

NESA Biochemistry Fall 2001
Review problems for the first exam

Acid/Base chemistry

Sections to review: 10.2, .3, .4, .6 .9, .12, .13

Complete the following sentences

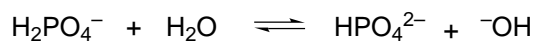
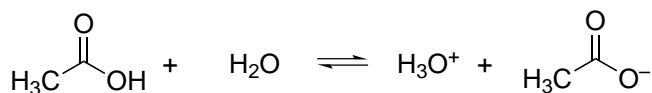
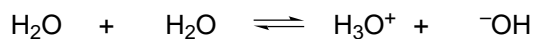
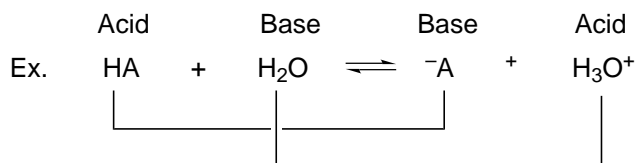
1. H_2CO_3 is a _____ acid.
2. The anion of a weak acid is a _____ base
3. _____ is the measure of a solutions acidity.
4. CH_3COOH and CH_3COO^- are known as a _____ acid-base pair.

True and False

1. A change of one pH unit is a tenfold change in the $[\text{H}_3\text{O}^+]$.
2. $\text{H}_2\text{SO}_4 / \text{HSO}_4^-$ is a good buffer system.
3. All bases are negatively charged.
4. Water can act as both an acid and a base.
5. Whether an acid or a base is strong or weak depends on its percent dissociation in water.

Additional problems:

1. Match and label the conjugate acid and base pairs in the following reactions. Which one of these systems is a good buffer?



2. Rank the following acids from strongest to weakest using the given information.

Strongest				Weakest

	Compound	Ka	pKa
1.	Formic acid	1.44×10^{-4}	3.75
2.	Benzoic acid	6.46×10^{-5}	4.90
3.	Acetic acid	1.75×10^{-5}	4.76
4.	Pyruvic acid	3.16×10^{-3}	2.50
5.	Citric acid	7.10×10^{-4}	3.09

Amino acids

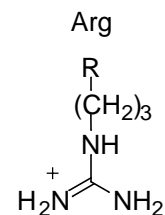
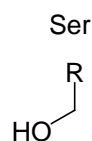
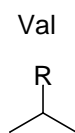
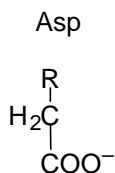
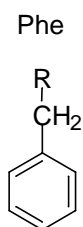
Sections to review: 18.2 – .6

Complete the following sentences

- Two molecules that differ only in the arrangement of groups around chiral carbon are called _____.
- Amino acids exist as dipolar ions called _____.
- _____ interactions pull nonpolar sidechains together to exclude water.

Additional problems

1. Classify the following amino acids (only the sidechains are shown) as polar charged (PC), polar uncharged (PU), or nonpolar (N). Sidechains are depicted at pH 7.0 and R = the rest of the amino acid.



2. Draw the dipeptide Ser-Glu (serine-glutamate) given the sidechains in question one. Draw the dipeptide as if it were in solution at pH 7.0.

Proteins

Sections to review: 18.7 – 18.12

Complete the following sentences

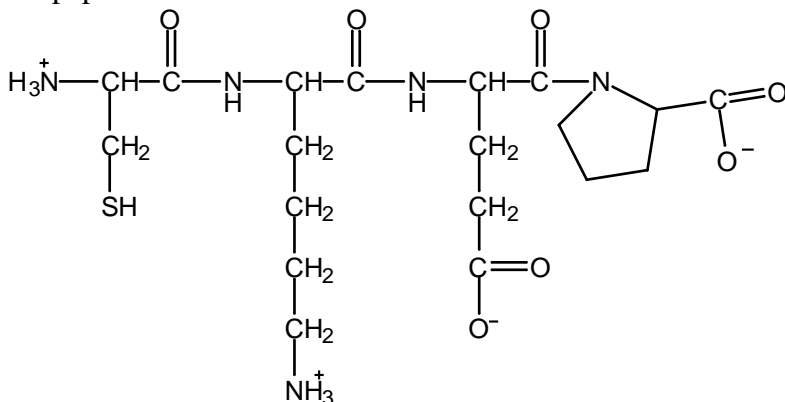
1. The repeating chain of amide bonds in a peptide is called the _____
2. _____ structure refers to how the entire protein is folded and coiled into a specific three-dimensional shape.
3. In secondary structure called a _____ _____, polypeptide chains lineup in a parallel arrangement held together by hydrogen bonds.

True or False

1. Protein denaturation disrupts the primary structure of a protein.
2. β -sheets and α -helix occur mostly in fibrous proteins.
3. Proteins, as well as amino acids, have isoelectric points.
4. Both fibrous and globular proteins are water soluble.
5. Proteins may be classified by biological function.

Additional problems

1. Which one of the following might change if one amino acid was substituted for another in a protein?
 - a. Secondary structure
 - b. Tertiary structure
 - c. Isoelectric point
 - d. All or not of the above, depending on the amino acids involved
2. Which level of protein structure doesn't involve hydrogen bonds?
 - a. Primary
 - b. Secondary
 - c. Tertiary
 - d. Quaternary
3. List some agents can cause denaturation of proteins.
4. Using the information in your book identify the primary structure of the following peptide.



Enzymes and Vitamins

Sections to review: 7.2, 7.4 – .6, 19.1, 19.2, 19.4 – .9

Complete the following sentences

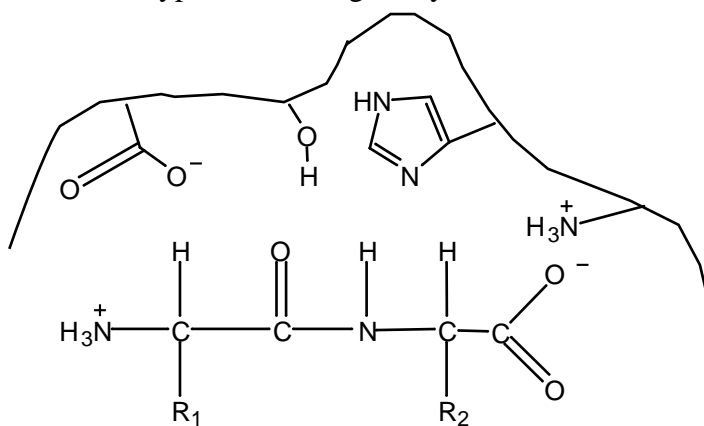
1. Addition of a _____ increases the rate of a reaction.
2. A reaction that easily proceeds in either direction is _____.
3. A reaction that absorbs heat from the surroundings is an _____ reaction.
4. For a chemical reaction to occur, reactant molecules must _____.
5. In the _____ - _____ model of enzyme action, an enzyme can change its shape slightly to fit different substrates.
6. In _____ inhibition, an inhibitor changes the shape of an enzyme by binding at a location other than the active site.
7. If the temperature becomes too high, enzymes begin to _____.

True and False

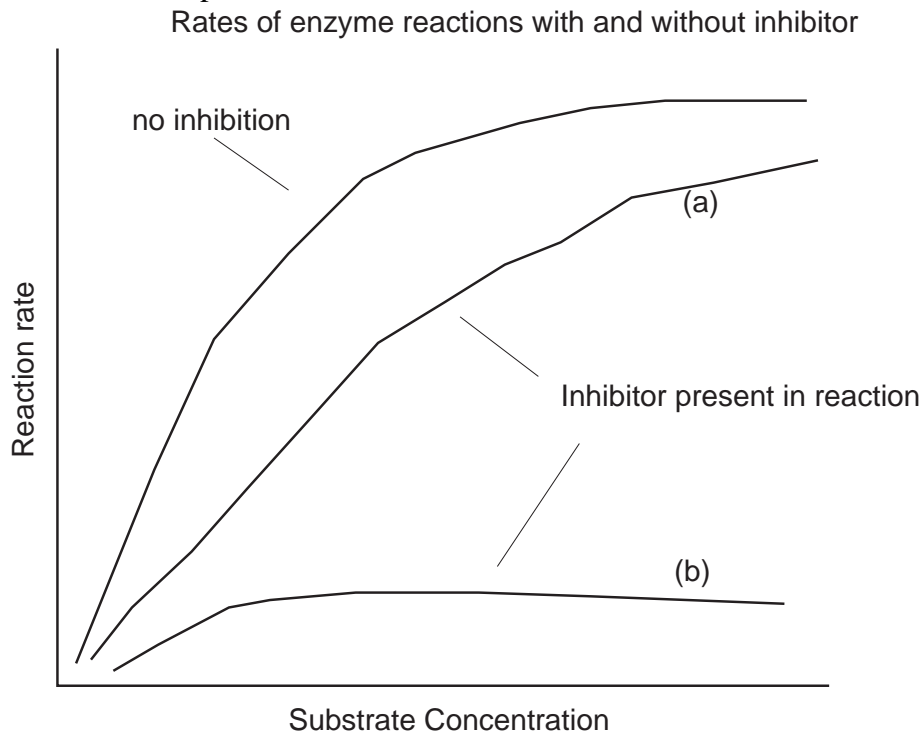
1. In an enzyme-substrate complex, the substrate is in its lowest energy shape.
2. At the active site, the enzyme and substrate can be held together only by covalent bonds.
3. As enzyme concentration is increased, the reaction rate eventually levels off.

Additional problems

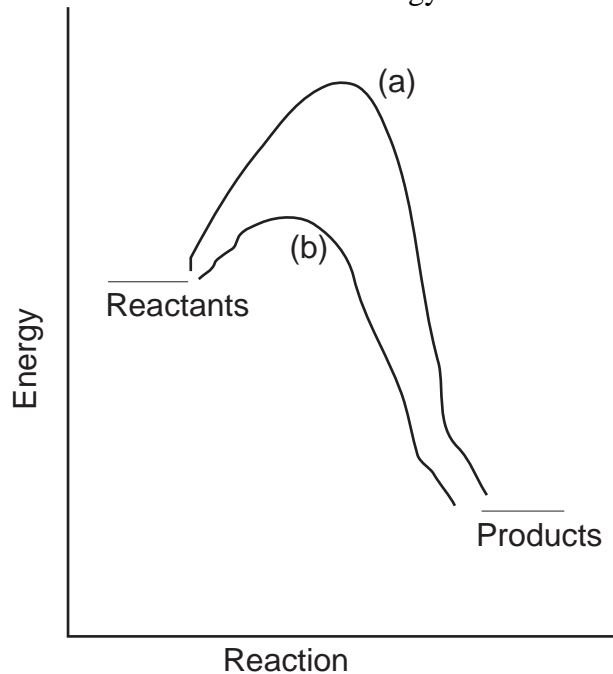
1. One the diagram shown below, indicate with dotted lines the bonding between the enzyme and substrate that might occur to form the enzyme-substrate complex. What are the two types of bonding likely to occur?



2. For the graph below identify curves (a) and (b) as a reaction containing competitive or non-competitive inhibitors.



3. In the following diagram which curve (a or b) represents the reaction with an enzyme. Which one has a lower energy of activation (E_{act})



Carbohydrates

Sections to review: 22.1 – 5, 22.7, 22.9

Complete the following sentences

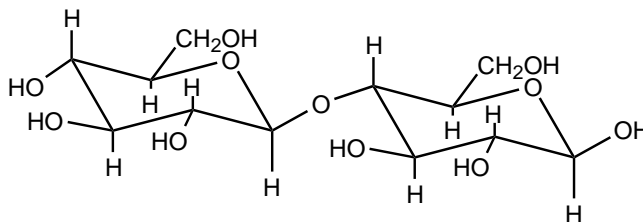
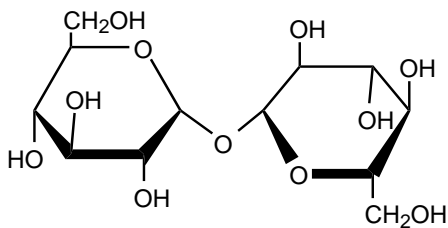
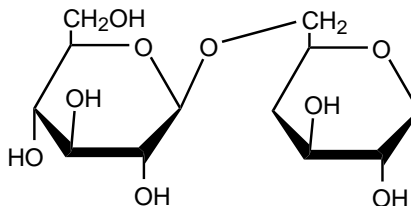
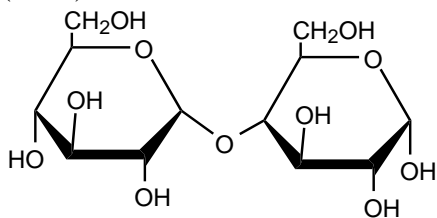
1. A reaction between an aldehyde carbonyl group and an alcohol hydroxyl group in the same molecule yields a _____.
2. _____ is used for food storage in animals.
3. D-Glucose can be classified as a _____.
4. An object with handedness is said to be _____.

True and False

1. All naturally occurring carbohydrates are chiral.
2. Humans can digest polysaccharides containing β -1,4 acetal links but not α -1,4 acetal links.
3. Two diastereomers rotate plane-polarized light in equal amounts but in opposite directions.

Additional problems

1. Label the glycosidic bonds on the following glucose disaccharides. Ex. $\alpha(1\rightarrow6)$, $\beta(1\rightarrow4)$ etc.



Lipids

Sections to review: 24.1 – .8

Complete the following sentences

- _____ is a mixture of long-chain fatty acid chains.
- The carboxylate end of a fatty acid is _____ and the organic chain end is _____.
- _____ and _____ are components of cell membranes.
- The common model of a cell membrane is called the _____ _____ model.
- Clusters of soap molecules in water are called _____.
- Phospholipids aggregate in a closed, sheet-like membrane called a _____ _____.

True or False

- Lipids are defined by their physical properties, not by their structure
- Saturated fats are lower melting than unsaturated fats.
- The main difference between fats and oils is in their melting points.
- Facilitated diffusion requires an energy investment.

Additional problems

- The fatty acid composition of three triacylglycerols (A, B, and C) is reported below. Predict which one has the highest melting point. Which one would you expect to be liquid (oil) at room temperature? Explain. Use the tables in chapter 24 (lipids chapter) to determine if the fatty acids are saturated or not. All numbers are percentages.

	Palmitic acid	Stearic acid	Oleic acid	Linoleic acid
A	21.4	27.8	35.6	11.9
B	12.2	16.7	48.2	22.6
C	11.2	8.3	28.2	48.6

- Complete hydrogenation of triacylglycerol A above would yield what fatty acid composition. How would this change the melting point?
- How do soaps clean?