Name _____

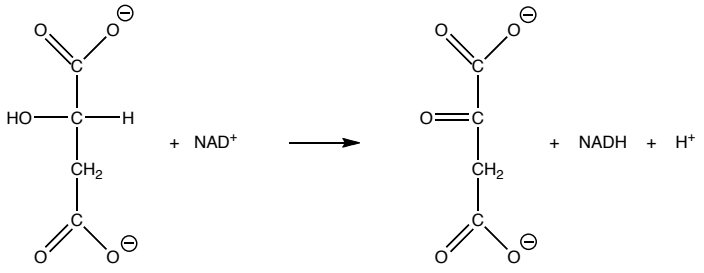
Chem 352 - Spring 2009 - Exam I

1. In an experiment that was carried out on the enzyme trypsin, it was found that the enzyme could catalyze approximately 100 reactions per second when fully saturated with substrate.
   a. If the V_{max} in this experiment was 44.6 nM/s, what was the enzyme concentration used?

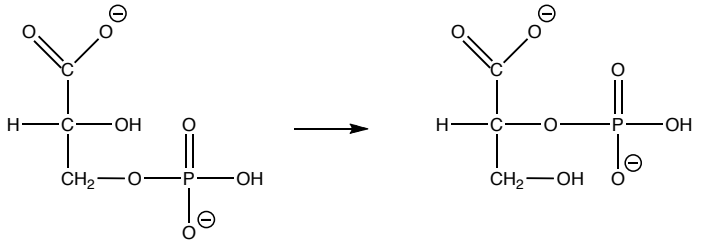
   b. If a noncompetitive inhibitor causes the V_{max} to drop to 26.1 nM/s, how many reactions are now being catalyzed per second when the enzyme is fully saturated with substrate.

   c. If the K_M for trypsin is 10 μM in the absence of an inhibitor, what is the value for K_M in the presence of the same inhibitor referred to in part b.

2. What class of enzyme catalyzes each of the following reactions?



a. Malate → Oxaloacetate Class: _____



b. 3-Phosphoglycerate → 2-Phosphoglycerate Class _____

   c. Malate is a chiral molecule, which enantiomer is shown in the Fisher projection above? _____

   d. 3-Phosphoglycerate is an example of both a sugar phosphate and a sugar acid. Which monosaccharide is it derived from? _____

3. Approximately 97% of the mass of a living cell comprises just six elements. Which are these?

   a. _____ b. _____ c._____ d. _____ e._____ f._____

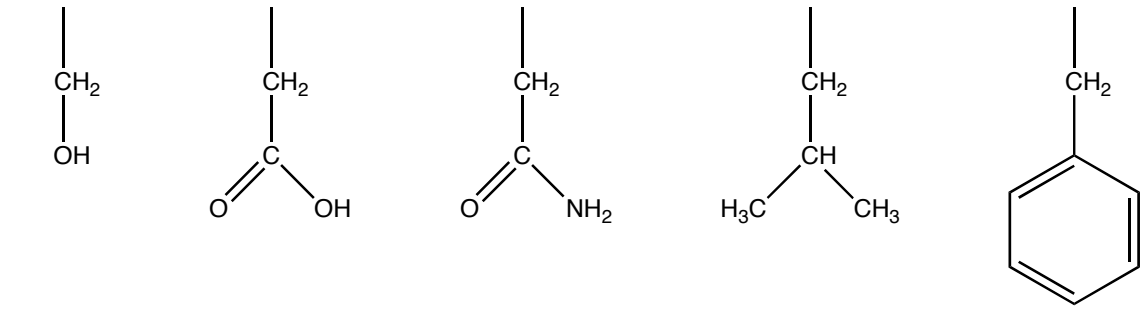
4. Who, back in the 1800's, proposed the "Lock-and-Key" model to explain how enzymes calalyze chemical reactions? _____

5. Three of the major classes of biomolecules include proteins, DNA and RNA. Francis Crick proposed that genetic information flows between these molecules in a specific order, which has become known as the "central dogma" of molecular biology. Using arrows to represent this flow, depict the "central dogma".

6. Shown below are the side chains for five amino acids:

   a. Using the three-letter codes, identify the amino acid that each side represents.

A._____ B._____ C._____ D._____ E._____



b.	Which of these is aliphatic? (*Circle all that apply.*)	A	B	C	D	E
c.	Which of these can hydrogen bond to water? (*Circle all that apply.*)	A	B	C	D	E
d.	Which of these is aromatic? (*Circle all that apply.*)	A	B	C	D	E
e.	Which of these is charged at neutral *pH* values? (*Circle all that apply.*)	A	B	C	D	E
f.	Which of these is hydrophobic? (*Circle all that apply.*)	A	B	C	D	E

7. Water displays some unusual properties for a molecule of its size and mass, such as high melting point, high heat of fusion and high boiling point. What is the explanation for this behavior. (*Please answer in three to four complete sentences*.)

   a. Which of the following molecules do you expect to be the most soluble in water (*Circle you your choice*):

   CH_3NH_2 CO_2 N_2 CH_3CH_3

   Explain:

8. In class we discussed two different modes that enzymes use to catalzye chemical reactions.
   a. What are these two modes?
      i. _____
      ii. _____
   b. Using the reaction mechanism that is used by serine proteases to cleave polypeptides, give two specific examples for each of these modes.
      i. Mode:
         1. Example 1:

         2. Example 2:

      ii. Mode:
         1. Example 1:

         2. Example 2:

9. Draw the Haworth projection for the glycoside β-D-glucopyranosyl-(1→4)-α-D-glucopyranose:

   a. What is the common name for this disaccharide? _____
   b. What glycosidic link is used to connect the two monosachharides?_____
   c. Is this disaccharide a *reducing sugar*? _____
   d. What polysaccharide is this disaccharide unit found in? _____

10. Draw the Fischer projection for D-galactose. Also, draw the Fischer projections and label examples of the following stereoisomers for D-galactose:

	Enantiomer of D-galactose	Epimer of D-galactose	Diastereomer of D-galactose
A. D-galactose	B. _____	C. _____	D. _____

11. Explain how the formation α-helical and β-sheet secondary structures help a protein's polypeptide to fold into its native tertiary structure. Include in this discussion a description of the role that non-covalent interactions play in this stabilization. (Please answer in three to four complete sentences.)

12. Acetic acid has a pKa of 4.8. How many milliliters of 0.2 M acetic acid and 0.1 M sodium acetate are required to prepare 1 liter of 0.1 M buffer solution having a pH of 4.8?

Extra Credit:

1. Ask the one question that you wanted me to ask, but I did not ask. (Up to 3 points will be awarded for an insightful, probing and well-worded question, which I can use on the Final Exam.)

2. Answer the question you posed in part 1. (Up to 2 point will be awarded for answering your question correctly.)