

Moorpark College Chemistry 11
Spring 2009

Instructor: Professor Torres

Examination # 5: Section Five
April 30, 2009

Name: _____ (print)

Name: _____ (sign)

Directions: Make sure your examination contains TWELVE total pages (including this cover sheet and the amino acids structure page on the back) when instructed to do so. Answer all the questions in the spaces provided. Be sure to show all your work for partial credit.

Question	Points
1. – 15. (30 pts.)	
16. (24 pts.)	
17. (20 pts.)	
18. (16 pts.)	
19. (5 pts.)	
20. (5 pts.)	
TOTAL (100 points)	

Chemistry 11 Spring 2009
Examination #5

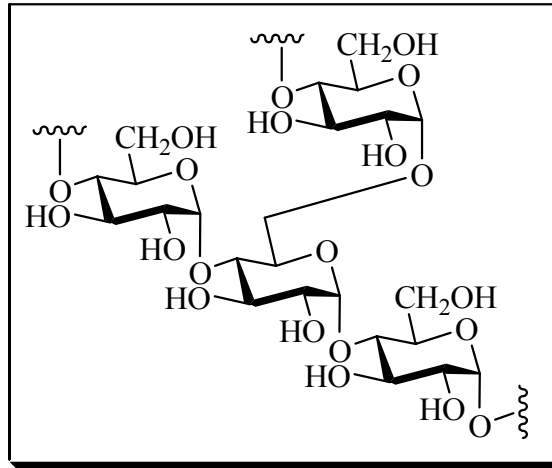
For the first portion of this exam, select the best answer choice for the questions below and mark the answers on your scantron. Then answer the free response questions that follow (100 pts. total; multiple choice 2 pts. each).

- Which of the following contributes to the tertiary structure of proteins?
 - the sequence of amino acids
 - hydrogen bonding within the backbone
 - hydrogen bonding between the side chains
 - the interaction of protein subunits
 - α -helix, β -pleated sheet, and random coils
- The complete hydrolysis of starch results in which of the following?

A. D-glucose and D-fructose	D. D-glucose
B. D-galactose and D-glucose	E. D-maltose
C. D-galactose and D-fructose	
- Determine which of the following statements is FALSE:
 - Maltose consists of two glucose units joined by an $\alpha(1 \rightarrow 4)$ glycosidic linkage.
 - Sucrose consists of D-glucose and D-fructose joined by an $\alpha 1 \rightarrow \beta 2$ glycosidic linkage.
 - Humans cannot use cellulose as food because our digestive systems do not contain β -glucosidases, enzymes that catalyze the hydrolysis of β -glucosidic bonds.
 - Glycogen is a branched polysaccharide of glucose units joined by only α -1,4-glycosidic bonds.
 - Lactose consists of D-galactose and D-glucose joined by a $\beta(1 \rightarrow 4)$ glycosidic linkage.
- Which functional group is involved in linking together the amino acids of proteins?

A. amine	D. aldehyde
B. amide	E. ketone
C. carboxylic acid	

5. Consider a portion of a polysaccharide shown below. How many anomeric carbons are present? (Note: wavy lines represent a continuation of the molecule not shown)

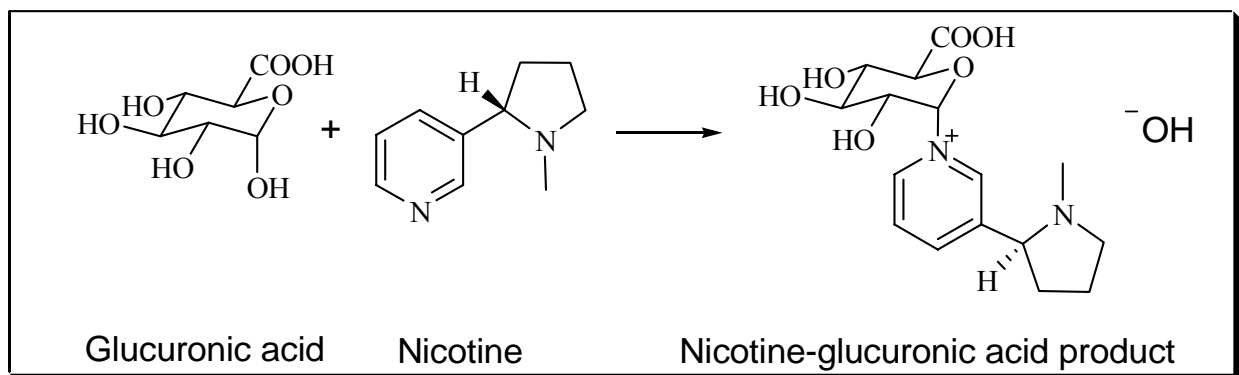


- A. 0
 B. 1
 C. 2
 D. 3
 E. 4
6. Glycosides do not undergo mutarotation because:
- A. there is no longer an anomeric carbon
 B. there are no longer any stereocenters
 C. the ring structure does not open to become the open-chain structure
 D. All of the above
 E. None of the above
7. The source of *trans* fatty acids found in some processed foods occurs due to which of the following reactions?
- A. condensation
 B. dehydration
 C. hydrogenation
 D. hydrolysis
 E. oxidation
8. Consider the four fatty acids described below and rank them in order of increasing expected melting points:

palmitic acid (16:0); stearic acid (18:0); oleic acid (18:1); linoleic acid (18:2)

- A. stearic < oleic < linoleic < palmitic
 B. stearic < oleic < palmitic < linoleic
 C. palmitic < linoleic < oleic < stearic
 D. linoleic < palmitic < oleic < stearic
 E. linoleic < oleic < palmitic < stearic

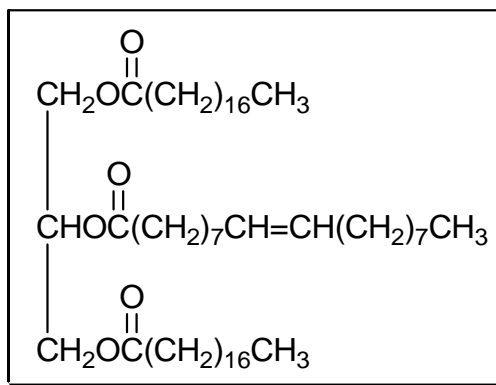
APPLICATION! For Questions 9 – 11, consider the process of glucuronation, a biochemical process in the liver whereby a molecule is attached to glucuronic acid in order to enhance its aqueous solubility. This enhanced aqueous solubility assists excretion, hormone distribution, and other biochemical processes. Nicotine, for example, is glucuronated (reaction shown below) to facilitate the removal of this toxin from the body:



9. The rules for labeling the stereochemistry of glucuronic acid are similar to other carbohydrates we have encountered. Which of the following correctly describes glucuronic acid?
- The molecule shown is D-glucuronic acid; the anomeric carbon is α .
 - The molecule shown is L-glucuronic acid; the anomeric carbon is α .
 - The molecule shown is D-glucuronic acid; the anomeric carbon is β .
 - The molecule shown is L-glucuronic acid; the anomeric carbon is β .
 - None of the above correctly describes glucuronic acid.
10. Glucuronic acid is synthesized by enzymatic oxidation of a monosaccharide. Based on the given structure of glucuronic acid, name the most likely monosaccharide for this oxidation process.
- D-fructofuranose
 - L-fructofuranose
 - D-glucopyranose
 - L-glucopyranose
 - None of the above

11. Which of the following statements is true when comparing the nicotine-glucuronic acid product to nicotine?
- A. The nicotine-glucuronic acid product is *less* soluble in water than nicotine because the product has more hydrophobic interactions than nicotine.
 - B. The nicotine-glucuronic acid product is *less* soluble in water than nicotine because the product is a salt.
 - C. Both the nicotine-glucuronic acid product and nicotine are equally soluble in water.
 - D. The nicotine-glucuronic acid product is *more* soluble in water than nicotine because the product has more areas for attractive interactions with water through hydrogen bonding.
 - E. Both the nicotine-glucuronic acid product and nicotine are not soluble in water.
12. When naming a protein or polypeptide, which of the following is TRUE?
- A. The convention for naming proteins is different from that for naming polypeptides.
 - B. They are named from the C-terminus to the N-terminus.
 - C. They are named from the middle towards the two ends.
 - D. They are named from the N-terminus to the C-terminus.
 - E. They can be named in any order as long as all the amino acids are included.
13. For the solvents water, ethanol, and benzene, which of the following gives the correct order of solubility with respect to monosaccharides?
- A. benzene > ethanol > water
 - B. water > ethanol > benzene
 - C. benzene > water > ethanol
 - D. water > benzene > ethanol
 - E. ethanol > water > benzene
14. Glycosides are formed as a result of reaction of monosaccharides with
- A. alcohols
 - B. amines
 - C. water
 - D. carboxylic acids
 - E. hemiacetals

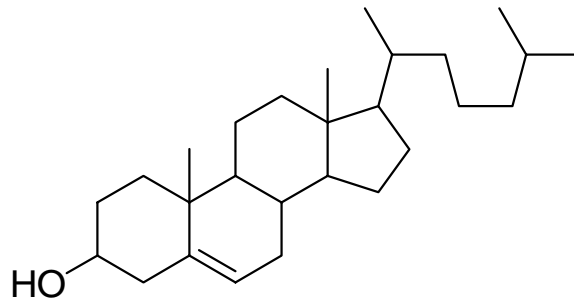
15. When the molecule below undergoes hydrolysis, which of the following products is formed?



- A. glycerol
- B. $\text{HOOC}(\text{CH}_2)_{16}\text{CH}_3$, $\text{HOOC}(\text{CH}_2)_7\text{CH}=\text{CH}(\text{CH}_2)_7\text{CH}_3$, $\text{HOOC}(\text{CH}_2)_{16}\text{CH}_3$
- C. sodium hydroxide
- D. sulfuric acid
- E. Both A and B
16. (24 pts. total) Reduction of D-glucose by NaBH_4 gives D-sorbitol, a compound used in the manufacture of sugar-free gums and candies. D-glucose can exist in an open-chain form or cyclic form. Answer the questions that follow.
- A. (4 pts.) Draw the Fischer projection of D-glucose. Which portion of D-glucose is susceptible to reduction by NaBH_4 ? Label this site on your structure below.
- B. (8 pts.) Draw the Haworth projections (cyclic and acyclic) for D-glucose, making sure to label each anomer.

- C. (2 pts.) Is mutarotation possible in part B? Briefly explain.
- D. (6 pts.) Draw both chair conformations of D-glucose, label each anomer, and indicate the most stable structure. Briefly explain your choice.
- E. (4 pts.) Based on the description found at the onset of this problem, propose a Fischer projection of D-sorbitol. What is the functional group that was produced on reduction of D-glucose?

17. (20 pts. total) Consider the structure of cholesterol below. Answer the following questions.



- A. (2 pts.) How is cholesterol transported in the body?
- B. (6 pts.) What is “good cholesterol” and “bad cholesterol”? Describe the relationship of HDL and LDL levels to cardiovascular disease.
- C. (4 pts.) Label all the carbon stereocenters in the cholesterol molecule above. How many stereocenters are present?
- D. (2 pts.) Determine the total number of possible stereoisomers.
- E. (6 pts.) In the lab, you performed a test to detect cholesterol in foods. Which functional group in cholesterol accounts for this reaction? What is the color for a positive reaction with cholesterol?

18. (16 pts. total; 4 pts. each) Identify the predominant type of noncovalent interaction occurring between the following amino acids. Draw the structure of the amino acid pair with the interacting groups facing each other, and show the type of interaction clearly wherever possible.

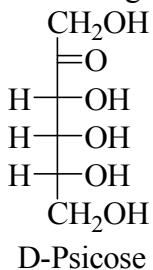
- A. Valine and phenylalanine
- B. Aspartic acid and lysine
- C. Tyrosine and serine
- D. Glutamic acid and glutamic acid

19. (5 pts. total) The protein keratin, which makes up human hair, contains a high percentage of disulfide bonds. These bonds are responsible for the shape of hair whether straight or curly.

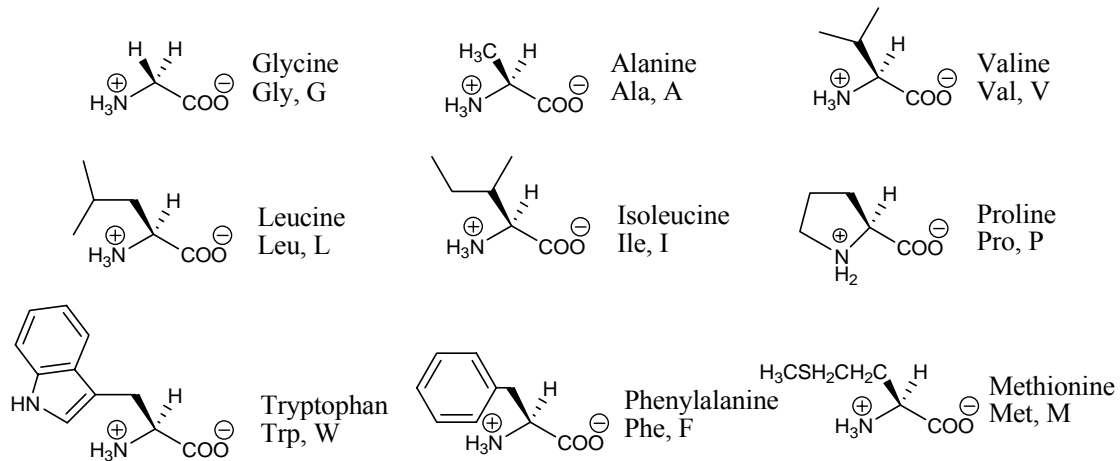
A. (3 pts.) What are the amino acids involved in the formation of the disulfide bond? Draw the structures of the amino acids and the bond formed between the pair of amino acids.

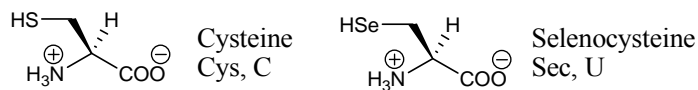
B. (2 pts.) In either permanent waving or straightening, the hair is first treated with a reducing agent such as 2-mercaptoethanol ($\text{HOCH}_2\text{CH}_2\text{SH}$). Determine the product formed as a result of this reduction. Is this an example of denaturation? Briefly explain.

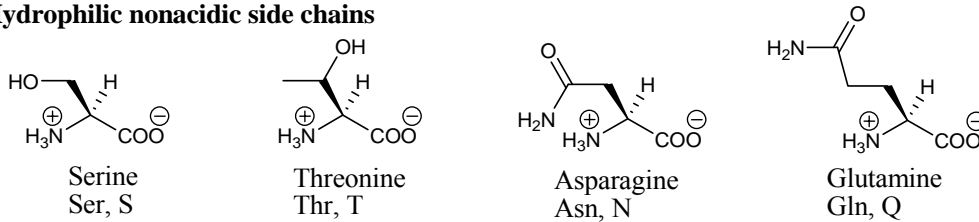
20. (5 pts.) Draw both anomers of the disaccharides formed from two D-Psicose units (shown below) joined by an $\alpha(2 \rightarrow 4)$ glycosidic linkage.

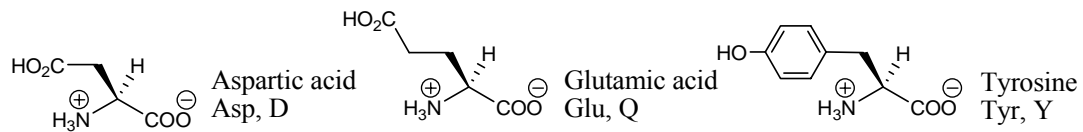


Are your disaccharides reducing or non-reducing sugars? Briefly explain.

Hydrophobic nonacidic side chains

Hydrophobic acidic side chains

Hydrophilic nonacidic side chains

Hydrophilic acidic side chains

Hydrophilic basic side chains