Reaction Kinetics

Reaction Rates

Given a reaction $n_A A + n_B B \longrightarrow$ *products* that has no intermediate steps.

Reaction Rate with respect to A $= \dfrac{\Delta[A]}{\Delta t}$

Overall Reaction Rate $= \dfrac{1}{n_A}\dfrac{\Delta[A]}{\Delta t} = \dfrac{1}{n_B}\dfrac{\Delta[B]}{\Delta t}$

Reaction Rate & Temp

Reaction rate approximately doubles for each 10°C increase in temperature.

Rate Law

Rate $= k[A]^a[B]^b$

- a & b are usually integers, unrelated to n_A and n_B.
- a is the "order of the reaction with respect to A."
- Overall order of the reaction is the sum of the individual orders (*i.e.*, $a + b$)

Determining Rate Order and Half-Life ($t_{½}$)

0th-Order: $[A] = [A]_0 - kt$

- Graph of $[A]$ vs t yields a straight line
- $t_{½} = \dfrac{[A_0]}{2k}$

1st-Order: $[A] = [A]_0 e^{-kt}$ or $\ln[A] = \ln[A]_0 - kt$

- Graph of $\ln[A]$ vs t yields a straight line
- $t_{½} = \dfrac{\ln 2}{k}$

2nd-Order: $\dfrac{1}{[A]} = \dfrac{1}{[A]_0} + kt$

- Graph of $\dfrac{1}{[A]}$ vs t yields a straight line
- $t_{½} = \dfrac{1}{k[A]_0}$

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