Kinetics & Organic Reactions

UCI Chem 51A
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Goals

- After this lesson you should be able to
  - Determine the general form of the rate law for a reaction based on given information
  - Predict the affect of changing concentration on the rate of reaction
  - Compare relative rates based on activation energies
  - Identify the rate-determining step in a reaction from a reaction coordinate diagram
  - Explain how a catalyst affects the rate of a reaction
Reaction Rates & Kinetic Molecular Theory

☐ Molecules must collide in the correct orientation and with the correct energy to react!

☐ Rates depend on:
  ☐ ________________
  ☐ ________________
Rate Laws: Effect of Concentration

Rates depend on concentration, but of what?

1st Order    2nd Order

Generally determined experimentally.
Transition States & Activation Energy

Note: Rates DO NOT depend on $\Delta G$, $\Delta H$, or $K_{eq}$!
Reactions with Multiple Steps

What determines the rate? Minimum energy needed to get reaction going depends on highest energy $T_s^\dagger$. 

Energy

Reaction Coordinate

$R$ $TS^\dagger_1$ $TS^\dagger_2$ $E_a_1$ Int $E_a_2$ $P$
Rate Law & Rate-Determining Steps

- What does the rate law tell us about the rate-determining step?
How Do Catalysts Work?

Catalysts provide alternative path with lower activation energy!

Energy

Reaction Coordinate

Rate 1 < Rate 2

TS⁻¹₁ > TS⁻¹₂

Rxn 2 catalyzed!

Different TS!
Wrapping Up

- Practice predicting the effect of concentration changes on rate of reaction
- Practice determining rate laws from changes in concentrations
- Practice comparing rates of reactions based on reaction coordinate diagrams
- Practice identifying the rate-determining step from a reaction coordinate diagram
- Practice identifying a catalyst or catalyzed reaction