Integrating Rate Expressions
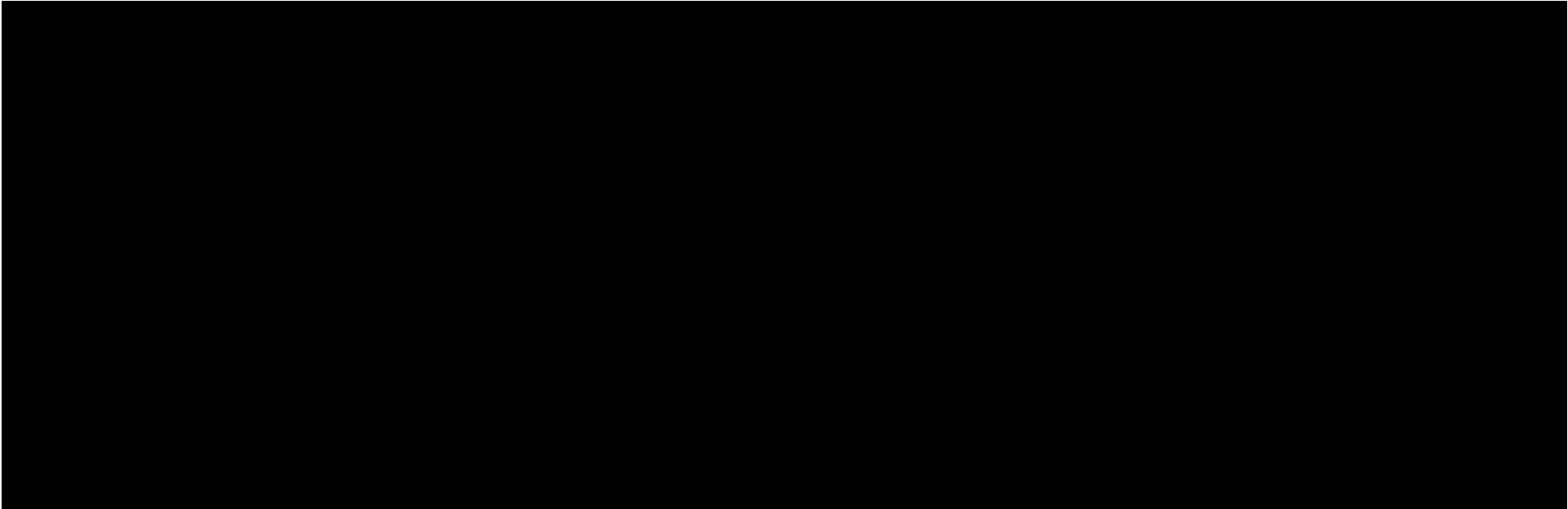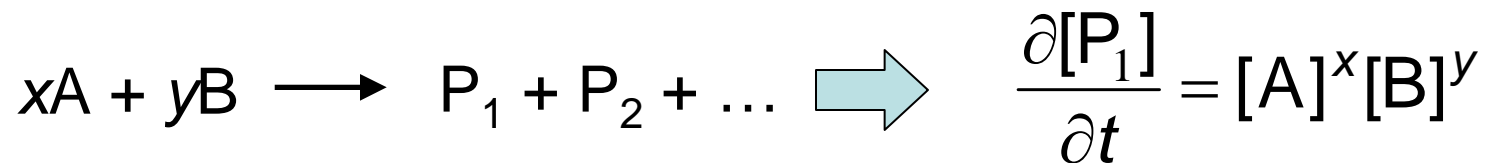
1. **Rewrite rate law in terms of one variable reactant ("[A]").**
2. **Rearrange to put all [A] on one side, ∂t on the other.**
3. **Integrate from $[A]_0$ to $[A]_t$ and time $t = 0$ to t.**
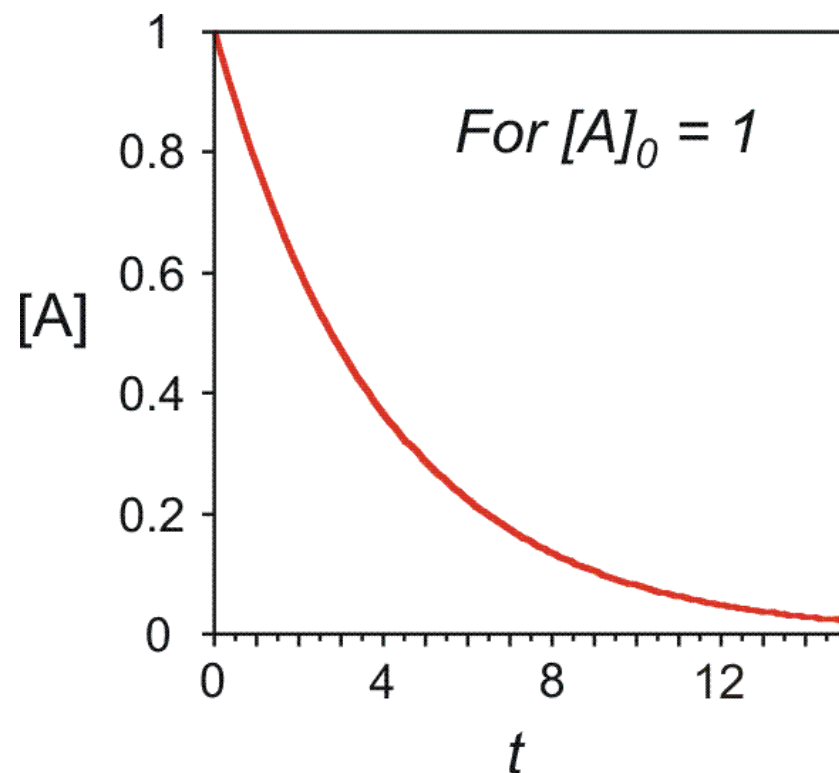4. **Fit integrated model law to data.**

Hypothesis: Kinetic Models are Composed of Elementary Steps

- Reactions can be described in terms of (multiple) elementary reaction steps involving no more than 2 reactant molecules;

- Elementary rate law for each step:

$$x A + y B \longrightarrow P_1 + P_2 + \ldots \implies \frac{\partial [P_1]}{\partial t} = [A]^x [B]^y$$

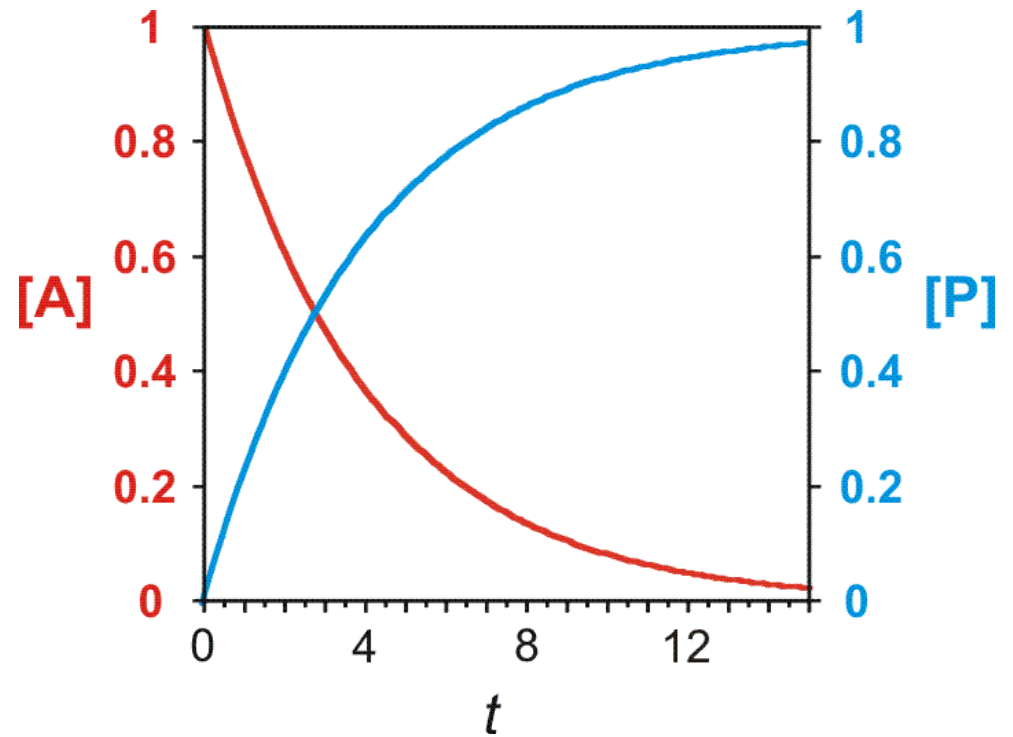# A First-Order Kinetic Plot

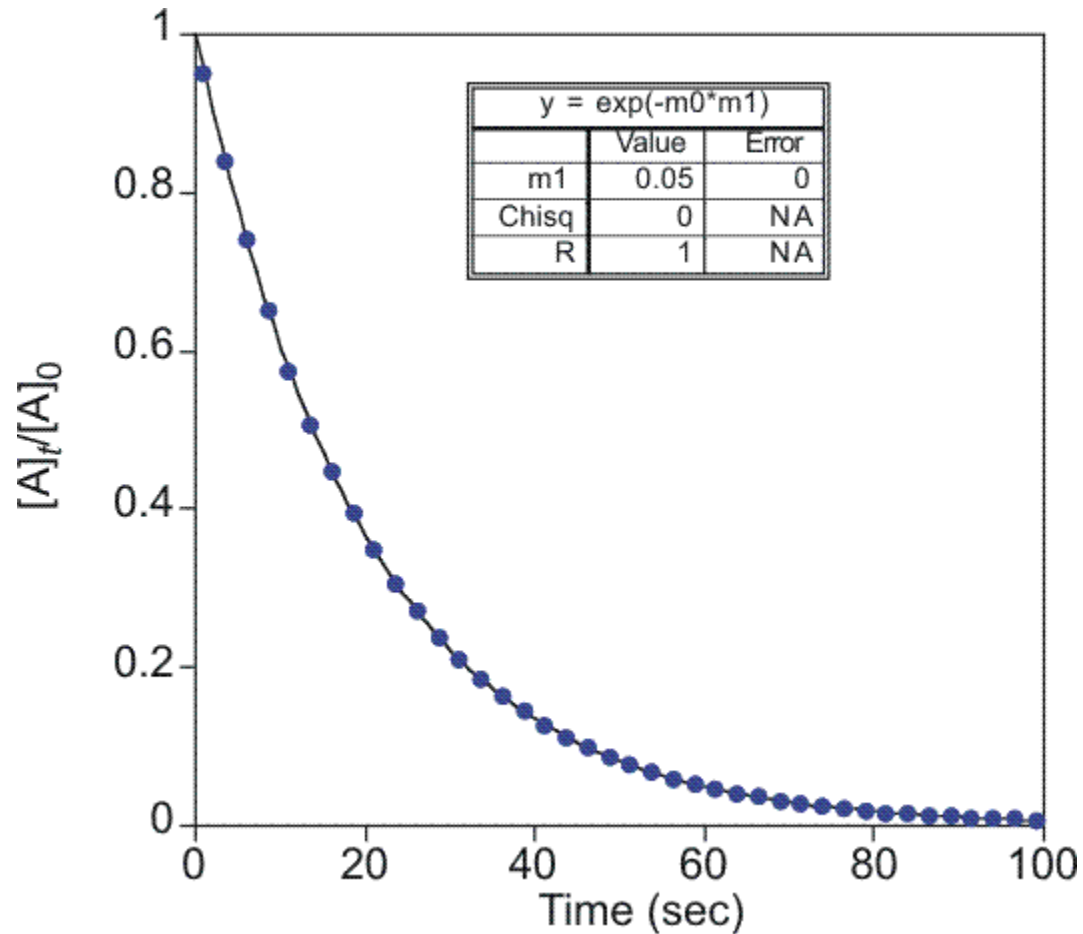$$[A]_t = [A]_0 e^{-kt}$$

For $[A]_0 = 1$

[A]

A First-Order Kinetic Plot

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

$$[P]_t = [A]_0(1 - e^{-kt})$$

A First-Order Kinetic Plot

Using Kaleidagraph, fit to

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

("m0" = t, "m1" = k)