**Anatomy & Physiology 12** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_date:\_\_\_\_\_\_\_\_\_blk:\_\_\_\_

**ONLINE ENZYME SIMULATION LAB**

<http://glencoe.mheducation.com/sites/dl/free/0078802849/383930/BL_11.html>

**Research Question:** How do substrate concentration and pH affect enzyme-controlled reactions?

**Objectives:**

* Determine the effect of substrate concentration on the initial rate of an enzyme-catalyzed reaction.
* Determine the effect of pH on the initial rate of an enzyme-catalyzed reaction.

**Background information: (read and highlight)**

To sustain the processes of life, a typical cell carries out thousands of biochemical reactions each second. Many of these reactions require the help of enzymes. Enzymes are proteins that speed up the rate of chemical reactions. Many important processes in the body involve the work of enzymes, including the digestion of nutrients such as carbohydrates, proteins and fats.

Enzymes are organic catalysts. A catalyst is a chemical that controls the rate of a reaction, but is itself not used up in the process. Reactions that are accelerated due to the presence of enzymes are known as enzyme-catalyzed reactions.

Enzymes are proteins that accelerate chemical reactions but do not change themselves in the reaction. Enzymes enable molecules to undergo chemical changes, forming new substances called products. Substrates are molecules that are acted upon by enzymes. For instance, amylase, an enzyme found in saliva, helps break down complex starch molecules (substrates) into smaller sugar molecules (products). In other biochemical reactions, substrates require assistance of specific enzymes to form new products.

Each substrate fits into an area of the enzyme called the active site. This fitting together is often compared to a lock-and-key mechanism. However, researchers believe that the fit between enzyme and substrate need not be exact. Enzymes are viewed as flexible keys that can shape and conform to the shape of the substrate.

**Procedure:**

1. Follow the directions for the simulation on the left side bar of the screen.

2. Click on the TV, it will show you a short video explaining enzyme activity.

3. Manipulate the materials and gather data, record your data in the data table below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Amt of substrate (g)** | **pH 3** | **pH 5** | **pH 7** | **pH 9** | **pH 11** |
| **0.5** |  |  |  |  |  |
| **1.0** |  |  |  |  |  |
| **2.0** |  |  |  |  |  |
| **4.0** |  |  |  |  |  |
| **8.0** |  |  |  |  |  |

4. Graph your data!! Check labelling of graph, use multiple colours if needed.

**Remember there are 2 objectives:**

* Determine the effect of substrate concentration on the initial rate of an enzyme-catalyzed reaction.
* Determine the effect of pH on the initial rate of an enzyme-catalyzed reaction.

5. Answer the Analysis Questions

**Analysis Questions: These are to be answered AFTER you graph your data!**

1. Describe the relationship between substrate concentration and the initial reaction rate of an enzyme-catalyzed reaction. Is this a linear relationship? What happens to the initial reaction rate as substrate concentration increases?

2. What is the maximum initial reaction rate for this enzyme at pH 7?

3. Explain why the maximum initial reaction rate cannot be reached at low substrate concentrations.

4. What does your data indicate about the optimum pH level for this enzyme-catalyzed reaction?

5. Enzymes function most efficiently at the temperature of a typical cell, which is 37 degrees Celsius. Increases or decreases in temperature can significantly lower the reaction rate. What does this suggest about the importance of temperature-regulating mechanisms in organisms? Explain.