Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Section \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Group Members \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Lab 17: Enzyme Activity**

**Purpose**: Looking back at our entry document, create a purpose of this lab. Note: to receive an “Integrating” grade, you MUST include outside research.

**Hypothesis:** Write down a hypothesis predicting the best temperature for your enzyme and explain why you chose this temperature.

*Things to consider: Where is this enzyme normally found? What is the temperature of where the enzyme is normally found?*

**Variables:** Identify your independent, dependent, and standardizing variables for your enzyme

|  |  |  |
| --- | --- | --- |
| THE SKILL ASSESSED | Integrating10, 9.5, 9 | Applying8.5, 8, 7.5 |
| Science 0: Experiment Set-Up | a. PURPOSE:  Writes a clear purpose including outside researchb. HYPOTHESIS: Creates an appropriate hypothesis that predicts experimental results and thoughtfully explains reasoning for predictionsc. VARIABLES: Explicitly distinguishes among independent, dependent, and standardizing variables | a. PURPOSE: Writes a clear purposeb. HYPOTHESIS: Creates an appropriate hypothesis to answer a problem or guiding question and explains reasoningc. VARIABLES:  Distinguishes among independent, dependent, and standardizing variables |

**Materials**:

- Safety Goggles

- Enzyme solutions

- Substrate Mixtures

- Test tubes & test tube holders

- Thermometer

- Stopwatch

- Temperature Stations (hot plates & beakers set to appropriate temperature)

**Enzyme Lab Procedure**: Using the table below, write down what enzyme you are collecting data for and which substrate you will be using to test your enzyme’s activity.

Partner \_\_\_\_\_\_ Enzyme \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Substrate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| **Lab Partner** | **Enzyme** | **Substrate** |
| A | Lactase | Milk |
| B | Amylase  | Refried Beans |
| C | Alpha-Galactosidase | Corn starch |
| D | Maltase | Edamame |

**For the experiment**:

Part I:

1. At each temperature station (0, 20, 40, 60, 80, and 100oC), record the temperature in the table below (Note: it will not be exactly 0, 20, 40, 60, 80 or 100 oC, but it will be close).

2. In the corresponding test tube, place 10 mL of your ENZYME into your substrate mixture.

**Example:** If you’re **Partner A** at the **20 oC station** studying lactase activity, you will

place **10mL of the lactase solution** into your **20 oC test tube** that already has **10 mL of milk.**

\*\*\****Be sure you do not contaminate the enzyme solution!\*\*\****

3. Dip a glucose test strip into each tube and remove. USE A SEPARATE TEST STRIP FOR EACH MEASUREMENT.

4. Wait **3 minutes** and then using the glucose reading chart, record the concentration of glucose in your table.

Part II:

5. Insert and hold the correct test tube in the designated temperature station for **2 minutes**

 **Example:** **40 oC test tube** is placed in **40 oC station.**

6. After **2 minutes** have passed, dip a glucose test strip into each tube for **2 seconds** and remove. USE A SEPARATE TEST STRIP FOR EACH MEASUREMENT.

7. Wait **3 minutes** and then using the glucose reading chart, record the concentration of glucose in your table.

|  |  |  |
| --- | --- | --- |
| THE SKILL ASSESSED | Integrating10, 9.5, 9 | Applying8.5, 8, 7.5 |
| Science 1: The Scientific Method and Experimental Design | a. EXPERIMENTAL DESIGN: Meticulously designs an experiment and identifies different experimental and control groupsb. PROCEDURE: Includes clear step-by-step description of experimental procedures (all steps are specific and include materials) - an outside observer can conduct the experiment using the procedures without prior knowledge of content | a. EXPERIMENTAL DESIGN: Designs a well-thought out experiment and identifies different experimental and control groupsb. PROCEDURE:  Includes a step-by-step description of experimental procedures (most steps are specific and include materials) - an outside observer might have some problems trying to conduct the experiment using the procedures without prior knowledge of content |

**Table of Values**

Partner \_\_\_\_\_\_ Enzyme \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Substrate \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |
| --- | --- |
| **Temperature** | **Glucose Concentration** |
| **Before** | **After** |
| 0oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |
| 20oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |
| 40oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |
| 60oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |
| 80oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |
| 100oCActual Temperature measured: \_\_\_\_\_\_\_\_\_ |  |  |

8. Once all your enzyme’s data is collected, construct a scatter plot of your enzyme’s activity on graph paper (**DO NOT CONNECT DATA POINTS!**) Be sure to create appropriate scales, label both axes, give a specific title, and plot all values for your particular enzyme.

|  |  |  |
| --- | --- | --- |
| THE SKILL ASSESSED | Integrating10, 9.5, 9 | Applying8.5, 8, 7.5 |
| Science 3: Presents Quantitative Data | a. TABLES: Student designs charts and tables in creative ways and in great detailb. CALCULATIONS: Student shows all calculations, all steps, and solves correctly with appropriate unitsc. GRAPH: Constructs appropriate graph from experimentally obtained data, including properly scaled and labeled axes, a title, AND *correct captions under all graphs* | a. TABLES:Student designs charts and tables  in conventional ways b. CALCULATIONS: Student shows most calculations and steps while using correct unitsc. GRAPH: Constructs appropriate graph from experimentally obtained data, including properly scaled, labeled axes and title |

**Conclusion**

***Sentence starters:***

In light of the data, my hypothesis was… because…

 -Specific data that (supported/did not support) my hypothesis…

Some trends I saw in my data were…

My findings will help me determine which enzyme to market because…

An error that could have occurred was…

 -This would have effected…

A second error that could have occurred was..

 -This would have effected…

To help make my data more accurate I could…

 -This would have improved…

In order to make a proposal about which enzyme to market, I still need to…

|  |  |  |
| --- | --- | --- |
| THE SKILL ASSESSED | Integrating10, 9.5, 9 | Applying8.5, 8, 7.5 |
| Science 4: Conclusion and Discussion of Experiment | a. HYPOTHESIS: Accurately evaluates and explains the original hypothesis **in light of the data**b. TRENDS: Exceptionally makes objective conclusions, analyzes, and **defends the data** for trends and patterns using scientific conceptsc. CONNECTIONS: Insightfully relates or connects the activity and experimental results to **concepts learned in class** d. WEAKNESSES: Thoughtfully critiques experiment by identifying sources of error and correctly explains in great detail how weaknesses in lab might have **altered their data**.e. IMPROVEMENTS: Comprehensively suggests improvements and recommendations for further studying  | a. HYPOTHESIS: Evaluates the original hypothesis in light of the datab. TRENDS: Makes objective conclusions, analyzes, and defends the data for trends and patterns using scientific conceptsc. CONNECTIONS: Relates or connects the activity and experimental results to concepts learned in class d. WEAKNESSES: Critiques experiment by identifying sources of error and explains how weaknesses in lab might have altered their datae. IMPROVEMENTS: Suggests improvements and recommendations for further studying |