CHEM 4400 Dr. Stone Fall 2013 Fun with Enzymes! Name_____

1. For the reaction: glucose + ATP → glucose-6 –phosphate + ADP

    a. Describe the effect that hexokinase has on Keq

    b. Describe the effect that hexokinase has on $\Delta G^{\circ\prime}$

    c. Describe the effect that hexokinase has on $\Delta G^{\pm}$

    d. What does effect does hexokinase have on the rate of the formation of glucose-6-phosphate?

2. Describe how v_o (initial velocity) is measured (in general).

3. A steady state is reached when the rate of formation of an enzyme-substrate complex is equal to the rate of breakdown of the enzyme-substrate complex.

$$E + S \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} ES \underset{k_{-2}}{\overset{k_2}{\rightleftharpoons}} E + P$$

    a. Write the rate law equations for the formation of ES

    b. Write the rate law equation for the breakdown of ES

    c. Why can we ignore the term with [P]?

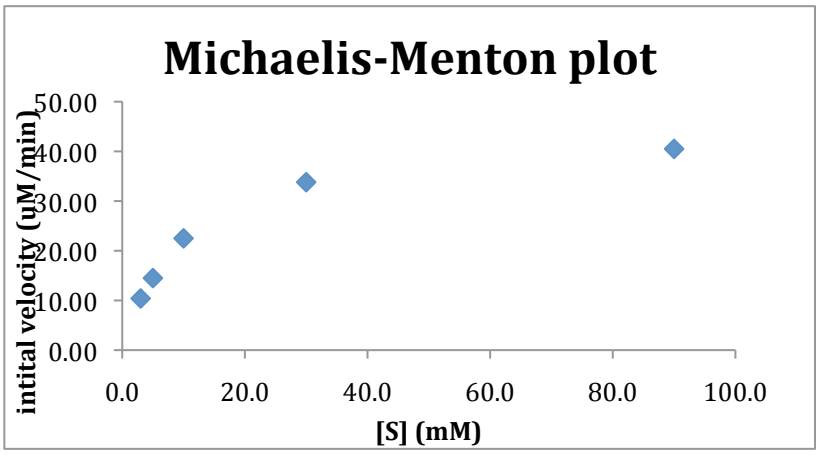
    d. Free E is often difficult to determine directly, so $[E_t]$-[ES] = [E], is substituted for [E].

    Rearrange everything to solve for [ES] on one side. Then, substitute v_o for [ES] and Vmax for [Et]. (When [ES] = [Et], then v_o = ½Vmax. Why?)

4. What is the equation for the line that results from plotting initial velocity vs substrate concentration?

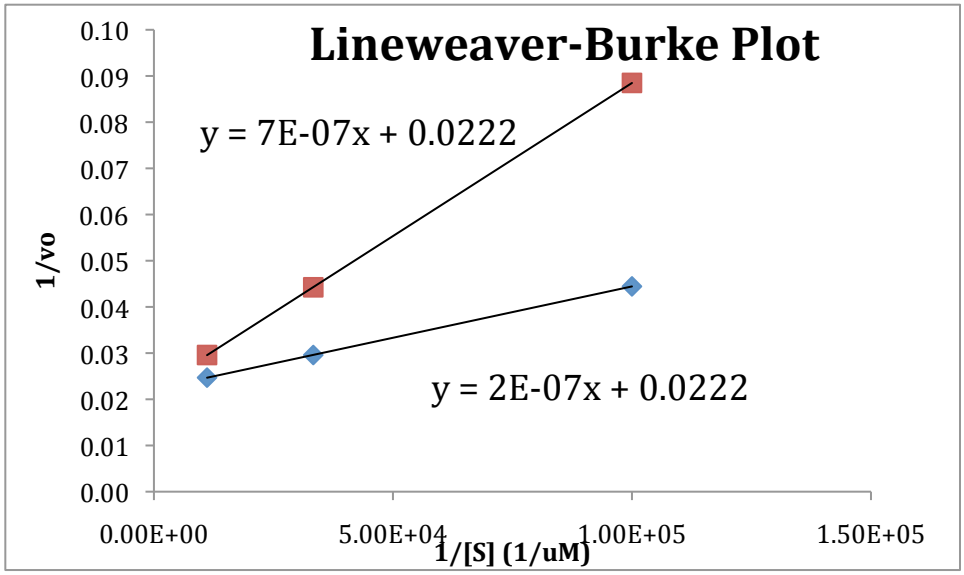
5. Find the relationship between Km and [S] when v_o = Vmax

6. Use the data in the graph below to find the following:
    a. Vmax
    b. Km



7. What is the equation of the line for a Lineweaver-Burke plot?

8. Use the Lineweaver-Burke plot shown below to find:
    a. Vmax (top line)
    b. Km (top line)
    c. Vmax (bottom line)
    d. Km (bottom line)



9. The data that is plotted in the Lineweaver-Burke plot is for the same enzyme. One experiment included a small molecule that bound to the enzyme and inhibited its activity.
    a. Which line is for the inhibitor?
    b. Which values were different for the inhibited enzyme? Km? Vmax?
    c. Propose a mechanism for the inhibition.