Natural Radiation

On the next three pages are the decay schemes of three radioisotopes found on earth: $^{238}U_{92}$, $^{232}Th_{90}$ and $^{235}U_{92}$.

Isotope	half-life	gamma energies
$^{238}U_{92}$	4.468×10^9 years	—-
$^{234}Th_{90}$	24.1 days	63.3 (3.67%) 92.38 (2.13%) 92.80 (2.10%) 112.8 (0.21%)
$^{234m}Pa_{91}$	1.17 minutes	765 (0.317%) 1001 (0.842%)
$^{234}U_{92}$	2.47×10^5 years	53.2 (0.123%)
$^{230}Th_{90}$	7.54×10^4 years	67.7 (0.377%)
$^{226}Ra_{88}$	1602 years	186.2 (3.59%)
$^{222}Rn_{86}$	3.823 days	510 (0.076%)
$^{218}Po_{84}$	3.05 minutes	——
$^{214}Pb_{82}$ (99.98%)	26.8 minutes	53.2 (1.1%) 242.0 (7.25%) 295.2 (18.4%) 351.9 (35.6%) 785.9 (1.06%)
$^{218}At_{85}$ (0.02%)	2 seconds	——
$^{214}Bi_{83}$	19.7 minutes	609.3 (45.5%) 768.4 (4.89%) 806.2 (1.26%) 934.1 (3.11%) 1120.3 (14.9%) 1238.1 (5.83%) 1377.7 (3.99%) 1408.0 (2.39%) 1509.2 (2.13%) 1729.6 (2.88%) 1764.5 (15.3%) 1838.4 (0.35%) 1847.4 (2.03%) 2204 (4.92%) 2447.7 (1.55%)
$^{214}Po_{84}$ (99.98%) $^{210}Tl_{81}$ (0.02%)	164 microsec 1.3 minutes	799 (0.014%) 296 (80%) 795 (100%) 1310 (21%)
$^{210}Pb_{82}$	21 years	46.5 (4.05%)
$^{210}Bi_{83}$	5.012 days	——
$^{210}Po_{84}$	138.4 days	803 (0.0011%)
$^{206}Pb_{82}$	Stable	

Isotope	half-life	gamma energies
$^{232}Th_{90}$	1.405×10^{10} years	63.8 (0.267%)
$^{228}Ra_{88}$	5.75 years	——
$^{228}Ac_{89}$	6.13 hours	57.7 (0.487%) 99.5 (1.26%) 129.0 (2.42%) 154.0 (0.722%) 209.3 (3.89%) 270.2 (3.46%) 328.0 (2.95%) 338.3 (11.3%) 409.5 (1.92%) 463.0 (4.40%) 772 (1.49%) 794.9 (4.25%) 835.7 (1.61%) 911.2 (25.8%) 964.8 (4.99%) 969.0 (15.8%) 1588.2 (3.22%)
$^{228}Th_{90}$	1.91 years	84.4 (1.19%)
$^{224}Ra_{88}$	3.64 days	241.0 (4.10%)
$^{220}Rn_{86}$	55 seconds	550 (0.07%)
$^{216}Po_{84}$	0.15 seconds	——
$^{212}Pb_{82}$	10.64 hours	238.6 (43.6%) 300.0 (3.30%)
$^{212}Bi_{83}$	60.6 minutes	39.9 (1.1%) 727.3 (6.67%) 785.4 (1.10%) 1620.5 (1.47%)
$^{212}Po_{84}$ (64.06%) $^{208}Tl_{81}$ (35.94%)	304 nsec 3.1 minutes	—— 277.4 (6.6%) 510.77 (22.6%) 583.2 (84.5%) 763.1 (1.79%) 860.6 (12.5%) 2614.5 (99.8%)
$^{208}Pb_{82}$	stable	

Isotope	half-life	gamma energy (KeV)
$^{235}U_{92}$	7.038×10^8 years	143.8 (10.96%) 163.33 (5.08%) 185.7 (57.0%) 205.3 (5.02%)
$^{231}Th_{90}$	25.5 hours	25.64 (14.1%) 84.2 (6.6%)
$^{231}Pa_{91}$	3.25×10^4 years	27.4 (10.5%) 300 (2.41%) 302.7 (2.87%)
$^{227}Ac_{89}$	21.6 years	70 (0.08%)
$^{227}Th_{90}$ (98.6 %)	1.82 days	50.1 (8.4%) 236.0 (12.9%) 256.3 (7.0%) 300 (2.21%)
$^{223}Fr_{87}$ (1.4%)	22 minutes	50.1 (34%) 79.7 (8.7%) 234.8 (3%)
$^{223}Ra_{88}$	11.43 days	144.2 (3.27%) 154.2 (5.7%) 269.5 (13.9%) 323.9 (3.99%) 338.3 (2.84%)
$^{219}Rn_{86}$	4 seconds	271.2 (10.8%) 401.8 (6.6%)
$^{215}Po_{84}$	1.78 millisec	——
$^{211}Pb_{82}$	36.1 minutes	404.9 (3.78%) 427.1 (1.76%) 832.0 (3.52%)
$^{211}Bi_{83}$	2.15 minutes	351.1 (13.02%)
$^{211}Po_{84}$ (0.28%)	0.52 seconds	569.6 (0.0016%) 897.8 (0.26%)
$^{207}Tl_{81}$ (99.7%)	4.79 minutes	897 (0.16%)
$^{207}Pb_{82}$	stable	