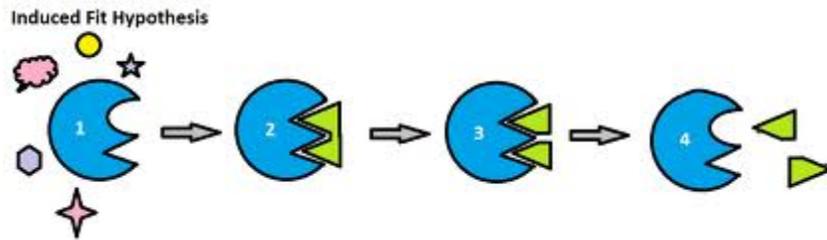


The Need for Speed—A Look at Enzyme Activity



Introduction:

Enzymes are **proteins** that are **catalysts**. This means they speed up **chemical reactions** in living organisms, but they aren't consumed in those reactions. Here are some important things you should know about enzymes:

- Enzymes are effective in **small amounts** (often too small to be detected by ordinary chemical tests) because they are **not used up** in the reaction that they catalyze.
- Enzymes are **specific** to the reactions that they catalyze, that is, each enzyme only catalyzes one specific chemical reaction. This relationship between the enzyme and its specific reaction is illustrated above in the picture and is described as a **"lock and key" relationship** (e.g. only one key fits into each lock).
- Enzymes do not affect the direction of the reaction but make the reaction reach equilibrium sooner by **lowering the activation energy** needed for the reaction to take place. **Activation energy** refers to the energy needed to get the reaction started.

Problem: How do enzymes function under different conditions?

Hypothesis: Form a hypothesis to answer the question above using "If...then...because..."

Purpose:

The purpose of this investigation is to demonstrate enzyme reactions and the environmental variables that affect these reactions.

Materials: Each team will need...

30 pennies	ball	lab tray
roll of masking tape	stop watch	

Procedure:

Part 1: Normal Enzyme Activity

1. Spread 30 pennies on one side of your lab table. The pennies represent the substrate and your hand will represent the enzyme.
2. One team member will attempt to pick up as many pennies as possible in 10 seconds. ***You must stop when the timer sounds!***
3. Place the lab tray on the other side of the lab table.
4. The team member picking up the pennies must observe the following rules:
 - a. Pick up only one penny at a time.
 - b. Take it back to the lab tray.
 - c. Lay it down FACE UP. This represents the product.
5. The other team members will be responsible for correctly recording the number of pennies picked up. ***Record your data in Data Table under Part 1.***
6. This process will be repeated for five more times.
7. Do not return the pennies until the end of Part 1.

Part 2: Denaturation

Denaturation is a form of non-competitive inhibition in which the enzyme changes shape. As a result, the substrate is not able to bind correctly and the enzyme becomes ineffective.

8. Tape your fingers together with masking tape. This represents denaturation. Your enzyme does not have the proper shape.
9. Your team will have 6 attempts at 10 second intervals to pick up as many pennies as possible.
10. **Record your data in Data Table under Part 2.**

Part 3: Competitive Inhibition

Competitive inhibition occurs when a substance other than the substrate blocks the active site, preventing the enzyme from binding.

11. Remove the tape from your fingers and tape the ball to the palm of your hand. This represents a molecule that binds with the enzyme to get in the way of the enzyme functioning.
12. Your team will have 6 attempts at 10 second intervals to pick up as many pennies as possible.
13. **Record your data in Data Table under Part 3.**
14. Calculate the averages for each part by adding the number of pennies collected in each trial and dividing by the number of trials.

Data Table Use a ruler to copy and complete.

Trials	Part 1 Normal Enzyme Activity	Part 2 Denaturation	Part 3 Competitive Inhibition
1			
2			
3			
4			
5			
6			
Averages			

Analysis Answer in complete sentences.

1. In this activity, what object represented the enzyme? the substrate? the inhibitor?
2. If we assume that the enzyme is represented by the hand, what happened to the active site during Part 2?
3. Why does an enzyme not work as well if its active site is changed?
4. What environmental factors affect the enzyme shape?
5. What effect did inhibition have upon the reaction rate?
6. Does your data support your hypothesis? Explain why or why not using your data.
7. Gelatin recipes that include frozen fruit often say not to use pineapple. Gelatin is mostly a protein. Pineapple contains an enzyme that is often used in meat tenderizers. What effect might pineapple have on gelatin? Why?

Conclusion

Write 3-5 meaningful sentences explaining what you learned about enzyme activity. Use appropriate vocabulary words in your explanation.