# Enzyme Control

1. All of the following are functions of an allosteric enzyme EXCEPT

   A) the binding of a substrate may stabilize the active conformation
   **B) the allosteric site serves as the active site in the presence of competitive inhibitors**
   C) the binding of a substrate may stabilize the inactive conformation
   D) they control key reactions in metabolic pathways
   E) their activity changes in response to fluctuating concentrations of regulators

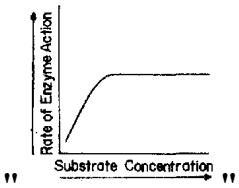
2. When an entire enzyme population is saturated, how would the cell increase productivity?

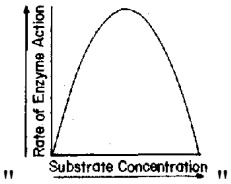
   A) Absorb more heat to denature the active site.
   **B) Add more enzyme.**
   C) Increase the substrate concentration.
   D) Decrease the substrate concentration.
   E) Add more active sites to the enzyme.

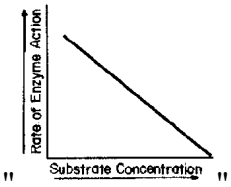
3. The following pairs have opposite effects on enzyme function EXCEPT

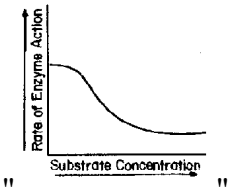
   A) cofactors and urea
   B) decreased temperature and increased substrate concentration
   C) sodium hydroxide and increased enzyme concentration
   **D) sulfuric acid and competitive inhibitors**
   E) coenzymes and repressors

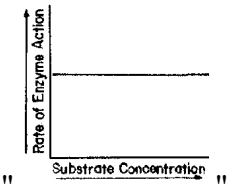
4. "Which figure best depicts the relationship between substrate concentration and enzyme activity?"

   **A)**
   
   

   B)
   
   

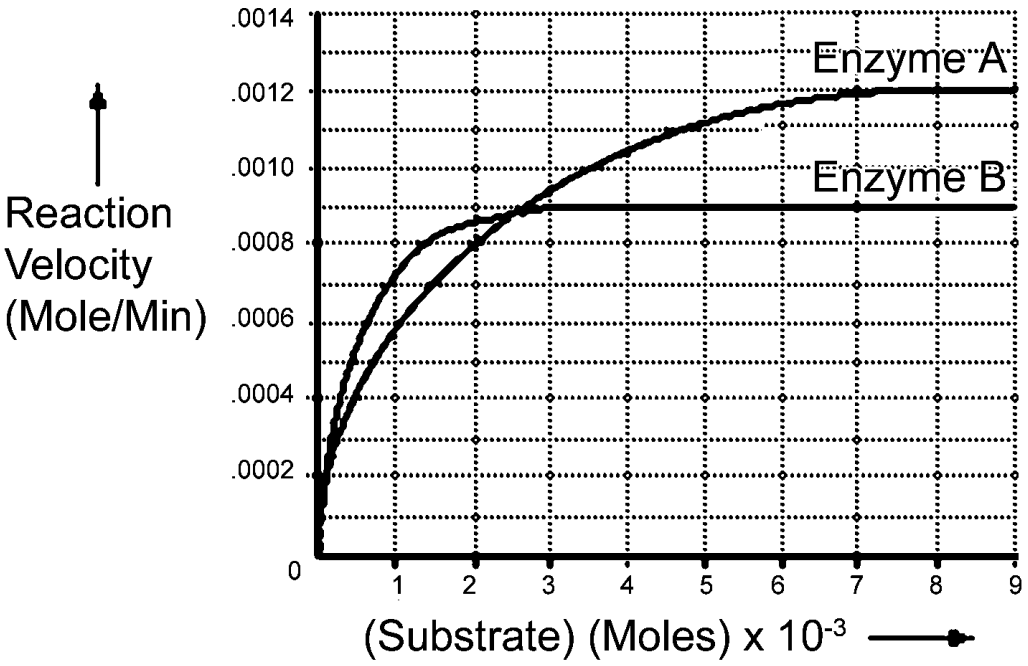
   C)
   
   

   D)
   
   

   E)
   
   

5. Base your answer to the following question on the graph and information below.

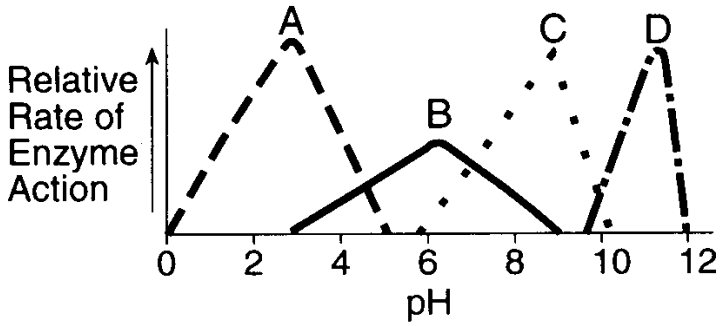
The reaction velocity was calculated for a culture containing protease and a constant excess supply of proteins starting from zero moles of substrate and is represented by the line denoting Enzyme A. A second culture was set up under the same conditions, except substance *X* was added and the results are indicated by the line denoting enzyme B.




Which of the following best accounts for the shape of the line for Enzyme B from the graph?

A) The active site was changed
**B) A competitive inhibitor was introduced into the culture**
C) Substrate was removed from the culture
D) Conformation of the enzyme has changed
E) None of the above

6. Base your answer to the following question on the graph below.




Which statement about the graph of enzyme activity is correct?

A) All four enzymes can work together at a certain pH.
B) Enzyme D works best at the most acidic pH.
**C) Enzyme D works best at the most alkaline pH.**
D) Enzyme A works best at the most basic pH.
E) Each enzyme works in both acidic and basic conditions.

7. Enzymes catalyze reactions by lowering the activation energy.

(a)Explain what is meant by the "induced fit" between enzyme and substrate.

(b)Describe the two types of enzyme inhibition. Discuss one specific example explaining the positive effects of enzyme inhibition within the human body.

(c) The human digestive system uses numerous enzymes in order to catabolize food molecules. Identify one digestive enzyme and explain its function. How would the body compensate for this enzyme if it were absent?

8. Cyanide is poisonous to humans because it

A) prevents complete gas exchange in alveoli
B) disrupts astrocyte function
**C) binds irreversibly to allosteric sites**
D) alters blood cell conformation
E) none of the above

9. The most accepted model of enzyme function is the

A) lock and key model
B) conformational hypothesis
C) substrate model
**D) induced fit hypothesis**
E) none of the above

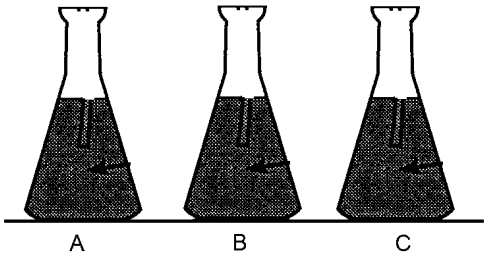
Base your answers to questions **10** through **12** on the information and diagram below.

A biologist prepares an analysis of the activity of the enzyme maltase, which promotes the hydrolysis of disaccharides to monosaccharides. Three flasks containing 10 milliliters of 4 percent maltose in water are prepared with the addition of the substances described below at time zero.

Beaker A: Addition of 0.6 ml 1% Maltase Solution

Beaker B: Addition of 0.6 ml Boiled Maltase Solution

Beaker C: Addition of 0.6 ml Distilled Water




10. After a few minutes, monosaccharides should be present in

**A) flask A only** B) flask B only
C) flask C only D) flasks A and B
E) flasks A, B and C

11. How can the biologist find proof for enzyme denaturation by observing starch digestion in the flasks?

**A) Compare flasks A and B a few minutes after time zero.**
B) Compare flasks B and C a few minutes after time zero.
C) Compare flasks A and C a few minutes after time zero.
D) Compare flask A at time zero and again few minutes later.
E) Compare flask C at time zero and again few minutes later.

12. If the object of this experiment was to test the effect of maltase on disaccharides, the control would be

A) flask A only B) flask B only
**C) flask C only** D) flask A and B
E) flask A and C

13. $E_1$ $E_2$ $E_3$
$A \rightarrow B \rightarrow C \rightarrow D$

In the series of enzyme reactions shown above, product C is able to occupy the active site of enzyme $E_1$. Product C can therefore inhibit the production of

A) $E_1$ B) A C) C D) $E_2$ **E) B**

# Answer Key
# Enzyme control

1. **B**
2. **B**
3. **D**
4. **A**
5. **B**
6. **C**
7. (essay)
8. **C**
9. **D**
10. **A**
11. **A**
12. **C**
13. **E**

# Answer Key
# Enzyme control

7. An enzyme can increase the rate of a reaction without itself being consumed by the reaction. By lowering the activation energy of reactions that are already destined to occur, enzymes make it possible for a cell to have a dynamic metabolism. The enzyme binds to a specific substrate and through a catalytic action converts the reactants to products. An enzyme can distinguish its substrate from compounds that are almost identical. For example sucrase will only act on sucrose, and will reject other disaccharides.
The specificity of an enzyme comes from the shape of its active site. A substrate must be compatible in shape to its correct enzyme. The enzyme is not a rigid structure, therefore once a substrate enters the active site, it induces the enzyme to change its shape slightly so that the fit is tighter. This "induced fit" is necessary for the enhancement of chemical reactions caused by weak interactions between hydrogen bonds and ionic bonds.
Some chemicals selectively inhibit the action of specific enzymes. Competitive inhibitors resemble the normal substrate molecule and compete for admission into the active site. These inhibitors reduce the productivity of the enzymes by blocking the correct substrate from entering the active site. To decrease the competition between the two substrates more enzyme can be added. A noncompetitive inhibitor impedes enzyme reactions by binding to another location on the enzyme, away from the active site. The binding causes the enzyme to change shape, which results in the active site becoming unreceptive to the substrate. An example of positive inhibition would be the drug penicillin. Penicillin blocks the active site of an enzyme that many bacteria use to make their cell walls, preventing addition bacterial growth.
Within the digestive system, many enzymes are used to breakdown the macromolecules in food. Salivary amylase is an enzyme secreted from the salivary glands into the mouth during the consumption of food. This is the first enzyme that contacts food and begins the breakdown of small polysaccharides and disaccharides. Without this enzyme, carbohydrate digestion would begin further down the digestive tract.