Lesson 36: Exponential Decay

Recall: If $\frac{dy}{dt} = ky$, then $y = Ce^{kt}$. (k: constant!, C: initial value.)

If $k<0$, then y decreases over time. This is called exponential decay.

Def The half-life of a radioactive substance is the time required for half of the atoms to decay.

Ex 1 ^{14}C has a half life of 5715 years. If there is currently 6g of ^{14}C, how much will be left in 1000 years?

$y = Ce^{kt}$

$3 = 6e^{k(5715)}$

$\frac{1}{2} = e^{5715k}$

$\ln \frac{1}{2} = 5715k$

$k = \frac{\ln 1/2}{5715}$

$y = 6e^{k(1000)}$ where $k = \frac{\ln 1/2}{5715}$

$= \boxed{5.315g}$

Note: $\boxed{\text{half-life} = \frac{\ln 1/2}{k} \quad \left(\text{or } k = \frac{\ln 1/2}{\text{half-life}}\right)}$