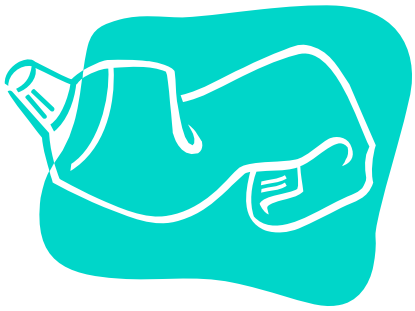
# *The Amazing Elephant Toothpaste!*



## Lesson Overview

Students will investigate chemical change.

## Suggested Grade Levels: 3-8

## Standards for Lesson

Content Standard A: Science as Inquiry
Content Standard B: Physical Science
VA SOL:
3.1 a, c, j; 3.3 a, b; 4.1 a, b, c, h; 5.1 f, g, h; 5.4 a, b;
6.1 e, f, g, h, i; 6.4 c, d, e, f; LS.1 a, b, f, g, i;
PS.1 a, g, h, i, k, l, m; PS.2 a, b, c; PS.5 c

## Time Needed

This lesson takes several class periods. Sample schedule:

| | |
|---|---|
| Day One: | Complete the **Engage, Explore** and **Explain** portion of lesson |
| Day Two: | Complete the **Elaborate** and **Evaluate** portion of the lesson |

## Materials for Lesson

- 16 oz. empty plastic soda bottle (preferably with a narrow neck such as those made by Coca-Cola)
- 1/2 cup 20-volume hydrogen peroxide (20-volume is 6% solution, purchased from a beauty supply store)
- Squirt of Dawn dish detergent
- 3-4 drops of food coloring
- 1 teaspoon yeast dissolved in 2 tablespoons very warm water
- Funnel
- Foil cake pan with 2-inch sides
- Lab goggles
- Lab smock

# Content Background

**Information for teacher:**

During a chemical change, the original substances are changed into a new substance. A chemical change is recognized by the disappearance of the reacting substance and the appearance of other substances. Indicators of chemical change include release of energy in the form of light, release or absorption of energy in the form of heat, odor change, the production of gas (bubbling) or a precipitate (solid), and a color change. Chemical changes can not be easily reversed.

Although in science the term 'chemical change' is reserved for processes in which the reacting chemical substances disappear and other (new) substances appear, several studies have found that children often use the term 'chemical change' to encompass changes in physical states and other physical transformations, particularly so when the color of a substance alters.

In this experiment, yeast serves as a catalyst which makes the peroxide molecule ($H_2O_2$) release the oxygen atom faster. A chemical reaction is taking place as evidenced by a gas being released and a temperature change. The bottle will feel warm to the touch as this is an exothermic reaction. The hydrogen peroxide decomposes to form water and oxygen.

$2H_2O_2 \longrightarrow 2\,H_2O + O_2$

Students will love this experiment. This is a kid-friendly activity. It is very easy and safe to do again at home using regular hydrogen peroxide from the drugstore.

# Engage

Ask students what they know about hydrogen peroxide. "Have you ever put hydrogen peroxide on a cut? What happens when it comes in contact with the cut?" (It bubbles)

Tell students that they are going to do an activity today that uses hydrogen peroxide.

# Explore

**TEAM PROJECT:** Assign lab roles: Principal Investigator who directs others to follow procedures; Materials Manager who does experiment; Reporter who records data; Timekeeper / Clean-Up Captain who keeps time and helps clean up. Distribute lab reports and materials.

1. At each student's place: cake pan, plastic bottle, Dawn in small cup, food coloring, funnel, goggles and smock, 1/2 cup peroxide, dissolved yeast mixture.
2. Stand up bottle in the center of the cake pan.
3. Put funnel in opening. Add 3-4 drops of food coloring to the peroxide and pour the peroxide through the funnel into the bottle.

4. Add the Dawn detergent to the peroxide in the bottle.
5. **SINGLE ROUND ROBIN**: Ask students to predict what they think will happen when yeast is added to the peroxide. Students share their prediction with teammates.
6. Have students record on their lab sheets a hypothesis based on their prediction: ***If yeast is added to the peroxide mixture, then…***
7. Pour the yeast mixture into the bottle and quickly remove the funnel.
8. The students can touch the bottle to feel any changes that take place.

# Explain

Students collect data and record observations.
*(The reaction creates foam that shoots up out of the bottle and pools in the pan. After a minute or so, it begins to come out in a moving stream that looks like toothpaste being squeezed out of a tube. The students can play with the foam as it is just soap and water with oxygen bubbles. The bottle will feel warm to the touch as this is an exothermic reaction.)*

Ask students to write questions that they have about the activity.

**CLASS DISCUSSION**: Discuss lab results and questions. Show a water molecule diagram and a peroxide molecule diagram, pointing to the extra oxygen that will be set free. Show students that the gas is oxygen by lighting a splint, blow it out, and immediately hold it in the gas. It should light again.

# Elaborate

Ask students how they might change one of the materials to affect what happened – question 3 of the 4-Question Strategy (more/less yeast, more/less detergent, different detergent). Ask students what they could measure or describe – question 4 of the 4-Question Strategy.

**PAIRED HEADS TOGETHER**: For each question, have students brainstorm the answers on their own and record on the form. Then students **RALLY ROBIN** with their shoulder partners. If their partner says an idea on their list, they check it off. If it is not on their list, they add the idea. After one minute, students share with their face partners.

**TEAMMATES CONSULT**: To complete the experimental design, students put pencils down. Teammates discuss each step of the lab report (does not have to be completed in order. Variables may be recorded before hypothesis). Everyone should contribute ideas, but everyone does not have to agree on the answer to the question. When everyone is ready with an answer, all team members pick up their pencils and SILENTLY write their answers. When each teammate is finished, the team repeats the steps with the next step.

Once all have completed experimental design portion of lab report and received approval from the teacher, students may begin experimentation.

***Observations and Conclusions***

1. Assign lab roles: Principal Investigator who directs others to follow procedures; Materials Manager who does experiment; Reporter who records data; Timekeeper / Clean-Up Captain who keeps time and helps clean up. Allow students to conduct experiment.
2. Students collect data and record observations. Tell students to do multiple trials.

# Evaluate

- Students write conclusion including three key parts:
  - Make a CLAIM: Statement saying if the results support or do not support the hypothesis.
  - Provide EVIDENCE for the CLAIM: Summary of the results and data
  - Provide REASONING that links the EVIDENCE to the CLAIM: Explanation of results

***Extension:***

- Encourage students to try experiment at home with their parent's supervision using the same materials or changing one of the materials.

# The Amazing Elephant

**Directions:**

1. Stand up the bottle in the center of the cake pan.
2. Put funnel in opening. Add 3-4 drops of food coloring to ½ cup of the peroxide and pour the peroxide through the funnel into the bottle.
3. Add a squirt of the Dawn detergent to the peroxide in the bottle.
4. Make a prediction. What do you think will happen when we add yeast to the hydrogen peroxide mixture?

   _____

5. Use your prediction to write a hypothesis, which is a cause-effect statement. Finish the hypothesis below.

   ***If yeast is added to the peroxide mixture, then…***

   _____

6. Pour the yeast mixture into the bottle and quickly remove the funnel.

**Write down your observations here:**

# Modified 4-Question Strategy: Amazing Toothpaste

1. How could you change each material to affect what the "toothpaste" does?

| **Yeast** | **Detergent** | |
|---|---|---|
| | | |

2. How could you measure or describe the response of the "toothpaste" to what you changed?

The purpose of this experiment is to determine the effect of

_____ on _____.

(**Independent Variable from question #1 above)** **(Dependent Variable from question #2 above)**

# AMAZING TOOTHPASTE PLANNING SHEET

My testable question is

What is the effect of _____ on

_____.

My hypothesis is

If _____, then

_____

**MATERIALS**

What **one** thing will I change on purpose? Scientists call this the **independent variable** or the **manipulated variable**

_____

_____

How will I know if the one thing I changed on purpose made any difference? (How I will measure, observe, and collect data in the experiment). Scientists call this the **dependent variable** or the **responding variable**

_____

_____

What things will I need to keep exactly the same in order to conduct a fair test? (Constants)

_____

_____