Name _____

Chem 150 - Fall 2015
Exam III

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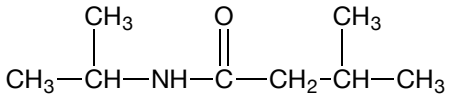
1. Given the structure shown below,



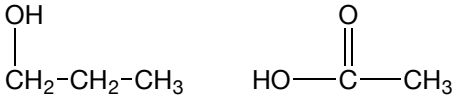
   a. Name this molecule _____

   b. *Using structural formulas*, draw a *balanced chemical equation* for the hydrolysis of this molecule

   c. Name the two organic products of this reaction

   _____ _____

2. Given these two structures,

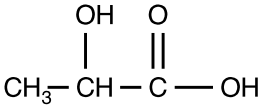


   a. Name each molecule _____ _____

   b. *Using structural formulas*, draw the *balance chemical equation* for the condensation of these molecules

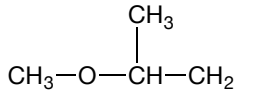
   c. Name the organic product of this reaction _____

3. Polylactic acid is a biodegradable, condensation polymer that is used to make the compostable plastic utensils that are available in the Davies Center foodcourt. The polymer is made from the condensation of lactic acid monomers. *Using a structural formula*, draw a tetramer for polylactic acid made from four lactic acid molecule.



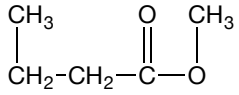
lactic acid

4. *Using structural formulas*, complete the balanced chemical equations for the *hydrolysis* of the following molecules and show the products as they exist under *physiological conditions* (*pH* 7). Place the name for each organic molecule on the lines provided.

a. 

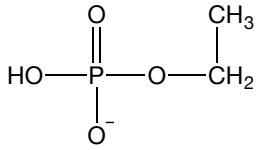
+ H_2O ⟶ +

_____ _____ _____

b. 

+ H_2O ⟶ +

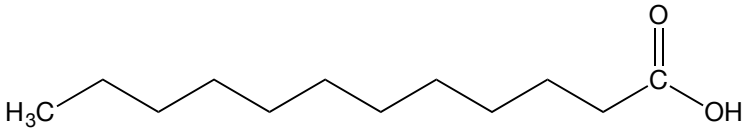
_____ _____ _____

c. 

+ H_2O ⟶ +

_____ _____ _____

5. The structure for the fatty acid lauric acid is shown below.



a. Draw the structure of the corresponding soap, using a sodium ion as the counter ion.

b. Describe the structure that forms when sodium laurate is mixed with water. Include in this discussion a description of the intermolecular interactions that are responsible for this structure.

6. Your body uses ATP molecules as one way of storing chemical energy that is released by catabolic reactions. You body then it uses ATP molecules to power anabolic reactions.
   a. Energy is stored as ATP by having ADP and an inorganic phosphate ions (P_i) undergo a condensation reaction to form the ATP. Using the abbreviations ATP, ADP and P_i, write a *balanced chemical equation* for this condensation reaction and include the word "Energy" to show that it is being stored as ATP in this reaction.

   b. In words, what does the abbreviation ATP stand for _____

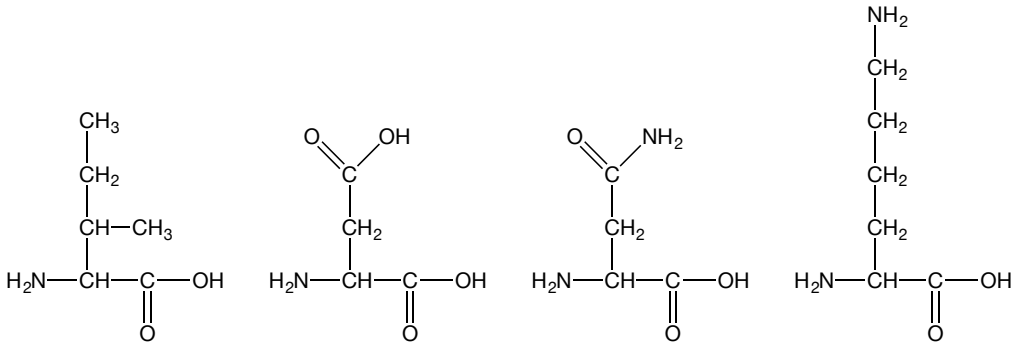
c. The stored energy is released from ATP by hydrolyzing the phosphate anhydride bond that was formed in the reaction described above. Using the same abbreviations, write a balanced chemical equation for this reaction and include the word "Energy" to show that it is being released in this reaction.

d. Describe what *catabolic reactions* do.

e. Describe what the *anabolic reactions* do.

7. Both the *hydration* and the *hydrolysis* reactions add water to organic molecules. How do these two reaction types differ from one another?

8. The structures of four out of the twenty amino acids used to make proteins are shown below in their unionized form.



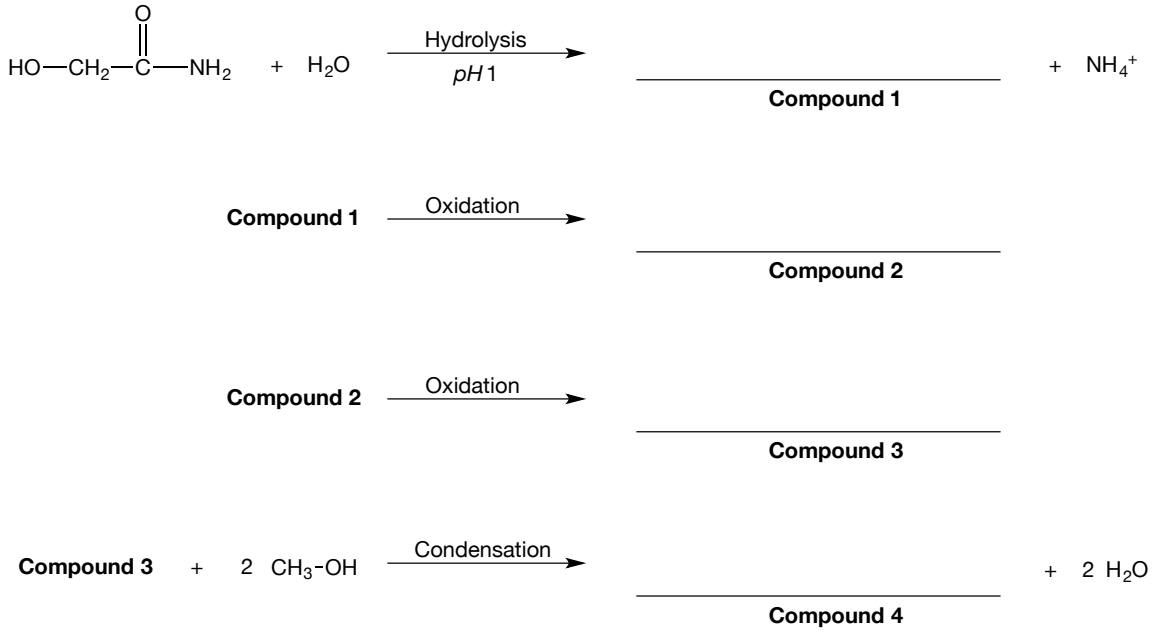
a. Draw the structure of the pentapeptide with the sequence Asn-Lys-Ile-Lys-Asp in the charged form that it exists as at physiological conditions (*pH* 7).

b. Circle each of the chiral carbons in your structure.
c. What level of protein structure does the character string Asn-Lys-Ala-Lys-Asp represent?

d. If this pentapeptide is part of a globular protein, list, using the three-letter abbreviations, where each of the amino acid side chains would prefer to be located.
   i. Those that prefer to be on the inside are _____
   ii. Those that prefer to be on the outside are _____

e. In humans, the amino acids isoleucine and lysine are considered *essential* amino acids, while aspartic acid and asparagine are considered *nonessential*. Since a human needs a supply of all twenty amino acids to synthesize proteins, why are some amino acids considered essential when others are not?

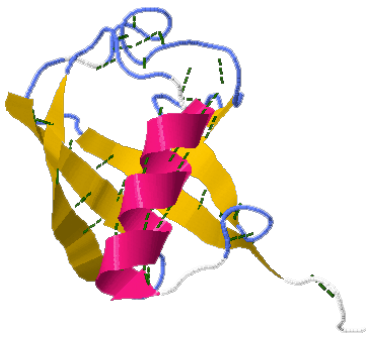
9. Complete the following sequence of reactions by drawing the structural formulas for Compounds 1 through 4 above the lines provided. Note, the oxidation reactions will not be written as balanced. (Hint: Compound 4 has the molecular formula $C_4H_6O_4$.)



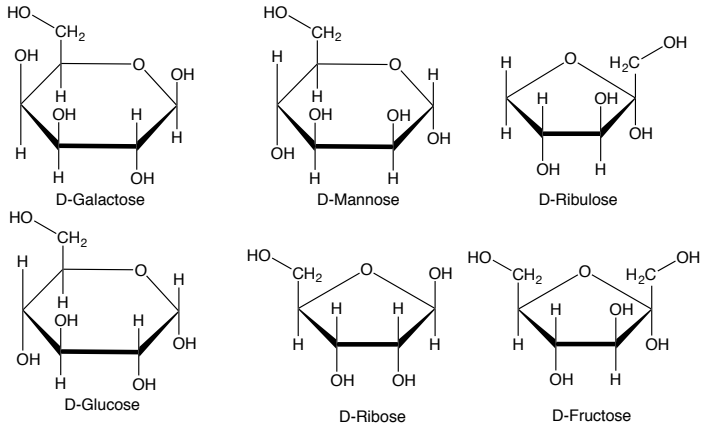
10. Shown to the right is a model of the 3-dimensional structure of the protein ubiquitin, in which a ribbon is used to trace the polypeptide backbone. Using this model to help illustrate your responses, describe, using sentences, the following levels protein structure
   a. primary structure -

   b. secondary structure -

   c. tertiary structure -



11. Shown below are the structures for some monosaccharides that are common to biological systems



a. Circle the anomeric carbon in each structure and label it as either α or β.

b. For each, indicate whether it is a *tetrose*, *pentose* or *hexose*, whether it is an *aldose* or a *ketose*, and whether it is a *reducing* or *non-reducing* sugar.

Monosaccharide	Tetrose/Pentose/ Hexose	Aldose/Ketose	Reducing/ Non-reducing
D-Galactose			
D-Mannose			
D-Ribulose			
D-Glucose			
D-Ribose			
D-Fructose			

c. Draw the structure of the disaccharide obtained by connecting D-glucose to D-glucose using a α(1→4) glycosidic bond.

What is the common name for the disaccharide you drew.

_____

What polymer is obtained if many additional D-glucose monsaccharides are joined together in the same way

_____

What is the biological function for this polymer?

d. Draw the structure of the disaccharide obtained by connecting D-galactose to D-glucose using an β(1→4) glycosidic bond.

What is the common name for the disaccharide you drew.

_____

What is the name for the condition that some people have because they have lost the ability to synthesize the enzyme responsible for hydrolyzing this glycoside bond.

_____