10. First, we figure out the mass of U-235 in the sample (assuming "3.0%" refers to the proportion by weight as opposed to proportion by number of atoms):

$$\begin{aligned} M_{\text{U-235}} &= (3.0\%)M_{\text{sam}}\left(\frac{(97\%)m_{238}+(3.0\%)m_{235}}{(97\%)m_{238}+(3.0\%)m_{235}+2m_{16}}\right) \\ &= (0.030)(1000\,\text{g})\left(\frac{0.97(238)+0.030(235)}{0.97(238)+0.030(235)+2(16.0)}\right) = 26.4\ \text{g}\ . \end{aligned}$$

Next, this uses some of the ideas illustrated in Sample Problem 43-5; our notation is similar to that used in that example. The number of ^{235}U nuclei is

$$N_{235} = \frac{(26.4\,\text{g})(6.02\times10^{23}/\text{mol})}{235\,\text{g/mol}} = 6.77\times10^{22}\ .$$

If all the U-235 nuclei fission, the energy release (using the result of Eq. 44-6) is

$$N_{235}Q_{\text{fission}} = \left(6.77\times10^{22}\right)(200\,\text{MeV}) = 1.35\times10^{25}\,\text{MeV} = 2.17\times10^{12}\ \text{J}\ .$$

Keeping in mind that a Watt is a Joule per second, the time that this much energy can keep a 100-W lamp burning is found to be

$$t = \frac{2.17\times10^{12}\,\text{J}}{100\,\text{W}} = 2.17\times10^{10}\,\text{s} \ \approx\ 690\ \text{y}\ .$$

If we had instead used the $Q = 208\,\text{MeV}$ value from Sample Problem 44-1, then our result would have been 715 y, which perhaps suggests that our result is meaningful to just one significant figure ("roughly 700 years").