

## Enzyme Cut-outs Activity

**Objective:** Enzymes are proteins that help chemical reactions occur at a faster rate by lowering the energy needed for the reactions. First, the enzymes react with a substrate to form an enzyme-substrate complex (like a lock and key). Once this complex is formed, the substrate becomes a product or products and leaves the enzyme. The enzyme can then repeat the reaction with more substrate. The enzyme is shaped so it will react with only one specific substrate. On the next page are shapes of enzymes, substrates, and products. Your job will be to cut them out, manipulate them, glue them, and explain the reaction that occurs. Complete Parts A, B, C, D.

### Materials

directions and class notes	construction paper	glue
cut-out sheet	scissors	pen or pencil

### Part A

Vocabulary—define the following terms (hint: you can use your notes!)

enzyme –  
 catalyst –  
 chemical reaction –  
 activation energy –  
 substrate –  
 active site –  
 denatured –

### Part B

1. Using one sheet of the cut-out paper, cut out all the enzymes, substrates, and products.
2. Organize the cut outs on the construction paper so the pieces demonstrate this equation:  

$$\text{enzyme} + \text{substrate} \rightarrow \text{enzyme-substrate complex} \rightarrow \text{enzyme} + \text{product 1} + \text{product 2}$$
3. Glue the cut outs in the appropriate places on the construction paper.
4. **Label** the cutouts that you glued as the following compounds:

Enzyme = lactase  
 Substrate = lactose  
 Products = glucose and galactose

5. With the above terms and equation, **explain** what happened (write your explanation on the same side of construction paper). Use as many vocabulary words from Part A as you can.

### Part C

1. Using the other sheet of the cut-out paper, cut out all enzymes, substrates, and products.
2. Follow the directions as above, this time demonstrating this equation:  

$$\text{Enzyme} + \text{substrate 1} + \text{substrate 2} \rightarrow \text{enzyme-substrate complex} \rightarrow \text{enzyme} + \text{product}$$
3. As with the previous sheet, glue and **label** the cutouts as the following compounds:

Enzyme = Sucrase  
 Substrates = glucose and fructose  
 Product = sucrose

4. With the above terms and equation, **explain** what happened (write your explanation on the backside of construction paper). Use as many vocabulary words from Part A as you can.

### Part D

Each enzyme works best at a certain temperature and pH. Below or above an enzyme's optimal temperature or optimal pH, the reaction is slower.

1. Using the table and grid below, **graph** the data to determine the optimum temperature for the enzyme catalase which speeds up the following reaction:  $\text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2$ .
2. Describe the line that you just drew; what happens as temperature increases?
  
3. What is the optimum temperature for which the enzyme activity is the greatest for this reaction? \_\_\_\_\_

Temp (°C)	Reaction Rate (mol/min)
5	0
10	5
20	15
25	20
30	22.5
35	25
40	22.5
42.5	15
45	0
50	0
55	0
60	0



