

LESSON 1:

ELEPHANT'S TOOTHPASTE

Students will learn about chemical reactions through an experiment with hydrogen peroxide and yeast.

OBJECTIVES

- How is elephant's toothpaste created?
- What is a catalyst in the experiment?
- What is the evidence that a chemical reaction has occurred

SUPPLIES

- 4 empty plastic soda bottles (about 16 oz)
- 2 bottles of hydrogen peroxide (the 3% version you can get at the store)
- 4 packages of quick-rise yeast
- Water
- 1 bottle of dish soap
- Food coloring (optional)
- 4 plates to hold the water bottle (and to contain any mess!)
- 4 plastic cups
- 4 spoons

PRE-TEST

 5-7 min

Tell the students that this session will be all about chemical reactions. Ask students:

- What do you think a chemical reaction is?
- Then, give children the following scenarios. They must try to identify the ones that are chemical reactions and the ones that are not. They will get one point for each correct answer. (Answer key: Chemical reactions are marked with - CR).

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|---|------------------------------|
| 1. Ice melting | 5. Boiling water |
| 2. Rust on your bike - CR | 6. Baking cookies - CR |
| 3. Dying your hair a different color - CR | 7. Digestion - CR |
| 4. Plants growing through photosynthesis - CR | 8. Dissolving sugar in water |
| | 9. Mixing sand and water |
| | 10. Fireworks - CR |

Review the answers with students and let them tally up how many they got correct. Then, ask them to discuss as a group, what do you think the chemical reactions have in common? Using this, how would they define a chemical reaction?

A chemical reaction is where different substances (reactants) are changed into a new substance (product). A chemical reaction produces a new material and is usually irreversible.

There are often clues that show that a chemical reaction has occurred. These include change of color, change of temperature, change of smell, production of gas, production of a solid, or emission of light.

In chemical reactions, a catalyst can be used to speed up the reaction.



CHEMICAL REACTION

A chemical reaction is where different substances (reactants) are changed into a new substance (product)

SIGNS

- change of color
- change of temperature
- change of smell
- production of gas
- production of a solid
- emission of light

KEYWORDS

- Reaction
- Catalyst
- Yeast
- Atoms
- Reactant
- Product
- Exothermic reaction

HOOK

⌚ 3-5 min

- What would elephant's toothpaste look like?
- How do you think we could make pretend elephant's toothpaste using the materials you see here?
- Let students brainstorm and discuss ideas for how it might be created.

HYPOTHESIS

⌚ 3-5 min

Using the ideas from their discussions, have students predict:

- How is elephant's toothpaste created?
- What chemical reaction occurs?
- Which materials interact to cause the chemical reaction?

EXPERIMENT

⌚ 20-25 min

1. Place students in groups of 3.
2. Prepare the experiment by adding about 1/2 cup of hydrogen peroxide into each water bottle.
3. Have students place the water bottles into the bowl or tray to contain the mess.
4. Let students choose the food coloring of their choice and add a few drops to the water bottle.
5. Then, have students add a squirt of dish soap to the bottle and swirl it to mix.
6. In a separate bowl, have students use a spoon to mix a packet of yeast with (if possible, warm) water until the yeast is nearly dissolved.
7. Then, have students carefully pour the yeast mixture into the water bottle and observe the results.
8. When the reaction is complete, ask students to carefully touch the foam and make note of any observations.



EXTENSION

🕒 7-10 min

If there is extra time, the students can extend this activity by experimenting with variables.

They can repeat the experiment with different amounts of yeast.

They should find that the less yeast, the slower the reaction since yeast is the catalyst.

Alternatively, they can try adding the yeast dry without water and seeing the impact that this makes.



OBSERVATION

🕒 5 min

Ask students to discuss: What happened when yeast was added to the water bottle?

EXPLANATION

🕒 5-10 min

- Hydrogen peroxide is a mixture of hydrogen atoms and oxygen atoms. It is usually stored in brown or dark colored bottles because light causes it to break down. When hydrogen peroxide breaks down, it separates into water and oxygen. This usually happens slowly over time.
- In this experiment, a catalyst, yeast, was added to speed up the breakdown of the hydrogen peroxide. Yeast contains a chemical called catalase which helps to quickly break the hydrogen peroxide down into water and oxygen. Oxygen is a gas and when the breakdown occurs, small oxygen gas bubbles are created. Usually, we cannot see these oxygen gas bubbles because they quickly pop. However, when dish soap is added to the mixture, it creates surface tension, allowing the oxygen gas bubbles to get trapped. This causes a foam to form.
- The foam felt warm to touch because the reaction was an exothermic reaction, meaning it produced heat. The foam is just water, soap and oxygen but is often referred to as 'elephant's toothpaste' because it looks like a big squirt of toothpaste. But be careful, it will not taste good so do not try it!

CLEAN UP & DISMISSAL

🕒 3-5 min

Students must then clean their workspace. Make sure to leave the classroom the way you found it.

