**Enzyme Cut-out Activity**

**Objective**: Enzymes are proteins that help chemical reactions occur at a faster rate by lowering the energy needed for the reactions (activation energy). 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.

**Part A**

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

enzyme –

catalyst –

chemical reaction – activation energy – substrate –

active site –

denatured –

First – Fold your paper long ways. Open your card strip and draw a line lengthwise along the middle



Then: color the diagrams on the white paper according to directions below then cut out each piece.

Enzyme – PINK

Triangular Substrate - PURPLE Square Substrate 1 - YELLOW

Product 1 - BLUE Square Substrate 2 - BLUE

Product 2 - RED Rectangular Product - GREEN

**Part B: Enzymes Can Break Down Substrates**

1. Label the TOP half of your colored paper with the words **Enzymes Can Break Down Substrates**

2. Organize and glue the cut outs on the colored paper so the pieces demonstrate this equation:

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

3. **Label** the cutouts that you glued as the following compounds:

**Enzyme = lactase**

**Substrate = lactose**

**Products = glucose and galactose**

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

**Part C: Enzymes Can Join Substrates**

1. Label the BOTTOM half of your colored paper with the words **Enzymes Can Join Substrates**
2. Organize the cut outs so the pieces demonstrate this equation:

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

1. **Label** the cutouts that you glued as the following compounds:
2. As with the previous example, glue and label the cutouts as the following compounds:

**Enzyme = Sucrase**

**Substrates = glucose and fructose**

**Product = sucrose**

1. 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.

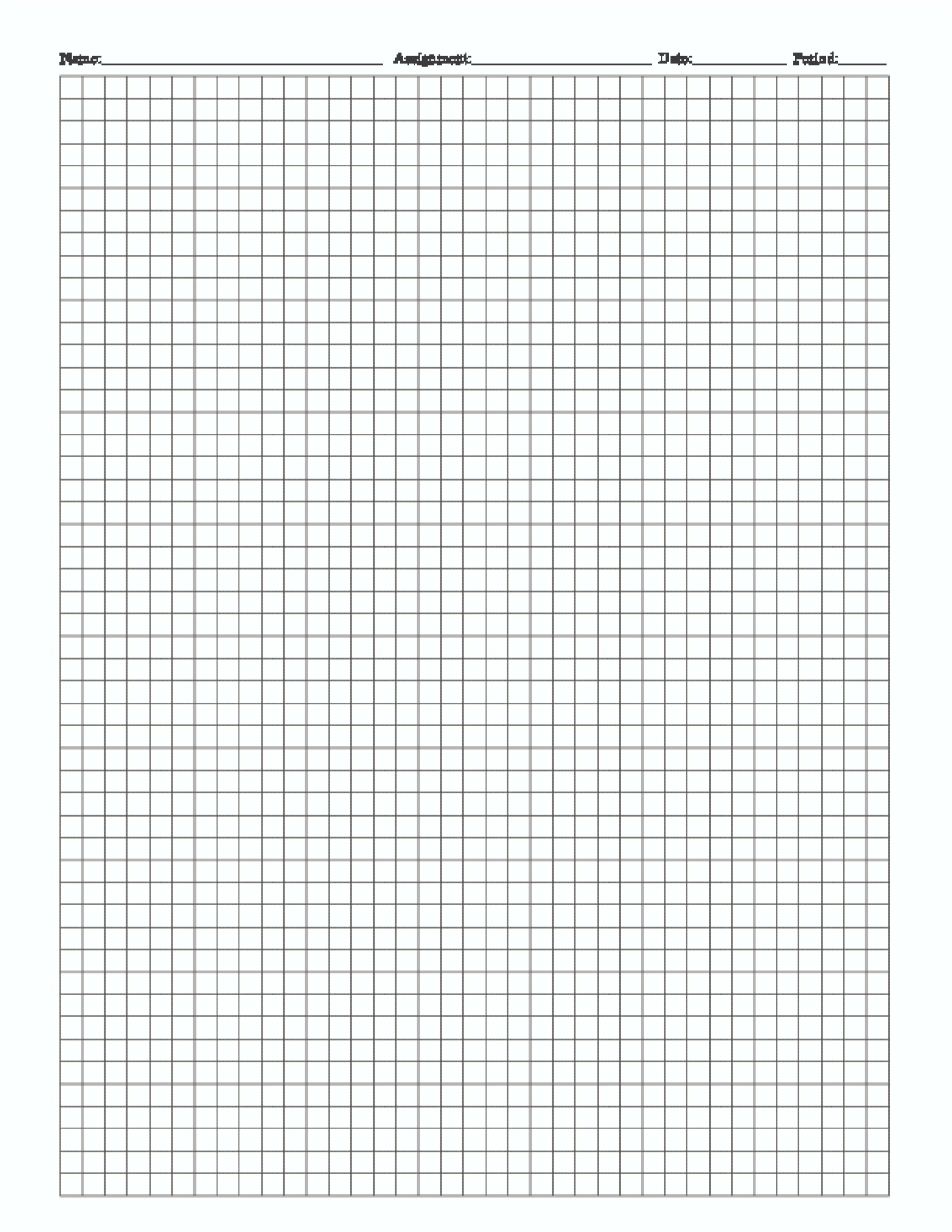
**Part D: Graphing**

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. Label the axes and title the graph below. Using the data table, **graph** the data to determine the optimum temperature for the enzyme catalase which speeds up the following reaction:

H2O2 H2O + O2.



* 1. Describe the line that you graphed; what happens as the temperature increases?
  2. What is the optimum temperature for which the enzyme activity is the greatest for this reaction?

|  |  |
| --- | --- |
| **Temp**  **( oC)** | **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 |

