Part 1 - Multiple Choice, Nomenclature and Matching

____ 1. Identify the secondary amide in the following selections.

a)  
\[
\begin{array}{c}
\text{NH}_2 \\
\text{CO} \\
\end{array}
\]

b)  
\[
\begin{array}{c}
\text{N} \\
\text{H} \\
\text{O} \\
\text{N} \\
\text{H} \\
\text{O} \\
\end{array}
\]

c)  
\[
\begin{array}{c}
\text{N} \\
\text{O} \\
\text{N} \\
\end{array}
\]

d)  
\[
\begin{array}{c}
\text{N} \\
\text{H} \\
\text{NH} \\
\end{array}
\]

____ 2. Which of the following compounds would be isolated from the saponification reaction:

\[
\begin{array}{c}
\text{NaOH} \\
\text{O} \\
\text{H} \\
\text{N} \\
\text{O} \\
\text{I} \\
\text{I} \\
\text{H} \\
\text{H} \\
\text{N} \\
\text{O} \\
\text{I} \\
\text{I} \\
\text{O} \\
\text{H} \\
\end{array}
\]

a) I & II  

b) III & IV  

c) I & III  

d) II & IV

____ 3. Which of the following statements is false concerning a pair of enantiomers?

a) They must be stereoisomers.  

b) They must rotate plane polarized light in equal directions.  

c) They must be mirror images of each other.  

d) They must be non-superimposable on each other.

____ 4. How many chiral carbons are present in the following amine?

a) 1  

b) 2  

c) 3  

d) 4

____ 5. What is the relationship between the following two structures:

a) same molecule  

b) enantiomers  

c) diastereomers  

d) meso compound

____ 6. Choose the carbohydrate that would give a + Benedict's and a + Barfoed's Test.

a) fructose  

b) starch  

c) sucrose  

d) lactose

____ 7. A ketose can internally react to produce an α or β cyclic form, which would be a_____

a) hemiacetal  

b) hemiketal  

c) acetal  

d) ketal

____ 8. Which of the following would be false for starch?

a) It is a reducing sugar and will undergo mutarotation.  

b) It is a polysaccharide derived from D-glucose.  

c) It contains glycosidic linkages, which are acetal carbons.  

d) It's backbone contains D-glucose linked together via α[1,4] linkages.

____ 9. Identify the type of lipid drawn to the left.

a) triglyceride  

b) eiconsanoid  

c) steroid  

d) sphingophospholipid
10. What reaction is used to harden vegetable oil to make margarine?
   a) hydrolysis  
   b) hydrogenation  
   c) esterification  
   d) saponification

11. Which of the following is true for a biological membrane?
   a) Membranes are composed of a protein bilayer.
   b) Membranes consist mainly of lipids and carbohydrates.
   c) The lipids that are used for membranes are amphipathic, such as sphingolipids.
   d) Cholesterol is not a useful lipid in membranes.

12. Choose which of the following would be the zwitterion for alanine.
   a)  \[
   \begin{align*}
   \text{NH}_2 & \quad \text{CH} & \text{CH}_3 \\
   \text{OH} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3 \\
   \text{NH}_2 & \quad \text{CH} & \text{CH}_3 \\
   \text{OH} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3
   \end{align*}
   \]
   b)  \[
   \begin{align*}
   \text{NH}_2 & \quad \text{CH} & \text{CH}_3 \\
   \text{H} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3 \\
   \text{NH}_2 & \quad \text{CH} & \text{CH}_3 \\
   \text{O} & & \text{H} \\
   \text{CH}_3 & & \text{CH}_3
   \end{align*}
   \]
   c)  \[
   \begin{align*}
   \text{NH}_3 & \quad \text{CH} & \text{CH}_3 \\
   \text{O} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3 \\
   \text{NH}_3 & \quad \text{CH} & \text{CH}_3 \\
   \text{O} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3
   \end{align*}
   \]
   d)  \[
   \begin{align*}
   \text{NH}_3 & \quad \text{CH} & \text{CH}_3 \\
   \text{O} & & \text{O} \\
   \text{CH}_3 & & \text{CH}_3 \\
   \text{NH}_3 & \quad \text{CH} & \text{CH}_3 \\
   \text{O} & & \text{H} \\
   \text{CH}_3 & & \text{CH}_3
   \end{align*}
   \]

13. Monosaccharides exist in nature as the ___ isomer, amino acids are present as the ___.
   a) D, L  
   b) L,D  
   c) D, D  
   d) L, L

14. The ___ structure of a protein is the conformation in a local region of a polypeptide.
   a) primary  
   b) secondary  
   c) tertiary  
   d) quaternary

(8 pts) **Nomenclature** - please draw or give the IUPAC names for the following:

a) CO_2H  
   b) N-benzyl-N,3,3-trimethylpentanamide

(10 pts) **Matching** - please choose the matching answer to place in the blank.

___ peptide bonds  
___ vitamin K  
___ pyranose of aldose  
___ estradiol  
___ globular proteins  
___ glycosidic linkage  
___ triglyceride  
___ meso compound  
___ pyranose of ketose  
___ stereocenter  
___ stereocenter  
___ stereocenter
Part II - please show your work.

(10 pts) 1. Draw all the possible stereoisomers for L-2-amino-3-hydroxybutanal. Label the relationships between the different isomers by filling in the blanks.

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Finish: relationship between

A & B _____________
A & C _____________
A & D _____________

If the boiling point of A is 134°C, can you predict what B will do - explain.

If A rotates light to the left 24°, can you predict what B will do - explain.

(10 pts) 2. Explain how you could use laboratory methods to distinguish between the following compounds: glucose (hexose aldose), arabinose (pentose aldose), fructose (hexose, ketose), lactose (disaccharide) and sucrose (disaccharide).

(11 pts) 3. Consider the following compound:

a) What is it? (hydrolysable? amphipathic?)

b) Would it be more likely to be found in corn oil or an animal fat? (Explain)

c) Draw the structure(s) that would be produced upon acidic hydrolysis. Label any fatty acids formed as saturated, mono or polyunsaturated. Label any unsaturated fatty acids with the correct ω numbers.
(11 pts) 4. Finish the Fischer Projection for a compound that is a D-hexose, an aldose, and contains 5 hydroxy groups. Then answer the following questions.

   a) Would you expect this to be a reducing sugar or not?

   b) Draw the $\alpha$-pyranose that would result from this monosaccharide.

   c) Draw a $\beta$-disaccharide formed by an $\alpha[1, 6]$ glycosidic linkage of the monosaccharides. Explain whether this disaccharide undergo mutarotation and whether it be a reducing sugar.

(12 pts) 5. Consider the tripeptide at physiological pH. Gly-Ser-Lys

   a) Please draw it

   b) Would it migrate under electrophoresis, which direction (anode or cathode -explain)

   c) Draw the products of basic hydrolysis.