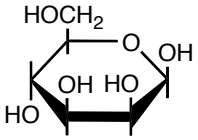
Name _____ Test 2
PHYS 0213 (Biochem) Spring 2006

1. (5 pts.) When glucose's C_6 is oxidized D-glucouronic acid forms.
   a. Draw a Fischer projection of D-glucouronic acid.

2. (8 pts.) Draw a Haworth projection for α-D-fructofuranose.

3. The questions that follow refer to the D-mannose that is drawn below.



a. (3 pts.) Is this the α or β form?

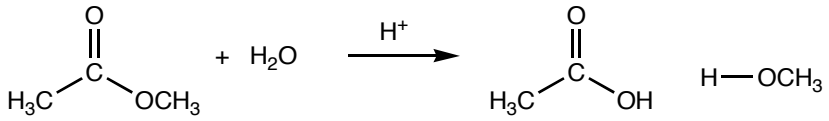
b. (3 pts.) Is this a pyranose or a furanose?

c. (3 pts.) Can this ring open to the linear sugar?

d. (3 pts.) Draw the Fisher projection for D-mannose.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____

4. In the presence of acid, esters can be hydrolyzed by water. The products of the reaction are a carboxylic acid and an alcohol.



a. (4 pts.) In the first steps of the acid catalyzed hydrolysis of an ester, which ester oxygen atom is protonated?

b. (4 pts.) What is the effect of protonating the aforementioned oxygen atom; that is, how does adding a proton to an oxygen atom make the ester more reactive?

5. The rate law predicted by the Michaelis-Menten model is written below.

$$\text{rate} = V_{max}\frac{[S]}{K_m + [S]}$$

a. (6 pts) Does the Michaelis-Menten model predict that the rate of the reaction is first order with respect to [S] or zero order with respect to [S] at high substrate concentration? Remember to explain your response.

b. (6 pts) Explain how the equation accounts for the observation that at low substrate concentrations, the reaction is first order with respect to the substrate concentration. When responding, consider the size of K_m.

6. By rearranging the rate law in problem 5 the following expression is obtained.

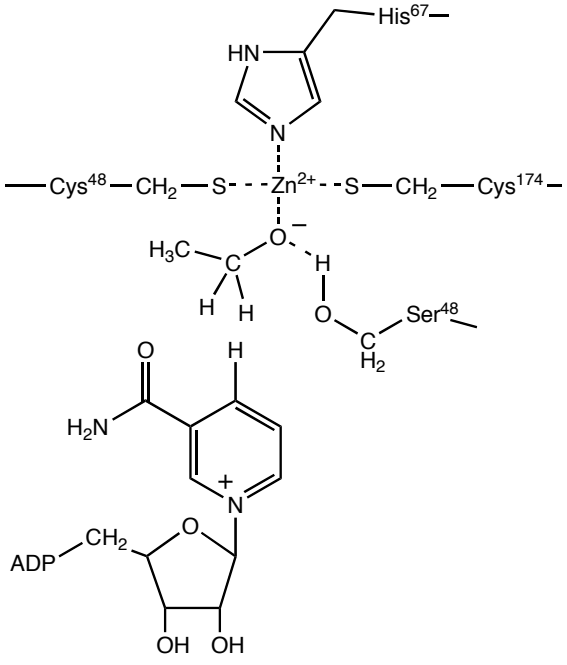
$$\frac{1}{\text{rate}} = \frac{K_m}{V_{max}[S]} + \frac{1}{V_{max}}$$

a. (4 pts.) To generate a Lineweaver-Burke plot what values are plotted as the x and y values?

b. (4 pts.) Using a Lineweaver-Burke plot makes it easy to determine what experimentally important value?

c. (4 pts.) How does a Lineweaver-Burke plot make it easier, from an experimental point of view, to determine the value in part b.

7. (2 pt. ea.) Drawn below is a graphical representation of the active site of alcohol dehydrogenase.



a. What is the role of the histidine residue?

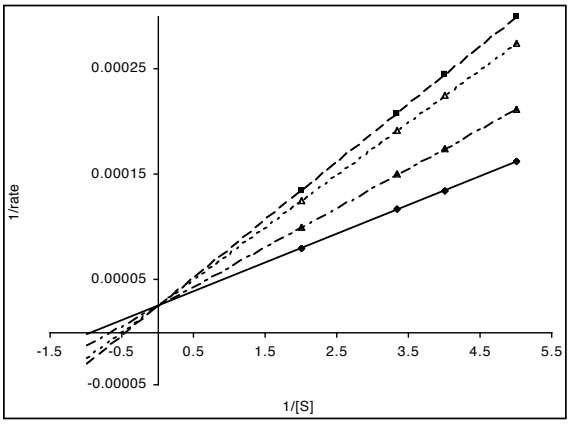
b. What are the roles of the cysteine residues?

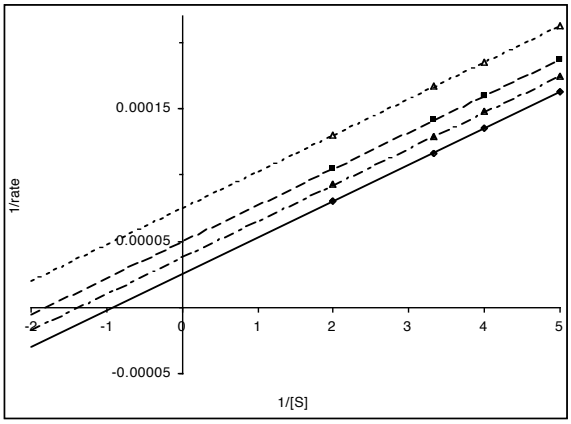
c. What is the role of the serine residue?

d. What is the role of Zn^{2+} ion?

e. What is the role of the NAD^+?

8. The graphs below show the rate of an enzyme catalyzed reaction under increasing inhibitor concentration.





a. (2 pts.) For both graphs, which line represents the uninhibited reaction (label the line)?

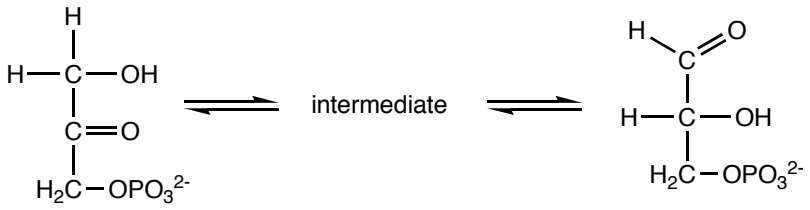
b. (2 pts.) For both graphs, which line represents the experiment with the highest concentration of inhibitor (label the line)?

c. (4 pts.) The graph on the left is consistent with competitive inhibition. What can we learn about V_{max} from the graph on the left?

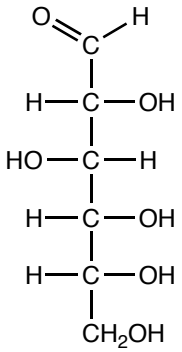
d. (2 pts.) On each graph, next to the appropriate axes, indicate which direction represents increasing reaction rate.

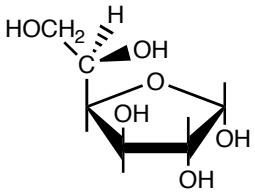
e. (2 pts) On each graph, next to the appropriate axes, indicate which direction represents increasing substrate concentration.

9. (8 pts.) Isomerization of sugars often occurs through an enediol intermediate. Dihydroxyacetonephosphate and glyceraldehyde-3-phosphate are shown below. Draw the enediol intermediate.

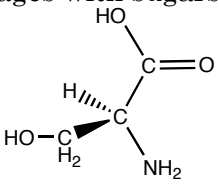


10. (8 pts.) The linear form of D-glucose is drawn below. To form the ring pictured on the right, which oxygen atom mounts a nucleophilic attack on which carbon atom?

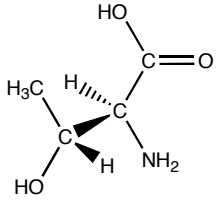




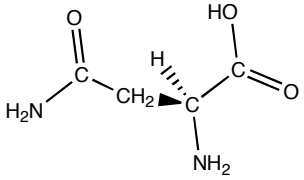
11. a. (4 pts.) What feature makes serine, threonine, and asparagine capable of forming glycosidic linkages with sugars? Explain.



serine



threonine



asparagine

b. (4 pts.) Pick one amino acid and draw a glycosidic linkage between the amino acid and a sugar.

12. (8 pts.) In noncompetitive inhibition, an inhibitor binds to an allosteric site. Explain why one of the consequences of this mode of inhibition is an apparent decrease in k_3 (or V_{max}). Remember, with competitive inhibition, k_3 (a.k.a. V_{max}) doesn't decrease.