Practice Problems for Enzymes and Enzyme Kinetics

1) What do catalysts do? How do they accomplish this?

2) a) What are all of the different ways to express the rate of the following balanced equation for the hydrolysis of adenosine triphosphate (ATP)?

$$ATP^{4-} + H_2O \rightarrow ADP^{3-} + H^+ + HPO_4^{2-}$$

b) What is a valid way to express the rate law for this reaction

3) Suppose you have the following reaction scheme:

$A + B \rightleftharpoons I$

$I + D \rightarrow E$ (slow, rate limiting step)

a) What is $\frac{d[I]}{dt}$ equal to?

b) What is the overall rate law for this reaction using the steady state approximation?

4) State the major assumptions we made when deriving the Michaelis-Menten equation.

5) Sketch a Michaelis-Menten plot for an enzyme following Michaelis-Menten kinetics and include hypothetical points along the plot . Label both axes, Vmax and Km and state how each point on the graph was obtained.

6) a) What equations are derived from the Michaelis-Menten equation to create an Eadie plot and a Lineweaver-Burk plot? Why do we need these equations?

b) Draw a diagram of each of these plots (Eadie and L-B), labelling both axes, the value of the slopes, y-intercepts and the x-intercepts. To find the x-intercept, set the y-value (not the y-intercept) in the equation to zero.

7) Draw MM and LB plots for four enzyme assays in which a competitive inhibitor is being introduced.

8) Explain why Vmax and Km values behave as they do for each type of inhibition we discussed.