CH 222 "q&d" Guide to Nuclear Chemistry

"q&d" = "Quick 'n' Dirty"

$$ {}^{A}_{Z}X^{n+/-} $$

X = element symbol
n = element charge (if any)
Z = atomic number (number of protons)
A = mass number (number of protons + neutrons)

Types of Radiative Processes

Alpha Decay:	Lose ${}^{4}_{2}He$	*Example:*	${}^{234}_{92}U \rightarrow {}^{4}_{2}He + {}^{230}_{90}Th$	*Note 1*
Beta Decay:	Lose ${}^{0}_{-1}e$	*Example:*	${}^{235}_{92}U \rightarrow {}^{0}_{-1}e + {}^{235}_{93}Np$	*Note 4*
Gamma Decay:	Emit Energy	*Example:*	${}^{99m}_{43}Tc \rightarrow \gamma + {}^{99}_{43}Tc$	*Note 2*
Positron Emission:	Lose ${}^{0}_{+1}e$	*Example:*	${}^{207}_{84}Po \rightarrow {}^{0}_{+1}e + {}^{207}_{83}Bi$	*Notes 3, 4*
Electron Capture:	Gain ${}^{0}_{-1}e$	*Example:*	${}^{7}_{4}Be + {}^{0}_{-1}e \rightarrow {}^{7}_{3}Li$	*Note 4*
Neutron Capture:	Gain ${}^{1}_{0}n$	*Example:*	${}^{6}_{3}Li + {}^{1}_{0}n \rightarrow {}^{4}_{2}He + {}^{3}_{1}H$	

Note 1: The alpha particle is actually charged, having a charge of +2. This makes the other product have a negative -2 charge (conservation of charge), but the charges of the ions are rarely considered in nuclear chemistry.

Note 2: Gamma emissions have energies in the range of roughly 1 MeV ($1.6*10^{-13}$ J).

Note 3: A positron is an *antielectron* (a particle of antimatter) - when a positron and an electron collide, they annihilate each other (${}^{0}_{+1}e + {}^{0}_{-1}e \rightarrow 2\gamma$).

Note 4: The beta decay process produces an antineutrino in addition to the other products, while the positron emission and electron capture processes result in the creation of a neutrino. This is due to the conservation of spin concept, but you need not concern yourself about neutrinos in *this* CH 222 class!