Chemistry 130 Kinetics Reference Sheet

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Zeroth Order

Rate

$$\text{Rate} = \frac{-d[\text{A}]}{dt} = k$$

Integrated Rate Law

$$[\text{A}]_t - [\text{A}]_0 = -kt$$

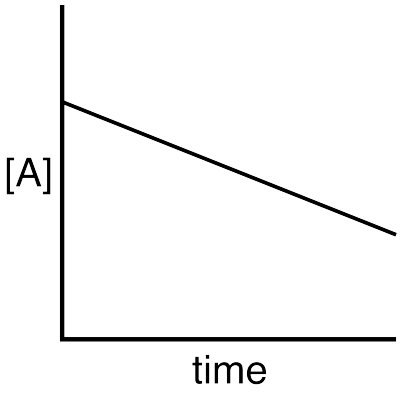
Half Life

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

Half Life Decreases With Time

Plot

$$[\text{A}]_t = -kt + [\text{A}]_0$$



First Order

Rate

$$\text{Rate} = \frac{-d[\text{A}]}{dt} = k[\text{A}]$$

Integrated Rate Law

$$\ln[\text{A}]_t - \ln[\text{A}]_0 = -kt$$

- or -

$$\frac{[\text{A}]_t}{[\text{A}]_0} = e^{-kt}$$

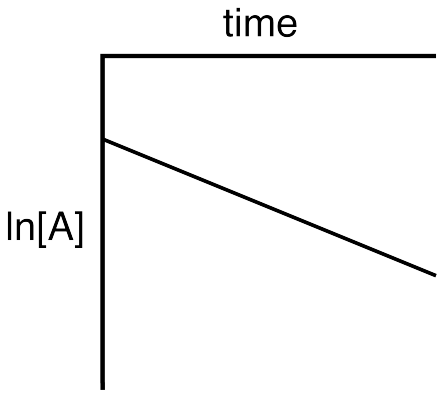
Half Life

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

Half Life is Independent of Time

Plot

$$\ln[\text{A}]_t = -kt + \ln[\text{A}]_0$$



Second Order

Rate

$$\text{Rate} = \frac{-1}{2}\frac{d[\text{A}]}{dt} = \frac{d[\text{B}]}{dt} = k_1[\text{A}]^2 \quad (1)$$

- or -

$$\text{Rate} = \frac{-d[\text{A}]}{dt} = k_2[\text{A}]^2 \quad (2)$$

Integrated Rate Law

$$\frac{1}{[\text{A}]_t} = 2k_1t + \frac{1}{[\text{A}]_0} \quad (1)$$

- or -

$$\frac{1}{[\text{A}]_t} = k_2t + \frac{1}{[\text{A}]_0} \quad (2)$$

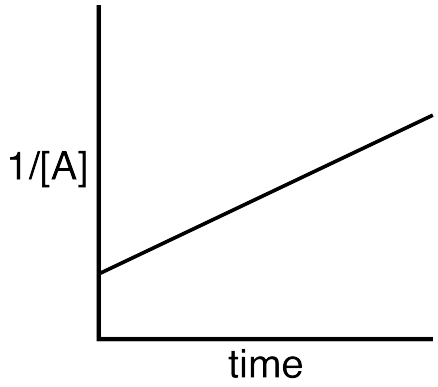
Half Life

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

Half Life is Independent of Time

Plot

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



Other Formulae for Kinetics

Arrhenius Equation

$$k = Ae^{\frac{-E_a}{RT}}$$

Arrhenius Plot Equation

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