

APPENDIX 4: MEDICAL PHYSICS

Appendix 4.1: “Get a Half Life”

Complete the chart below to determine how long it would take for each fraction of the atoms in each element to decay.

Element	Half Life	50% Remains	25% Remains	12.5% Remains
Americium — 241	475 years			
Bismuth — 212	60.5 minutes			
Carbon — 14	5730 years			
Hydrogen — 3	12.26 years			
Iron — 59	45.6 days			
Polonium — 216	0.16 seconds			
Sodium — 24	15 hours			
Uranium — 235	710 000 000 years			
Uranium — 238	4.5 billion years			



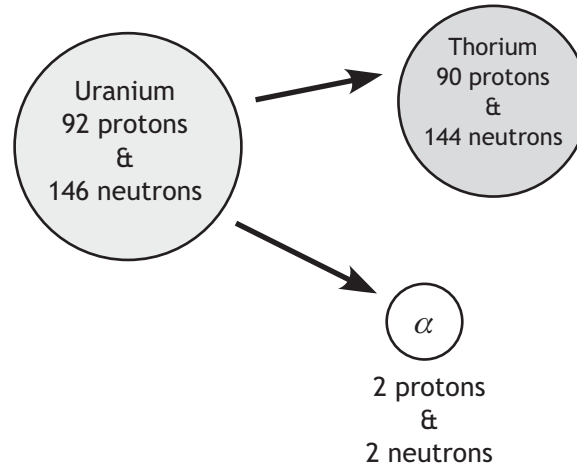
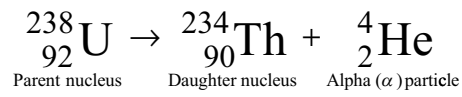
Answer Key: “Get a Half Life”

Element	Half Life	50% Remains	25% Remains	12.5% Remains
Americium — 241	475 years	475 years	950 years	1425 years
Bismuth — 212	60.5 minutes	60.5 minutes	121 minutes	181.5 minutes
Carbon — 14	5730 years	5730 years	11 460 years	17 190 years
Hydrogen — 3	12.26 years	12.26 years	24.52 years	36.78 years
Iron — 59	45.6 days	45.6 days	91.2 days	136.8 days
Polonium — 216	0.16 seconds	0.16 seconds	0.32 seconds	0.48 seconds
Sodium — 24	15 hours	15 hours	30 hours	45 hours
Uranium — 235	710 000 000 years	710 000 000 years	1 420 000 000 years	2 130 000 000 years
Uranium — 238	4.5 billion years	4.5 billion years	9 billion years	13.5 billion years

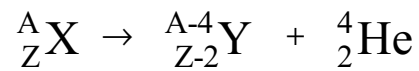


Appendix 4.2: Alpha Decay

The following is an example of the emission of an alpha particle (helium nucleus):

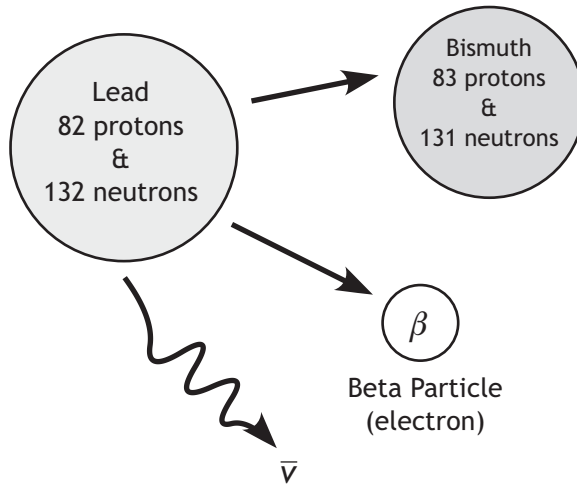
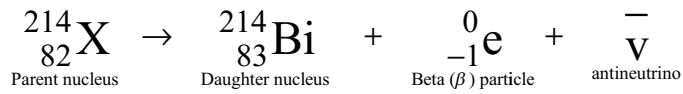


In general, gamma decay can be summed up with the following equation:



Appendix 4.3: Beta Decay

The following represents an example of the emission of a beta particle (electron):

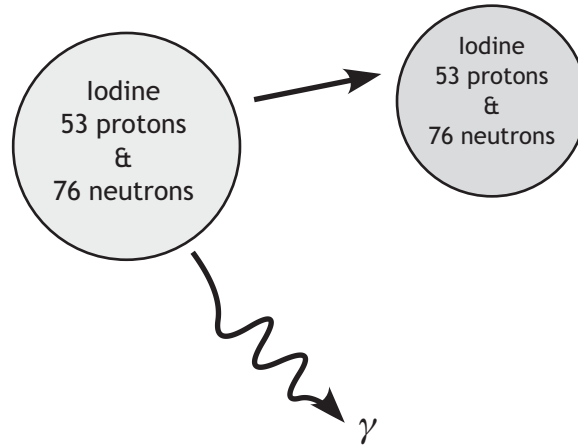
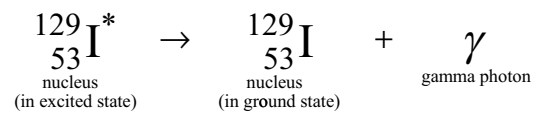


What happens in the nucleus? In general, beta decay can be summed up with the following equation:

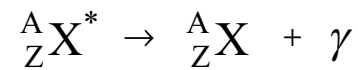


Appendix 4.4: Gamma Radiation

The following is an example of the emission of gamma radiation:



In general, gamma decay can be summed up with the following equation:



Appendix 4.5: Radioisotopes and Their Use in the Diagnosis or Treatment of Illness

Isotope	Half Life	Uses
Arsenic-74	17.9 days	locate brain tumours
Barium-131	12.0 days	detect bone tumours
Carbon-14	5730 days	treat brain tumours
Chromium-51	27.8 days	determine blood volume
Cobalt-60	5.26 years	treat brain tumours
Gold-198	64.8 hours	test kidney activity
Iodine-131	8.05 days	treat thyroid problems; find blood clots
Iron-59	45.6 days	test rate of red blood cell production
Mercury-197	65.0 hours	find brain tumours; test spleen function
Technetium-99	6.0 hours	detect brain tumours; detect blood clots

