

15 • Kinetics

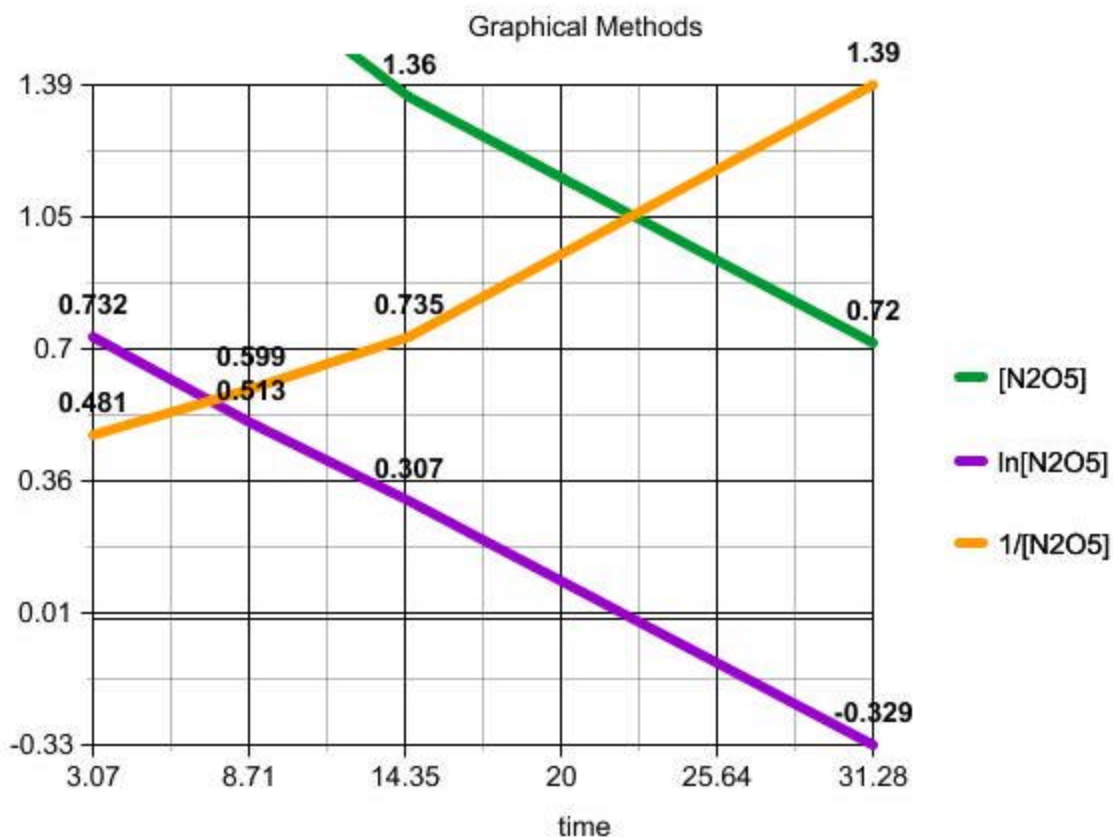
Graphical Methods of Determining Reaction Order and the Rate Constant

Practice Problem:

Data for the decomposition of N_2O_5 in a particular solvent at $45^\circ C$ are as follows:

| $[N_2O_5]$ (mol/L) | t (min) | $\ln[N_2O_5]$ | $1/[N_2O_5]$ |
|--------------------|-----------|---------------|--------------|
| 2.08 | 3.07 | .732 | .481 |
| 1.67 | 8.77 | .513 | .599 |
| 1.36 | 14.45 | .307 | .735 |
| 0.72 | 31.28 | -.329 | 1.39 |

Plot $[N_2O_5]$, $\ln[N_2O_5]$, and $1/[N_2O_5]$ versus time, t .
 What is the order of the reaction? What is the rate constant, k , for the reaction?



Graphical Methods Worksheet

The graph of $\ln[N_2O_5]$ vs. time is a straight line. The reaction is **first order** with respect to $[N_2O_5]$.

$$\text{slope} = -k = -\frac{(-0.329) - 0.732}{31.28 - 3.07} = \frac{-1.061}{28.21} = \mathbf{0.0376 \text{ min}^{-1}}$$