Kinetics

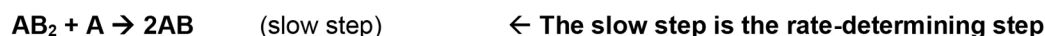## Basis of Chemical Reactions and Rates

Gibbs Free Energy (ΔG): **When positive, reaction is <mark>nonspontaneous</mark>**
When negative, reaction is <mark>spontaneous</mark>

Within a given reaction mechanism:

2A + B₂ → 2AB   (Balanced, simplified reaction)

A + B₂ → AB₂   (fast step)   ← AB₂ is a reaction intermediate

AB₂ + A → 2AB   (slow step)   ← **The slow step is the rate-determining step**

Important Concept: K_{eq}
$K_{eq} < 1$	Reactant Favored
$K_{eq} > 1$	Product Favored
$K_{eq} = 1$	Equilibrium

Collision Theory of Chemical Kinetics:

- Reaction rate increases as rate of intermolecular collisions increases
- Collisions increase or decrease due to:
    - Reaction Concentrations (Le Châtelier's, K_{eq})
    - Temperature (remember physiological limits!)
    - Medium (correct solute)
    - Presence of catalysts

Things to consider for test day:

- If the passage focuses on gen chem, then kinetics questions may be more chem focused
- If the passage delves into biochemistry, then keep in mind physiological constraints and understand rates with regards to enzyme activity

Reactions Rates and Rate Laws

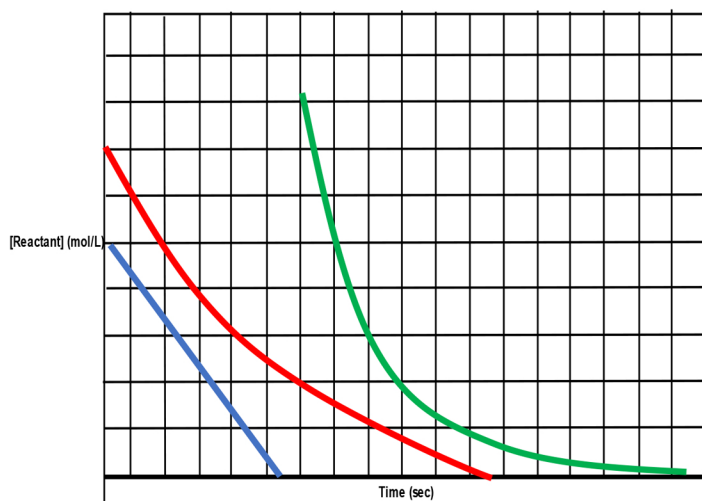Reaction rates are basically the **rate of product formation** or **rate of reactant consumption**

A couple of things to memorize:
aA + bB → cC + dD
Rate = k[A]ˣ [B]ʸ
Reaction order = x + y

Reaction Orders Shortcut:
Zeroth = Zero Dependence
First = One Dependent
Second = Squared or Two

Zeroth Order Reactions:
Reactant concentration will have no effect on rate

First Order Reactions:
Rate will increase/decrease linearly to reactant concentration
        Double reactant = double rate

Second Order Reactions:
Rate will increase/decrease exponentially to reactant concentration
        Double reactant = quadruple rate

Each reactant will have its own rate, and the rate of the overall reaction will be the sum of individual reactant rates

Focus on kinetics with respect to rates of individual reactants

[Reactant] (mol/L) vs Time (sec)