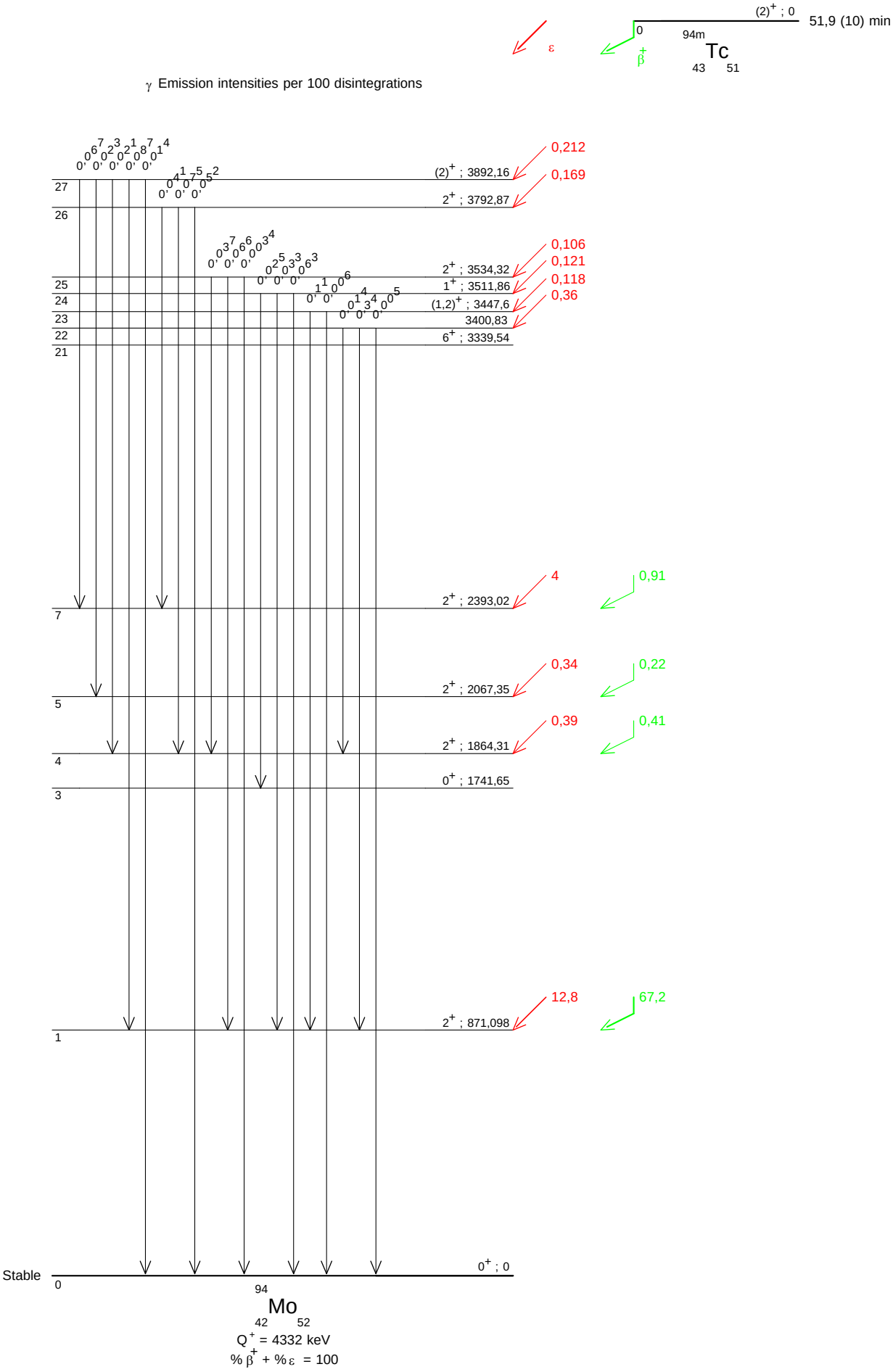
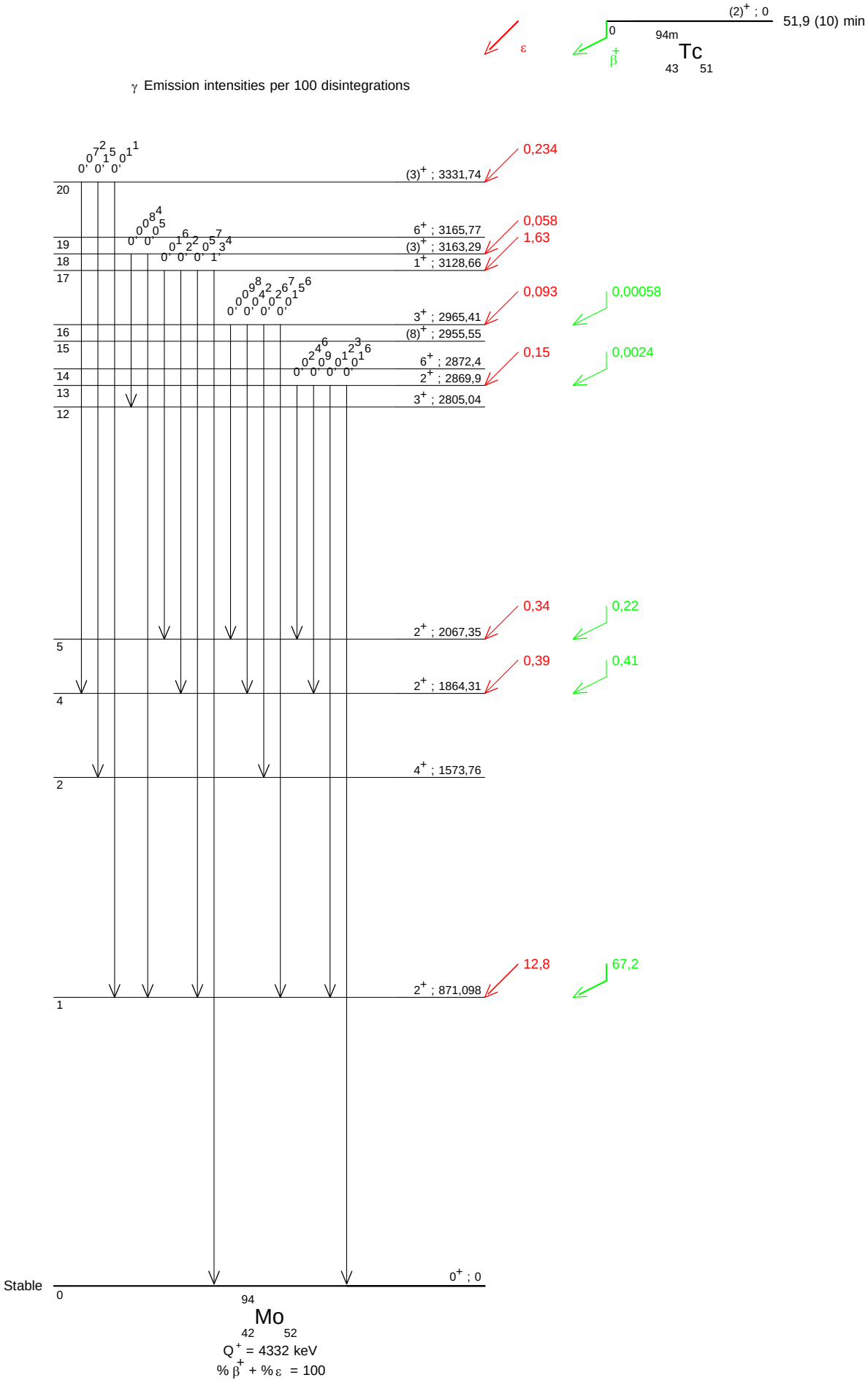
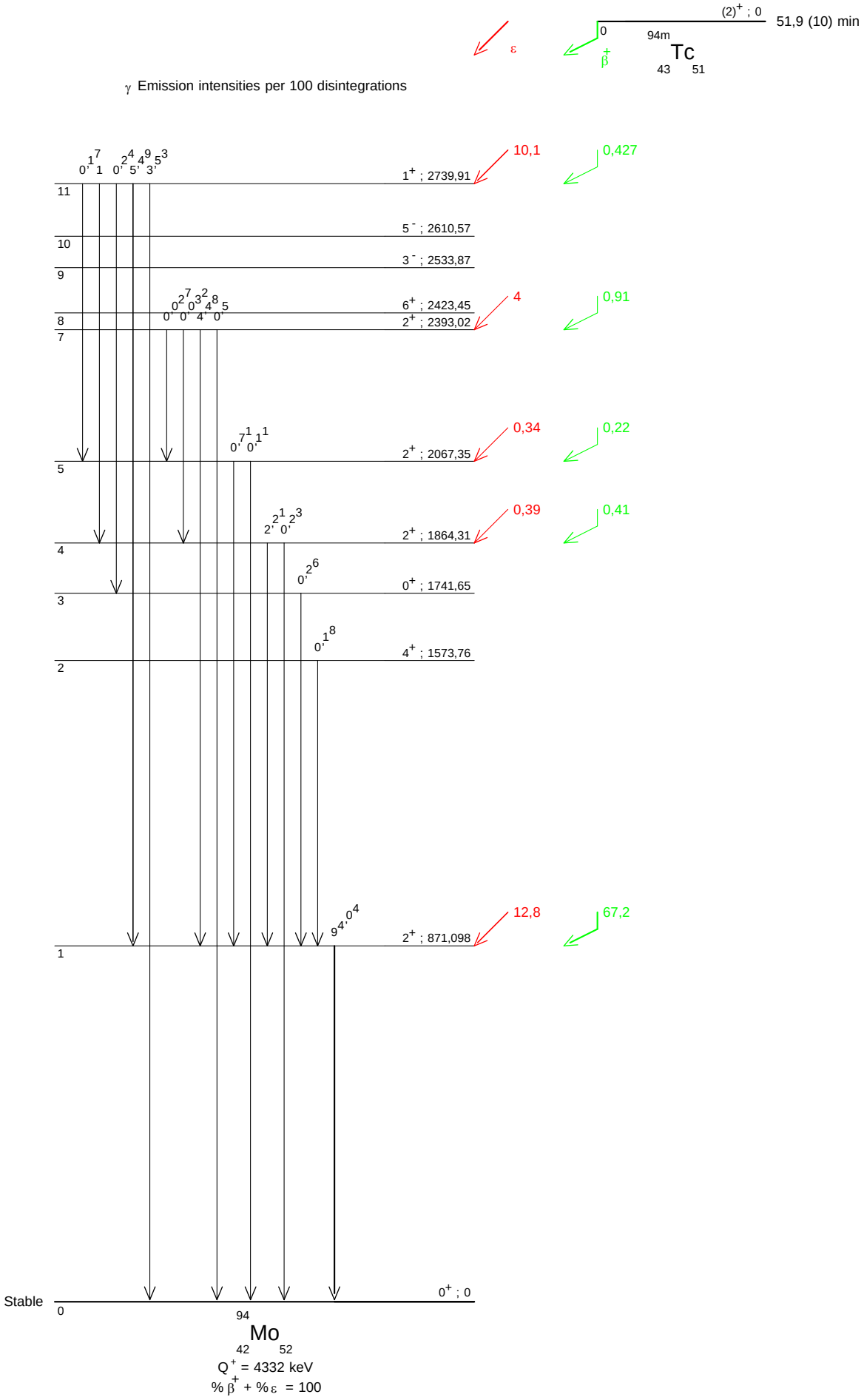
94m 43 Tc 51


(2)+ ; 0
51,9 (10) min
0
94m
Tc
43 51
ε
β+
γ Emission intensities per 100 disintegrations
0,212
0,169
(2)+ ; 3892,16
2+ ; 3792,87
27
26
0,106
0,121
0,118
0,36
2+ ; 3534,32
1+ ; 3511,86
(1,2)+ ; 3447,6
3400,83
6+ ; 3339,54
25
24
23
22
21
4
0,91
2+ ; 2393,02
7
0,34
0,22
2+ ; 2067,35
5
0,39
0,41
2+ ; 1864,31
4
0+ ; 1741,65
3
12,8
67,2
2+ ; 871,098
1
Stable
0+ ; 0
0
94
Mo
42 52
Q+ = 4332 keV
% β+ + % ε = 100

94m 43 Tc 51


(2)+ ; 0
51,9 (10) min
0
94m
Tc
43 51
ε
β+
γ Emission intensities per 100 disintegrations
0,234
(3)+ ; 3331,74
20
0,058
6+ ; 3165,77
1,63
(3)+ ; 3163,29
19
1+ ; 3128,66
18
17
0,093
0,00058
3+ ; 2965,41
16
(8)+ ; 2955,55
15
0,15
0,0024
6+ ; 2872,4
14
2+ ; 2869,9
13
3+ ; 2805,04
12
0,34
0,22
2+ ; 2067,35
5
0,39
0,41
2+ ; 1864,31
4
4+ ; 1573,76
2
12,8
67,2
2+ ; 871,098
1
Stable
0+ ; 0
0
94
Mo
42 52
Q+ = 4332 keV
% β+ + % ε = 100

94m 43 Tc 51


(2)+ ; 0
51,9 (10) min
0
94m
Tc
43 51
ε
β+
γ Emission intensities per 100 disintegrations
10,1
0,427
1+ ; 2739,91
5- ; 2610,57
3- ; 2533,87
4
0,91
6+ ; 2423,45
2+ ; 2393,02
0,34
0,22
2+ ; 2067,35
0,39
0,41
2+ ; 1864,31
0+ ; 1741,65
4+ ; 1573,76
12,8
67,2
2+ ; 871,098
11
10
9
8
7
5
4
3
2
1
Stable
0
0+ ; 0
94
Mo
42 52
Q+ = 4332 keV
% β+ + % ε = 100