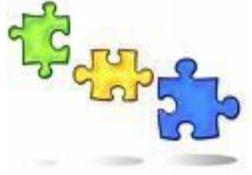


# The Puzzling Nature of Enzymes

academic



Name: \_\_\_\_\_ Per: \_\_\_\_\_ Date: \_\_\_\_\_

## Phenomena:

Observe the [pictures/video](#) of the Siamese cat. List observations and questions that develop.

**Directions:** Today you are the enzyme puzzlease. **This enzyme is responsible for putting together puzzles.** Under different conditions your group will act as the enzyme puzzlease to assemble a puzzle. The enzyme's activity rate will be measured by number of seconds per assembled puzzle piece.

## Procedure guidelines:

- ✓ Students will complete the puzzle without tape and then complete puzzle with wrapped fingers (denatured enzyme). Maximum time allowed to complete puzzle is 20 minutes.
- ✓ One phone per group will be used as a timer to record time taken to complete puzzle.

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**Group Prediction:** How will the condition (wrapped fingers) affect the rate of the puzzlease enzyme?

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## Investigate:

Design an experiment to explore enzyme activity by building a puzzle.

### Experimental Design

Independent variable: \_\_\_\_\_

Dependent variable: \_\_\_\_\_

Constants (provide 3): \_\_\_\_\_

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Control group: \_\_\_\_\_

Title: Time in seconds per puzzle piece assembled in different conditions

	Hand Wrapped with tape (denatured enzyme)	Hand unwrapped (normal enzyme)
Your group		
Additional group's data		
Average		

**Measuring Math Competency**

In the space provided, construct a formula that will allow you to calculate the speed of the reaction (i.e. time per assembled puzzle piece) under your chosen condition. Identify the proper formula you will use, write your formula, and show your calculations **FOR BOTH CONDITIONS.**

**Variables:**

- X = total number of assembled puzzle pieces
- Y = time (seconds) needed to complete puzzle (1200 seconds = 20 min)
- Z = Time in sec/assembled puzzle piece. (Rate of reaction)

**Formula:** Choose the proper formula to calculate puzzle assembly reaction rate. Circle the formula and calculate in the open space.

1.  $(z)(x) = y$
2.  $(x)(y) = z$
3.  $x / y = z$
4.  $y / x = z$

**Calculations**

Average Reaction Rate for normal enzyme: **Hand Unwrapped**

Average Reaction Rate for denatured enzyme: **Hand wrapped**

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High School: Understanding and Applying Number Systems  
I understand the world of numbers and can quantitatively solve problems using a variety of mathematical strategies fluently.

Indicators	Not Yet	Progressing	Competency	Mastery			
Score →	.5 4	1	1.5	2	2.5	3	3.5
1b. Manipulate equations and formulas using arithmetic and algebraic properties.	I can...identify steps and/or properties that could be used to manipulate an equation or formula.	I can...use properties to complete some steps toward manipulating an equation or formula.	I can...manipulate an equation or formula using appropriate properties.	I can...select and apply properties to efficiently manipulate an equation or formula.			

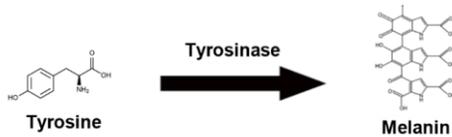
## Analysis Questions

1. How did this activity represent enzyme activity? Write the letter of the correct term from the right column next to the term in the left column.

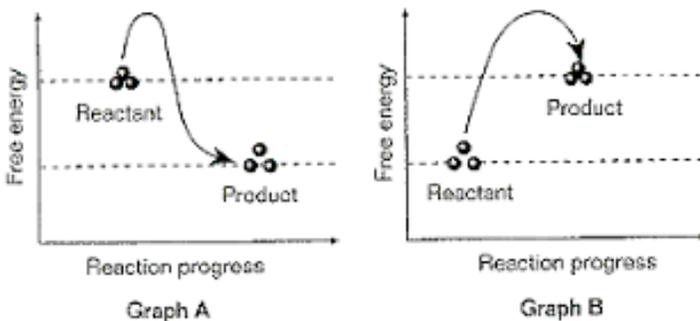
1.	Hands	A.	Enzyme
2.	Student	B.	Taped Hands
3.	Puzzle Pieces	C.	Active Site
4.	Completed Puzzle	D.	Substrate (reactant)
5.	Denatured enzyme	E.	Product

2. Did the data support the prediction? Explain.

3. Tyrosinase is an enzyme that builds melanin which is a pigment which makes fur dark. Label the chemical reaction below with the terms: product, substrate, and enzyme. Is this reaction a lytic or synthetic reaction? How do you know?



4. Which [chemical reaction graph](#) below would accurately show the chemical reaction above?



5. The Siamese cat has a mutation in tyrosinase that makes it denature (not work properly) in warm temperatures. Therefore in this species of cat it turns fur dark in cooler temperatures only. How would the graph below be changed to show this change? Explain.

