

Toothpickase

Remember that enzymes are proteins that act as catalysts to speed up reactions. The rate of an enzyme-catalyzed reaction can be affected by several factors, including substrate concentration, enzyme concentration, and the presence of inhibitors.

In this activity you will simulate how the function of an enzyme responds to a variety of changes in the environment. Your fingers will be the enzyme toothpickase, which breaks toothpicks in half. The enzyme substrate is a toothpick. To perform the reaction, place a toothpick between your thumb and forefinger of both hands and break it in half. Always break the toothpicks one at a time. Do not look at the desk or toothpicks as you break them.

Part A

1. Select 20 toothpicks and spread them out well on a desk. Do not line them up.
2. With one partner timing, determine how long it takes to break the 20 toothpicks as fast as possible.
3. Calculate the rate of enzyme activity in toothpicks per second.

Part B

4. Select 40 new toothpicks and spread them out on a desk. Do not line them up.
5. With one partner timing, determine how long it takes to break the 40 toothpicks as fast as possible.
6. Calculate the rate of enzyme activity in toothpicks per second.

Part C

7. Select 20 new toothpicks and spread them out randomly on a desk. Do not line them up.
8. This time both partners will break toothpicks. Measure the time required for both partners to break the toothpicks simultaneously.
9. Calculate the rate of enzyme activity in toothpicks per second.

Part D

10. If time permits, put on the heat-resistant gloves.
11. Select ten new toothpicks and spread them out on a desk. Do not line them up.
12. Determine how long it takes to break ten toothpicks as fast as possible.
13. Calculate the rate of enzyme activity in toothpicks per second.

Questions

1. What simulated the active site?
2. What conditions is each part of this activity meant to model?
3. Under what conditions did the fastest reaction rate occur?
4. Suggest a modification of the procedure to simulate an experiment showing the effect of each of:
 - a) competitive inhibitor
 - b) noncompetitive inhibition
 - c) change in temperature
 - d) change in pH
 - e) non-reversible inhibitor