

Marks
2

- If a medical procedure calls for 1.0 mg of ^{128}Ba , how much isotope would be required to be able to use it exactly one week later? The half life of ^{128}Ba is 2.43 days.

The decay constant, λ , is related to the half life, $\lambda = \frac{\ln 2}{t_{1/2}} = \frac{\ln 2}{2.43 \text{ days}} = 0.285$

days^{-1} . The number of radioactive nuclei present reduces with time according to:

$$\ln\left(\frac{N_0}{N_t}\right) = \lambda t$$

With a decay constant, $\lambda = 0.285 \text{ days}$, and $N_t = 1.0 \text{ mg}$ for $t = 7 \text{ days}$, the amount originally present would have to be:

$$\ln\left(\frac{N_0}{(1.0 \times 10^{-3} \text{ g})}\right) = 0.285 \times 7$$

$$N_0 = 0.0074 \text{ g} = 7.4 \text{ mg}$$

Answer: **7.4 mg**