

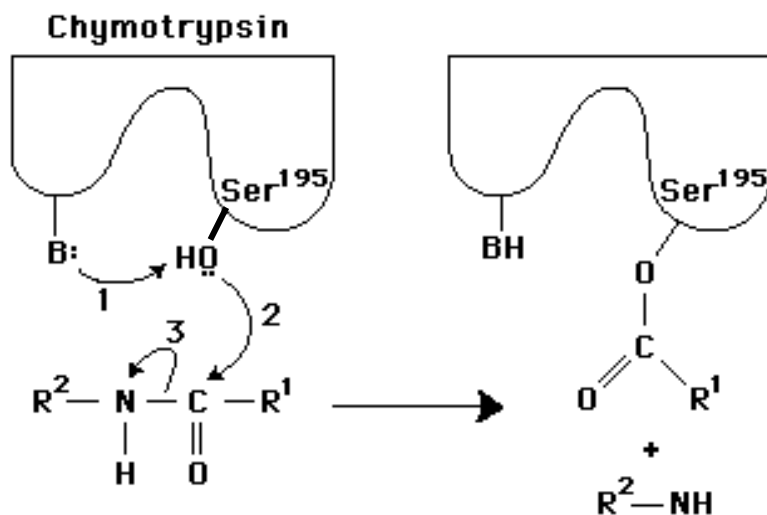
## Biochemistry Quiz Review III

A general note: Short answer questions are just that, short. Writing a paragraph filled with every term you can remember from class won't improve your answer— just answer clearly, succinctly, and in your own words.

1. Enzymes are very potent catalysts. In terms of Gibbs free energy, what do enzymes do to the reactions they catalyze?

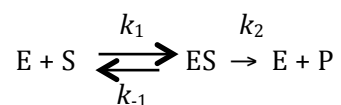
2. Explain what is wrong with this statement: “For the reaction  $S \rightarrow P$ , a catalyst shifts the reaction equilibrium to the right.”

3. In the following diagram of the first step in the reaction catalyzed by the protease chymotrypsin, the process of acid/base catalysis is illustrated by the number \_\_\_\_\_, and the process of covalent catalysis is illustrated by the number \_\_\_\_\_.



4. Why do we measure initial velocities for enzymatic reactions?

5. Given a typical Michaelis-Menten reaction (shown below), what is the rate of breakdown of the enzyme-substrate complex?



6. Given the following data for an enzyme-catalyzed reaction known to follow Michaelis-Menten kinetics, estimate the  $K_m$  and  $V_{max}$ . Show how you could use a Lineweaver-Burke plot to determine these constants.

$V_0$ ( $\mu\text{mol}/\text{min}$ )	Substrate added ( $\text{mmol}/\text{L}$ )
217	0.8
325	2
433	4
488	6
647	1,000

7. On a double-reciprocal plot, the  $K_m$  is derived from which axis intercept?

8. In a plot of  $1/V$  versus  $1/S$ , what will the presence of a competitive inhibitor alter on the graph?

9. How does the total enzyme concentration affect turnover number ( $k_{cat}$ ) and  $V_{max}$ ?

10. Give a "more formal" name for the cyclic form of Fructose, which encodes its ring structure, number of carbons, and functional group.

11. The simple sugar that is used as the reference for naming D and L states of sugars is:

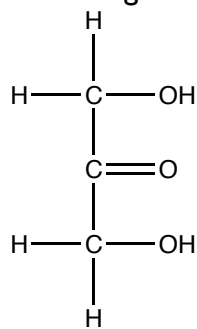
12. Draw glucose and a C-3 epimer of glucose.

13. Draw the cyclic forms of D-glucose and indicate the anomeric carbon with a \*. Name the forms.

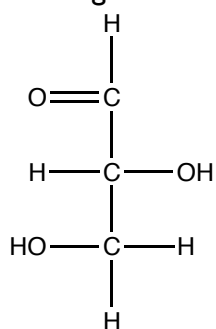
14. Give an example of a reducing sugar and a non-reducing sugar.

15. Describe the structure of starch. Include the identity of its subunits, and the details of the bonds between them.

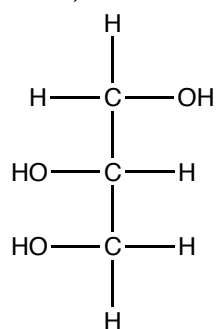
16. Categorize the following as aldose, ketose, or neither.



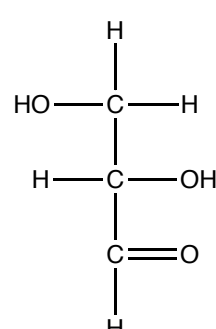
(a)



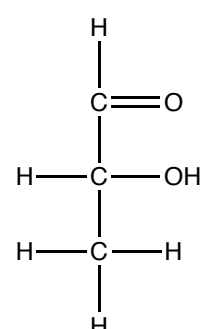
(b)



(c)



(d)

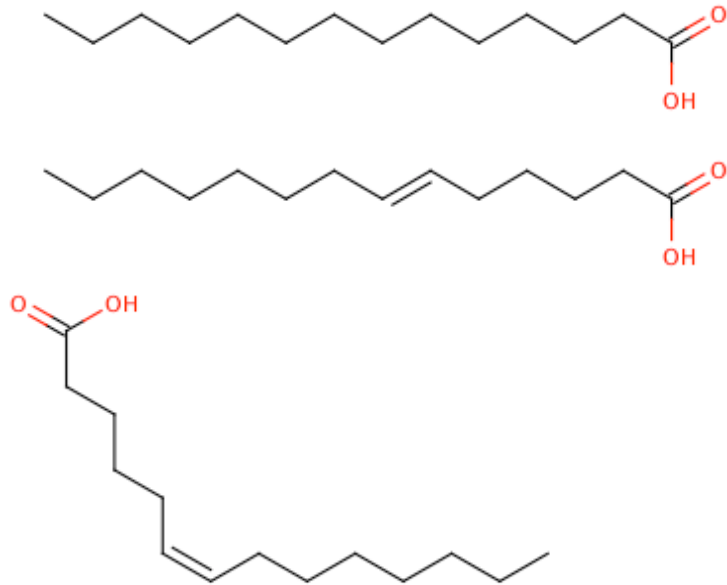


(e)

17. In your own words, what is an enantiomer?

18. Why can humans not use cellulose as a nutrient?

19. Circle the following fatty acid that would have the lowest melting point. Put a square box around the fatty acid that is unlikely to be a natural product. Lastly, Name the fatty acid that you have not Circled or Boxed.



20. In cells, fatty acids are stored as triacylglycerols for energy reserves. Draw the molecule that fatty acids react with to form these energy storage molecules.

21. How does the structure of a triacylglycerol and a phospholipid differ? What difference in properties does this create?

22. What is the role of cholesterol in terms of membrane fluidity?

23. There are a variety of fairly common human genetic diseases in which enzymes required for the breakdown of fructose, lactose, or sucrose are defective. However, there are very few cases of people having a genetic disease in which one of the enzymes of glycolysis is severely affected. Why do you suppose such mutations are seen so rarely?

24. In glycolysis there are two reactions that require one ATP each and two reactions that produce one ATP each. What are these four reactions?  
This being the case, how can fermentation of glucose to lactate lead to the net production of two ATP molecules per glucose?

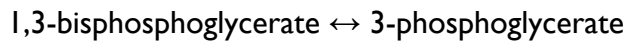
25. Describe the part of the glycolytic pathway from fructose 6-phosphate to glyceraldehyde 3-phosphate. Show structures of intermediates, enzyme names, and indicate where any cofactors participate.

26. The pyruvate produced by glycolysis has different ultimate fates depending on whether the cell has access to oxygen or not. What are those alternate fates?

27. There are two reactions in glycolysis which involve the isomerization of an aldose to a ketose or vice-versa. What enzymes catalyze those two reactions?

28. When glucose labeled with a  $^{14}\text{C}$  at C-2 passes through glycolysis, the glyceraldehyde 3-phosphate that is produced from it still contains the radioactive carbon atom. Draw the structure of glyceraldehyde 3-phosphate, and circle the atom(s) that would be radioactive.

29. When a mixture of 1,3-bisphosphoglycerate and 3-phosphoglycerate is incubated with the enzyme phosphoglycerate kinase in the presence of an excess of ADP and ATP, the final mixture contains approximately 1750 molecules of 3-phosphoglycerate for every 1 molecule of 1,3-bisphosphoglycerate. Estimate the  $\Delta G'^0$  of the reaction below ( $R = 8.315 \text{ J/mol}\cdot\text{K}$  and  $T = 298 \text{ K}$ ).



30. The pyruvate dehydrogenase complex performs complex functions in the cell. What are all of the reactants and products of the PDC? Then, name three molecules that inhibit the activity of the PDC.