

Name _____

Date _____

Elephant Toothpaste Lab

Purpose: To observe how a catalyst can speed up a chemical reaction.

Background Information: Hydrogen Peroxide, H_2O_2 , is a liquid compound generally used as an antiseptic to kill bacteria in cuts and scrapes. Hydrogen peroxide breaks down into oxygen, O_2 , and water, H_2O , in the presence of light, which is why it is stored in dark brown bottles. Normally, this breakdown happens very slowly. But, the addition of a catalyst can speed up this reaction.

Catalase is a protein enzyme found in almost all living organisms, that are exposed to oxygen, and acts as a catalyst by helping them break down naturally occurring hydrogen peroxide.

During this lab, we are going to use yeast cells as a source of the catalase protein enzyme. Mixing yeast with hydrogen peroxide, will cause the hydrogen peroxide to break down into water and oxygen gas. The oxygen gas forms bubbles. These bubbles would usually escape from the liquid and pop quickly. But adding a little dish soap provides surface tension, allowing the bubbles to get trapped, resulting in the formation of a lot of foam. This foam looks like a giant squeeze of toothpaste – almost big enough for an elephant!

Materials:

- Plastic Bottle
- 3% Hydrogen Peroxide
- $\frac{1}{2}$ Cup Measuring Cup
- Safety Goggles
- Dry Yeast
- Food Coloring
- Tablespoon
- Timer
- Liquid Dish Soap
- Warm Water
- Small plastic cup
- Outside Location

Procedure:

1. Measure $\frac{1}{2}$ cup of hydrogen peroxide, and carefully pour it into the bottle.
2. Add a big squirt of dish soap into the bottle, and swirl gently to mix.
3. If you want to make your foam a single color, add a few drops of food coloring directly into the hydrogen peroxide, and swirl the bottle gently to mix. If you want to give your foam stripes, like some toothpastes, put the drops along the inside rim of the bottle's mouth. Let them drip down inside the bottle, but do not mix.
4. In a measuring cup, mix together one tablespoon of yeast and three tablespoons of warm water. Stir for about 30 seconds.
5. Have one student ready with a timer to time how long the reaction lasts.
6. Pour the yeast mixture into the bottle then quickly step back, and watch your chemical reaction go!

Observations:

1. What happened? _____

2. How long did your chemical reaction last? _____

Analysis:

The bubbles are created when oxygen gas, O_2 , is released as hydrogen peroxide is broken down. Since the oxygen is a gas, it wants to escape the liquid, but the dish soap traps the bubbles, resulting in the formation of foam.

1. What happened when you added the hydrogen peroxide to the dish soap?
 - a. Were there any bubbles? _____
 - b. Did a chemical reaction take place at this point? _____
2. What needed to be added in order for the chemical reaction to take place? _____

3. What chemical did the yeast contain that helped speed up this reaction? _____

4. What term is used to refer to a chemical that helps speed up chemical reactions? _____

5. Fill in the blanks, in order to make this a complete statement:

_____ acts as a _____ by speeding up the chemical reaction where _____ is broken down into _____ (H_2O) and _____ (O_2) gas.

6. Match the terms with their associated structures in the diagram:

