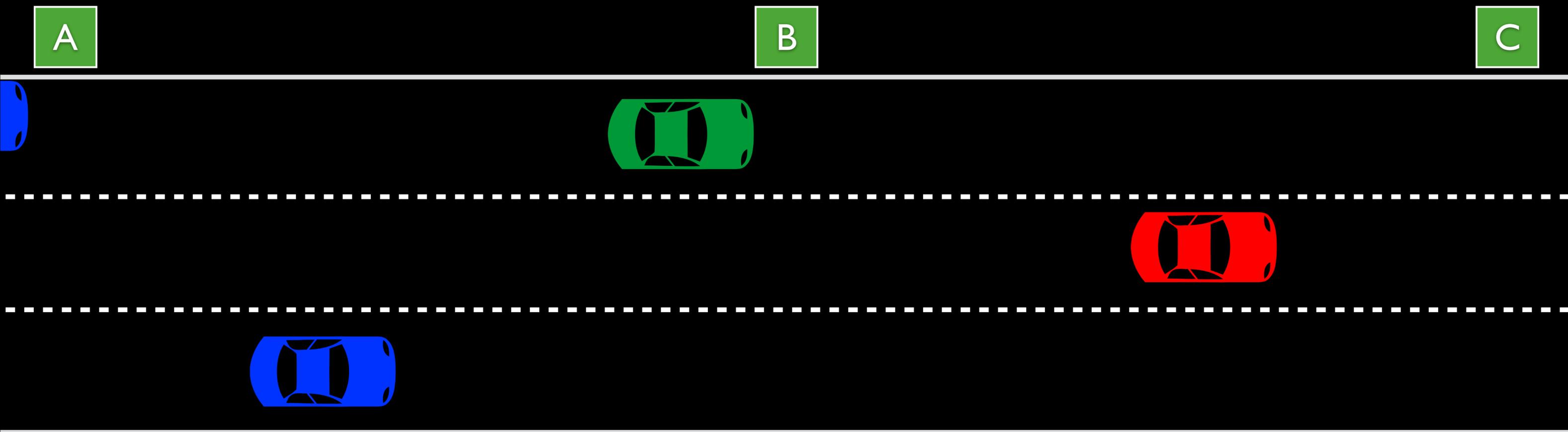
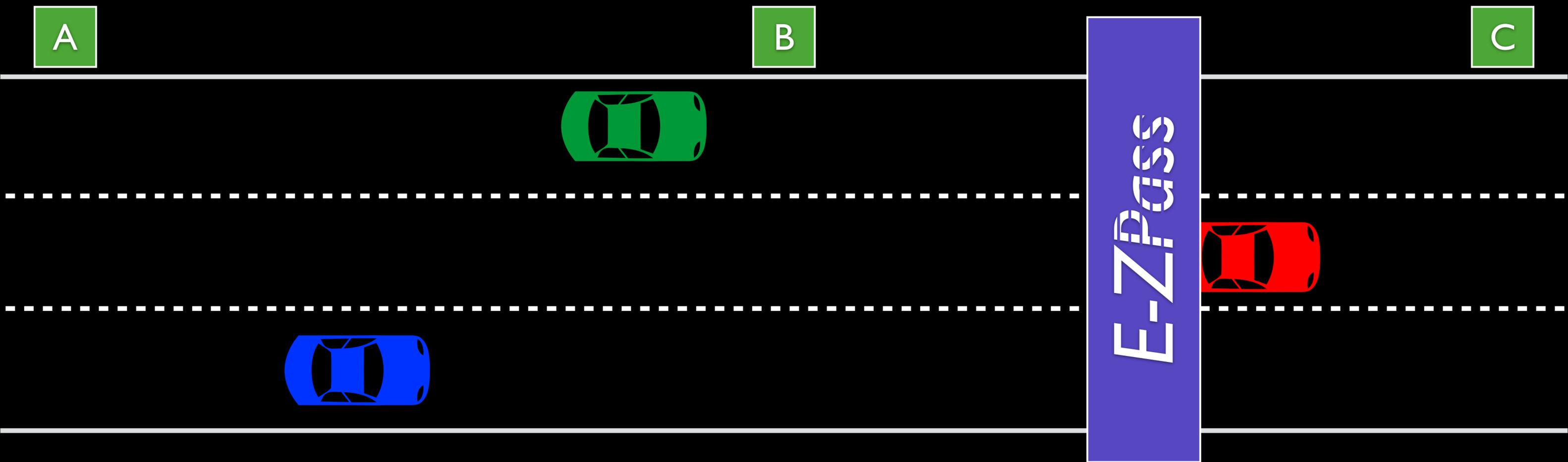


The Rate-Limiting Step



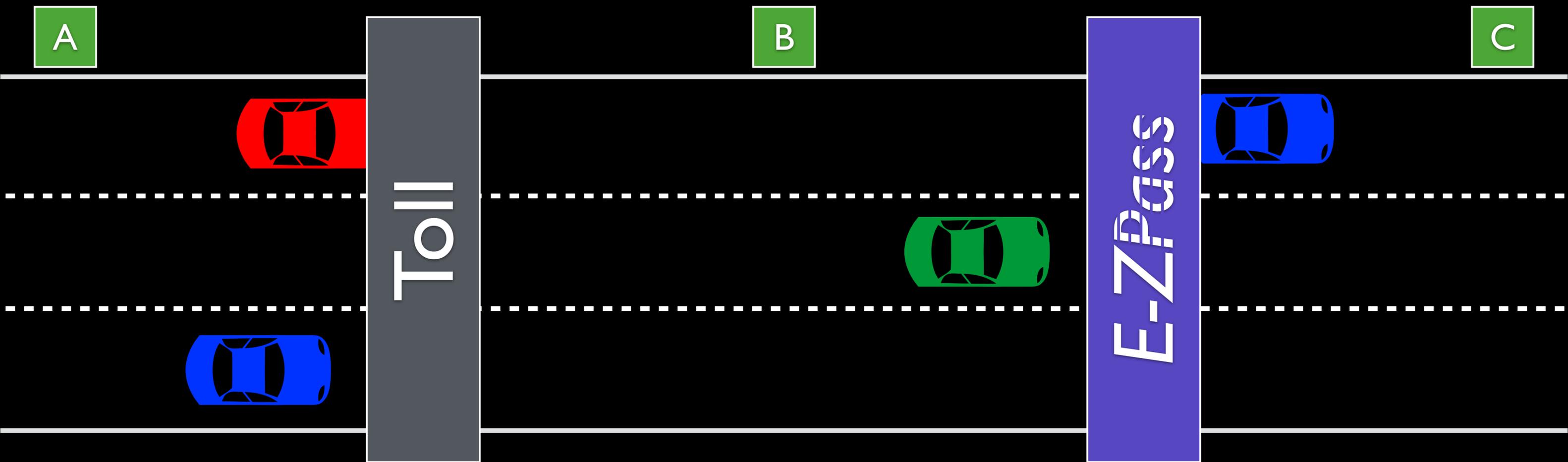
Chemistry Essentials - 042

The Rate-Limiting Step

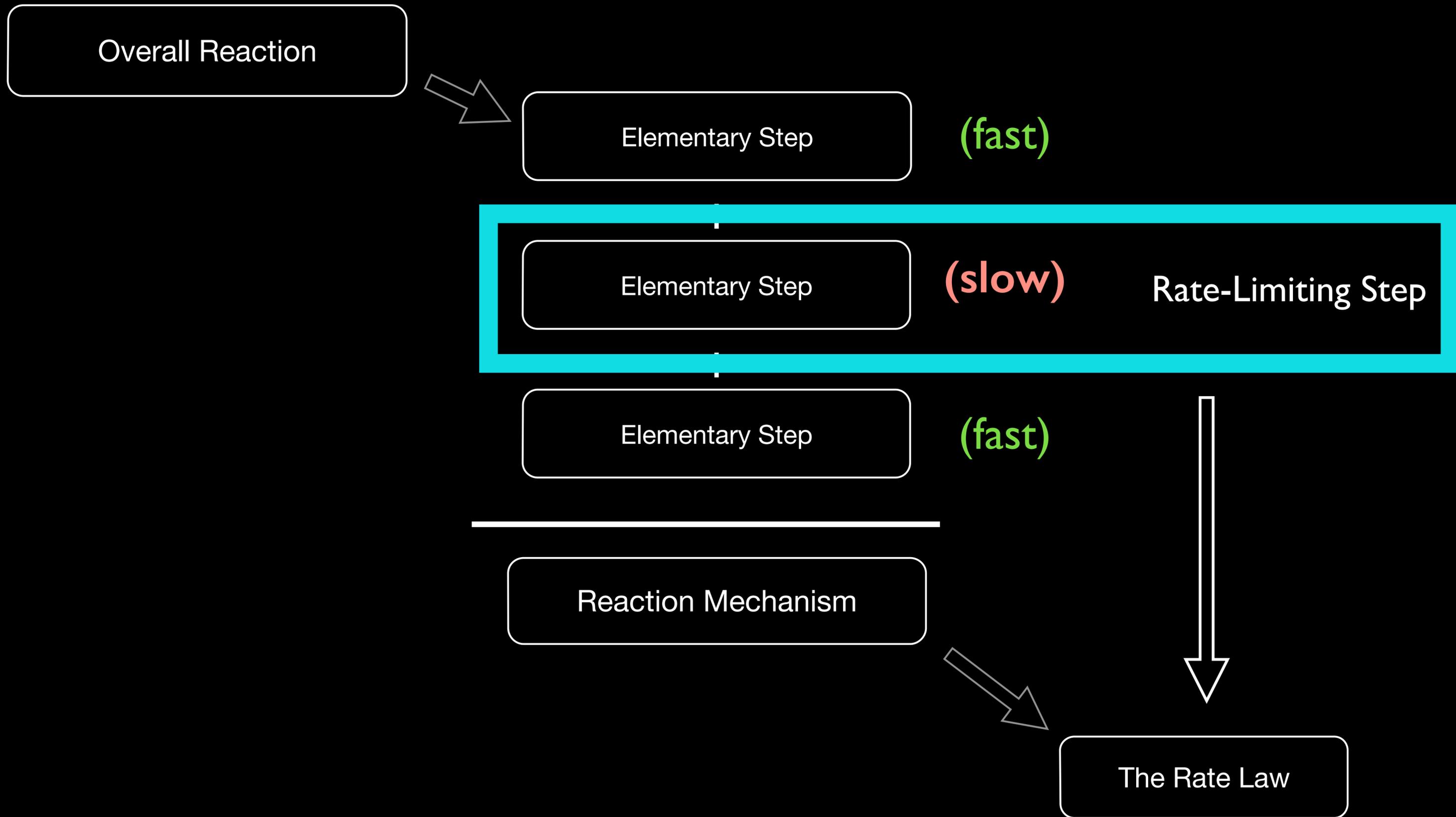


Chemistry Essentials - 042

The Rate-Limiting Step



Chemistry Essentials - 042



Time-Limiting Step

Point A → Point B

Toll

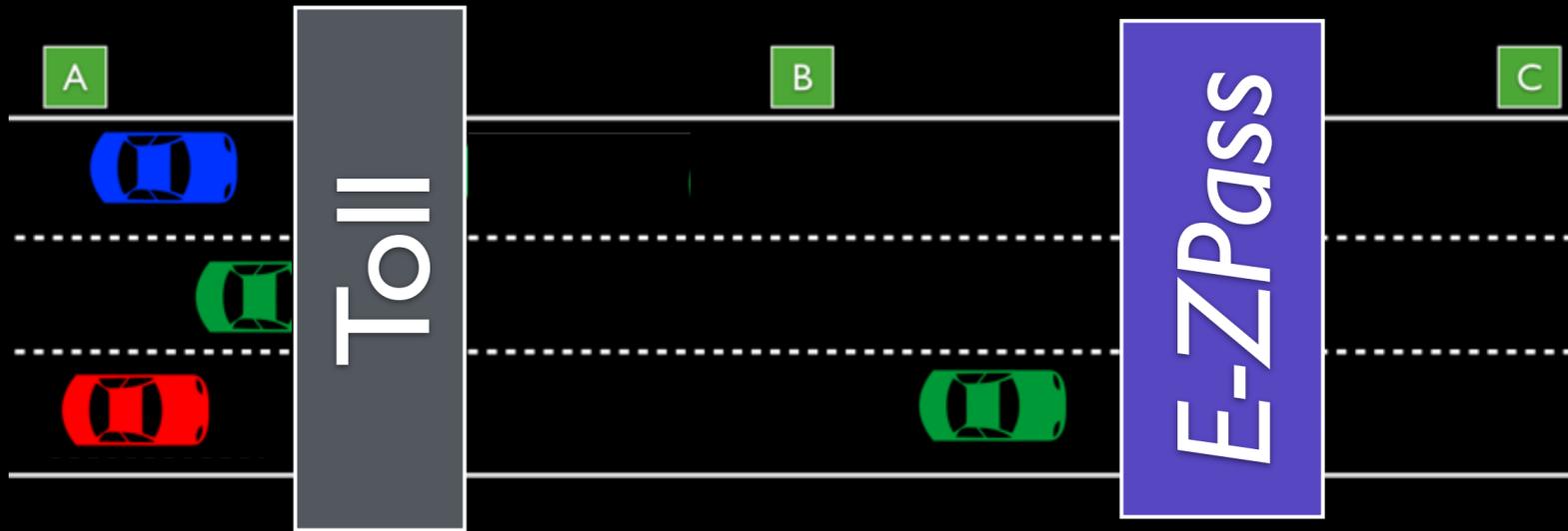
+

Step 2: Point B → Point C

E-ZPass

Overall: Point A → Point C

Toll



Time-Limiting Step

Point A → Point B

Toll

+

Step 2:

Point B → Point C

E-ZPass

Overall:

Point A → Point C

Toll

Rate =

Toll

[



]

Time-Limiting Step



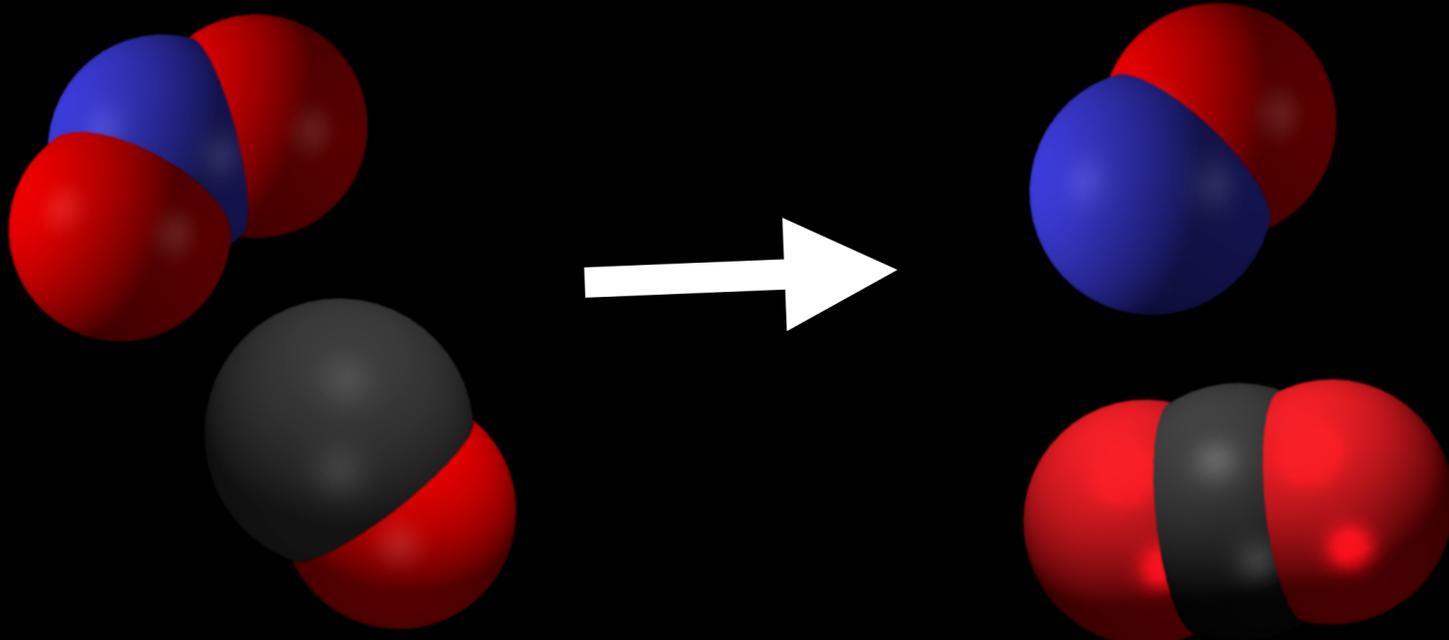
(slow)

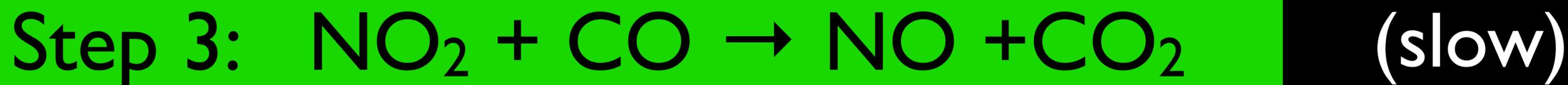
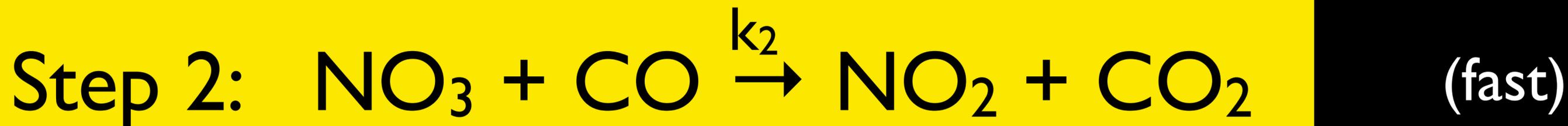
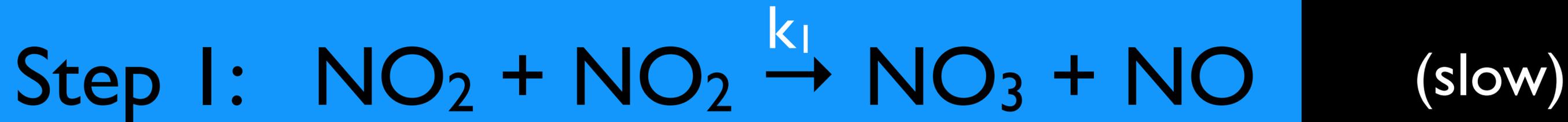


(fast)



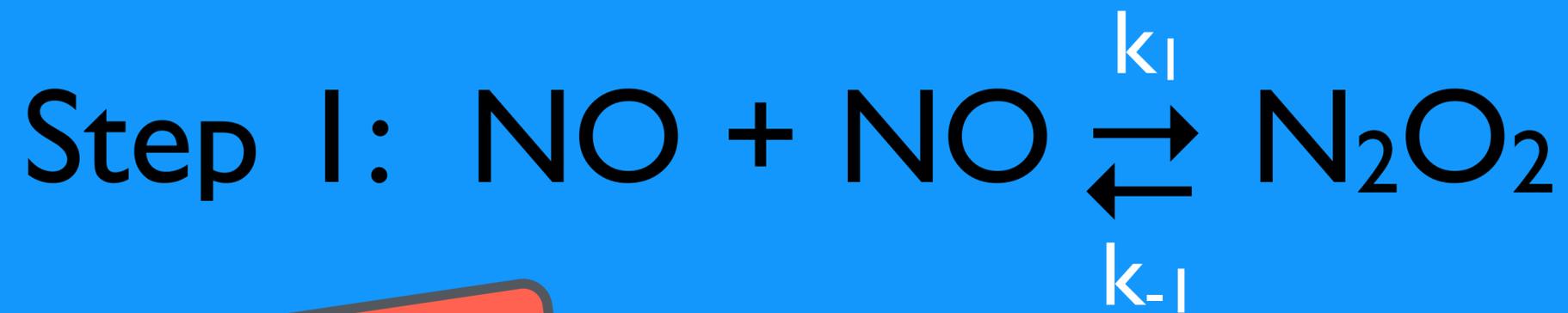
(slow)





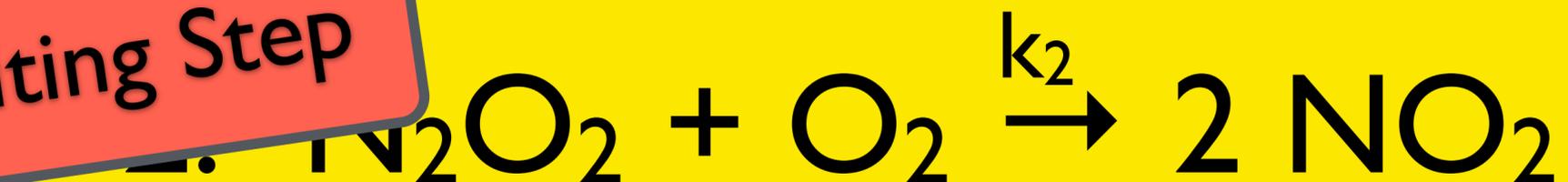
$$\text{rate} = k_1 [\text{NO}_2]^2$$

No intermediates

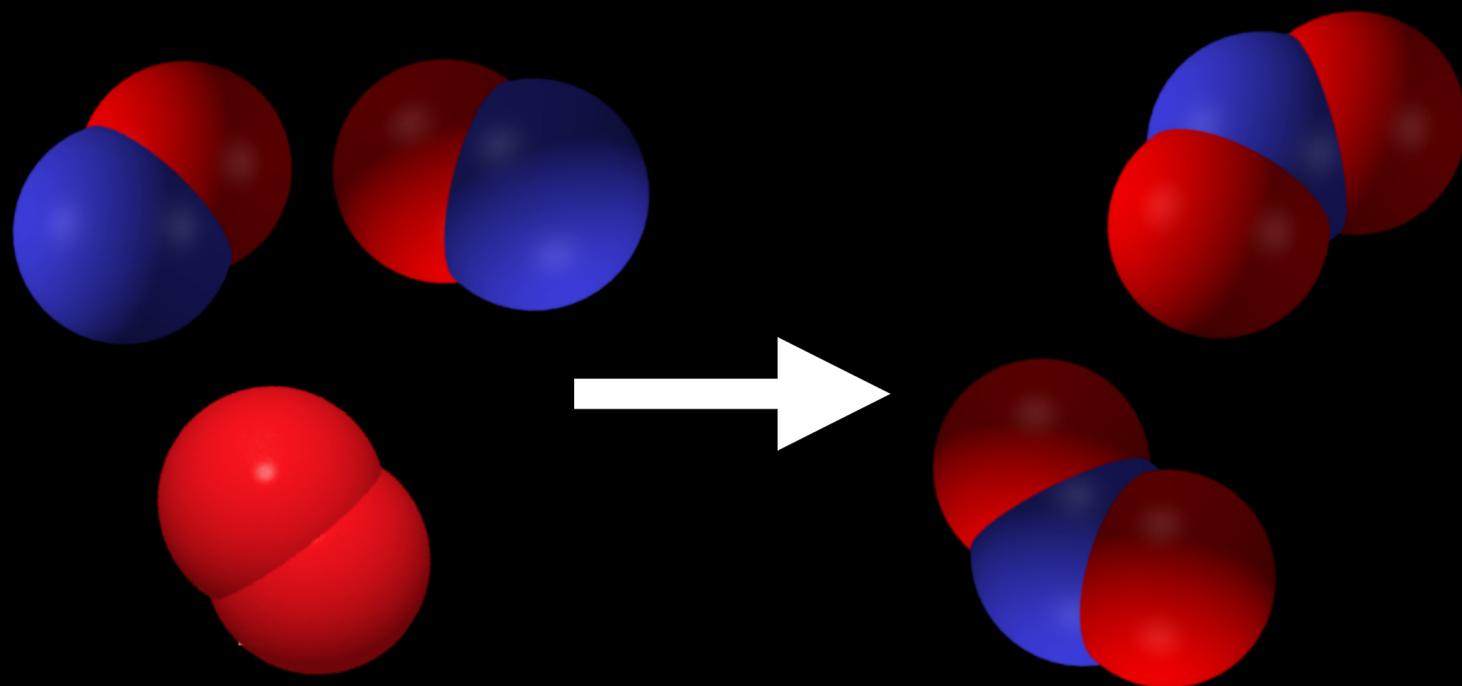
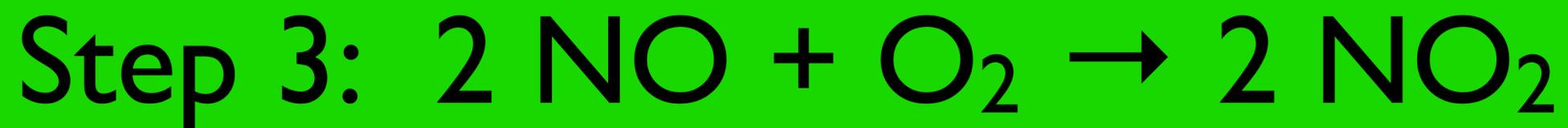


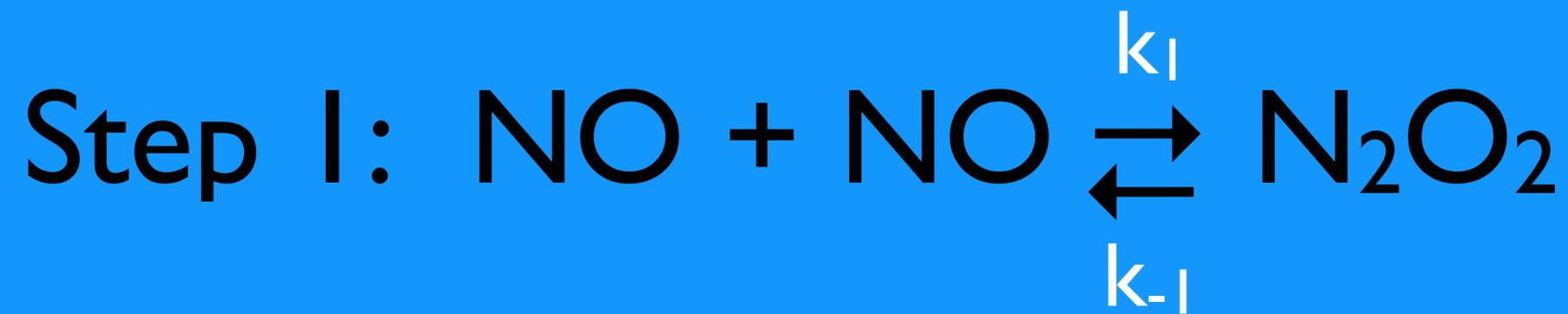
(fast)
equilibrium

Time-Limiting Step



(slow)

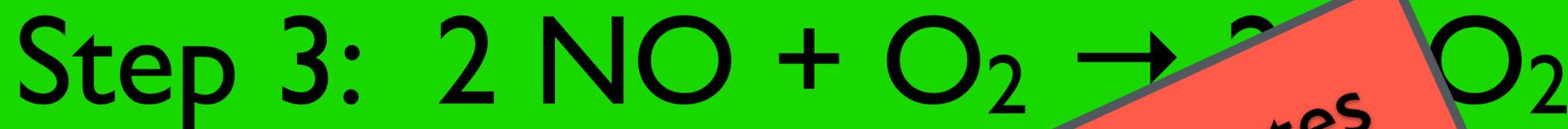




(fast)
equilibrium



(slow)



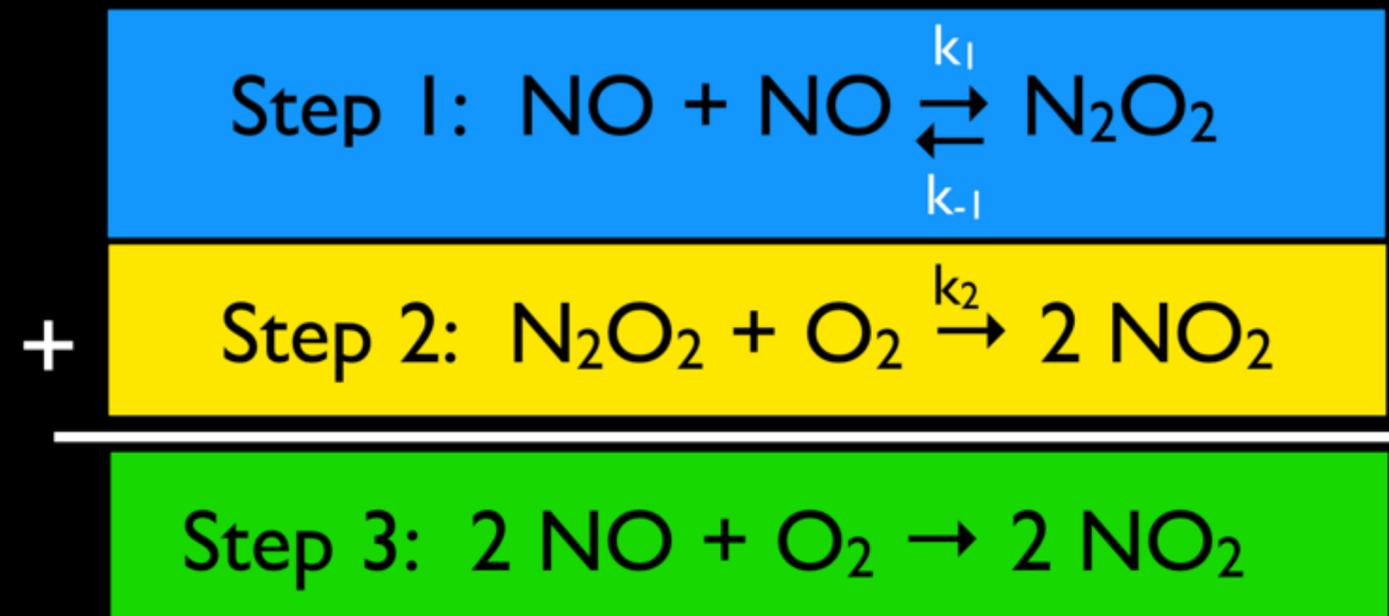
No intermediates

$$\text{rate} = k_2[\text{N}_2\text{O}_2][\text{O}_2]$$

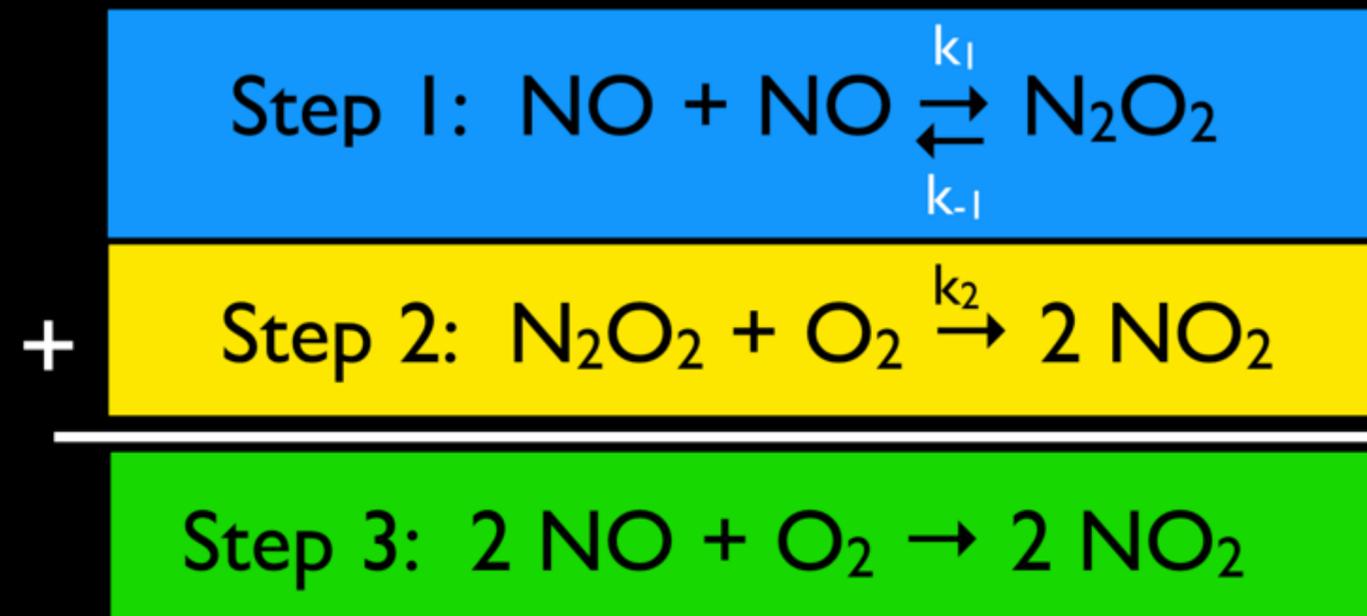
$$\text{rate} = k_2[\text{N}_2\text{O}_2][\text{O}_2]$$

$$k_1[\text{NO}]^2 = k_{-1}[\text{N}_2\text{O}_2]$$

$$[\text{N}_2\text{O}_2] = \frac{k_1}{k_{-1}} [\text{NO}]^2$$



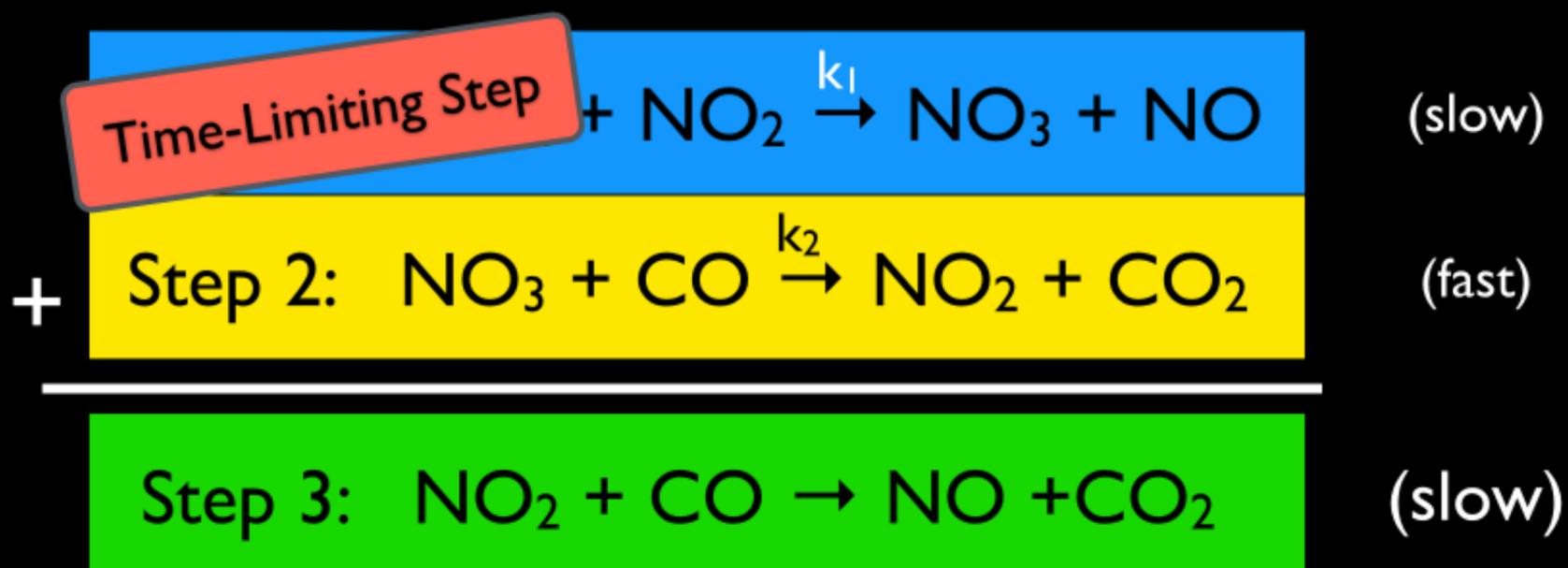
$$\text{rate} = k_2 [\text{N}_2\text{O}_2][\text{O}_2]$$
$$= \frac{k_1}{k_{-1}} [\text{NO}]^2$$



$$\text{rate} = k_2 \frac{k_1}{k_{-1}} [\text{NO}]^2 [\text{O}_2]$$



Did you learn?



The rate of the reaction is set by the slowest elementary reaction.

Acknowledgements

Jeremykemp. Blind Spot Diagram with Three Cars, (original upload date). Originally from en.wikipedia; description page is/was here. http://commons.wikimedia.org/wiki/File:Blindspot_three_cars_illus.svg.



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