

8. (a) Using Eq. 43-19 and adapting Eq. 43-20 to this sample, the number of fission-events per second is

$$\begin{aligned}
 R_{\text{fission}} &= \frac{N \ln 2}{T_{1/2 \text{ fission}}} = \frac{M_{\text{sam}} N_A \ln 2}{M_{\text{U}} T_{1/2 \text{ fission}}} \\
 &= \frac{(1.0 \text{ g})(6.02 \times 10^{23} / \text{mol}) \ln 2}{(235 \text{ g/mol})(3.0 \times 10^{17} \text{ y})(365 \text{ d/y})} = 16 \text{ fissions/day} .
 \end{aligned}$$

- (b) Since $R \propto \frac{1}{T_{1/2}}$ (see Eq. 43-19), the ratio of rates is

$$\frac{R_{\alpha}}{R_{\text{fission}}} = \frac{T_{1/2 \text{ fission}}}{T_{1/2 \alpha}} = \frac{3.0 \times 10^{17} \text{ y}}{7.0 \times 10^8 \text{ y}} = 4.3 \times 10^8 .$$