deSTEMber

SCIENCE ★ TECHNOLOGY ★ ENGINEERING ★ MATH

PRESENTED BY: girlstart

Exploding Toothpaste

Ella the elephant is out of toothpaste and you've been hired to make a new batch! Use the recipe and instructions below to learn about exothermic reactions and catalysts as you prep a new batch of "toothpaste" for Ella.

TEKS:

3.5D Explore and recognize that a mixture is created when two materials are combined, such as gravel and sand, or metal and plastic paper clips.

4.6A Differentiate among forms of energy, including mechanical, sound, electrical, light, and heat/thermal.

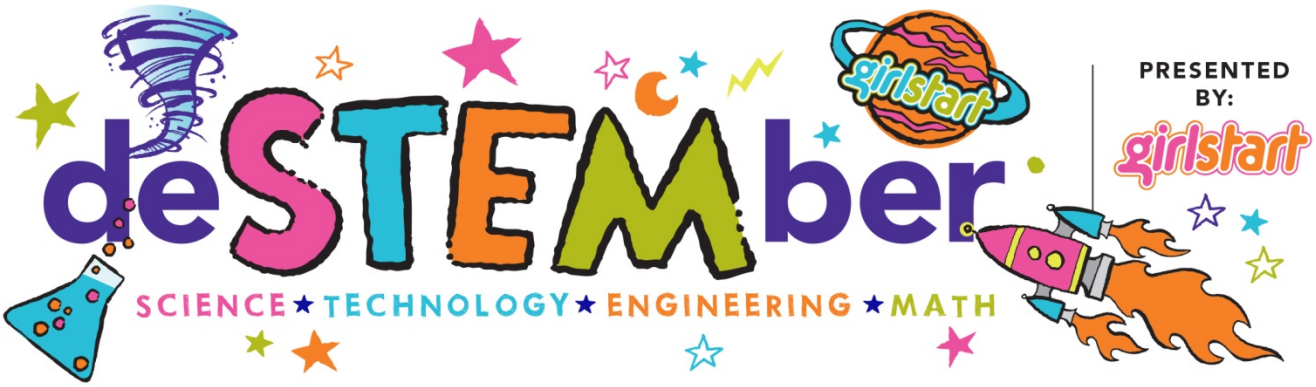
5.5D(ss) Identify changes that can occur in the physical properties of the ingredients of solutions such as dissolving salt in water or adding lemon juice to water.

6.5D Identify the formation of a new substance by using the evidence of a possible chemical change such as production of a gas, change in temperature, production of a precipitate, or color change.

6.9B Verify through investigations that thermal energy moves in a predictable pattern from warmer to cooler temperatures until all the substances attain the same temperature such as an ice cube melting.

Materials:

- Optional: markers, paper, scissors, and tape to create an "elephant toothpaste" decorative decal for the bottle(s)
- Food coloring
- Liquid dish soap
- Funnel
- 1 liter plastic soda bottle (clean and empty)
- Measuring spoons
- Safety glasses
- Rubber gloves
- Tarp or other material to cover table **--OR--** a foil pan with 2" sides
- Small plastic cups
- 4 oz. package of dry yeast (fast-rising works best) – if using a jar, you will need 2¼ teaspoon
- 3% hydrogen peroxide (found at grocery store) **--OR--** for an improved reaction, 12% (40 volume) hydrogen peroxide (found at beauty supply store)



How To:

Note: Although this is a "kid-friendly" activity, adults should supervise appropriately.

1. If desired, create and apply a decorative "toothpaste" decal to the clean, empty 1-liter bottle.
2. Cover the demo table with a tarp or other protective cloth **--OR--** place the 1-liter bottle in a pan with 2" sides.
3. In a small plastic cup, mix 1 package (about 2¼ teaspoons) of dry yeast with 4 tablespoons of warm water (warm water is important to activate yeast!). If the mixture is thick or paste-like, use additional water to thin out the mixture.
4. Put on rubber gloves and safety glasses.
5. Use a funnel to add 4 ounces (120 mL) of hydrogen peroxide to the liter bottle.
6. Add a few drops of food coloring and a squirt of liquid dish soap to the bottle.
7. Gently swirl the bottle around to blend the ingredients.
8. The final and fun step is to pour the prepared yeast mixture into the liter bottle and watch as Ella's "toothpaste" is created!

Why Does It Work?

Ella's toothpaste experiment includes the concepts of exothermic reactions and catalysts. The yeast acts as a catalyst to release the oxygen from the hydrogen peroxide. Catalysts are used to speed up a reaction. An enzyme called peroxidase in the yeast makes the reaction happen a lot faster than if we just used the peroxide and dish soap alone. The "toothpaste" reaction is an example of an exothermic reaction, which is a chemical reaction that releases energy by heat. As a result, the bottle will feel warm to the touch immediately after the reaction. This activity also shows that gases can be a product of a reaction. We usually can't see gases being produced, but the dish soap added to the bottle traps oxygen as it is released from the hydrogen peroxide.

Career Connection:

Chemical engineers apply the principles of chemistry to solve the problems that affect our everyday lives. If you enjoy working in a chemistry laboratory and are interested in developing useful products for people, then a career as a chemical engineer might be in your future. Read more about chemical engineering here: http://www.egfi-k12.org/ - /cards/chemical and here: http://www.sciencebuddies.org/science-engineering-careers/engineering/chemical-engineer#whatdotheydo

Additional Resources:

- Alternative experiment: http://psuscienceeducation.wikispaces.com/Elephant+Toothpaste
- The real chemistry in toothpaste: http://science.howstuffworks.com/chemistry-in-a-tube-of-toothpaste-info.htm

