

### Quiz 31.1A

The activity of a sample of Iodine-131 is 0.455 Curies. The half-life of I-131 is 8.02 days. Assume the mass of Iodine-131 is 131 u.

- How many grams of Iodine-131 are in this sample?
- After how many days will the activity of the sample be reduced to 0.0100 Curies?

$$a) a_0 = 0.455 \text{ Ci} \cdot \frac{1 \text{ Bq}}{2.7 \times 10^{-11} \text{ Ci}} = 1.685 \times 10^{10} \text{ Bq}$$

$$T_{1/2} = 8.02 \text{ days} \cdot \frac{24 \text{ hrs}}{\text{day}} \cdot \frac{3600 \text{ s}}{\text{hr}} = 6.93 \times 10^5 \text{ s}$$

$$\lambda = \frac{0.693}{T_{1/2}} = 1.00 \times 10^{-6} \text{ s}^{-1}$$

$$a_0 = \lambda N_0$$

$$1.685 \times 10^{10} = (1.00 \times 10^{-6}) N_0$$

$$\Rightarrow N_0 = 1.685 \times 10^{16} \text{ atoms}$$

$$M_{TOT} = N_0 m_I = (1.685 \times 10^{16})(131 \text{ u})(1.66 \times 10^{-24} \frac{\text{kg}}{\text{u}})$$
$$= \underline{\underline{3.66 \times 10^{-6} \text{ g}}}$$

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$$b) 0.01 = .455 e^{-\lambda t}$$

$$0.02198 = e^{-\lambda t}$$

$$-3.8177 = -(1.00 \times 10^{-6})t$$

$$t = 3.82 \times 10^6 \text{ s}, \frac{1 \text{ day}}{86400 \text{ s}} = \underline{\underline{44.2 \text{ days}}}$$