ZERO & FIRST ORDER REACTION

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First Order Reactions

For a A $\rightarrow$ products

Differential:

$$\text{rate} = -\frac{\Delta[A]}{\Delta t} = k[A]$$

Integrated:

$$\ln[A]_t = -kt + \ln[A]_0$$

$$\ln \frac{[A]_0}{[A]_t} = kt$$

Half-life, first order reactions

Integrated law :

$$\ln \frac{[A]_0}{[A]_t} = kt$$

Half-life :

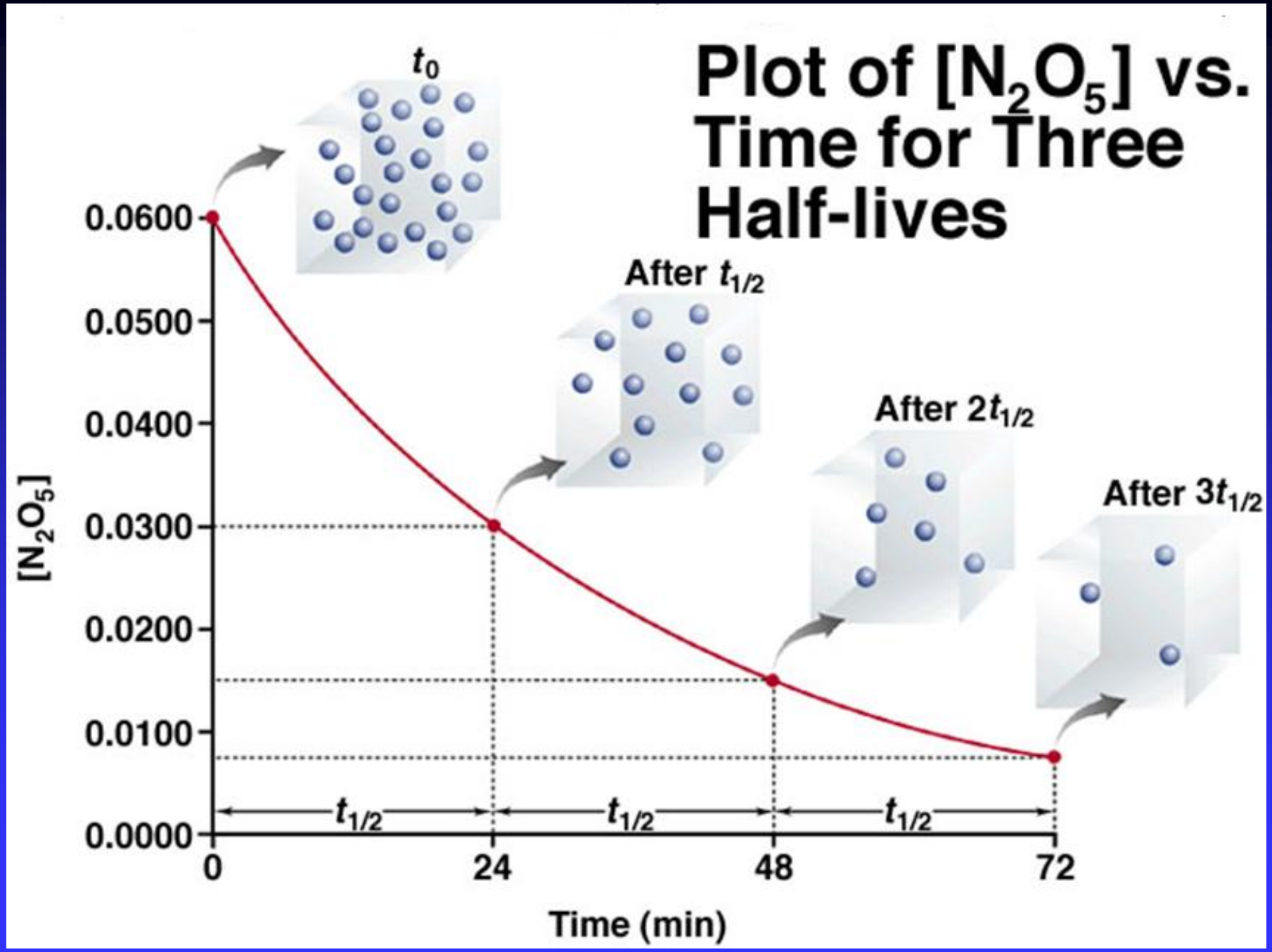
Half of initial reacted

$[A]_t = \frac{1}{2}[A]_0$

Independent of $[A]_0$

$$t_{\frac{1}{2}} = \frac{\ln 2}{k}$$

$$t_{\frac{1}{2}} = \frac{0.693}{k}$$


Plot of [N2O5] vs. Time for Three Half-lives
t0
After t1/2
After 2t1/2
After 3t1/2
0.0600
0.0500
0.0400
0.0300
0.0200
0.0100
0.0000
[N2O5]
t1/2
t1/2
t1/2
0
24
48
72
Time (min)

Zero Order Reactions

For a A $\rightarrow$ products

Differential:

$$\text{rate} = -\frac{\Delta[A]}{\Delta t} = k[A]^0 = k$$

Integrated:

$$[A]_t = -kt + [A]_0$$

$$[A]_t - [A]_0 = -kt$$

Elementary Reactions and Molecularity

Table 16. Rate Laws for General Elemetary Steps

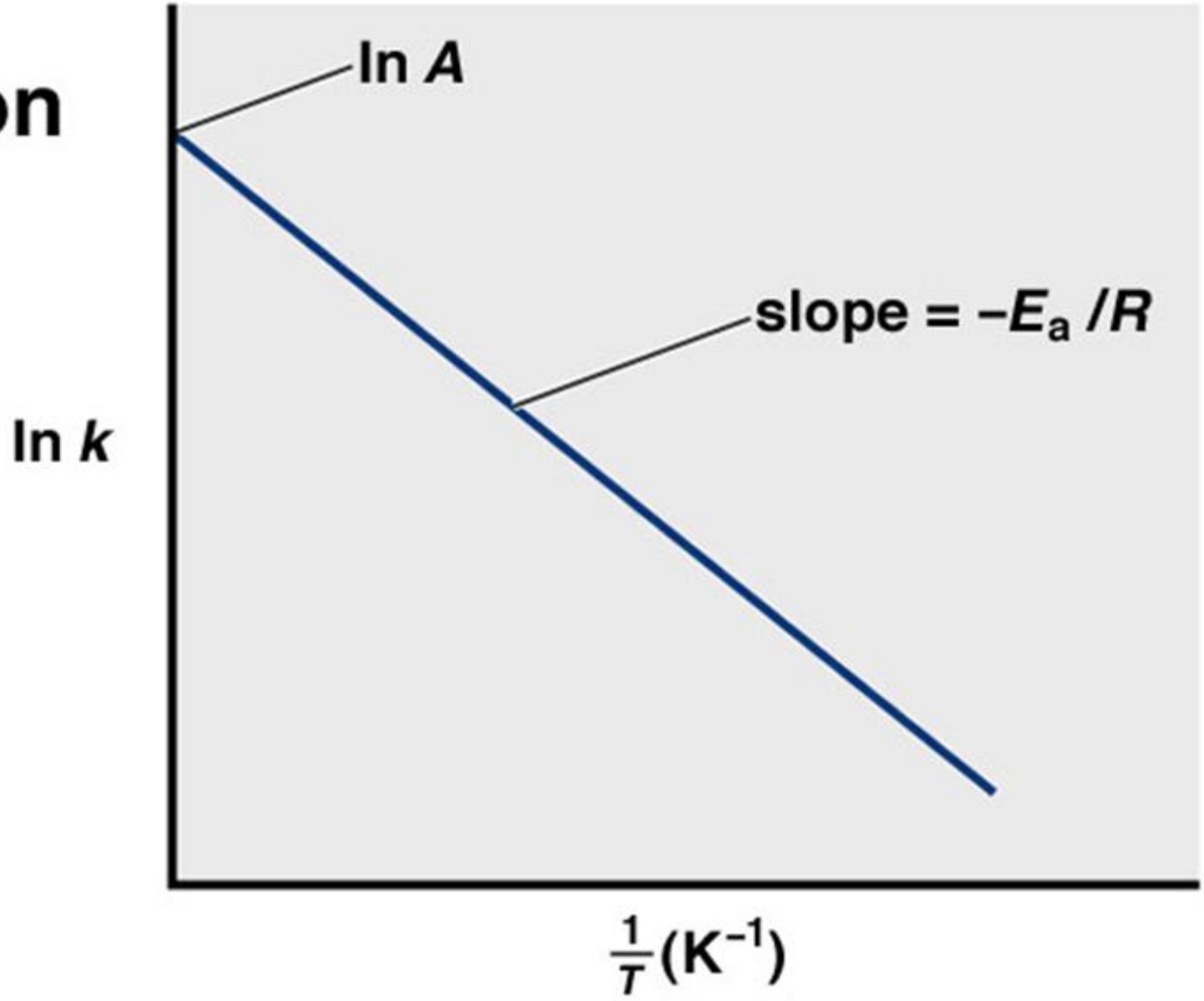
Elementary Step	Molecularity	Rate Law
$A \longrightarrow$ product	Unimolecular	Rate = $k[A]$
$2A \longrightarrow$ product	Bimolecular	Rate = $k[A]^2$
$A + B \longrightarrow$ product	Bimolecular	Rate = $k[A][B]$
$2A + B \longrightarrow$ product	Termolecular	Rate = $k[A]^2[B]$

Arrhenius Equation

$$k = Ae^{-\frac{E_a}{RT}}$$

- k : rate constant
- E_a: activation energy (minimum required)
- T: absolute temperature
- R: universal gas constant
- A: orientation factor

Determination of the Activation Energy.




Thank you!