Orders of Reactions

Chem1B, General Chemistry II

RATE LAW: For $A + B \rightarrow D + E$,

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

ZERO ORDER REACTIONS: rate = k Example: $2 \text{ NH}_3(g) \rightarrow N_2(g) + 3 \text{ H}_2(g)$

- Reaction rate is **independent** of concentration of reactant
- Linear plot: rate vs. [A] (slope of the line = -k)
- Integrated Rate Law: [A]_t = -kt + [A]₀



FIRST ORDER REACTIONS: rate = k[A]*Example:* $H_2O_2(aq) \rightarrow H_2O(I) + \frac{1}{2}O_2(g)$

- Reaction rate is **directly dependent** on concentration of reactant
- Linear plot: rate vs. ln[A])(slope of the line= -k)
- Integrated Rate Law: In[A]_t = -kt + In[A]₀
- Half-Life: **t**_{1/2} = **0.693/k** Dependent ONLY on rate constant, NOT initial concentration



SECOND ORDER REACTIONS: rate = k[A]²

Example: 2 NO₂(g) \rightarrow 2 NO(g) + O₂(g)



- Reaction rate is dependent by squares on concentration of reactant
- Linear plot: rate vs. 1/[A] (slope of line = + k)
- Integrated Rate Law: 1/[A]_t = kt + 1/[A]₀
- Half-Life: t_{1/2} = 1/(k[A]₀)
 Dependent on rate constant AND initial concentration