Name: **SAMPLE Results**

"PAPERCLIPASE" ACTIVITY

C /8 A /13

INTRODUCTION

This is a lesson in enzyme action, demonstrating the natural increase in reaction rate, the leveling off of the reaction and the subsequent drop in products produced as the substrate is used up. You are to pretend that paperclips are the substrate to be put together and your hands are an enzyme, complete with an active site (between your fingers and thumb.) Notice that the enzyme (your hand) is much larger than the substrate (paperclips). As you will be performing the activity with your eyes closed, this simulates the random contact made between substrate and enzyme. The object of the activity is to hook as many paper clips together into **dimers** as possible in 1.5 minutes.

During the activity, you will also notice that the substrates will not hook together unless you find just the right spot (the bonding site) and that you will naturally find a maximum rate of reaction, the top speed at which your hands can find and connect monomers. This speed may lower during the activity as your hands become tired and the substrates get more and more scattered in the solution (your desk). Throughout the activity, notice that the enzyme (your hands) remains unchanged throughout the reaction.

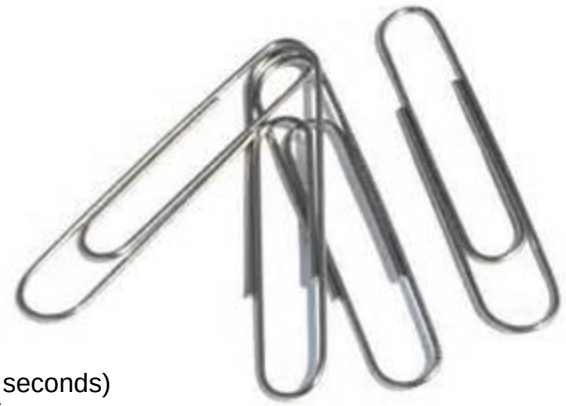
MATERIALS

Paperclips Stopwatch Calculator Socks Tennis Ball

PROCEDURE

The Rules:

1. You must only connect 2 paperclips at a time
2. You must check to ensure paperclips have been connected.
3. You cannot begin before the timer calls Go!
4. You must stop <u>precisely</u> when timer says STOP!
5. You must keep your **eyes closed** throughout the entire activity.



1. Baseline

1 Spread the paperclips on the lab table in a random pile.
2. When Ms. Loree yells "GO!" begin connecting paperclips.
3. After 10 seconds, Ms. Loree will yell STOP!
4. Count and record the number of paperclip dimers created.
5. Repeat for 20, 30, and another 30 more seconds. (A total of 90 seconds)
6. Record the **<u>total number</u>** of paperclip dimers created at each time.

2. Enzyme concentration

1 Disconnect previously connected paperclips
2 Spread paperclips on the lab table in a random pile.
3. **2 people will be acting as enzymes and connecting paperclips at the same time.**
4. Repeat the same procedures at the baseline but keep track of your own time.

3. Partial Denaturation

1 Disconnect previously connected paperclips
2 Spread paperclips on the lab table in a random pile.
3. **Socks will be worn over your hands to represent a shape change in the enzyme (partial denaturation). Only one person (2 hands) will act as an enzyme.**
4. Repeat the same procedures at the baseline but keep track of your own time.

4. Competitive Inhibition

1 Disconnect previously connected paperclips
2 Spread paperclips on the lab table in a random pile.
3 The "enzyme" bounce a ball while performing the enzyme function. You will, bounce a ball twice with each hand before putting a dimer together. This simulates the process of competing for the active site.
4. Repeat the same procedures at the baseline but keep track of your own time.

5. Role of a Coenzyme

1 Disconnect previously connected paperclips
2 Spread paperclips on the lab table in a random pile.
3 A paper clip collector (with their eyes open) picks up the clips as the "enzyme" is putting a dimer together and has more ready when the enzyme binding sites are empty. This simulates the function of coenzymes as helpers to enzymes.
4. Repeat the same procedures at the baseline but keep track of your own time.

Table 1: **Enzyme SAMPLE Results**

Situation	Total # of Dimers Created Since the Beginning @			
	10 sec	30 sec	60 sec	90 sec
1. Baseline	4	15	31	48
2. Enzyme Concentration	7	18	38	52
3. Partial Denaturation	2	8	18	28
4. Competitive Inhibition	2	6	15	24
5. Role of a Coenzyme	6	15	34	48

RESULTS: [C 8]

Create a graph with your data (time vs. dimers created) for all 5 situations (HINT: Line graph with 5 lines)

DISCUSSION: [A 13]

1. What represents the active site in this activity? [1]

2. Which situation has the fastest rate of reaction? It is what you expected? Explain [2]

3. Draw another line on your graph that shows what an increase in substrate concentration would look like. Clearly label it. Explain your predicted shape/slope [2]

4. a) In what way**s** is this activity **different** than actual enzymatic activity in a cell? [2]

   b) In what ways is it **similar** to actual enzymatic activity in a cell? [2]

5. a) In the partial denaturation simulation, what happened to the efficiency of the enzyme's activity? Explain this in the terms of enzyme structure and function. [2]

   b) What condition**s** might cause this type of change in enzymes? [2]