Table 4: Short-lived radioactive decay systems for the Earth.

Decay system	Decay mode	Shape factor $S(p,q)$	Q (MeV)	Q_h (MeV)	$t^{\ddagger}_{1/2}$	$(\tilde{h}/A)$ [nW/kg-elem] at t_{zero} (CAI)	Mole frac. (%) parent nuclide	ref
^{41}Ca $\rightarrow$ ^{41}K	EC	–	0.4217	0	$9.94(15) \times 10^4$	0	$(^{41}\text{Ca}/^{40}\text{Ca})_i = (4.2\pm1.9)\times10^{-9}$	[53]
^{99}Tc $\rightarrow$ ^{99}Ru	β^-	$0.54p^2 + q^2$ [16]	0.2975	0.0957	$2.111(12) \times 10^5$	46.71	$(^{99}\text{Tc}/^{100}\text{Ru})_i = <3.9\times10^{-5}$	[54]
^{81}Kr $\rightarrow$ ^{81}Br	EC	–	0.2809	0.0008	$2.29(11) \times 10^5$	–	*not available*	–
^{126}Sn $\rightarrow$ ^{126}Te	β^-, β^-	$1^!$, NuDat$^!$	4.0502	2.8597	$2.35(7) \times 10^5$	3.773×10^4	$(^{126}\text{Sn}/^{124}\text{Sn})_i = \leq3 \times10^{-3}$	[55]
^{36}Cl $\rightarrow$ ^{36}Ar	β^- (98.1%)	from [16]	0.7095	0.3343	$3.01(2) \times 10^5$	0.9557	$(^{36}\text{Cl}/^{35}\text{Cl})_i = (1.9\pm0.5)\times10^{-8}$	[56]
^{36}Cl $\rightarrow$ ^{36}S	ε (1.9%)	NuDat$^!$	1.1421^{EC}	7×10^{-6}	$3.01(2) \times 10^5$	2.011×10^{-5}	"	"
^{79}Se $\rightarrow$ ^{79}Br	β^-	$p^2 + q^2$ [th.]	0.1506	0.0559	$3.26(28) \times 10^5$	–	*not available*	–
^{26}Al $\rightarrow$ ^{26}Mg	EC (18.3%)	–	4.0044	0.3610	$\lambda_{\text{EC}}/\lambda = 0.1827$	2057		
^{26}Al $\rightarrow$ ^{26}Mg	β^+ (81.7%)	$p^4 + \frac{10}{3}p^2q^2 + q^4$ [th.]	2.9824	2.7593	$\lambda_{\beta^+}/\lambda = 0.8173$	1.572×10^4		
^{26}Al $\rightarrow$ ^{26}Mg	Overall			3.1203	$7.17(24) \times 10^5$	1.777×10^4	$(^{26}\text{Al}/^{27}\text{Al})_i = (5.2\pm0.2)\times10^{-5}$	[57]
^{10}Be $\rightarrow$ ^{10}B	β^-	$p^4 + \frac{10}{3}p^2q^2 + q^4$ [th.]	0.5568	0.2527	$1.387(12) \times 10^6$	2.270×10^4	$(^{10}\text{Be}/^{9}\text{Be})_i = (5.3\pm1.0)\times10^{-4}$	[58]
^{93}Zr $\rightarrow$ ^{93}Nb	β^-	$p^2 + q^2$ [th.]	0.0903	0.0456	$1.61(5) \times 10^6$	–	*not available*	–
^{150}Gd $\rightarrow$ ^{146}Sm	α	–	2.8077	2.8077	$1.79(8) \times 10^6$	–	*not available*	–
^{135}Cs $\rightarrow$ ^{135}Ba	β^-	$0.10p^2 + q^2$ [16]	0.2688	0.0615	$2.3(3) \times 10^6$	119.4	$(^{135}\text{Cs}/^{133}\text{Cs})_i = (2.8\pm2)\times10^{-4}$	[59]
^{60}Fe $\rightarrow$ ^{60}Ni	β^-, β^-	$1^!$, NuDat$^!$	3.0598	2.7077	$2.62(4) \times 10^6$	1.367	$(^{60}\text{Fe}/^{56}\text{Fe})_i = (3.8\pm6.9)\times10^{-8}$	[23]
^{154}Dy $\rightarrow$ ^{150}Gd	α	–	2.9451	2.9451	$3.0(15) \times 10^6$	–	*not available*	–
^{53}Mn $\rightarrow$ ^{53}Cr	EC	–	0.5968	0	$3.74(4) \times 10^6$	0	$(^{53}\text{Mn}/^{55}\text{Mn})_i = (6.5\pm1.9)\times10^{-6}$	[60]
^{98}Tc $\rightarrow$ ^{98}Ru	β^-	$1^!$	1.794	1.5165	$4.2(3) \times 10^6$	1449	$(^{98}\text{Tc}/^{98}\text{Ru})_i = <1.5\times10^{-3}$	[61]
^{97}Tc $\rightarrow$ ^{97}Mo	EC	–	0.3247	0	$4.21(16) \times 10^6$	0	$(^{97}\text{Tc}/^{98}\text{Ru})_i = <2\times10^{-5}$	[62]
^{107}Pd $\rightarrow$ ^{107}Ag	β^-	$p^2 + q^2$ [th.]	0.0341	0.0133	$6.5(3) \times 10^6$	0.2768	$(^{107}\text{Pd}/^{108}\text{Pd})_i = (2.573\pm0.07)\times10^{-5}$	[63]
^{182}Hf $\rightarrow$ ^{182}W	β^-, β^-	$p^2 + q^2$ [th.], NuDat$^!$	2.1958	1.8276	$8.90(9) \times 10^6$	87.07	$(^{182}\text{Hf}/^{180}\text{Hf})_i = (1.018\pm0.043)\times10^{-4}$	[32]
^{129}I $\rightarrow$ ^{129}Xe	β^-	$p^2 + 3.16q^2$ [16]	0.1889	0.0853	$1.57(4) \times 10^7$	12.71	$(^{129}\text{I}/^{127}\text{I})_i = (1.4\pm0.1)\times10^{-4}$	[64]
^{205}Pb $\rightarrow$ ^{205}Tl	EC	–	0.05067	0	$1.73(7) \times 10^7$	0	$(^{205}\text{Pb}/^{204}\text{Pb})_i = (1.0\pm0.4)\times10^{-3}$	[65]
^{92}Nb $\rightarrow$ ^{92}Zr	EC	–	2.0059	1.4956	$3.47(24) \times 10^7$	16.71	$(^{92}\text{Nb}/^{93}\text{Nb})_i = (1.7\pm0.6)\times10^{-5}$	[66]
^{244}Pu $\rightarrow$ ^{232}Th	3α, $2\beta^-$ †	NuDat$^!$	17.0845	15.6264	$8.11(3) \times 10^7$	1.363×10^4	$(^{244}\text{Pu}/^{238}\text{U})_i = 0.008$	[67]
^{146}Sm $\rightarrow$ ^{142}Nd	α	–	2.5288	2.5288	$1.03(5) \times 10^8$	0.0754	$(^{146}\text{Sm}/^{144}\text{Sm})_i = (8.28\pm44)\times10^{-3}$	[68, 69]

Q is the energy of transition (Q value) not accounting for possible branching; Q_h is the energy that remains in the Earth to provide radiogenic heating per decay, accounting for branching. $^!$In some cases, we use shape factors equal to 1 or NuDat-tabulated mean electron energies for forbidden transitions, due to lack of better inputs. $^{\text{EC}}$Reports the Q value of EC branch. ‡ Half-lives are from NNDCs www.nndc.bnl.gov. Heating coefficients $(\tilde{h}/A)$ (in nW kg-elem^{-1}), so that radiogenic power per unit mass of rock $\tilde{h}$ can be calculated from $\tilde{h} = (\tilde{h}/A) \times A$, A being the elemental mass fraction (kg-element/kg-rock), are obtained similarly to equation (6). † ^{244}Pu also undergoes spontaneous fission to $^{130-136}$Xe isotopes with a fission branching probability of 0.12%. The individual decay energies for the double β^- steps are as follows: $^{126}\text{Sn} \rightarrow {}^{126}\text{Te}$: $Q = 0.3782 + 3.6720 = 4.0502$ MeV; $^{60}\text{Fe} \rightarrow {}^{60}\text{Ni}$: $Q = 0.237 + 2.8228 = 3.0598$ MeV; $^{182}\text{Hf} \rightarrow {}^{182}\text{W}$: $Q = 0.3813 + 1.8145 = 2.1958$ MeV. The individual decay energies for $^{244}\text{Pu} \rightarrow {}^{232}\text{Th}$: $Q = 4.6655 + 0.3991 + 2.1901 + 5.2558 + 4.5731 = 17.0836$ MeV