Altering Enzymes w/Vernier

In this lab we will be using the enzyme catalase. Catalase is found in all living cells and is used to break down Hydrogen Peroxide (H_2O_2). Hydrogen peroxide is a by-product of cellular metabolism and is toxic (poisonous) to a cell. Catalase and H_2O_2 fit together like a lock and its key. As long as the key (catalase) fits the lock (H_2O_2), the enzyme catalase can function at it's optimal rate. If the key or lock change their shape in any way, it can affect the reaction rate.

When catalase and H_2O_2 are in contact with one another the catalase enzyme breaks the H_2O_2 substrate into liquid water (H_2O) and gaseous oxygen (O_2). We can observe the gas formed and use the temperature of the reaction to rate the reactivity of the enzyme under various conditions. As the reactivity of an enzyme increases, then we would expect the temperature of the reaction to also increase.

Purpose:

Materials:

Procedure:

Alter pH of Enzyme

1. Get five test tubes and put .5 ml catalase in each test tube.
2. Get five test tubes and put .5 ml Hydrogen Peroxide in each test tube.
3. Label your test tubes and treat the catalase with .5 ml of the following solutions: HCl at pH 1, HCl at pH 3, Water at pH 7, NaOH at pH 9, NaOH at pH 11.
4. Let each test tube sit for 10 minutes.
5. Connect the temperature probe to LabQuest
6. Insert tip of probe into catalase solution at pH 1. Wait for temperature to stabilize.
7. When the temperature has stabilized tap the play button (arrow button in left-bottom corner of screen). This starts recording data and the screen will turn to a graph.
8. Add .5 ml H_2O_2 to the extract and carefully observe the reaction.
9. When the reaction temperature peaks, continue recording data for an additional 20 seconds then tap the stop button. (the same button that you used for play, but now has a square symbol.)
10. In your data table describe the reaction. Pay attention to the size of the bubbles, height they rise in the tubes, and the frequency in which they are produced.
11. Record the peak temperature rating. Tap any data point and the LabQuest will give you the X and Y values.
12. Return to the sensor screen (tap the meter picture in the top left corner). Rinse off the temperature probe and insert the tip into the next sample to be tested. Wait for the temperature to stabilize.
13. Repeat steps 6-11 for the rest of your catalase samples. When you tap the play button it will ask if you would like to save your run. Tap store. (**warning!! Data collection will start for the next run when you hit store. Be ready.**)

Alter Temperature of Enzyme

1. Get five test tubes and put .5 ml catalase in each test tube.
2. Get five test tubes and put .5 ml Hydrogen Peroxide in each test tube.
3. Label your test tubes and treat the catalase by placing each test tube in the following temperatures: 4^0C, 25^0C, 37^0C, 50^0C, 80^0C

4. Let each test tube sit for 10 minutes.
5. Connect the temperature probe to LabQuest
6. Insert tip of probe into catalase solution at Temperature 4^0C. Wait for probe temperature to stabilize.
7. When the temperature has stabilized tap the play button (arrow button in left-bottom corner of screen). This starts recording data and the screen will turn to a graph.
8. Add .5 ml H_2O_2 to the extract and carefully observe the reaction.
9. When the reaction temperature peaks, continue recording data for an additional 20 seconds then tap the stop button. (the same button that you used for play, but now has a square symbol.)
10. In your data table describe the reaction. Pay attention to the size of the bubbles, height they rise in the tubes, and the frequency in which they are produced.
11. Record the peak temperature rating. Tap any data point and the LabQuest will give you the X and Y values.
12. Return to the sensor screen (tap the meter picture in the top left corner). Rinse off the temperature probe and insert the tip into the next sample to be tested. Wait for the temperature to stabilize.
13. Repeat steps 6-11 for the rest of your catalase samples. When you tap the play button it will ask if you would like to save your run. Tap store. (**warning!! Data collection will start for the next run when you hit store. Be ready.**)

14. **Graph Results-** Make separate line graphs for your pH and temperature results. Show the independent variable on the x-axis and dependent variable on the y-axis (don't forget all rules of graphing).

Data/Observations:

Altering Enzyme Data:

Treatment of Enzyme	Observations	Change in Temp (peak-stable)

Conclusions:

1. What gas is being released in the enzymatic reaction? _____
2. What is the liquid in the test tube after the reaction has occurred? _____
3. Which pH worked best for your enzyme?_____
4. Why do you think this pH worked the best? _____

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_____

5. Which temperature worked best for your enzyme?_____
6. Why do you think this temperature worked the best?_____

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