

Problem 1-05 First-order reactions- radioactive decomposition

The age of water or aqueous solutions can be determined from the content of the radioactive tritium, arising in nature by the action of the cosmic rays. Calculate the age of the cognac showing ten times lower radioactivity than freshly made sample. Your cognac was stored in the place shaded from the cosmic rays. The half-life of the tritium is 12.5 years.

$$[\tau = 41.524 \text{ years}]$$

Řešení:

$$\tau_{1/2} = 12.5 \text{ years} \Rightarrow k = \frac{\ln 2}{\tau_{1/2}} = \frac{\ln 2}{12.5} \text{ year}^{-1}$$

desetkrát nižší radioaktivita: $c/c_0 = 0.1$

$$\ln \frac{c}{c_0} = -k \cdot \tau$$

$$\tau = -\frac{1}{k} \cdot \ln \frac{c}{c_0} = -\frac{12.5}{\ln 2} \cdot \ln 0.1$$

$$\tau = 41.524 \text{ years}$$