NAME: _____
BLOCK: _____ DATE: _____

TOOTHPICKASE: MODELLING ENZYME ACTIVITY

This lab is a model of enzyme activity. Your fingers are used to represent the ***enzyme "toothpickase."*** *The toothpicks are used to represent the* ***substrate****, and the* ***enzyme activity*** *is represented by the breaking of the toothpicks.* ***Toothpickase*** *is a DIGESTIVE ENZYME. It breaks down toothpicks into two units. To hydrolyse the toothpick, place a toothpick between the thumb and the first finger of each hand and break the toothpick in two pieces.*

This activity requires ***three people:*** *one "enzyme", one timer, and one recorder.*

PURPOSE: To simulate and model the effects of different factors on enzyme activity.

MATERIALS: one 1000 ml beaker or wide-mouthed bowl, flat wooden toothpicks, paper clips or pieces of wire, rubber gloves, stopwatch/timer, ice water

OBSERVATIONS AND RESULTS:

Trial #	Trial	# Broken	Reaction Rate
1	60 toothpicks, two hands		
2	50 toothpicks, 10 paperclips, two hands		
3	60 toothpicks, two hands (cold)		
4	60 toothpicks, two hands, rubber gloves		
5	60 toothpicks, one hand (two fingers only), rubber glove		

PROCEDURE:

Standard Enzymatic Reaction

1. Select approximately **60 wooden toothpicks** and place them in a **bowl**.
2. To represent an enzymatic reaction, you will **CLOSE YOUR EYES** and break as many toothpicks as you can in **30 seconds**. ***You can only break one toothpick at a time***. Once a toothpick is broken, return it to the bowl. You cannot break a toothpick more than once. The timer should tell you when you should start and stop. The recorder should record your total and then calculate the number of toothpicks per second that you broke. It is okay if you get a decimal as your answer.

Inhibition

3. To simulate **inhibition**, add **10 straightened paper clips (cut to same length as toothpicks)** and 50 wooden toothpicks to the bowl. Repeat step 2.

Temperature

4. Re-set the bowl to contain 60 toothpicks. To simulate the effect of **temperature** on enzyme activity, place your hand in **cold water** for 2 full minutes. (CAUTION: If your hand begins to cramp up and hurt, remove it from the water). Repeat step 2.

Slight Denaturation

5. Re-set the bowl to contain 60 toothpicks. To simulate the effect of **slight denaturation** on enzyme activity, cover your hands with **rubber gloves**. Repeat Step 2.

Massive Denaturation

6. Re-set the bowl to contain 60 toothpicks. To simulate the effect of **massive denaturation** on enzyme activity, put a rubber glove on **one hand** and **use only two fingers** to break the toothpicks. Repeat Step 2.

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QUESTIONS

1. What would you expect to happen to the **rate** of the "enzymatic reaction" if we added:
   a) more substrate (toothpicks)?

   b) more enzyme (hands)?

2. The following is the equation for a typical enzymatic reaction:

$$\mathbf{E + S \rightarrow ES \rightarrow E + P}$$

(***E*** *= enzyme,* ***S*** *= substrate,* ***ES*** *= enzyme-substrate complex, and* ***P*** *= product)*

   Write the equation for the enzymatic reaction that was demonstrated in this activity.

3. Explain how the paper clips act as inhibitors in the enzymatic reaction that was demonstrated in this activity.

4. Explain (in scientific terms) how lowering the temperature of the enzyme affects enzyme activity.

5. Which do you think will have a greater effect on enzyme activity: temperature or inhibition? Explain in scientific terms.

6. How is inhibition related to denaturation?