

## Additional Homework for Chapter 5

*Due Date: September 7, 2010*

1. The  $K_m$  of an enzyme can be found empirically by determining the substrate concentration at which half the maximal rate is attained. Using the Michaelis-Menten equation, show that  $v = \frac{1}{2}V_{max}$  when  $[S] = K_m$ .
2. The  $K_m$  of a certain enzyme is  $1.0 \times 10^{-5}$  in a reaction that is described by Michaelis-Menten kinetics. At a substrate concentration of 0.1 M, the initial rate for the reaction is 37  $\mu\text{mol}/\text{min}$  for a certain concentration of enzyme. However, you observe that at a lower substrate concentration of 0.01 M the initial reaction rate remains 37  $\mu\text{mol}/\text{min}$ .

Using numerical calculations, show why this 10-fold reduction in substrate concentration does not alter the initial reaction rate.

3. Ten reaction mixtures, each containing the same concentration of enzyme, were made up to various substrate concentrations and the initial velocities were determined as shown in the Table below. Using the Lineweaver-Burk equation, graphically determine  $K_m$  and  $V_{max}$ . One of the critical factors in the accuracy of this determination is the proper selection of scales for the ordinate and the abscissa. What range of substrate concentrations is most useful for these determinations?

**[S] in mole/L**

**v in  $\mu\text{mol}/\text{min}$**

$1.0 \times 10^{-3}$	65
$5.0 \times 10^{-4}$	63
$1.0 \times 10^{-4}$	51
$5.0 \times 10^{-5}$	42
$3.0 \times 10^{-5}$	33
$2.0 \times 10^{-5}$	27
$1.0 \times 10^{-5}$	17
$5.0 \times 10^{-6}$	9.5
$1.0 \times 10^{-6}$	2.2
$5.0 \times 10^{-7}$	1.1