CHEM523 Test 2 Name: _____

Answer each of the following questions as completely and succinctly as possible. You may use a scientific calculator or a spreadsheet program to plot any kinetic data necessary. **THIS IS NOT AN OPEN BOOK/OPEN NOTE/OPEN INTERNET test**. You have 75 minutes to complete the exam and an additional 5 minutes to scan your answers and send me your test via Rocketbook.

Section 1: Stretch your mental muscles and get ready. 5 points each

1) What is the Michaelis-Menton equation and what does a Michaelis-Menton plot of enzyme activity look like? Be sure to label all axes and important points on the plot.

2) What is the Lineweaver-Burk equation and what does a Lineweaver-Burk Plot of enzyme activity look like? Be sure to label all axes and important points on the plot.

3) What are the 3 types of reversible inhibition? Draw a Lineweaver-Burk plot for each type of inhibition, making sure to include a line corresponding to no inhibitor present for each case.

4) What is an enzyme and how do they work?

5) What amino acids are phosphorylated in proteins? Why only those and not others?

Section 2: Now that you're warmed up, time to pick up the pace. 5 points each.

6) Answer the following 2 questions (6a and 6b) about an enzyme-catalyzed reaction. You will need to use Excel or a scientific calculator to determine the linear regression equation of the data.

Suppose that the data shown below are obtained for an enzyme-catalyzed reaction.

[S](mM)	V (mmol ml^{-1} min^{-1})
0.1	3.33
0.2	5.00
0.5	7.14
0.8	8.00
1.0	8.33
2.0	9.09

a. From a double-reciprocal plot of the data, determine K_M and V_{max}.
b. Assuming that the enzyme present in the system had a concentration of 10^{-6} M, calculate its turnover number.

7) Suppose that the data shown below are obtained for an enzyme-catalyzed reaction in the presence and absence of inhibitor X.

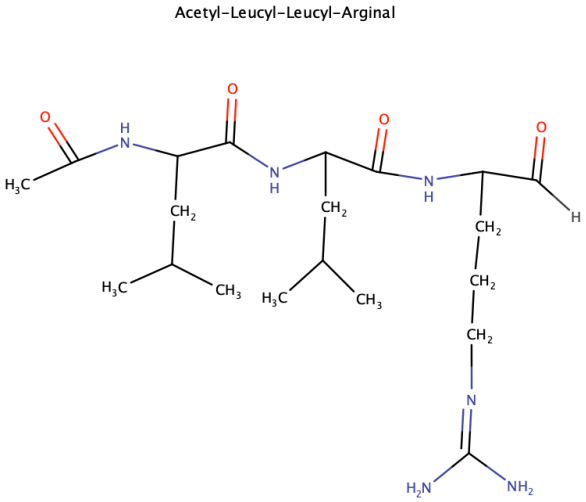
$[S](mM)$	Without X	With X
0.2	5.0	3.0
0.4	7.5	5.0
0.8	10.0	7.5
1.0	10.7	8.3
2.0	12.5	10.7
4.0	13.6	12.5

a) Using double-reciprocal plots of the data, determine the type of inhibition that has occurred. Just tell me the type of inhibition, I don't need to see your plot.
b) Does inhibitor X combine with E, with ES, or with both? Explain.

8) If you were studying an enzyme that catalyzed the reaction of ATP and fructose 1-phosphate to form fructose 1,6-bisphosphate and ADP and discovered that a plot of the initial velocity of formation of fructose 1,6-bisphosphate versus ATP concentration was not hyperbolic, but rather sigmoid, what would you suspect?

9) Answer the following 2 questions about trypsin and its inhibition.

a) The following molecule is a known inhibitor of trypsin. Knowing what you know about enzyme inhibitors, what type of inhibitor do you think this molecule is and why?



b) Show the reaction mechanism that occurs when the inhibitor interacts with trypsin.

Section 3: Maximum Effort! 10 points each

10) What are the 3 rules for mechanisms we discussed in class?

11) Draw the mechanism for carbonic anhydrase.

12) Draw the mechanism for **one** of the following enzyme catalyzed reactions: metalloprotease catalyzed hydrolysis of a peptide bond, aspartyl protease catalyzed hydrolysis of a peptide bond, protein kinase phosphorylation of a protein substrate.

13) What are the 5 ways to modulate the activity of an enzyme and give an example of each.

14) What is the importance of the ratio of $[S]0.8_{Vmax}/[S]0.1_{Vmax}$ for allosteric enzymes versus non-allosteric enzymes?

15) Explain the two types of molecular evolution we discussed in class using the serine proteases as the basis for your answer.