TOOTHPICKASE

**INTRODUCTION**

This activity will model enzyme action, demonstrating how different variables affect enzyme activity. You are to pretend that the toothpicks are the substrate to be broken down and your hand is an enzyme (*Toothpickase*). Notice that the enzyme (your hand) is much larger than the substrate (toothpicks.) As you will be performing the activity with your eyes closed, this simulates the random contact made between substrate and enzyme.

**PROCEDURE**

**The Rules for all groups:**

1. **You must keep your eyes closed throughout the entire activity.**

2. You must break each toothpick one at a time.

3. You must break each toothpick with one hand ONLY.

4. You must break each toothpick completely in half.

5. You cannot begin before the timer calls Go!

6. You must stop precisely when timer says STOP!

7. All trials will last 15 seconds.

**GROUP 1 – NORMAL ENZYME ACTIVITY**

1. Spread 50 toothpicks in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field

6. Repeat for 3 total trials

**GROUP 2 – INCREASED SUBSTRATE CONCENTRATION**

***\*This group will be working within a much smaller playing field so the toothpicks are closer together.***

1. Spread 50 toothpicks in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field

6. Repeat for 3 total trials

**GROUP 3 – DECREASED SUBSTRATE CONCENTRATION**

***\*This group will be working within a much larger playing field so the toothpicks are more spread out.***

1. Spread 50 toothpicks in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field

6. Repeat for 3 total trials

**GROUP 4 – INCREASED ENZYME CONCENTRATION**

***\*This group will have TWO people (enzymes) breaking toothpicks at the same time.***

1. Spread 50 toothpicks in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field

6. Repeat for 3 total trials

**GROUP 5 – ENZYMES ARE SUBSTRATE SPECIFIC (LOCK AND KEY MODEL)**

***\*Our enzyme (toothpickase) only works on REGULAR toothpicks. If the enzyme picks up a colored toothpick, the lab partners will say WRONG and the enzyme has to drop this toothpick.***

1. Spread 25 regular toothpicks and 25 colored toothpicks in your playing field.

2. If the enzyme picks up a colored toothpick, then the partners should say “WRONG” and

the enzyme should drop it and pick another.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field

6. Repeat for 3 total trials

**GROUP 6 – DENATURED ENZYMES**

***\*This group’s enzyme should tape their thumb and pointer finger together.***

1. Spread roughly 50 toothpicks in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field.

6. Repeat for 3 total trials.

**Group 7- Competitive Inhibitor**

***\* This group will have straws among their toothpicks. If the straws are picked up, the enzyme cannot grab another toothpick until they can break the straw in half.***

1. Spread 30 toothpicks and 20 straws in your playing field (inside the tape on your lab table)

2. When the clock starts, begin grabbing toothpicks and breaking them one at a time.

3. Your lab partners will count how many toothpicks you break as you go.

4. When time is up, record your data on your data table.

5. Reset the playing field.

6. Repeat for 3 trials.

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period:\_\_\_\_\_\_\_\_\_**

**My Group # \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Hypothesis:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Data Chart: My Group**

|  |  |  |  |
| --- | --- | --- | --- |
| **Trial 1** | **Trial 2** | **Trial 3** | **Average** |
|  |  |  |  |

**Class Data Chart**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Group #** | **Group 1** | **Group 2** | **Group 3** | **Group 4** | **Group 5** | **Group 6** | **Group 7** |
| **What did this group represent?** |  |  |  |  |  |  |  |
| **Average # of toothpicks broken** |  |  |  |  |  |  |  |

**Analysis Questions**

1. In this activity, what represented the enzyme?

2. In this activity, what represented the substrate?

3. In this activity, what represented the product?

4. Which group had the highest rate of enzyme activity? What variable did their group represent?

5. What do you think would happen to the enzyme activity rate if we doubled the amount of toothpicks in each trial?

6. What was the dependent variable in this activity?

7. What groups acted as the control for this experiement?

8. What causes an enzyme to become denatured? (Hint: there is more than 1 reason)

9. What kind of affect can the presence of competitive inhibitors have on how enzymes work?

**CRITICAL THINKING AND DATA ANALYSIS.**

Using the blank templates below, create two line graphs of how you think the rate of enzyme activity will be affected as enzyme concentration increases and as substrate concentration increases.

10. Explain your graphs in complete sentences, using the appropriate enzyme vocabulary.

\*Use the back of the paper to write your answers\*

