

Chemistry 11 Fall 2007
Examination #5 **ANSWER KEY**

For the first portion of this exam, select the best answer choice for the questions below and mark the answers on your scantron. Then answer the free response questions that follow (100 pts. total; multiple choice 2 pts. each).

For Questions 1 – 5, refer to the following answer choices for the listed descriptions:

- A. Primary protein structure
 - B. Secondary protein structure
 - C. Tertiary protein structure
 - D. Quarternary protein structure
 - E. All of the above
1. Three-dimensional arrangement of every atom in a protein **C**
 2. Sequence of amino acids **A**
 3. Interaction of protein subunits **D**
 4. Arrangement of protein chains into patterns **B**
 5. Is not affected by denaturation **A**
 6. Which of the following contains $\beta(1 \rightarrow 4)$ glycosidic bonds?
 - A. amylose
 - B. amylopectin
 - C. glycogen
 - D. cellulose**
 - E. maltose
 7. Determine which of the following triglycerides is most likely to be an OIL:
 - A. one which contains relatively short chain saturated fatty acids
 - B. one which contains relatively short chain unsaturated fatty acids**
 - C. one which contains linear D-glucose units
 - D. one which contains long chain saturated fatty acids
 - E. one which contains long chain unsaturated fatty acids

8. How many carbon atoms are associated with the generic steroid structure?
- A. 15
 - B. 16
 - C. 17**
 - D. 18
 - E. 19
9. Of the 21 common and naturally occurring amino acids mentioned in lecture, which is the least likely to be encountered or most rare?
- A. Selenocysteine**
 - B. Cysteine
 - C. Glycine
 - D. Proline
 - E. Glutamate
10. Glycogen is most structurally similar to which of the following?
- A. Amylose
 - B. Amylopectin**
 - C. Cellulose
 - D. Sucrose
 - E. Lactose
11. Hemoglobin is made up of how many *different* types of protein chains?
- A. 1
 - B. 2**
 - C. 3
 - D. 4
 - E. 5
12. Which of the following amino acids is NOT optically active?
- A. Valine
 - B. Tryptophan
 - C. Glycine**
 - D. Proline
 - E. Phenylalanine

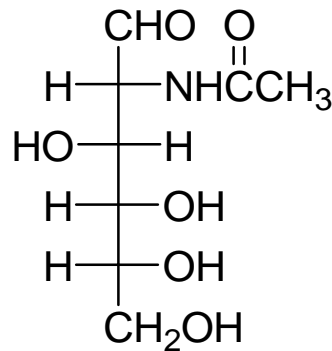
13. Sucrose undergoes hydrolysis to yield which of the following monosaccharides?
- A. two glucose monosaccharides
 - B. one galactose and one glucose
 - C. two galactose monosaccharides
 - D. one glucose and one fructose**
 - E. two fructose monosaccharides
14. When the α and β anomers of glucose reach equilibrium, ...
- A. there is more β anomer present than the α anomer.**
 - B. the solution does not exhibit optical activity.
 - C. there are equal amounts of both anomers.
 - D. the solution does not undergo mutarotation between anomers.
 - E. they are both equally stable.
15. How many different tripeptides can be made from glycine, alanine, and aspartate if the tripeptide contains each amino acid only once?
- A. 3
 - B. 6**
 - C. 8
 - D. 9
 - E. 12
16. The insolubility of lipids in water is best explained by which of the following?
- A. Lipids are polar molecules.
 - B. The polar portion of lipids is much larger than the nonpolar portion.
 - C. The polar portion of lipids is much smaller than the nonpolar portion.**
 - D. The polar and nonpolar portions of lipids are of comparable size.
 - E. Lipids deliver chemical signals from one part of the body to another.
17. Determine the relationship between the dipeptides ala-gly and gly-ala:
- A. None; they are identical.
 - B. They are resonance structures.
 - C. They are allotropes.
 - D. They are isomers.**
 - E. They are mirror images.

18. Which of the following inorganic reagents is involved in saponification?
- A. a strong acid
 - B. a weak acid
 - C. a strong base**
 - D. a weak base
 - E. a salt

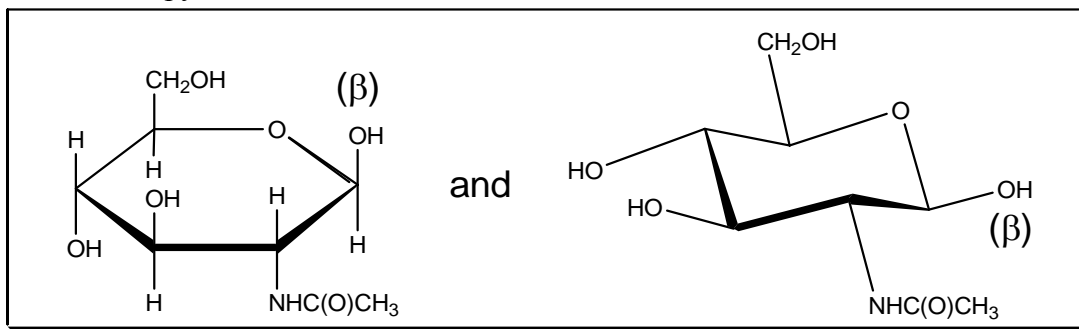
For Questions 19 – 21, refer to the following sets of amino acids for the listed descriptions:

- A. Alanine and Glutamine
 - B. Aspartate and Lysine
 - C. Leucine and Phenylalanine
 - D. Serine and Tyrosine
 - E. Proline and Glycine
19. Capable of forming a salt bridge **B**
20. Characterized by predominantly hydrophobic interactions **C**
21. Can form hydrogen bonds **D**
22. When a monosaccharide is converted to an amino sugar, which of the following is true?
- A. An amino group replaces an aldehyde carbonyl.
 - B. An amino group replaces a ketone carbonyl.
 - C. An amino group replaces a hydroxyl group.**
 - D. A phosphate group replaces a hydroxyl group.
 - E. A hydrogen atom replaces a hydroxyl group.
23. “Bad cholesterol” is denoted by which of the following?
- A. HDL
 - B. LDL**
 - C. VLDL
 - D. Chylomicrons
 - E. Testosterone

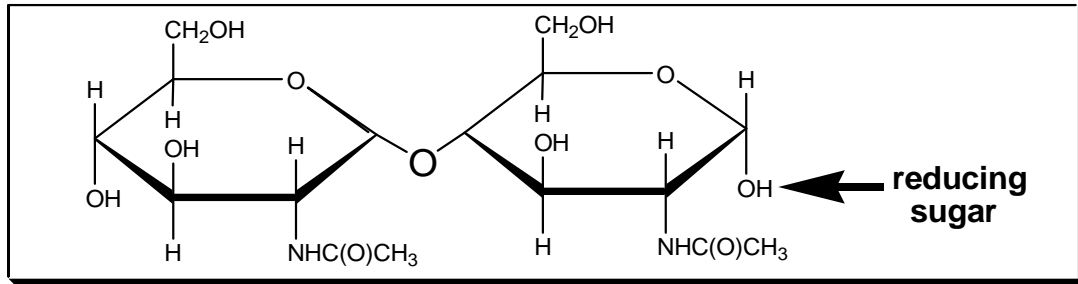
24. "Good cholesterol" is denoted by which of the following?
- HDL**
 - LDL
 - VLDL
 - Chylomicrons
 - Testosterone
25. Which of the following is TRUE of the spacial distribution of the hydroxyl groups in β -D-glucopyranose?
- They are all in axial positions.
 - They are all in equatorial positions.**
 - The hydroxyl on carbon-1 is axial; those remaining are equatorial.
 - The hydroxyl on carbon-1 is equatorial; those remaining are axial.
 - They have equal but opposite optical rotations.
26. (14 pts. total) Consider the Fischer projection of *N*-acetyl-D-glucosamine shown below:



- A. (8 pts.) Draw a Haworth projection AND a chair conformation for the β -pyranose form of this monosaccharide.



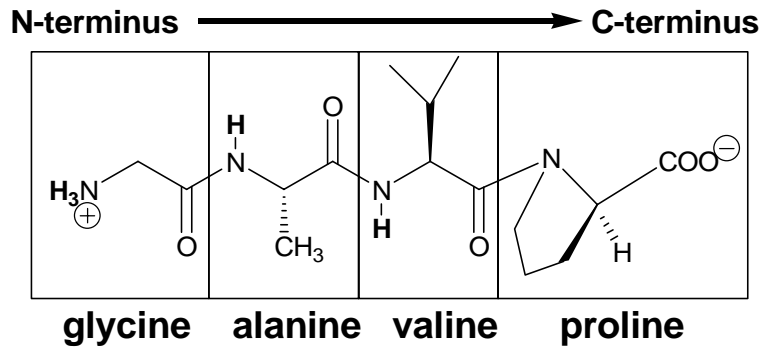
- B. (4 pts.) Now draw a Haworth projection for the disaccharide formed by joining two units of the pyranose form of *N*-acetyl-D-glucosamine by an α -1,4-glycosidic bond.



- C. (2 pts.) Is this a reducing sugar? Briefly explain why or why not.

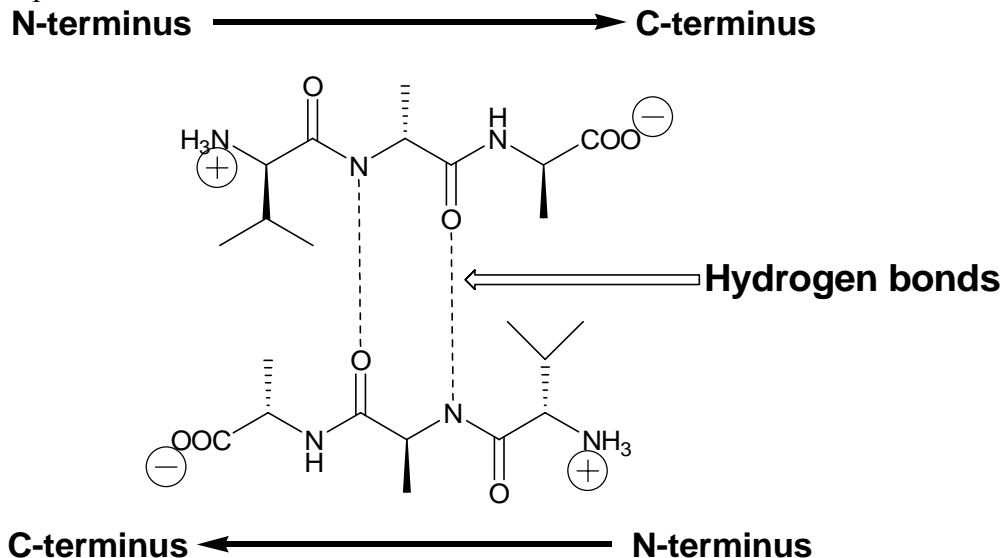
Yes, see above. The glycosidic bonds above CAN open to give an aldehyde.

27. (14 pts. total) Examine the peptide shown below and answer the questions that follow:



- A. (1 pt.) Is this a tripeptide, tetrapeptide, etc.? **Tetrapeptide**
 B. (2 pts.) Label the C- and N- termini. **See above**
 C. (3 pts.) Select the hydrogen atoms that can participate in hydrogen bonding within an α -helix or β -sheet. **See above; these hydrogens are boldfaced**
 D. (8 pts.) Draw boxes around each of the amino acids in the peptide and name each of the amino acids present. **See above; gly-ala-val-pro**

28. (13 pts. total) Based on the structure shown below, answer the next set of questions:

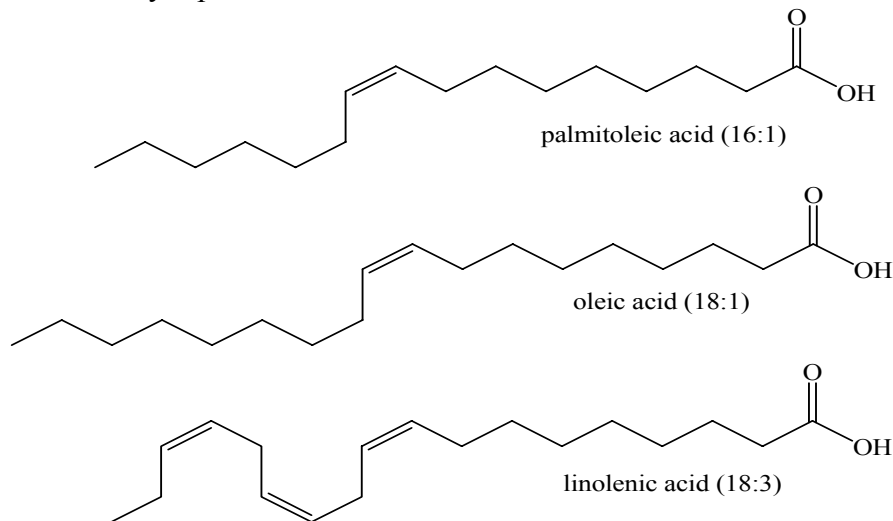


- (1 pt.) Are these peptide chains parallel or antiparallel? **Antiparallel**
- (2 pts.) Label the N-terminus on BOTH chains. **See above**
- (4 pts.) Use dotted lines to show the hydrogen bonding interactions that could hold these two chains together in an α -helix or β -sheet. **See above**
- (6 pts.) How does an α -helix differ from a β -sheet? Briefly explain.

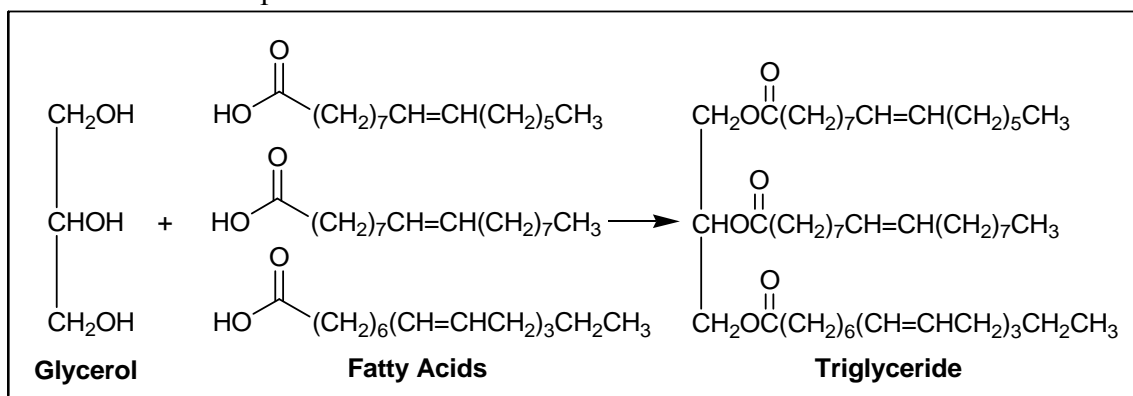
In the α -helix, a single protein chain twists so that it resembles a coiled helical spring. The chain is held in the helical shape by numerous intramolecular hydrogen bonds between carbonyl oxygens and amide hydrogens in adjacent turns of the helical backbone. The protein backbone forms the coil, and the side chains (amino acids) extend outward from the coil.

In the β -pleated sheet, several protein chains lie side by side and are held in position by hydrogen bonds between the amide carbonyl oxygens of one chain and the amide hydrogens of an adjacent chain. The β -sheet structure can occur between molecules when polypeptide chains run parallel (all N-terminal ends on one side) or antiparallel (neighboring N-terminal ends on opposite sides).

29. (9 pts. total) Three fatty acids—palmitoleic acid, oleic acid, and linolenic acid—are structurally represented below. **MULTIPLE POSSIBILITIES HERE!**



- A. (4 pts.) When 1 mole of each fatty acid reacts with glycerol, predict the final product of this reaction.



- B. (5 pts.) When the product formed in part A is saponified, predict the outcome of this reaction. Write a balanced chemical equation for this process.

