

## Biochem (Biol/Chem 361)

## Study Guide Exam 2

### Chemical reactions

- Transition state theory
- Collision theory

### Definitions of Chemical equilibrium

- Proportion of reactants and products no longer changes  
(expressed in  $K_{eq}$  equation)
- Rate of forward and reverse reactions equal  
(also expressed as proportion of rate constants)
- No energy is liberated or consumed  
( $\Delta G = 0$ )

### Free energy (G) and change in free energy ( $\Delta G$ )

Definitions of exergonic and endergonic, and which is spontaneous.

### Energy diagram for a reaction

- Be able to identify the part of the graph that represents the:
  - $\Delta G$  for the reaction
  - Activation energy
  - Position of reactants, products and transition state

Boltzmann-Maxwell graphs of reactants/products (# of molecules vs. energy)

### Free energy equations

$$\Delta G = \Delta G^{\circ} + RT \ln \frac{[\text{product}]}{[\text{reactant}]}$$

$$\Delta G^{\circ} = -RT \ln K_{eq}$$

(I'll give you the gas constant and temp.)

Two ways that cells get reactions with positive  $\Delta G^{\circ}$  to go.

### Basic chemical kinetics

- Rate equation/rate constant
- Relate reaction rate to Boltzmann-Maxwell graphs
- Derivation of relationship between rate constants and  $K_{eq}$

### Enzymes (general ideas)

- Lower activation energy
- Provide alternate path to transition state

## Enzyme Kinetics

- Kinetic experiment: measure  $V_o$  at different  $[S]$
- M&M plots ( $V_o$  vs.  $[S]$ )
- L-B plots (a.k.a. double-reciprocal plot)
- How to find  $K_M$  and  $V_{max}$
- How to calculate  $k_{cat}$  (a.k.a.  $k_2$  and turnover number)

## Enzyme inhibitors

- Reversible vs. irreversible
- Reversible: Competitive, Noncompetitive, Uncompetitive
- General definition of each
- Know how to recognize reversible inhibitors from L-B plots (i.e., how each affects  $K_M$  and  $V_{max}$ )

## Mechanisms of enzyme catalysis (know the mechanisms well!)

- Types of enzymes
  - Proteases
  - Carbonic anhydrase
  - Restriction enzyme
  - Ribozyme
- Know the following (when applicable) for each enzyme type
  - Nucleophiles and electrophiles
  - How nucleophiles are activated
  - Acid/Base reactions
  - Stabilization of transition states
  - Covalent intermediate
  - Role of metal ions
  - Proton shuttle of carbonic anhydrase
  - Catalytic triad of serine/cysteine proteases

## Regulation of enzyme activity

- General concepts of allostery, covalent modification and isozymes