Experimental Rate Law

- Communicates how the concentration of each reactant affects the rate.

e.g. for $A + B \rightarrow C + D$

$$\text{Rate} = k[A]^m[B]^n$$

m, n = order

[A], [B] = "concentration of"

k = constant

Overall order: $m+n+\ldots$

Examples-Determining Rate Law

p. 544 – table 17.3

Substance A -

Trial	[A]	[B] ← control	Rate
1	0.100	0.100	2×10^{-3}
2	0.200	0.100	4×10^{-3}

Δ[A]	Δ Rate
$\frac{0.200}{0.100} = 2$	$\frac{4 \times 10^{-3}}{2 \times 10^{-3}} = 2$

$$\Delta[A]^n = \Delta \text{ rate}$$

$$2^n = 2$$

$2^1 = 2$ so $n = 1$

Reaction is "first" order for A.

B. Use trials 2 & 3 where [A] is constant

Trial	[B]	Rate
2	0.100	4×10^{-3}
3	0.200	16×10^{-3}

[B]	Rate
$\frac{0.200}{0.100} = 2$ times	$\frac{16 \times 10^{-3}}{4 \times 10^{-3}} = 4$ times

$\Delta[B]^m = \Delta \text{rate}$

second order → $2^m = 4$

$m = 2$ (so $2^2 = 4$)

So $\text{Rate} = k[A][B]^2$

overall order $= 1 + 2 = 3$

p. 545 #16-18

p. 555 #64, 69-71