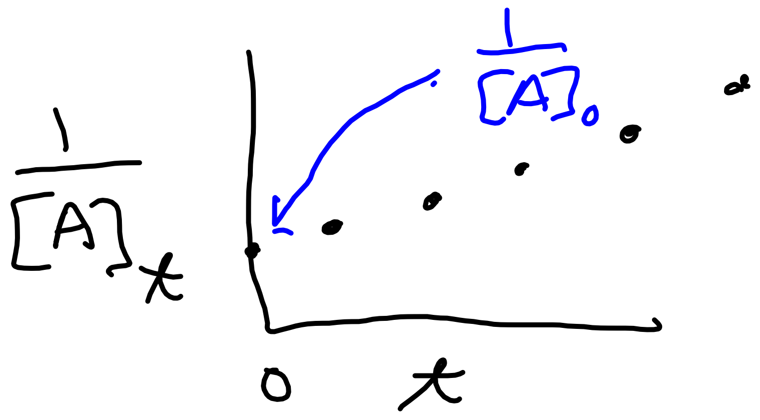
SECOND ORDER

$aA \rightarrow prod(s)$

$R = k[A]^2$

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

$$y = b + mx$$



HALF-LIFE

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

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

ZERO ORDER:

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

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

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

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

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

ZERO ORDER HALF-LIFE

↓ algebra

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

HALF-LIFE

FIRST ORDER

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

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

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

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

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

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

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

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

FIRST ORDER HALF-LIFE

$$\Big\downarrow \text{algebra}$$

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

SECOND ORDER

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

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

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

$$\frac{2}{[A]_0} - \frac{1}{[A]_0} = \cancel{\frac{1}{[A]_0}} - \cancel{\frac{1}{[A]_0}} + kt_{\frac{1}{2}}$$

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

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

SECOND ORDER HALF-LIFE

$\downarrow$ algebra

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

$aA \rightarrow \text{prdd(s)}$

$R = k[A]^x$

Arrhenius Equation

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

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