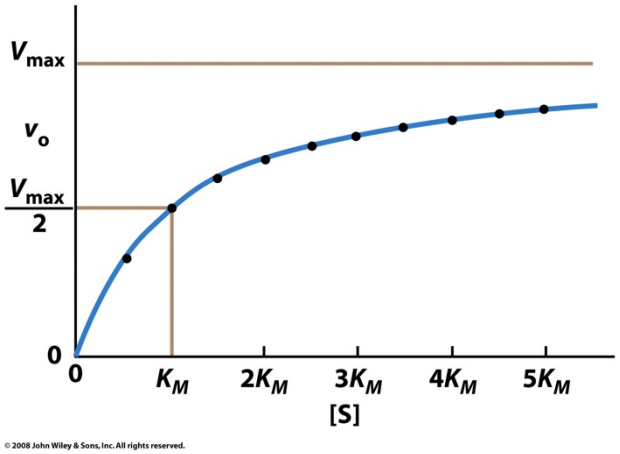
Biochemistry I Kinetic Homework _____

1) **(20 points)** Consider the following plot of initial velocity of a reaction versus substrate concentration:

a. Describe the meaning of K_M in words. Using the Michaelis-Menten equation, show mathematically how K_M values change v_0 (i.e. how does a small or large K_M value change v_0).



b. Using the Michaelis-Menten equation, show mathematically why at low substrate concentrations v_0 is very small.

c. Using the Michaelis-Menten equation, show mathematically why $v_0 = \frac{1}{2} V_{max}$ when K_M = [S]

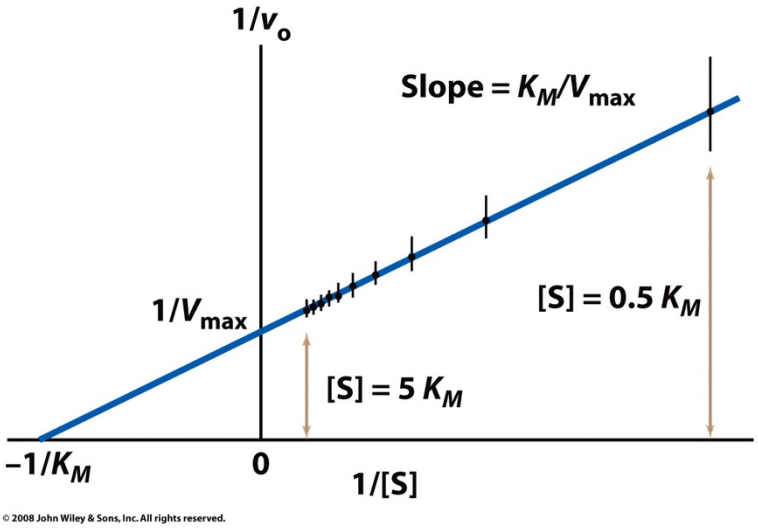
d. Using the Michaelis-Menten equation, show mathematically why at high substrate concentrations, $v_0 \approx V_{max}$.

e. At high [S], k_2 becomes the rate limiting step of the reaction. Knowing this information, mathematically explain how $K_M \approx K_S$.

f. Using the Michaelis-Menten equation, explain why it would be good to have a very small K_M (K_S) value.

Applications of Enzyme Kinetics:

2) (10 points) Consider the following variation of the Michaelis-Menten equation, and the corresponding Lineweaver-Burk plot of $1/v_0$ versus 1/[S]:



a. What does the x-intercept give you?

b. What does the y-intercept give you?

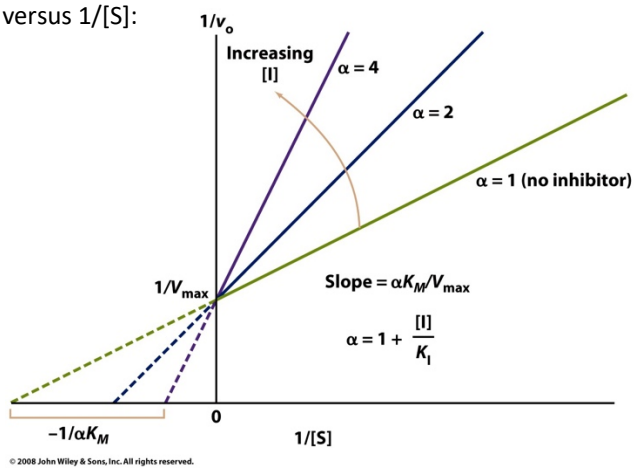
c. Why does the data tend to cluster on the left hand side of the graph?

d. What is the propensity for error on the right side of the plot and what significance does that have?

e. Why is this type of a plot useful experimentally?

Applications of Enzyme Kinetics:

3) **(20 points)** Consider the following Lineweaver-Burk plot of $1/v_0$ versus 1/[S]:



a. What type of inhibition is this, and how can you tell?

b. How does this mechanism of inhibition work? Be sure to address where the inhibitor binds, and how this affects the enzyme.

c. Describe:
- in words what the parameter "α" is
- what its limits (i.e its maximum and minimum values) are
- how K_I can impact the magnitude of α
- what impact α has on the observed Linweaver-Burke plot.

d. Describe what happens to the following terms with increasing [I]:
- K_M
- α
- V_{max}

e. What is the capability of increasing [S] to overcome the inhibition?