Biochemistry Exam Review

2017-2018
Do you know your properties of water?

What does it mean to be organic vs inorganic? Which one is water?

Is water organic or inorganic?

What does it mean to be polar vs. nonpolar?

Hydrogen bonding and water

Cohesive vs. Adhesive
(a) Dehydration synthesis
Monomers are joined by removal of OH from one monomer and removal of H from the other at the site of bond formation.

(b) Hydrolysis
Monomers are released by the addition of a water molecule, adding OH to one monomer and H to the other.
What is hydrolysis?

Hydrolysis adds a water molecule, breaking a bond.
Carbohydrates

- Structure of carbohydrates
- Function of carbohydrates
- Examples of carbohydrates: Monosaccharides, Disaccharides, Polysaccharides
- Biological importance
Proteins

What is a structural protein?

What are functions of proteins?

How are proteins denatured? Enzymes are proteins - How are they denatured?

DNA codes for mRNA which codes for Proteins

Protein Folding

Structure of proteins

Biological importance
Protein Folding

- quaternary structure
- tertiary structure
- secondary structure
  - α-helix
  - β-sheet

primary structure

Tyr-Lys-Ala-Ala-Val-Asp-Leu-Ser-His-Phe-Leu-Lys-Glu-Lys
Asp-Trp-Trp-Glu-Ala-Arg-Ser-Leu-Thr-Thr-Gly-Glu-Thr-Gly-Tyr-Pro-Ser.
Protein Folding in Sickle Cell Anemia

- **Primary structure**
  - Normal hemoglobin
  - Sickle-cell hemoglobin

- **Secondary and tertiary structures**
  - Normal hemoglobin (top view)
  - Exposed hydrophobic region

- **Quaternary structure**
  - Molecules do not associate with one another; each carries oxygen.
  - Molecules interact with one another and crystallize into a fiber; capacity to carry oxygen is greatly reduced.

- **Function**
  - Normal red blood cells are full of individual hemoglobin molecules, each carrying oxygen.
  - Fibers of abnormal hemoglobin deform red blood cell into sickle shape.
Dipeptides / and formation of peptide bonds

Peptide bonds

Peptide bonds are formed by a condensation reaction of carboxylic group of an amino acid and amino group of another amino acid with removal of water molecule.
What is allosteric regulation?

What is an allosteric inhibitor?

What is competitive inhibition?

What is non-competitive inhibition?

What is a cofactor?

What is a non-competitive inhibitor?

What is a co-enzyme?

What is the induced fit hypothesis?

What are activators?

Enzymes

Enzymes are proteins - How are they specifically denatured?

How do these concepts apply to the above question?

- Substrate concentration
- Temperature
- modifying the conformation of the protein
- catalytic activity
- reaction time
- pH

Biological importance
Do you know the pH scale and how it would affect an enzyme?

Do you know a basic pH scale?

Do you know how pH affects an enzyme?

What does it mean to be alkaline?

What does it mean to be acidic?

Do you know how alkaline and acidic are represented on a pH scale?
How does temperature affect enzymes?

Heat energy causes more collisions between enzyme and substrate. Optimum temperature for humans is close to 37°C. Enzymes denature at high temperatures so rate falls rapidly.

Rate of Enzyme Activity

Temperature °C

Optimum Temperature

What happens to enzymes at low temperatures? INACTIVE

What happens to enzymes at high temperatures? DENATURED
Do you understand enzymes, substrates, enzyme-substrate complex, and products?

Enzymes are made of long chains of amino acids. The chains are folded to form the active site.

1. The substrate can bind to the enzyme to form an enzyme-substrate complex.
2. When the reaction is complete the products are released and the enzyme can be used again.
1. The **substrate**, sucrose, consists of glucose and fructose bonded together.

2. The substrate binds to the enzyme, forming an **enzyme-substrate complex**.

3. The binding of the substrate and enzyme places stress on the glucose-fructose bond, and the bond breaks.

4. Products are released, and the enzyme is free to bind other substrates.
Competitive vs Non-Competitive Inhibition

Non-Competitive inhibition

- competitive inhibition interferes with active site of enzyme so substrate cannot bind
- non-competitive inhibition changes shape of enzyme so it cannot bind to substrate.

Competitive inhibition

- $\frac{1}{v}$ vs $\frac{1}{[S]}$ graph showing competitive inhibition.

Figure U2-4.1 Competitive, noncompetitive and uncompetitive inhibition

- (a) Competitive inhibition
- (b) Non-competitive inhibition
- (c) Uncompetitive inhibition
What is catalase? Watch this video for enzyme catalysis!
Do you know your monomers and polymers for each biomolecule?

What are the four biomolecules?
What is their structure?
What is their function?
What are their monomers?
Do you know examples of each?

What does it mean to be soluble or insoluble? Do you know which biomolecules are soluble or insoluble?
What does it mean to be polar vs nonpolar? How does this concept apply to biomolecules?
Can you recognize the following bonds and linkages?

Hydrogen bonds
Peptide bonds
Ester linkages
Glycosidic linkages
What is a nucleic acid?

What are the examples of nucleic acids and their function?

What is the monomer for nucleic acids? Could you recognize its structure and components?

What are purines? Could you recognize them?

Nucleic Acids and hydrogen bonding

Structure of Nucleic Acids

Biological importance

What are pyrimidines? Could you recognize them?

What are the sugars in both nucleic acids?

What does it mean to be anti-parallel with regards to DNA?

What is a mutation?

Base pairs for DNA

Base pairs for RNA
Lipids

Properties of Lipids
Structure of lipids
Function of lipids
Examples of lipids
Role within a cell / body / organism
Saturated fats vs Unsaturated fats vs Poly-unsaturated fats
Which lipid has phosphorous?
Biological importance
Phospholipids

What is the structure of a phospholipid?

Hydrophilic vs hydrophobic

Polar vs non-polar
Do you know me?

Starch?  The role of water in animal metabolism?
Enzymes?  Cellulose vs. Starch and different properties
Water?  Deoxyribose?
Glucose?  Triglycerides?
RNA?  Monosaccharides?