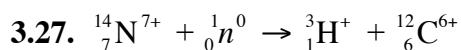
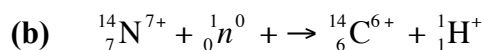
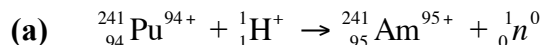
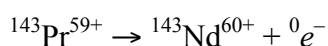
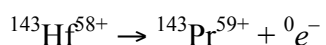
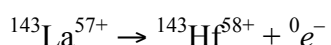
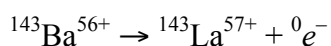
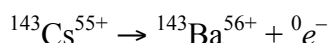
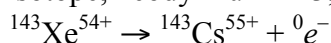


A. 3.26.**3.31.**

The series of six successive beta particle emissions by which xenon-143 decays to a stable isotope, neodymium-143, are:

**3.37.**

Fusion is the reaction between two or more nuclei to form a product that is more massive than any of the reacting nuclei. Fission is the reaction of a heavy elemental nucleus breaking up into smaller nuclei of approximately equal mass plus two or more neutrons. Elements lighter than iron tend to undergo fusion, heavier elements tend to undergo fission. In both cases the products of the reaction have a higher nuclear binding energy than the reactants, so the products are more stable.

B. (a) Using the plot in Fig. 3.14 on p. 178, one can see that after about 8 half-lives, there is less than 1% ${}^{14}\text{C}$ remaining. If one half-life is 5730 yrs then:

$$8 \text{ half lives} \times 5730 \text{ yrs/half life} = 46,000 \text{ years.}$$

So after 50,000 yrs there will be so little ${}^{14}\text{C}$ remaining that it will be difficult—and have large errors—to measure the quantity accurately.

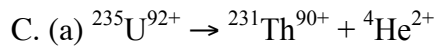
(b) For 35% ${}^{14}\text{C}$ remaining, one can write to find the number, **n**, half-lives:

$$(1/2)^n = 0.35$$

using logarithms: $n \log(0.5000) = \log(0.35)$

$$n = 1.515 \text{ half lives}$$

then: 1.515 half lives \times 5730 yrs/half life = 8680 years: the child lived about 8700 years ago.



(b) If the stalactites are assumed to be formed starting in 700 BC. They are ~ 2706 years old. The number of half lives this is equal to is given by:

$$2706 \text{ years half lives} / 1.7 \times 10^8 \text{ yrs/half life} = 3.8 \times 10^{-6} \text{ half lives}$$

The amount of uranium left that has not yet decayed to thorium is then:

$$(1/2)^{3.8 \times 10^{-6}} = 0.9999973 \text{ or than material has } 99.99973\% \text{ of original U.}$$

The amount of Th formed is 0.00027% of original U.

The final ratio is 0.00027 Th/ 99.99973 U ~ 0.00027% Th. Not much!
They much have a sensitive detector!