

(Each problem must be completed on a separate page.)

1. Derive a velocity equation for an ordered bisubstrate enzyme with a competitive inhibitor for the substrate that binds *second*.

2. A particular uni uni enzyme has a glutamate in its active site that must be deprotonated for the enzyme to be active. In its local environment, this particular Glu has a pK_a of 6.0. The effect of pH on the activity of an enzyme was assessed. The substrate and the product of the reaction are both positively charged throughout the pH range of the experiment.
 - a. Sketch a graph for V_o as a function of pH in a situation where the substrate concentration is much greater than the K_M value.

 - b. On the same axes, sketch a graph for V_o as a function of pH in a situation where the substrate concentration is much less than the K_M value.

 - c. At what pH with the velocity equal $\frac{1}{2}$ of the maximal velocity attainable under these conditions.

3. You discover a novel hydrolase that de-acetylates glutamine residues on polypeptides in a mechanism that involves a covalent intermediate to a lysine in the enzyme's active site.
 - a. Propose a *kinetic* mechanism for this enzyme (using the specific substrates and products rather than 'A', 'B', 'P', 'Q', etc.).

 - b. Propose a *reaction* mechanism for this enzyme given the information in the question.

 - c. Design a small molecule that could act as a competitive inhibitor for this enzyme.