

Plutonium Decay

Plutonium has a half-life of 24,000 years. Suppose that 50 pounds of it is deposited at a nuclear waste site. How long will it take to decay into 10 lbs?

$$Y = A b^{t=?}$$

↑
10 lbs

↑
50 lbs

$$\frac{1}{2}\text{-life} = 24,000 = -\frac{\log 2}{\log b}$$

$$24,000 (\log b) = \left(\frac{-\log 2}{24,000} \right)$$

$$b = 10^{(-\log 2 / 24,000)}$$

$$= 0.999971119$$

$$\frac{10}{50} = 50 b^t$$

$$0.2 = b^t$$

$$\log 0.2 = t \log b^t$$

It will take

$$t = \frac{\log 0.2}{\log b} \approx 55,726 \text{ years to decay to 10 lbs.}$$