Name_____**Period**_____**Assignment #**_____

_____Teacher initials (**must have data with best fit lines saved on flash drive or in student folder**)

Enzyme Action: Testing Catalase Activity

$$2\ H_2O_2 \longleftrightarrow 2\ H_2O + O_2$$

Although this reaction occurs spontaneously, enzymes increase the rate considerably. At least two different enzymes are known to catalyze this reaction: *catalase*, found in animals and protists, and *peroxidase*, found in plants. A great deal can be learned about enzymes by studying the rates of enzyme-catalyzed reactions. The rate of a chemical reaction may be studied in a number of ways including:

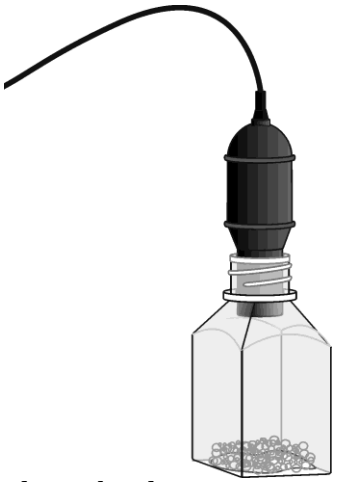
- measuring the rate of appearance of a product (in this case, O_2, which is given off as a gas)
- measuring the rate of disappearance of substrate (in this case, H_2O_2)
- measuring the pressure of the product as it appears (in this case, O_2).

At the start of the reaction, there is no product, and the concentration is the same as the atmosphere. After a short time, oxygen accumulates at a rather constant rate. The slope of the curve at this initial time is constant and is called the *initial rate*. As the peroxide is destroyed, less of it is available to react and the O_2 is produced at lower rates. When no more peroxide is left, O_2 is no longer produced.

OBJECTIVES

In this experiment, you will

- Use an Oxygen Gas Sensor to measure the production of oxygen gas as hydrogen peroxide is destroyed by the enzyme catalase or peroxidase



MATERIALS

LabQuest
Vernier O_2 Gas Sensor
2 10 mL graduated cylinders
2 18 × 150 mm test tubes
250 mL Nalgene bottle
3.0% H_2O_2
enzyme suspension
test tube rack
thermometer

PROCEDURE

1) Obtain and wear goggles.
2) Connect the O_2 Gas Sensor to LabQuest and choose New from the File menu. If you have an older sensor that does not auto-ID, manually set up the sensor.
3) On the Meter screen, tap Rate. Change the data-collection rate to 0.2 samples/second and the data-collection length to 180 seconds.
4) Change units of measure
    a. Tap Sensors, then Change Units, then CH1: Oxygen Gas, then ppm
5) From the Sensors dropdown menu, Tap Zero, then CH1: Oxygen Gas
6) Fill one test tube with 5 mL of 3.0% H_2O_2 and one with 1 mL of catalase solution.
7) Initiate the enzyme catalyzed reaction.
    a. Pour the H_2O_2 solution into a clean 250 mL Nalgene bottle.
    b. Pour the catalase solution into the 250 mL Nalgene bottles and swirl.
    c. Place the O_2 Gas Sensor into the bottle as shown in Figure 1. Gently push the sensor down into the bottle until it stops. The sensor is designed to seal the bottle with minimal force.
8) When 30 seconds has passed, start data collection.
9) When data collection is complete, a graph of O_2 gas *vs.* time will be displayed. Remove the O_2 Gas Sensor from the Nalgene bottle. Rinse the bottle with water and dry with a paper towel.
10) Perform a linear regression to calculate the rate of reaction.
11) Choose Curve Fit from the Analyze menu.
12) Select Linear for the Fit Equation. The linear-regression statistics for these two data columns are displayed for the equation in the form

$$y = mx + b$$

13) Select OK.
14) Store the data from the first run by tapping the File Cabinet icon.
15) Repeat procedure 3 times
16) Graph all three runs of data on a single graph.
17) Tap Run 3, and select All Runs. All three runs will now be displayed on the same graph axes.
18) Insert USB drive
19) Tap File, then save, then USB icon
20) Tap Table. Choose Clear All Data from the Table menu.
21) Open the file on a school computer
22) Copy and paste it into a word document and resize it so it is a reasonably small and readable representation of the data