

if a radioactive material has a half-life of 2 years, a sample is reduced to 1/8 of its mass in?

According to the law of radioactive decay

$$N = 2^{-\frac{t}{T}} = \frac{1}{8} \gg t = -T \log_2 \frac{1}{8} = T \log_2 8 = 3T = 6 \text{ years}$$