Half-Life

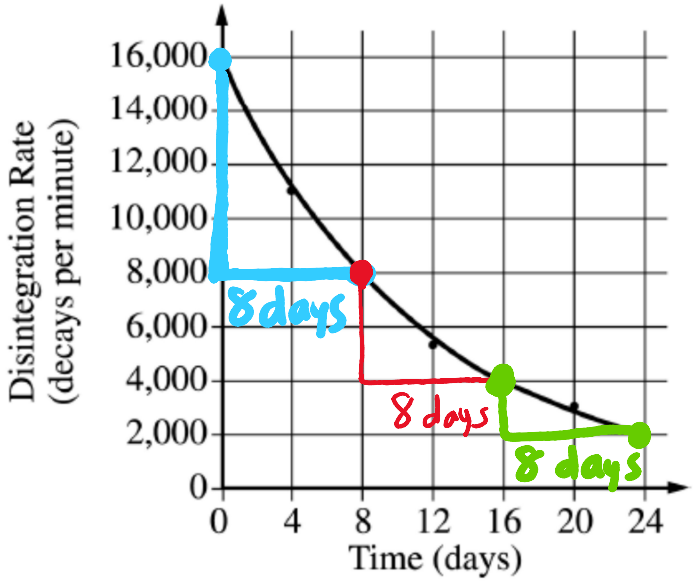
Sunday, February 24, 2019 8:46 AM

Half-life = time required for $\frac{1}{2}$ mass to decay

time it takes to go from 100% mass to 50% mass

Half-life Example

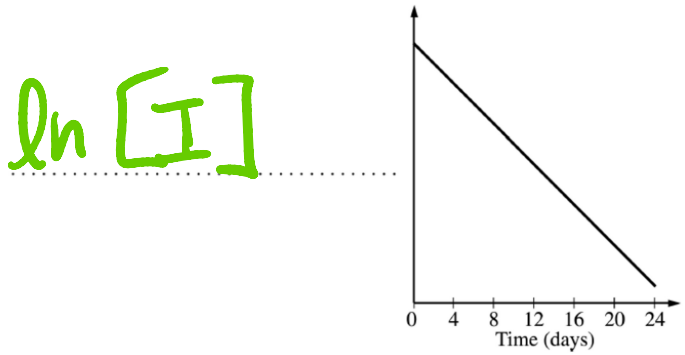
The decay of the radioisotope I-131 was studied in a laboratory. The radioactivity of a sample of I-131 was measured. The data collected are plotted on the graph below.



(a) Determine the half-life, $t_{1/2}$, of I-131 using the graph above.

$t_{1/2} = 8$ days

(b) The data can be used to show that the decay of I-131 is a first-order reaction, as indicated on the graph below.



(i) Label the vertical axis of the graph above.

(ii) What are the units of the rate constant, k, for the decay reaction? $\frac{1}{\text{days}}$

(iii) Explain how the half-life of I-131 can be calculated using the slope of the line plotted on the graph.

$k = |\text{slope}|$ of line in $\ln[I]$ vs. time

$t_{1/2} = \frac{\ln(2)}{k}$ $t_{1/2} = \frac{0.693}{k}$ Formula

★ $t_{1/2} = \frac{\ln(2)}{k}$ $t_{1/2} = \frac{0.693}{k}$ Formula sheet

(c) Compare the value of the half-life of I-131 at 25°C to its value at 50°C.

Half-life is independent of T.

Half-life at 25°C is the same as that at 50°C.