

Exercise 32

An isotope of sodium, ^{24}Na , has a half-life of 15 hours. A sample of this isotope has mass 2 g.

- (a) Find the amount remaining after 60 hours.
- (b) Find the amount remaining after t hours.
- (c) Estimate the amount remaining after 4 days.
- (d) Use a graph to estimate the time required for the mass to be reduced to 0.01 g.

Solution

The mass (in grams) of sodium-24 remaining after t hours is

$$m(t) = 2 \left(\frac{1}{2} \right)^{\frac{t}{15}}.$$

If $t = 60$ hours, then

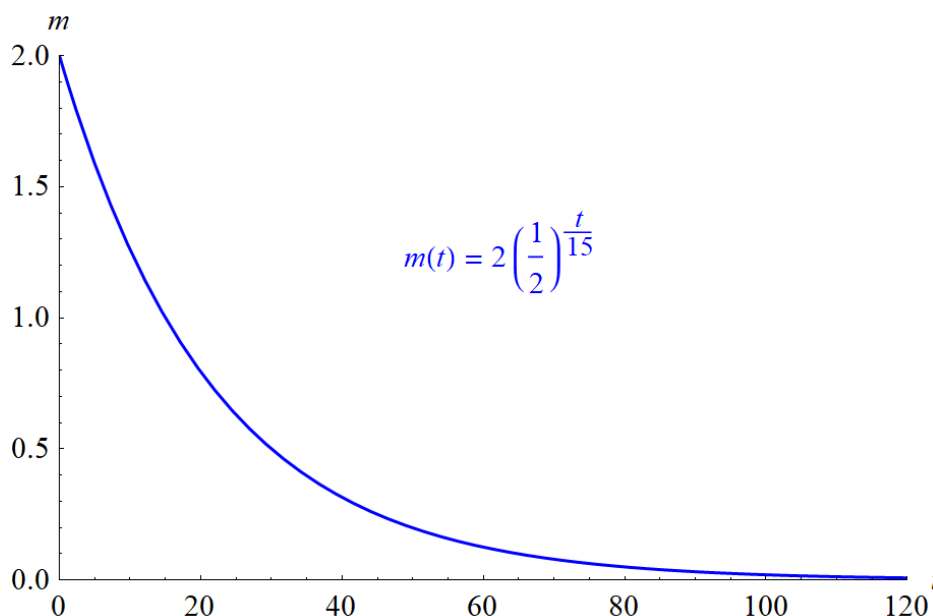
$$m(60) = 2 \left(\frac{1}{2} \right)^4 = 0.125 \text{ g.}$$

If

$$t = 4 \cancel{\text{ days}} \times \frac{24 \text{ hours}}{1 \cancel{\text{ day}}} = 96 \text{ hours,}$$

then

$$m(96) = 2 \left(\frac{1}{2} \right)^{\frac{96}{15}} \approx 0.0237 \text{ g.}$$



Judging from the graph, the mass reaches 0.01 g at $t \approx 115$ hours.