Find k ← The half life of Helium is 119 years. ← t

Example: The half life of Helium is 119 years. What is the annual decay rate? Express the decimal result to four significant digits and the percentage to two significant digits.

$y = ae^{kt}$

$\frac{1}{2}a = ae^{119k}$

$\frac{1}{2} = e^{119k}$

$k = \frac{\ln(\frac{1}{2})}{119} = -.0058$

$-.58\%$

Example: A biologist recorded a count of 400 bacteria after 12 minutes and 1200 bacteria after 20 minutes.

$y = ae^{kt}$

a) To the nearest whole number, What was the initial population in the culture?

$(12, 400)$ (t, y) $(20, 1200)$ (t, y)

$400 = ae^{12k}$

$a = \frac{400}{e^{12k}}$

$1200 = ae^{20k}$

$1200 = \left(\frac{400}{e^{12k}}\right)e^{20k}$

$1200 = 400e^{8k}$

$3 = e^{8k}$

$k = \frac{\ln(3)}{8}$

$k = .1373$

b) Rounding to six significant digits, write an exponential equation representing the situation.

$y = 77e^{.1373t}$

$\frac{400}{e^{12(.1373)}} = 77$

c) To the nearest minute, how long did it take the population to double?

$154 = 77e^{.1373t}$

$2 = e^{.1373t}$

$t = \frac{\ln(2)}{.1373} = 5 \text{ min}$