

- Tritium, ${}^3_1\text{H}$, in nuclear warheads decays with a half life of 12.26 years and must be replaced. What fraction of the tritium is lost in 5.0 years?

The number of radioactive nuclei N decreases with time according to the equation,

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

where λ is the decay constant. The decay constant is related to the half life by

$$\lambda = \frac{\ln 2}{t_{1/2}} = \frac{\ln 2}{12.26} = 0.05654 \text{ years}^{-1}$$

After 5 years,

$$\ln\left(\frac{N_0}{N_t}\right) = 0.05654 \times 5.0 = 0.28$$

or

$$\frac{N_0}{N_t} = e^{0.28} = 1.3$$

The fraction remaining is therefore $\frac{N_t}{N_0} = 0.75$ and so 0.25 or 25% is lost.

ANSWER: 0.25 or 25%