

84. We note that 3.82 days is 330048 s, and that a becquerel is a disintegration per second (see §43-3). From Eq. 34-19, we have

$$\frac{N}{\mathcal{V}} = \frac{R}{\mathcal{V}} \frac{T_{1/2}}{\ln 2} = \left(1.55 \times 10^5 \frac{\text{Bq}}{\text{m}^3} \right) \frac{330048 \text{ s}}{\ln 2} = 7.4 \times 10^{10} \frac{\text{atoms}}{\text{m}^3}$$

where we have divided by volume \mathcal{V} . We estimate \mathcal{V} (the volume breathed in 48 h = 2880 min) as follows:

$$\left(2 \frac{\text{Liters}}{\text{breath}} \right) \left(\frac{1 \text{ m}^3}{1000 \text{ L}} \right) \left(40 \frac{\text{breaths}}{\text{min}} \right) (2880 \text{ min})$$

which yields $\mathcal{V} \approx 200 \text{ m}^3$. Thus, the order of magnitude of N is

$$\left(\frac{N}{\mathcal{V}} \right) (\mathcal{V}) \approx \left(7 \times 10^{10} \frac{\text{atoms}}{\text{m}^3} \right) (200 \text{ m}^3) \approx 10^{13} \text{ atoms} .$$