

Element	U-238 Decay Series				Th-232 Decay Series				U-235 Decay Series			
Uranium	U-238 4.47×10 ⁹ y	U-234 2.48×10 ⁵ y							U-235 7.04×10 ⁸ y			
Protactinium	Pa-234 1.18 min	Pa-234 1.18 min							Th-231 25.5 h	Pa-231 3.25×10 ⁴ y		
Thorium	Th-234 24.1 d	Th-230 7.52×10 ⁴ y	Th-232 1.40×10 ¹⁰ y	Th-228 1.91 y	Th-228 1.91 y				Th-231 25.5 h	Th-227 18.7 d		
Actinium				Ac-228 6.13 h	Ac-228 6.13 h				Ac-227 21.8 y			
Radium		Ra-226 1.62×10 ³ y		Ra-228 5.75 y	Ra-224 3.66 d					Ra-223 11.4 d		
Francium												
Radon		Rn-222 3.82 d			Rn-220 55.6 s					Rn-219 3.96 s		
Astatine												
Polonium		Po-218 3.05 min	Po-214 1.64×10 ⁻⁴ s	Po-210 138 d	Po-216 0.15 s	Po-212 3.0×10 ⁻⁷ s	Po-212 3.0×10 ⁻⁷ s	Po-215 1.78×10 ⁻³ s				
Bismuth		Bi-214 19.7 min	Bi-214 19.7 min	Bi-210 5.01 d	Bi-210 5.01 d	Bi-212 60.6 min	Bi-212 60.6 min			Bi-211 2.15 min		
Lead		Pb-214 26.8 min	Pb-210 22.3 y	Pb-206 stable	Pb-212 10.6 h	Pb-208 stable	Pb-208 stable	Pb-211 36.1 min		Pb-207 stable		
Thallium						Tl-208 3.05 min	Tl-208 3.05 min			Tl-207 4.77 min		

Figure 5.18. A chart of the nuclides showing the decay pathways and half lives of isotopes in the three naturally occurring decay chains. Arrows that point downward indicate α decay, in which a nucleus loses two neutrons and two protons, thus decreasing in atomic number by 2 and atomic mass by 4. The arrows that slant upward to the right indicate β decay, in which a neutron in the nucleus becomes a proton (one negative charge is lost from the nucleus), causing an increase in atomic number but little change in atomic mass.