Answer on Question #59725-Physics-Atomic and Nuclear Physics

The age of the dead sea scrolls was measured using radiocarbon dating. If the measurement gives a ratio of 0.78 for the ratio of the activity in the sample to the activity in a sample of corresponding live material of similar mass, calculate the age of the scrolls.

Solution

Starting from scratch we only know the half-life of C14, 5730 years. For exponential decay,

$$\frac{A_0}{2} = A_0 e^{5730k}$$

where Ao is amount at time t = 0 and k is a constant.

So we have

$$\frac{1}{2} = e^{5730k}$$

ln 0.5 = 5730 k

$$k = \frac{ln(0.5)}{5730} = -1.21 \cdot 10^{-4}$$

So we can write

$$A = A_0 e^{(-1.21 \cdot 10^{-4}t)} = 0.78 A_0$$

$$t = \frac{ln(0.78)}{-1.21 \cdot 10^{-4}} = 2050 \text{ years.}$$