Chemistry 4055 (Spring 2013)
Exam 2 Study Guide

Terms/Equations

1. Supersecondary structure
    a) β-α-β loop
    b) α-α corner

2. Tertiary structure
    a) Fibrous Proteins
        i. Structure
        ii. Function
        iii. α-keratin
        iv. Collagen

    b) Globular Proteins
        i. Structure
        ii. Function
        iii. Myoglobin
        iv. Hemoglobin
        v. Enzymes
        vi. Protein conformation
        vii. Protein fold motifs
        viii. Domains
        ix. β barrel
        x. α/β loop

3. Quaternary Structure
    a) Subunits
    b) Oligomer
    c) Multimer
    d) Protomer
    e) Symmetry
        i. Rotational symmetry
            - Cyclic symmetry
            - Dihedral symmetry
        ii. Helical symmetry

4. Protein size/limits

5. Protein denaturation
    a) Folding/protein stability
    b) Melting temperature
    c) Methods to gauge denaturation
    d) Reversible denaturation
    e) Semireversible denaturation

f) Irreversible denaturation
g) Denaturants

6. Protein Renaturation

7. Molecular chaperones

8. Protein disulfide isomerase (PDI)

9. Peptide prolyl cis-trans isomerase (PPI)

10. Protein-ligand binding

a) Oxygen-binding proteins
    i. Heme group
    ii. Myoglobin
        - Oxygen storage
    iii. Hemoglobin
        - Oxygen transport
        - T state
        - R state
        - pKa of residues
        - Bohr effect
        - CO_2
        - H^+
        - 2,3-bisphosphoglycerate
b) Equilibrium expression for binding
c) K_a (association constant)
d) K_d (dissociation constant)
e) θ (fraction of ligand binding sites on the protein that are occupied by ligand)
f) Partial pressure of gases
g) Hyperbolic binding curve
h) Sigmoidal binding curve
i) Protein cooperativity
    - Concerted model
    - Sequential model
j) Structural factors affecting binding
k) Positive and negative modulators
l) Homotropic and heterotropic modulators
m) Le Chatelier's Principle
n) Sickle-cell anemia
o) Hemoglobin S
p) Antibodies
    i. Monoclonal
    ii. Polyclonal
q) Antigen

r) ELISA assay
s) Western blot

11. Enzymes

a) Cofactor
b) Coenzyme
c) Prosthetic group
d) Holoenzyme vs apoenzyme
e) Enzyme clases
f) Active site
g) Substrate
h) Reaction equilibria
i) Reaction rates
j) Biochemical standard free-energy change
k) Activation energy
l) Transition state
m) Reaction coordinate diagram for a chemical reaction
n) Reaction intermediates
o) Rate-limiting step
p) Rate constant and units
q) Rate equation
r) Thermodynamic equations for rate and equilibria
s) Binding energy
t) Covalent catalysis
    i. General acid-base catalysis
    ii. Covalent catalysis
    iii. Metal ion catalysis
u) Enzyme kinetics
    i. Initial rate (or initial velocity)
    ii. Isosbestic point
    iii. Maximum Velocity ($V_{max)}$
    iv. Steady-state kinetics
    v. Michaelis-Menten equation (general versión and specific one)
    vi. Hyperbolic kinetics curve
    vii. K_m
    viii. k_{cat}
    ix. k_{cat}/K_m (specificity constant)
    x. Inhibitors
        - Irreversible
        - Reversible
        - Competitive
        - Uncompetitive
        - Mixed
        - Noncompetitive
    xi. Chymotrypsin
        - Know its cleavage pattern

- Know catalytic triad
- Know key roles by amino acids in the active site

xii. Factors that affect enzyme catalysis
- Temperature
- pH
- Enzyme activation and nomenclature
- Enzyme covalent modification
- Cooperativity
- Positive and negative modulators
- Sigmoidal kinetics curve

12. Transferrin

a) Location in the body
b) Type of protein
c) Holoprotein form
d) Metal binding site residues
e) Endocytosis
f) Endosome
g) Transferrin Receptor
h) pH stability of Fe(III) bound transferrin
i) Iron reléase in the cell
j) Fe(III) reduction to Fe(II)
k) Steap3
l) Divalent metal transporter (DMT)
m) Ferrochelatase