HALF-LIFE

FIRST ORDER

$aA \rightarrow prod(s)$

$$\ln[A]_t = \ln[A]_0 - kt$$

When $t = t_{\frac{1}{2}}$

then $[A]_t = \frac{1}{2}[A]_0 = \frac{[A]_0}{2}$

$$\ln\left(\frac{1}{2}[A]_0\right) = \ln[A]_0 - kt_{\frac{1}{2}}$$

$$\ln\left(\frac{1}{2}\right) + \ln[A]_0 = \ln[A]_0 - kt_{\frac{1}{2}}$$

$$-kt_{\frac{1}{2}} = \ln\left(\frac{1}{2}\right)$$

$$-kt_{\frac{1}{2}} = \ln\left(2^{-1}\right)$$

$$-kt_{\frac{1}{2}} = -1 \cdot \ln(2)$$

$$kt_{\frac{1}{2}} = \ln(2)$$

$$\boxed{t_{\frac{1}{2}} = \frac{\ln(2)}{k}}$$

FIRST ORDER HALF-LIFE

↓ algebra

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

SECOND ORDER

$$\frac{1}{[A]_t} = \frac{1}{[A]_0} + kt$$

$$\frac{1}{\frac{1}{2}[A]_0} = \frac{1}{[A]_0} + k t_{\frac{1}{2}}$$

$$\frac{2}{[A]_0} = \frac{1}{[A]_0} + k t_{\frac{1}{2}}$$

$$\frac{2}{[A]_0} - \frac{1}{[A]_0} = \frac{1}{[A]_0} - \frac{1}{[A]_0} + k t_{\frac{1}{2}}$$

$$k t_{\frac{1}{2}} = \frac{1}{[A]_0}$$

$$t_{\frac{1}{2}} = \frac{1}{k[A]_0}$$

SECOND ORDER HALF-LIFE

↓ algebra

$$k = \frac{1}{t_{\frac{1}{2}} \cdot [A]_0}$$

$aA \longrightarrow$ product(s)

$R = k[A]^x$

Arrhenius Equation

$k = A \cdot e^{-\frac{Ea}{RT}}$

$R = 8.314 \frac{J}{mol\,K}$

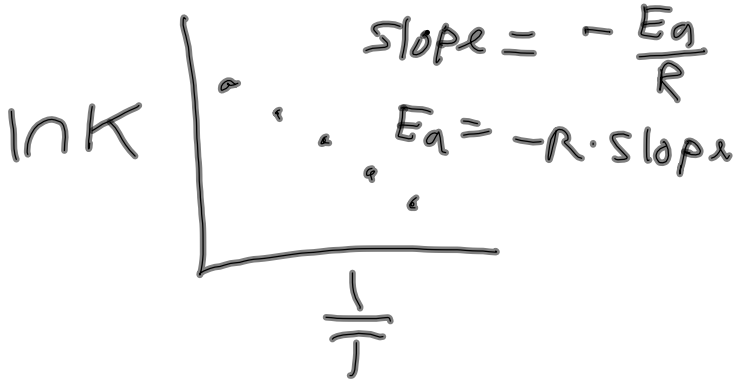
$\ln k = \ln\left(A \cdot e^{-\frac{Ea}{RT}}\right)$

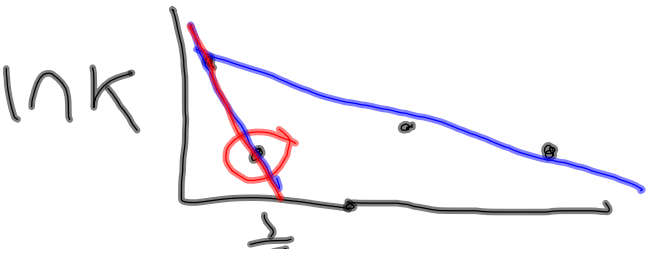
$\ln k = \ln A + \ln e^{-\frac{Ea}{RT}}$

$\ln k = \ln A - \frac{Ea}{RT}$

$\ln k = \ln A - \left(\frac{Ea}{R}\right)\left(\frac{1}{T}\right)$

$y = b + m \cdot x$





(T_1, k_1), (T_2, k_2)

$$\ln k_2 = \ln A - \left(\frac{E_a}{R}\right)\left(\frac{1}{T_2}\right)$$

$$-\left[\ln k_1 = \ln A - \left(\frac{E_a}{R}\right)\left(\frac{1}{T_1}\right)\right]$$

$$\ln k_2 - \ln k_1 = \left(\frac{E_a}{R}\right)\left(\frac{1}{T_1}\right) - \left(\frac{E_a}{R}\right)\left(\frac{1}{T_2}\right)$$

$$\ln\left(\frac{k_2}{k_1}\right) = \left(\frac{E_a}{R}\right)\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$$

very slow

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

I^- fast

$$2H_2O_2(aq) \longrightarrow 2H_2O(l) + O_2(g)$$

$$H_2O_2(aq) + I^-(aq) \rightarrow H_2O(l) + IO^-(aq)$$

$$H_2O_2(aq) + IO^-(aq) \rightarrow H_2O(l) + O_2(g) + I^-(aq)$$

$$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$$