Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Hour: \_\_\_\_\_\_

**Catalyst Lab**

**Introduction:** A catalyst is substance that increases the rate of a chemical reaction, but is not consumed or changed by the reaction. A catalyst works by reducing the activation energy needed to initiate and sustain the reaction. For example, two molecules of hydrogen peroxide can react to form two molecules of water and one molecule of molecular oxygen gas by the following reaction:

2H2O2(aq) → 2H2O(l) + O2(g)

At room temperature, this reaction occurs very slowly because few of the collisions between hydrogen peroxide molecules have sufficient energy to activate the reaction. Furthermore, commercial hydrogen peroxide solutions, such as the 3% hydrogen peroxide solution sold in drugstores, are treated with stabilizers (sometimes called negative catalysts) that increase the activation energy for the reaction, further inhibiting it from occurring.

If you add a catalyst to a solution of hydrogen peroxide, the effect is immediately evident. The solution begins bubbling, as oxygen gas is evolved. Numerous substances can catalyze the reaction of hydrogen peroxide to water and oxygen gas, including many metal oxides such as manganese dioxide, but the efficiency of catalysts varies. One of the most efficient catalysts for hydrogen peroxide is the enzyme catalase, which is present in many organisms, including the yeast that will be used for this lab. In humans, catalase functions as a peroxide scavenger, destroying peroxide molecules that would otherwise damage cells.

One catalase molecule can catalyze the reaction of millions of hydrogen peroxide molecules per second. Immediately after each pair of hydrogen peroxide molecules reacts, catalyzed by the catalase molecule, that catalase molecule is released unchanged and becomes available to catalyze the reaction of another pair of hydrogen peroxide molecules. When all of the hydrogen peroxide has reacted to form water and oxygen gas, you end up with as many catalase molecules remaining as you started with.

In this lab, we will observe the activity of catalase and also observe that this enzyme catalyst is not consumed during the process of the chemical reaction.

**Materials:**

* graduated cylinder
* hydrogen peroxide solution (3%)
* yeast
* popsicle stick
* detergent solution
* plastic pipette

**Procedure:**

1. Add 10 mL of hydrogen peroxide solution to a graduated cylinder. Add 1 drop of detergent solution. Swirl gently and watch the solution for any bubbling. The detergent solution is not a required component of the chemical reaction, but it allows for easier detection of the oxygen gas being released. Record your observations below:
2. Use the end of a popsicle stick to add a small amount of yeast to the hydrogen peroxide in the graduated cylinder and swirl. Watch the solution for any bubbling. Record your observations below:
3. Hold the graduated cylinder. Does the cylinder feel warmer or colder? Record your observations below:
4. After all bubbling has subsided, add 5 mL more of hydrogen peroxide and another drop of detergent solution if necessary. Are more bubbles formed? Record your observations below:

**Post Lab Questions**

1. What observations did you make that a chemical reaction occurred in this lab?
2. Write the chemical equation for this reaction. Should yeast be included on either side of the reaction arrow?
3. What evidence do you have that this reaction proceeded faster in the presence of a catalyst?
4. What evidence do you have that the catalyst was not used up in this reaction?
5. Would you expect the reaction rate to increase, decrease or stay the same if you increased the amount of catalyst added?