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 –

THEN—fold your card strip into four sections.

NEXT – open your card strip and draw a line lengthwise along the middle

THEN: color the diagrams on the white cardstock according to the following:
- Enzyme – PINK
- Triangular Substrate - PURPLE
- Product 1 - BLUE
- Product 2 - RED
- Square Substrate 1 - YELLOW
- Square Substrate 2 - BLUE
- Rectangular Product - GREEN

**Part B: HYDROLYSIS**

1. In the first block of your strip, label the TOP with the word **Hydrolysis**

Then - Using the enzyme cut-out card stock paper, cut out all of the triangular shaped enzymes, substrates, and products.

2. ACROSS THE TOP: Organize the cut outs on the remaining blocks of your strip so the pieces demonstrate this equation:
   
   enzyme + substrate → enzyme-substrate complex → enzyme + product 1 + product 2

3. Glue the cut outs in the appropriate places on the construction paper and then label each block with the above terms.
Part C: DEHYDRATION SYNTHESIS

1. In the first block of your strip, label the BOTTOM with the words **Dehydration Synthesis**

Then - Using the enzyme cut-out card stock paper, cut out all of the square/rectangular shaped enzymes, substrates, and products.

2. ACROSS THE BOTTOM: Organize the cut outs on the remaining blocks of your strip so the pieces demonstrate this equation:

   Enzyme + substrate 1 + substrate 2 → enzyme-substrate complex → enzyme + product

Part D: Graphing

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 data table, **graph** the data to determine the optimum temperature for the enzyme catalase which speeds up the following reaction:

   \[ \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{O} + \text{O}_2. \]

   **Don’t forget to include a title!**

2. Describe the line that you graphed; what happens as the temperature increases?

3. What is the optimum temperature for which the enzyme activity is the greatest for this reaction?

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<th>Temp (°C)</th>
<th>Reaction Rate (mol/min)</th>
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