**Toothpickase Activity**

Consider that your hands are like an enzyme called toothpickase. Your hands (the enzyme) can split toothpicks (your substrate) in half.

Part 1: How fast toothpickase works

Directions: Break as many toothpicks as you can without looking. Record how many toothpicks are broken in 10 second intervals.

|  |  |
| --- | --- |
| Time (seconds) | Number of toothpicks broken |
| 0 |  |
| 10 |  |
| 20 |  |
| 30 |  |
| 40 |  |
| 50 |  |
| 60 |  |
| 70 |  |
| 80 |  |
| 90 |  |

1. How does the number of toothpicks broken change over time?

## Part 2: Adding another substrate into the mix

Directions: Mix some paperclips in with your toothpicks. Break as many toothpicks as you can without looking. Record how many toothpicks are broken in 10 second intervals.

|  |  |
| --- | --- |
| Time (seconds) | Number of toothpicks broken |
| 0 |  |
| 10 |  |
| 20 |  |
| 30 |  |
| 40 |  |
| 50 |  |
| 60 |  |
| 70 |  |
| 80 |  |
| 90 |  |

1. How does mixing in a “wrong” substrate affect how many toothpicks are broken by toothpickase?

# Part 3: How temperature affects how fast toothpickase works

# *Directions: Time how long it takes you to break 10 toothpicks without looking. Then, ice your hands for a few minutes. Try breaking the 10 toothpicks again while timing yourself.*

|  |  |
| --- | --- |
| Temperature | Time to break 10 toothpicks (seconds) |
| Room temperature toothpickase |  |
| Cold toothpickase |  |

# 1. How does temperature affect the time in which toothpicks are broken by toothpickase?

# Conclusions

1. What is an enzyme? What is the enzyme is this activity?
2. What is a substrate? What is the substrate in this activity?
3. Write a sentence to describe how mixing in another substrate affects how fast an enzyme works.
4. Write a sentence to describe how temperature affects how fast an enzyme works.

Part 1: How fast toothpickase works

|  |  |
| --- | --- |
| Time (seconds) | Number of toothpicks broken |
| 0 |  |
| 10 |  |
| 20 |  |
| 30 |  |
| 40 |  |
| 50 |  |
| 60 |  |
| 70 |  |
| 80 |  |
| 90 |  |

## Part 2: Adding another substrate into the mix

|  |  |
| --- | --- |
| Time (seconds) | Number of toothpicks broken |
| 0 |  |
| 10 |  |
| 20 |  |
| 30 |  |
| 40 |  |
| 50 |  |
| 60 |  |
| 70 |  |
| 80 |  |
| 90 |  |

How does adding in a second substrate affect the enzyme? Use the graph to support your answer.

Graph your data from Part 1 and connect the dots to make a line. Then, graph your data from Part 2 and connect the dots to make a line. Use different colors for each line and make a key to the graph. Finally, answer the question.

**Toothpickase Efficiency**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Number of toothpicks broken |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Time (seconds)

 KEY