

Name: _____

Date: _____ Pd: _____

Modeling Enzyme Catalyzed Reactions with Toothpicks

Setup

1. Divide into groups of three.
2. Each group member should obtain 50 toothpicks (for a total of 150 toothpicks per group). This may already be done for you.
3. In addition, one group member will need 15 nails, and one group member will need a bowl of ice water.

Part A

4. Blindfold one of your group members, and place 50 toothpicks on the table in front of him/her.
5. Start the stopwatch and say "go".
6. Once you say go, the blindfolded group member will pick up a toothpick, break it in half, place the two halves back in the pile, and continue to break as many toothpicks as possible.
7. If a broken toothpick is picked up, attempt to break it as if it were a whole toothpick (but don't actually break it), place it back in the pile and select another substrate (toothpick) to break.
8. After **ten** seconds have passed, stop breaking and count how many toothpicks have been broken—record in the data table below.
9. Mix all toothpicks evenly (broken and unbroken), and have the blindfolded group member break toothpicks for **20** more seconds.
10. After 20 seconds (a cumulative time of 30 seconds), record the *cumulative* number of toothpicks broken in the data table below.
11. Break toothpicks for **30** more seconds, and record the *cumulative* number of toothpicks broken in the data table below.
12. Break toothpicks for **30** more seconds, and record the *cumulative* number of toothpicks broken in the data table below.
13. Break toothpicks for **30** more seconds, and record the *cumulative* number of toothpicks broken in the data table below.
14. Break toothpicks for **60** more seconds, and record the *cumulative* number of toothpicks broken in the data table below.
15. Break toothpicks for **180** more seconds, and record *cumulative* number of toothpicks broken in the data table below.

Part B

16. Blindfold another group member; place 50 toothpicks and 15 nails on the table in front of him/her.
17. Follow steps 5-15.
18. If a nail is picked up, try to break it as if it was a toothpick. Once you realize it is not a toothpick, place it back in the pile, and pick up another substrate molecule.

Part C

19. Have the third group member soak their hands in ice water for three minutes (or as long as you can take).
20. Place 50 toothpicks in front of the group member and blindfold them.
21. Follow steps 5-15.

Reaction Rate = $\frac{(\text{final \# of broken toothpicks} - \text{Initial \# of broken toothpicks})}{(\text{final time} - \text{initial time})}$

Name: _____

Data Table

	Cumulative number of toothpicks broken		
Cumulative Time (seconds)	Part A	Part B	Part C
0	0	0	0
10			
30			
60			
90			
120			
180			
360			

Data Analysis – Make a Graph of your on the graph paper provided

Calculate the Reaction Rate from 10-90 seconds for each part and put in the box below. SHOW YOUR WORK!

	Part A	Part B	Part C
Work for Reaction Rate			
Final Answer			

Discussion

1. What part of this model illustrated the enzyme?
2. What part of this model illustrated the active site?
3. What part of this model illustrated the substrate?
4. What was the effect of low temperature on the reaction rate?
5. If temperature was increased, what would be the initial effect on reaction rate?
 - a. Would this effect continue indefinitely; explain why or why not.
6. What was the effect of adding a nail on the reaction rate?
7. What is the term that is used to describe the nail in this scenario?
8. When was the reaction rate the greatest?
9. When was the reaction rate the slowest?
10. List two ways to speed up reaction rate.
11. List two ways to slow down reaction rate.