CHEM106 Problem Set 2 Fall 2019 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Due on 9 October, 2019

Answer the following questions. Each question is worth 5 points.

1. Draw the general structure of an amino acid and indicate the chemical groups that participate in the formation of peptide bonds.
2. Define the term pKA and explain why some amino acids have two pKA and others have three.
3. Distinguish between the structures of an -helix and a -sheet.
4. Summarize the molten globule model for protein folding.
5. Most proteins denature at temperatures above approximately 50°C because of the disruptive effects the heat has on the chemical bonds that stabilize secondary and tertiary structures. However, some bacteria live at high temperatures, for example in hot springs, and their proteins retain their tertiary structures at temperatures up to 95°C. Speculate on the structural innovations that might enable a protein to survive such high temperatures.
6. Why is the free energy of the transition state central to any discussion of enzyme-catalyzed reactions?
7. How does substrate concentration affect the rate of an enzyme-catalyzed reaction?
8. Define the term “allosteric inhibition” and describe why allosteric inhibition is important in the control of metabolic pathways.
9. Describe how the Lineweaver-Burk plot is derived from the Michaelis-Menton equation, and draw examples from the Lineweaver-Burk plots expected in the presence of: a) a competitive, reversible inhibitor and (b) a non-competitive reversible inhibitor.
10. The initial velocity was measured for an enzyme-catalyzed reaction at different substrate concentrations, with and without the presence of two different inhibitors. Using the data in the table below, determine Vmax and Km values for the enzyme with and without the inhibitors and identify the type of inhibition that is occurring in each case.

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| --- | --- | --- | --- |
| Substrate Concentration (mM) | Initial velocity (M/sec) | | |
|  | No inhibitor | Inhibitor 1 | Inhibitor 2 |
| 1.0 | 2.0 | 1.1 | 1.0 |
| 2.0 | 3.3 | 2.0 | 1.7 |
| 5.0 | 5.9 | 4.0 | 3.0 |
| 10.0 | 7.7 | 5.9 | 4.0 |
| 20.0 | 10.0 | 8.3 | 5.0 |
|  |  |  |  |