

## Biochemistry Study Guide for Final Exam

Definition of pK<sub>a</sub>

Amino acid structure

Be able to diagram an example of the following types of side chains:

Uncharged, non-polar

Uncharged, polar

Charged, acidic

Charged, basic

Definitions of primary, secondary, tertiary and quaternary structure

Hemoglobin

Cooperative binding, O<sub>2</sub> binding curves, factors that affect O<sub>2</sub> binding

Definitions of Chemical equilibrium

Free energy (G) and change in free energy (ΔG)

Definitions of exergonic and endergonic, and which is spontaneous.

Energy diagram for a chemical reaction (catalyzed and uncatalyzed)

Free energy equations

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

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

Two ways that cells get reactions with positive ΔG<sup>o</sup> to go.

Enzyme Kinetics

M&M plots (V<sub>o</sub> vs. [S]) and L-B plots (a.k.a. double-reciprocal plot)

How to find K<sub>M</sub> and V<sub>max</sub>

How to calculate k<sub>cat</sub> (a.k.a. k<sub>2</sub> and turnover number)

Enzyme inhibitors

Reversible: Competitive, Noncompetitive, Uncompetitive

Know how to recognize reversible inhibitors from L-B plots

### Enzyme Mechanisms

Serine protease

Carbonic anhydrase

Glyceraldehyde-3-phosphate Dehydrogenase (glycolysis)

Pyruvate Dehydrogenase (TCA)

Succinyl-CoA Synthetase (TCA)

### Glycolysis

Know what goes in (glucose, ATP, NAD<sup>+</sup>), what comes out (pyruvate, ATP, NADH).

Rationale for steps of glucose phosphorylation, isomerization of G6P to F6P.

Know the reactions in structural detail through the formation of 3-PG.

Allosteric regulation of PFK

The reactions with the largest negative ΔG.

### Fatty Acid Catabolism

Beta-oxidation of even-numbered, saturated fatty acids.

Know all of the reactions in structural detail.

Know what happens to the products of this pathway.

### TCA Cycle

What goes in (acetyl-CoA), what comes out (NADH, FADH<sub>2</sub>, GTP), what is regenerated.

Role of CoA in the first reaction.

What happens to designated methyl and carbonyl carbons in reactions 2-5.

Be able to follow oxidation states of these carbons.

Fate of methyl and carbonyl carbons throughout TCA cycles.

### Electron Transport

Calculate  $\Delta G^\circ$  of redox reactions from reduction potentials of redox couples.

Overall pathway of electrons from NADH and FADH<sub>2</sub> to O<sub>2</sub>.

Role of proteins in electron transport.

Mobile electron carriers.

O<sub>2</sub> Reduction in Complex IV.

How ATP synthetase works.

Connections between metabolism and cancer.