2025

AP® Biology

Sample Student Responses and Scoring Commentary

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Free-Response Question 5

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Question 5: Analyze Model or Visual Representation of a Biological Concept or Process — 4 points

Figure 1 shows the reactions of the metabolic pathway used to synthesize amino acid B from amino acid A in cells.

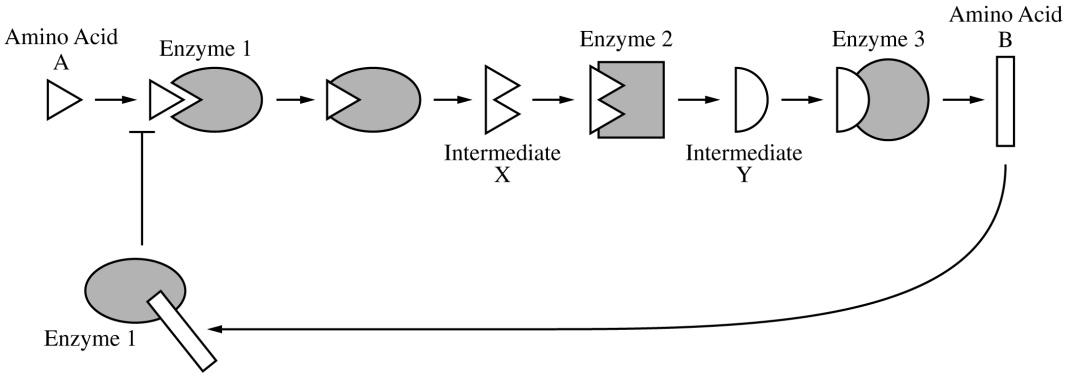

Figure 1. Synthesis of amino acid B from amino acid A

A	**Describe** a characteristic of an enzyme's active site that allows it to catalyze a specific chemical reaction. Examples of acceptable responses may include the following: • (The active site) is able to bind to a (specific) substrate/amino acid. • The shape/charge of the active site of an enzyme is compatible with a (specific) substrate/amino acid. • (The active site) positions the substrate/amino acid in a way that makes the reaction more likely. • Induced fit stresses bonds so that a reaction is more likely to occur.	**1 point**
B	Based on Figure 1, **explain** how the binding of amino acid A to enzyme 1 is regulated by amino acid B. Examples of acceptable responses may include the following: • Amino acid B inhibits the binding of amino acid A to enzyme 1. • Amino acid B binds to an allosteric site of enzyme 1 and prevents amino acid A from binding to enzyme 1. • The binding of amino acid B causes the enzyme to change shape and prevents amino acid A from binding to enzyme 1.	**1 point**
C	Using the information in Figure 1, **identify** the product of the reaction catalyzed by enzyme 2: intermediate X, intermediate Y, or amino acid B. • (Intermediate) Y	**1 point**
D	Based on Figure 1, **explain** how a change in pH could affect enzyme 3 in such a way that amino acid B cannot be produced. Examples of acceptable responses may include the following: • (A change in pH) could change the structure/active site/enzyme so that intermediate Y/the substrate cannot bind. • (A change in pH) could denature (enzyme 3) so that intermediate Y/the substrate cannot bind.	**1 point**

Question 5

Write your response to **QUESTION 5** on this page. Do not skip lines.

A each active site fits a specific substrate which catalizes a specific reaction depending on the substrate bound to the enzyme

B. when amino acid B is bound to enzyme 1, the binding of amino acid A to enzyme 1 is inhibited. Amino acid b is a noncompetitive inhibiter that changes the shape of enzyme 1 so amino acid A can no longer bind to the active site

C. intermediate Y is the product of the reaction catalyzed by enzyme 2

D. a change in pH could change the shape of enzyme 3 because it is not at its optimum which could cause intermediate Y to not be able to bond with enzyme 3 and therefore cause Amino acid B to not be produced.

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Q5526/10

Question 5

Write your response to **QUESTION 5** on this page. Do not skip lines.

A.) Active sites are specific to its substrate which is called lock & key, allowing specific chemical reactions.

B.) The binding of A is regulated by B as in the presence of B, enzyme 1 is allosterically inhibited, not allowing A to bind to it.

C.) The product of enzyme 2 is intermediate Y.

D.) If the pH is too low/acidic, enzyme 3 could denature, further prohibiting the reaction catalyzed that produces ~~enzyme B~~ amino acid B.

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Q5626/10

Question 5

Write your response to **QUESTION 5** on this page. Do not skip lines.

A) An enzyme's active site is shaped in a specific way to carry out a specific function - catalyzing a specific chemical reaction.

B) When Amino Acid B binds to Enzyme 1, Enzyme 1 inhibits the binding of Amino Acid A to Enzyme 1.

C) Amino Acid B

D) A change in pH could change the shape of Enzyme 3, preventing the binding of Intermediate Y and thus preventing the production of Amino Acid B

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Question 5

Note: Student samples are quoted verbatim and may contain spelling and grammatical errors.

Overview

NEW for 2025: The question overviews can be found in the *Chief Reader Report on Student Responses* on AP Central.

Sample: 5A
Score: 4

The response earned 1 point in part A for describing that "each active site fits a specific substrate." The response earned 1 point in part B for explaining that "when amino acid B is bound to enzyme 1, the binding of amino acid A to enzyme 1 is inhibited." The response earned 1 point in part C for identifying intermediate Y. The response earned 1 point in part D for explaining that "a change in pH could change the shape of enzyme 3 ... which could cause intermediate Y to not be able to bond with enzyme 3."

Sample: 5B
Score: 3

The response earned 1 point in part A by describing that "[a]ctive sites are specific to its substrate." The response earned 1 point in part B by explaining that "enzyme 1 is allosterically inhibited, not allowing A to bind to it." The response earned 1 point in part C by identifying intermediate Y. The response did not earn a point in part (D) because it does not explain that the denatured enzyme 3 would not be able to bind to the substrate Y.

Sample: 5C
Score: 2

The response did not earn a point in part A because it does not describe that the active site enables a substrate to interact with an enzyme. The response earned 1 point in part B for explaining that "Amino Acid B binds to Enzyme 1, Enzyme 1 inhibits the binding of Amino Acid A to Enzyme 1." The response did not earn a point in part C because it incorrectly identified amino acid B. The response earned 1 point in part D for explaining that pH "could change the shape of Enzyme 3, preventing the binding of Intermediate Y."