Answer on Question # 83686, Physics / Atomic and Nuclear Physics

Question 1. *Living matter has* $1.3 \cdot 10^{-10}\,\%$ *of its carbon in the form of* ^{14}C *which has a half-life of* $5730\,y$. *A mammoth bone has a* $300\,g$ *sample of carbon separated from it, and the sample is found to have an activity of* 20 *decays per second. How old is the bone?*

Solution. The normal activity of living carbon containing matter is found to be about 15 decays per minute for every gram of carbon, i.e 0.5 decays per second for every gram. We have $20/300 = 1/15$ decays per second for every gram of carbon separated from mammoth bone.

Determine decimal fraction of ^{14}C remaining: $\frac{1/15}{0.5} = 2/15$.

Determine how many half-lives have elapsed: $(1/2)^n = 2/15 \Rightarrow n \log 0.5 = \log 2/15 \Rightarrow n \approx 2.90689$.

Determine length of time elapsed: $5730n \approx 16656.4797$.

Hence the bone is approximately 16656.4797 years old. □