

Question #63529, Physics / Atomic and Nuclear Physics

calculate the half lives of the following samples.

1. A sample of iodine-123 whose activity falls from 1000 Bq to 250 Bq in 14.4 hours.
2. A sample of technetium -99m whose activity falls from 200 Bq to 25 Bq in 18 hours.
3. A sample of strontium-90 whose activity falls 500 Bq to 62.5 Bq in 86.4 years.

Solution

$$A = A_0 2^{-\frac{t}{T_{1/2}}}$$

$$1. \quad 250 = 1000 \times 2^{-\frac{14.4}{T_{1/2}}};$$

$$2^{-\frac{14.4}{T_{1/2}}} = \frac{1}{4};$$

$$-\frac{14.4}{T_{1/2}} = -2;$$

$$T_{1/2} = 7.2 \text{ hours}$$

$$2. \quad 25 = 200 \times 2^{-\frac{18}{T_{1/2}}};$$

$$2^{-\frac{18}{T_{1/2}}} = \frac{1}{8};$$

$$-\frac{18}{T_{1/2}} = -3;$$

$$T_{1/2} = 6 \text{ hours}$$

$$3. \quad 62.5 = 500 \times 2^{-\frac{86.4}{T_{1/2}}};$$

$$2^{-\frac{86.4}{T_{1/2}}} = \frac{1}{8};$$

$$-\frac{86.4}{T_{1/2}} = -3;$$

$$T_{1/2} = 28.8 \text{ years}$$