Buffet: Enzyme Controlled Reactions Virtual Lab
AP Biology

Go to: McGraw Hill Virtual Biology Lab > Enzyme Controlled Reactions
Use the lab to answer any 2 of the following:
A. What is the ideal pH for maximum product production?
B. Are the effects of acidic and basic conditions on enzyme action the same?
C. How little substrate can be used to achieve the maximum product formation?
D. What is the relationship between substrate concentration and reaction rate?
E. What is the effect of substrate amount on product formation?

• Record the relevant data in the table below, or in Excel/Sheets, or use the table/graph feature built into the virtual lab (has some axis labeling issues but useable). Print tables and graphs, attach to this, and include in your homework buffet.
• Answer each of the questions with a claim. Use the data/graph as your evidence.
• Answer the questions below, and on the back.

| Table 1: Number of product molecules per minute |
|-----------------|--------|--------|--------|--------|--------|
| Substrate       | pH 3   | pH 5   | pH 7   | pH 9   | pH 11  |
| (Lactose)       |        |        |        |        |        |
| 0.5 g           |        |        |        |        |        |
| 1.0 g           |        |        |        |        |        |
| 2.0 g           |        |        |        |        |        |
| 4.0 g           |        |        |        |        |        |
| 8.0 g           |        |        |        |        |        |

1. Identify the experimental variables and key constants.

2. The maximum rate of this reaction is 350 molecules product/minute. Why is there a maximum rate?

3. Why does the graph ‘level off’ over time, regardless of the enzyme or substrate concentration used?

4. List changes you could make in the experimental conditions or variables that would increase the reaction rate. Justify.
Check Your Understanding

1. Which of the following terms, if any, does NOT apply to an enzyme?
   a. Catalyst   b. Inorganic
   b. Protein   d. All of the above apply to an enzyme

2. Which of the following statements is accurate in describing the activity of the lactase enzyme?
   a. Lactase can function equally effectively at many different pH levels
   b. The shape of lactase does not change during the reaction
   c. Lactase is converted to glucose and galactose by the reaction
   d. One lactase enzyme can catalyze many reactions

3. Choose any/all that describe the action of the enzyme illustrated in the video.
   a. anabolic   b. catabolic
   c. endergonic   d. exergonic
   f. decreasing entropy   e. increasing entropy
   g. negative change in G   h. positive change in G

4. When an enzyme catalyzes a reaction:
   a. Substrate(s) bind in the active site
   b. Products bind in the active site
   c. The shape of the enzyme remains unchanged
   d. The enzyme is consumed by the reaction

5. Which of the following would interfere most with the ability of an enzyme to catalyze a reaction?
   a. Reduced concentration of substrate available
   b. Reduced concentration of product available
   c. Increased concentration of substrate available
   d. A change in the pH

6. Feedback mechanisms regulate the rate of enzyme activity, effectively “turning off” an enzyme in a reversible way until more product is needed. Which of the following would be most effective as a feedback mechanism?
   a. Reduced concentration of product
   b. Increased concentration of substrate
   c. A change in pH
   d. Temporary binding of a non-substrate molecule in the active site

7. The “lock and key” is a common model/analogy for how enzymes and substrates come together. What is accurate about the model? What are the limitations of the model?