

Problem Definition

Problem 71. **Chemistry: Carbon Dating** The remnants of an ancient fire in a cave in Africa showed a carbon-14 decay rate of 3.1 counts per minute per gram of carbon. Assuming that the decay rate of carbon-14 in freshly cut wood (corrected for changes in carbon-14 in the atmosphere) is 13.6 counts per minute per gram of carbon, calculate the age of the remnants. The half-life of carbon is 5715 years. Use the integrated first-order law,

$$\ln(N/N_0) = -kt$$

where N is the number of nuclides present at time t , N_0 is the number of nuclides present at time $t = 0$, $k = 0.693/5715$, and t is the time of the fire.

Solution Step 1:

For the present problem we can write

$$\ln((3.1)/(13.6)) = -\frac{0.693}{5715}t$$

This becomes

$$-1.4787 \approx (0.0001212)t$$

or $t \approx 12,194$ years.