

# CHEMISTRY

## CHEAT SHEET

### CHEMICAL KINETICS

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**DEFINITIONS:**

- Rate of Reaction:** The change in concentration of a reactant or product per unit time.
- Rate Law:** An equation that relates the rate of a reaction to the concentration of the reactants.
- Order of Reaction:** The sum of the exponents in the rate law.
- Half-life:** The time required for the concentration of a reactant to decrease to half its initial value.

**FACTORS AFFECTING RATE:**

- Temperature
- Concentration
- Surface Area
- Catalysts

**Rate of Reaction:**

For a reaction:  $aA + bB \rightarrow cC + dD$

Rate =  $-\frac{1}{a} \frac{d[A]}{dt} = -\frac{1}{b} \frac{d[B]}{dt} = \frac{1}{c} \frac{d[C]}{dt} = \frac{1}{d} \frac{d[D]}{dt}$

**Rate Law:**

For a reaction:  $aA + bB \rightarrow cC + dD$

Rate =  $k[A]^m[B]^n$

Where  $k$  is the rate constant,  $[A]$  and  $[B]$  are the concentrations of the reactants, and  $m$  and  $n$  are the orders of reaction.

**Order of Reaction:**

For a reaction:  $aA + bB \rightarrow cC + dD$

Order =  $m + n$

**Half-life:**

For a reaction:  $aA + bB \rightarrow cC + dD$

Half-life =  $\frac{\ln 2}{k}$

#### Reaction Orders

Order	Rate Law	Half-life	Graph
Zero-order	Rate = $k[A]$	$t_{1/2} = \frac{[A]_0}{k}$	Graph of $[A]$ vs $t$ is a straight line with a negative slope.
First-order	Rate = $k[A]$	$t_{1/2} = \frac{\ln 2}{k}$	Graph of $\ln[A]$ vs $t$ is a straight line with a negative slope.
Second-order	Rate = $k[A]^2$	$t_{1/2} = \frac{1}{k[A]_0}$	Graph of $\frac{1}{[A]}$ vs $t$ is a straight line with a positive slope.

#### Graphs of Reaction Orders

**Zero-order:**

Graph of  $[A]$  vs  $t$  is a straight line with a negative slope.

Graph of  $\ln[A]$  vs  $t$  is a curve.

Graph of  $\frac{1}{[A]}$  vs  $t$  is a curve.

**First-order:**

Graph of  $[A]$  vs  $t$  is an exponential decay curve.

Graph of  $\ln[A]$  vs  $t$  is a straight line with a negative slope.

Graph of  $\frac{1}{[A]}$  vs  $t$  is a curve.

**Second-order:**

Graph of  $[A]$  vs  $t$  is a curve.

Graph of  $\ln[A]$  vs  $t$  is a curve.

Graph of  $\frac{1}{[A]}$  vs  $t$  is a straight line with a positive slope.

# Kinetics Study Guide

**K Morrison**



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