Name _____

Chem 150 - Spring 2015
Exam III - Practice Exam

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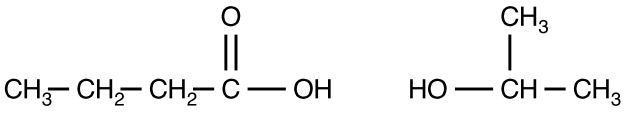
1. Given these two structures,

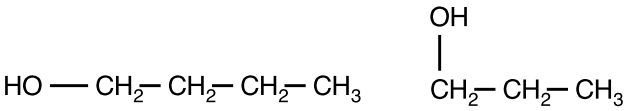


   a. Name each molecule _____ _____

   b. Draw the balance chemical equation for the condensation of these molecules

   c. Name the products of this reaction _____ _____

2. Given these two structures,

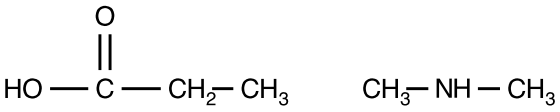


   a. Name each molecule _____ _____

   b. Draw the balance chemical equation for the condensation of these molecules

   c. Name the products of this reaction _____ _____

3. Given these two structures,



   a. Name each molecule _____ _____

   b. Draw the balance chemical equation for the condensation of these molecules

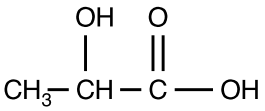
   c. Name the products of this reaction _____ _____

4. Using structures,

   a. Draw a balanced chemical equation for the phosphorylation of ethanol.

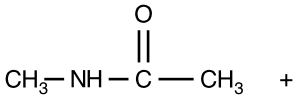
   b. Draw a balanced chemical equation for the formation of the phosphodiester that forms from the organic product of reaction in part a. with a second molecule of ethanol.

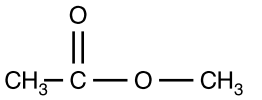
5. Polylactic acid is a biodegradable polymer that is used to make the compostable plastic utensils that are available in the Davies Center foodcourt. The polymer is made from the condensation of lactic acid monomers. Show a representative trimer structure for polylactic acid made from three lactic acid molecule.

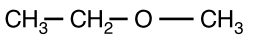


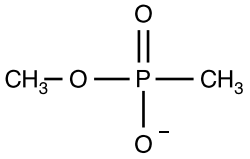
lactic acid

6. Using structures, complete the balanced chemical equations for the hydrolysis of the following molecules and show the products as they exist under physiological conditions.

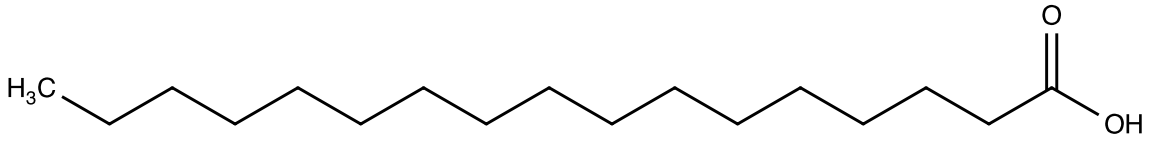
a. 

b. 

C. 

d. 

7. The structure of palmitic acid, which is a fatty acid, is show below.

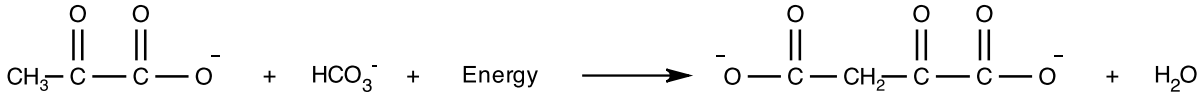


   a. Draw the structure of the corresponding soap, using a sodium ion as the counter ion

   b. Describe the structure that forms when this resulting soap is mixed with water.

8. Your body can break down glycerol to obtain energy, which is stored in the form of ATP. Is this an *anabolic* or *catabolic* process?

9. When the liver converts lactate to glucose, one of the reactions in this pathway involves the carboxylation of pyruvate to produce oxaloacetate,



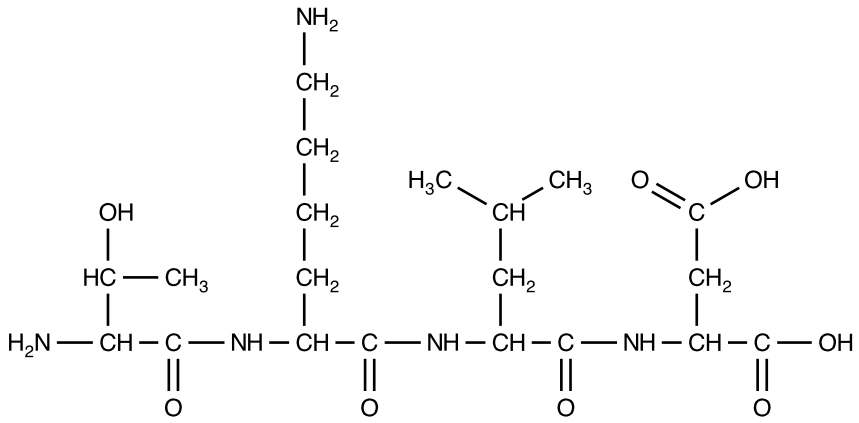
   a. This reaction also involves ATP; describe the role that ATP plays in this reaction.

   b. Write a balanced chemical equation that illustrates ATP's involvement.

10. Both the dehydration and the condensation reactions remove water form organic molecules. How do these two reaction differ from one another?

11. What functional groups are formed when the follow molecules are condensed
   a. a carboxylic acid and an amine _____
   b. two alcohols _____
   c. an alcohol and a carboxylic acid _____

12. The structure of a tetrapeptide in its unionized form is shown below.



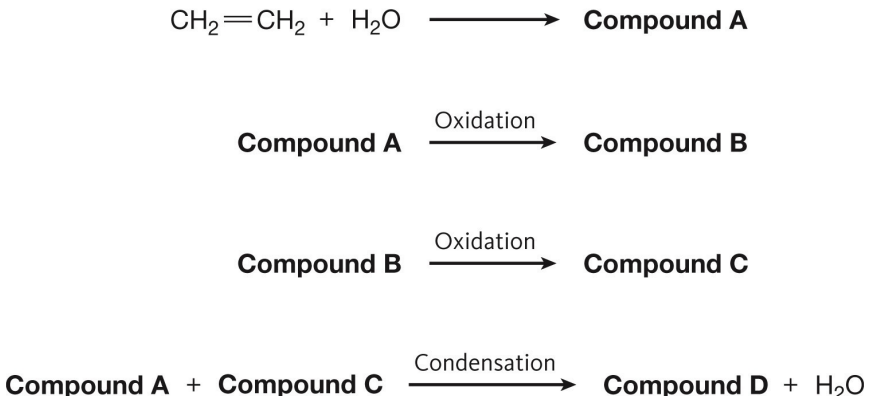
a. Circle the backbone portion of this tetrapeptide.
b. Draw the structures for each of the amino acids that will be released when this tetrapeptide is hydrolyzed. Show the amino acids as they would appear at the physiological *pH*.

c. Describe for each of these amino acids whether they would prefer to be found on the inside or the outside of a folded globular protein.

inside/outside inside/outside inside/outside inside/outside

d. Circle each of the *chiral* carbons in the structures you have draw above.

13. Complete the following sequence of reactions by drawing the structures of compounds A three D. (Hint: Compound D has the molecular formula $C_4H_8O_2$.



14. When proteins fold, the backbone often adopts periodic conformations which are described as α-helices and β-sheets

    a. In terms of the level of structure (*primary*, *secondary*, *tertiary*, and *quaternary*), what do α-helices and β-sheets represent?

    b. Describe how the backbone and side chain portions participate in the structure you have identified above.

15. Which of the following are disrupted when a protein is *denatured* (circle all that apply).

    a. primary structure

    b. secondary structure

    c. tertiary structure

    d. quaternary structure

16. Describe what an *enzyme is.*

17. Define the following terms

    a. substrate -

    b. active site -

    c. enzyme-substrate complex -

18. The side chain for the α-amino acid *valine* is an isopropyl group.

a. Draw the structure for unionized valine.	b. Draw the structure for valine at physiological *pH*

19. Many enzymes catalyze reactions that involve phosphate ions. Many of these enzymes contain magnesium ions at their active sites. Explain why these ions may help the enzyme bind phosphate ions.

20. Does the activity of a typical enzyme catalyzed reaction decrease, increase, or remain the same as the temperature rises from 30°C to 50°C? Explain you answer.

21. Does the activity of a typical enzyme catalyzed reaction decrease, increase, or remain the same as the temperature rises from 50°C to 80°C? Explain you answer.

22. With respect to enzyme-catalyzed reactions, define the following terms,

    a. competitive inhibitor -

    b. non-competitive inhibitor-

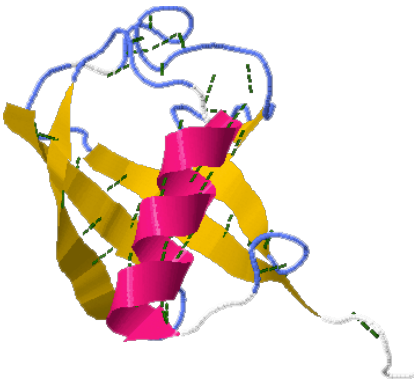
    c. positive effector -

    d. active site

    e. substrate

    f. enzyme-substrate complex

23. 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 the following levels protein structure



    a. primary structure -

    b. secondary structure -

    c. tertiary structure -

24. Which level of protein structure was not included in Question 23? Describe what this is and why the model shown for ubiquitin does not illustrate this level of structure.

25. What is the difference between *essential* and *non-essential* amino acids?

26. The following sequence of amino acids occurs in a globular protein, and it forms an α-helix. Would you expect this section of the polypeptide to be located in the interior or the exterior of the protein? Explain (You may use Table 14.1 in your text to help with your response.)

Leu-Ser-Phe-Ala-Ala-Ala-Met-Asn-Gly-Leu-Ala

27. A solution containing an enzyme is dissolved in water. Which of the following treatments will likely lead to a loss of enzyme activity? If it does lead to loss, explain why this happens.

a. cooling the solution to 10°C

b. heating the solution to 75°C

c. adding water to the solution

d. adding 2-propanol (isopropanol) to the solution

e. adding 1 M HCl to the solution

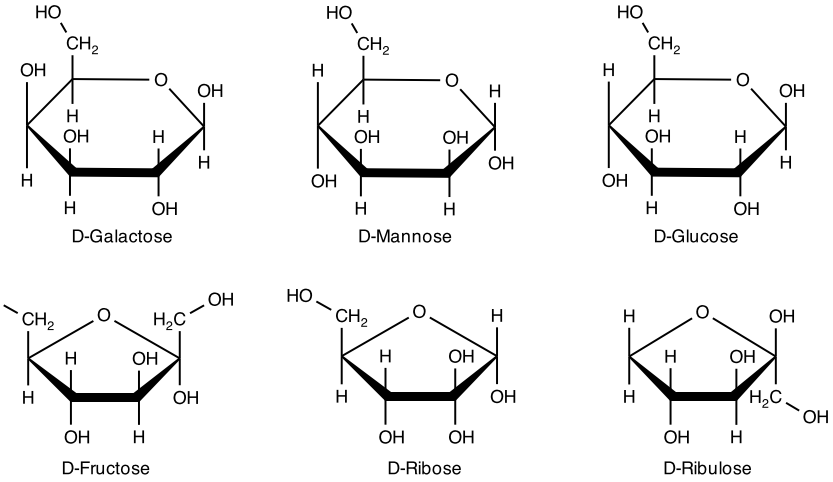
f. whipping the solution in a blender.

28. The activity of trypsin reaches a peak at *pH* of 7 to 8. Based on tis, would you expect trypsin to play an important role in the digestion of protein in you stomach? Explain your answer.

29. Atorvastatin (lipitor) is widely prescribed to lower blood cholesterol levels. This medication is a competitive inhibitor the the enzyme hydroxymethylglutaryl-CoA reductase, which catalyzes one of the first reactions in the pathway leading to the synthesis of cholesterol in the body. Would you expect the structure of atorvastatin to resemble the structure of hydroxymethylglutaryl-CoA? Explain your answer.

30. Mannose is a simple *hexose*. What is the chemical formula for mannose? _____

31. Shown below are the structures for some monosaccharides that are common in 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-Glucose			
D-Fructose			
D-Ribose			
D-Ribulose			

c. What does the "D" in front of each name signify?

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

What is the common name for the disaccharide you drew. _____

e. Draw the structure of the disaccharide obtained by connecting D-glucose to D-fructose by an α(1→2)β glycosidic bond. δ

What is the common name for the disaccharide you drew. _____

32. Both amylose, a form of starch, and cellulose are linear polymers of glucose. Humans, such as yourself, are able to readily break amylose done to glucose monomers and use that glucose as a source of energy. Cellulose, on the other hand is totally indigestible to humans.

    a. Explain why this is so.

    b. Draw a trisaccharide unit for amylose:

    c. What type of glycosidic bond did you use in your structure? _____

    d. Draw a trisaccharide unit for cellulose

    e. What type of glycosidic bond did you use in your structure? _____

33. Write the overall chemical equation for the complete oxidation of glucose to CO_2 and H_2O.

    a. In the human body, what three biochemical pathways are joined together to bring this about?

        i. _____

        ii. _____

        iii. _____

    b. What is the total number of steps involved? _____

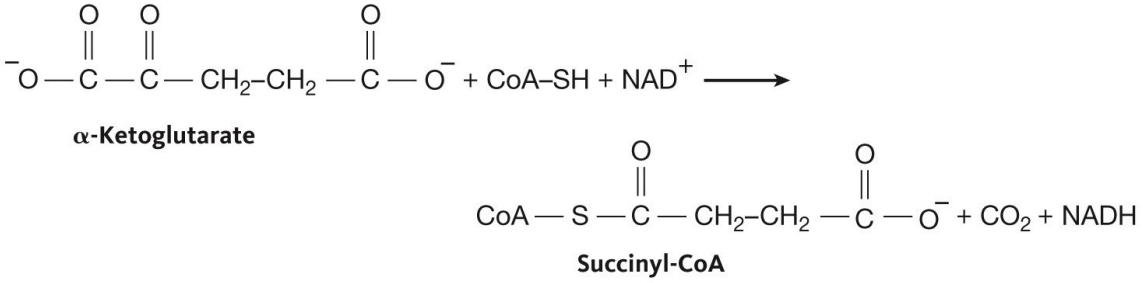
    c. In the human body, what is the energy released in these reactions used for?

    d. Under conditions of heavy exertion, when in sufficient O_2 is delivered to the muscles, what is the glucose converted to instead? _____

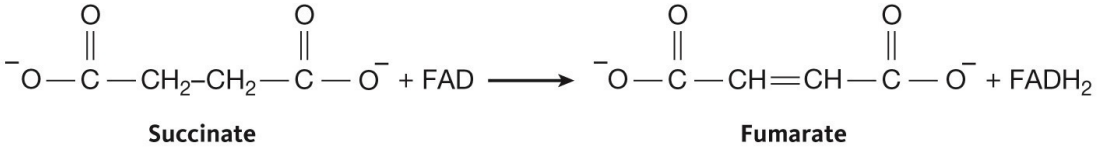
        i. What is the fate of this product?

34. For of the reactions found in the citric acid cycle are shown below

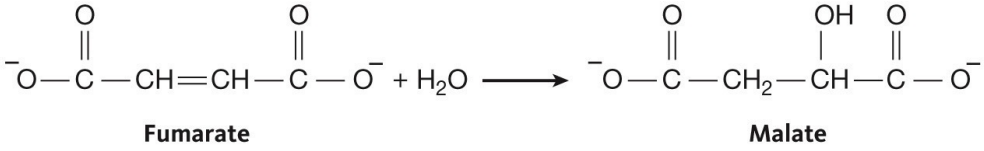
a)



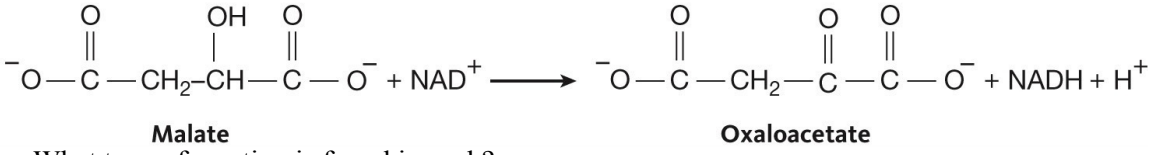
b)



c)



d)



a. What type of reaction is found in each?
   i. Reaction a): _____
   ii. Reaction b): _____
   iii. Reaction c): _____
   iv. Reaction d): _____

b. What role is NAD^+ playing in reactions a) and d)? _____

c. CoA-SH is an abreviation for what molecule? _____

d. What becomes of the NADH + H^+ that is produced in these reactions?