

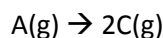
Determining Rate Laws: $\text{rate} = k [A]^m [B]^n$ 1) Find **m** and **n**

$$\text{a) } \frac{\text{rate}_2}{\text{rate}_1} = \frac{k[A_2]^m[B_2]^n}{k[A_1]^m[B_1]^n} \quad \text{or} \quad \frac{\text{rate}_2}{\text{rate}_1} = \frac{k[A_2]^m[B_2]^n}{k[A_1]^m[B_1]^n}$$

$$\text{b) } \text{rate}_2 = [A_2]^m \quad \text{or} \quad \text{rate}_2 = [B_2]^n$$

2) Find **k**

$$\text{a) } \text{rate}_1 = k[A_1]^m[B_1]^n$$

Clicker Question:

1 unit of A makes 2 units of C, so C is appearing 2x as fast as A is disappearing (or A is disappearing $\frac{1}{2}$ as fast as C is appearing).

$\frac{1}{2}(6.2 \times 10^{-2}) = 3.1 \times 10^{-2}$, therefore -3.1×10^{-2} is the answer (negative sign for disappearing)

Half-life: time it takes for $\frac{1}{2}$ of the substance to react1. time of $\frac{1}{2}$ life only depends on the k value (rest are constants)a. $[A_t]$ is going to become $\frac{1}{2} [A_0]$

$$\text{i. } \frac{[A_t]}{[A_0]} = \frac{1}{2} = 2$$

b. $\ln[A_t] = \ln[A_0] - k t$

$$\text{i. } k t = \ln \left(\frac{[A_0]}{[A_t]} \right)$$

ii. $k t_{\text{half-life}} = \ln 2$

$$\text{c. } t_{\text{half-life}} = \frac{\ln 2}{k}$$

$$2. \quad [A_t] = \frac{1}{2} t_{\text{half-life}} [A_0]$$

$$\text{a. } \frac{t}{t_{\text{half-life}}} = \# \text{ of half-lives}$$

b. t = time elapsed

$$\text{c. } [A_{\text{end}}] = \frac{1}{2} t_{\text{half-life}} [A_{\text{start}}]$$

Causes of Reaction Rates

1. Concentration Rates
 - a. [A] and [B]
 - i. More collisions → more reactions
2. Temperature
 - a. T
 - i. More collisions → more reactions
3. Frequency Factor (% of collisions that happen at the right orientations of the reactants to create products)
 - a. A
 - i. Higher % → more reactions
4. Activation Energy (Energy required to start off the reaction)
 - a. E_a
 - i. Lower E_a → more reactions

Summed up by:

5. $k = A e^{-\left(\frac{E_a}{RT}\right)}$

Can be rewritten by:

6. $(\ln k) = (\ln A) - \left(\frac{E_a}{R}\right) * \left(\frac{1}{T}\right)$

7. (y value) = (y intercept) - (slope) (x value)

Therefore:

8. $-\frac{E_a}{R} = \frac{\Delta y}{\Delta x}$