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

Effect of Catalase on Hydrogen Peroxide

**Introduction:**

Metabolism is the sum total of chemical reactions in the body that are necessary to the maintenance of life. Enzymes are biological catalysts that can speed up, and control, chemical reactions that would otherwise virtually never occur at normal body temperature, 37°C. Thousands of chemical reactions are occurring in the human body every moment of life, and each of these reactions is controlled by a particular enzyme. Enzymes are extremely efficient. Some of the chemical reactions that take place in the body produce toxic by-products, which must be quickly degraded or converted. For example, certain reactions in the liver produce hydrogen peroxide, which is extremely poisonous. Under the influence of an enzyme called catalase, the hydrogen peroxide is broken down into water and oxygen. Catalase acts quickly; one molecule of it can deal with six million molecules of hydrogen peroxide in one minute. This same reaction can be catalyzed by iron. However, to achieve the same speed there would need to be about six tons of iron.

**Enzymes have five important properties that you should know:**

1. They are always proteins.

2. They are specific in their action. Each enzyme controls one particular reaction, or type of reaction.

Thus sucrase degrades sucrose and only sucrose (table sugar).

3. They are not altered by the reaction. This means that an enzyme can be used repeatedly. It also

means that enzymes appear neither in the reactants nor in the products of a chemical equation.

4. They are destroyed by heat. This is because enzymes are proteins, and all proteins are destroyed by

heat. Destruction of protein by heat (or under any extreme conditions of pH or salt concentration) is called denaturation.

5. They are sensitive to pH. The term pH refers to the degree of acidity and alkalinity of a solution. Most intracellular enzymes work best in neutral conditions, i.e. conditions that are neither acidic nor alkaline. In this experiment you will investigate the action of catalase, from a small piece of beef liver, on hydrogen peroxide, under varying conditions.

**Materials:**

3% Hydrogen Peroxide Solution

.1M acetic acid solution

Fresh chicken liver

Boiled chicken liver

Water

**Procedure:**

1. Obtain 2 test tubes. Pour a 3% hydrogen peroxide solution into one of them to a depth of about 2 cm. Caution: hydrogen peroxide is corrosive and can irritate the skin. Pour water into the other test tube to a depth of about 2 cm.

2. Drop a small piece of liver into each test tube. Liver contains considerable catalase. Watch the reaction and record your observations in a data table.

3. Repeat the experiment using a piece of liver which has been boiled for three minutes. Record your

observations.

4. Pour approximately 2 cm of 0.1 M acetic acid solution into a test tube. Add 2 cm of hydrogen peroxide. Is the pH of this solution less (more acidic) or greater (more basic) than hydrogen peroxide? \_\_\_\_\_\_ Drop a small piece of liver into the test tube. Record your observations in the data table.

**Data Table**

**Analysis Questions**

1. **Explain why, in your first trial, you used two test tubes, one with hydrogen peroxide and one with water.**
2. **What effect did boiling the liver have on the reaction? Why?**
3. **What effect did acetic acid have on the reaction? Why?**
4. **After observing the effects of heat on proteins, why do you think people die from high fevers?**
5. **What happens to a protein when it denatures?**