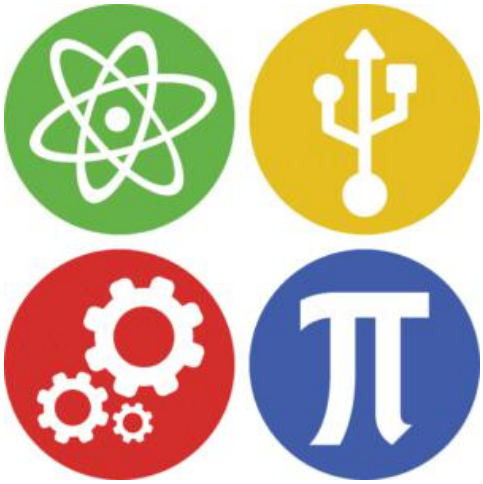
Planting a STEM:
A Science Experiment Guide



Erica Friedman

Table of Contents

Coiling Snake

Recommended Grade Levels: K-2
Time: 10 min

What You'll Need

- Snake Template
- Markers
- Scissors
- Hole Puncher
- String

Directions

1. Color in the snake template.
2. Cut out the snake template along the black outline.
3. Punch a hole about ½ inch down from the tip of the snake's head between its eyes.
4. Cut a piece of string about 8 inches long.
5. Tie the string through the hole in the snake's head.
6. Hold the end of string to see snake's coiling effect.

Learn More!

Snakes are extremely cool and diverse reptiles. With over 2,500 different types, snakes occupy every continent except for Antarctica. It sure is chilly there! Unlike us humans, snakes smell with their tongues by picking up chemicals in their environment. They are also able to shed their skin, so they have a new coat every few months.

Elephant Toothpaste

Recommended Grade Levels: 5-8
Time: 15 min

What You'll Need

- Tray/Absorbant Material*
- 16-oz Bottle of Water
- 3oz Hydrogen Peroxide (3%)
- Dish Soap
- Food Coloring
- 1 Packet of Dry Yeast
- Warm Water
- Small Cup

Directions

1. If you are doing this inside, place absorbent materials on the surface that you plan to do the experiment (alternatively, you can use a tray to contain the 'toothpaste').
2. Empty out the bottle of water.
3. Add 3oz hydrogen peroxide, a few squirts of dish soap, and a few drops of food coloring to the plastic bottle.
4. Cap the bottle, and shake it until all of the ingredients are thoroughly combined.
5. Pour yeast into a small cup.
6. Fill the rest of the cup with warm water.
7. The yeast will activate fairly quickly, so after 45 seconds, pour it into the plastic bottle.
8. Stand back, and watch the 'toothpaste' erupt.

What Happened?

In this experiment, the yeast acted as a catalyst, something that accelerates a chemical reaction, to decompose hydrogen peroxide into water and oxygen. Because of this, the oxygen bubbles in the soapy water created the fun foam you saw. If you touched the bottle while it was foaming, you may have noticed that it was a little warm. This happened because an exothermic reaction occurred, meaning it produced heat.

* Disposable 9-inch round cake pans are perfect.

Floating Paper Clip

Recommended Grade Levels: K-2
Time: 5 min

What You'll Need

- Bowl
- Water
- Paper Clip
- Tissue Paper
- Toothpick

Directions

1. Fill a bowl with water about ¾ full.
2. Place the paper clip on the top of the water, and watch as it sinks.
3. Remove the paper clip from the water.
4. Tear a small piece of tissue paper (a rectangle a little larger than the paperclip will suffice).
5. Place the piece of tissue paper on the surface of the water so that it floats.
6. Dry the paper clip, and place it on top of the tissue paper so that it also floats.
7. Use the toothpick to push the tissue paper to the bottom of the bowl, but make sure that you do not touch the paper clip while doing this.
8. Now, watch as the paper clip floats on the water's surface.
9. This process may take a few tries, so if you accidentally knock the paper clip to the bottom of the water, repeat steps 4-8 with a new piece of tissue paper.

What Happened?

This experiment works due to surface tension, a force that holds liquids together. In this case, imagine the water molecules (very small particles of water) on the surface holding hands. When you initially put the paper clip in the water, you broke this tension, so the molecules couldn't hold hands. However, with the help of the tissue paper, the tension remained intact, so the water molecules were able to keep holding hands and support the paper clip.

Lava Lamp

Recommended Grade Levels: 5-8
Time: 10 min

What You'll Need

- Bottle of Water
- Vegetable Oil
- 2 Alka-Seltzer Tablets
- Food Coloring

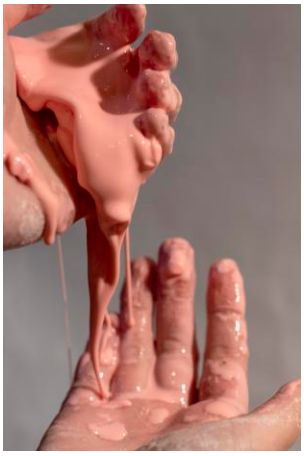
Directions

1. Remove the label from the bottle of water.
2. Pour out water in bottle until ¼ full. If you are starting with an empty bottle, fill it ¼ full with water.
3. Add a few drops of food coloring to the bottle.
4. Cap the bottle, and swirl until the food coloring and water are combined.
5. Remove cap, and add vegetable oil to the bottle. Stop filling when the oil reaches about ½ inch from the top.
6. Wait for the oil and water to settle and separate; this should take a few seconds.
7. While waiting, break 1 Alka-Seltzer tablet up into pieces that will fit through the bottle's opening.
8. Remove the cap, and squeeze the bottle; this lets the air escape, so the pressure in the bottle does not build up too high.
9. While squeezing the bottle, add the Alka-Selzer pieces, and quickly screw the cap back on the bottle.
10. Watch as the dyed water begins to bubble up to the top like a lava lamp.
11. This reaction lasts a short amount of time, but you can repeat by redoing steps 7-10.

What Happened?

Since oil is less dense than the water, it settled on top. When you put the seltzer tablet into the bottle, it began dissolving, which created a gas. This in turn formed bubbles of colored water, which floated towards the surface but didn't interact with the oil. This is because of intermolecular polarity. Basically, water molecules don't like to interact with oil molecules because they are not of the same type.

Non-Newtonian Fluid



Recommended Grade Levels: 5-8
Time: 15 min

What You'll Need

- Bowl
- ½ cup of Corn Starch
- ½ cup of Water
- Plastic Sandwich Bag

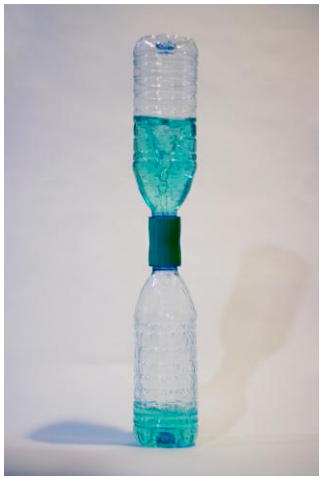
Directions

1. Put half of the corn starch in the bowl.
2. Add half of the water to the bowl.
3. Begin mixing the two ingredients until combined.
4. Add the rest of the corn starch.
5. *Slowly* add more water while mixing.
6. When you achieve a slime-like consistency, stop adding water.
7. If performed correctly, the fluid should be firm when you apply pressure and return to a liquid when you let go.
8. Have fun molding your Non-Newtonian fluid!
9. As you play with the fluid, it will begin to dry out, so you may need to add some more water.
10. To keep it moist, store the fluid in a plastic bag.

What Happened?

Most liquids like water or molasses take the form of their containers; however, there are some exceptions to this rule, which we call Non-Newtonian fluids. These are substances that when you apply pressure to them act like solids. When you mixed the corn starch and the water, you created one of these special fluids, which is why the mixture suddenly hardened when you squeezed it and turned back into a liquid when you released pressure.

Tornado in a Bottle



Recommended Grade Levels: 4-6
Time: 5 min

What You'll Need

- 2 Bottles of Water
- Food coloring
- ⅛ tsp Glitter (optional)
- Tornado Tube

Directions

1. Remove the label on the bottle of water, and cut the ring underneath the screw cap. This will enable the tornado tube to fit on the bottle.
2. Empty one bottle until it is ⅔ full of water. If you are starting with an empty bottle, fill it ⅔ full with water.
3. Add a few drops of food coloring (do not add too much otherwise the twister will be harder to observe) and glitter, and shake until combined.
4. Screw on the tornado tube.
5. Empty the second bottle of water.
6. Attach the empty bottle to the top of the tornado tube. Screw until both bottles are tightly secured to avoid water spillage.
7. Flip the bottles upside down so that the filled bottle is on top.
8. Holding the bottles with both hands, quickly move them in a circle (about 6 rotations) so that a twister begins to form.
9. Place the bottles on a hard surface, and watch the tornado magic.
10. To create another twister, repeat steps 6-8.

What Happened?

By swirling the bottles in a circular motion, you created a vortex or whirlpool! This made the water spin super fast around an axis and drain out of the top bottle. As this happened, the water formed the tornado-like shape you observed. Tornados are destructive wind vortexes that act like super powerful vacuums. They can reach speeds of up to 250 miles per hour and travel over 50 miles—that's approximately half the width of Tennessee!

*As long as the bottles are the same, the size doesn't matter.

6-Layer Liquid

Recommended Grade Levels: 6-8
Time: 15 min

What You'll Need

- Flat-bottom Tube
- Honey
- Corn syrup
- Dish soap
- Water
- Vegetable Oil
- Rubbing Alcohol
- 1 Pipette
- Food Coloring
- Mini Cup

Directions

1. Pour the honey into the tube until it is ~1/7 full; try to pour the honey so that it does not touch the sides of the container as it will take a long time to reach the bottom.
2. Wait for the liquid to settle.
3. Pour the corn syrup into the tube until it is ~2/7 full, again avoiding the sides of the tube.
4. Wait for the liquid to settle.
5. Add the dish soap on top of the corn syrup until the tube is ~3/7 full.
6. Wait for the liquid to settle.
7. Add water and a few drops of food coloring to the mini cup.
8. Cap and shake the cup until the water is uniformly dyed.
9. Fill the pipette with the dyed water, and add the liquid to the tube until it is ~4/7 full. Initially, the water will mix with the dish soap layer, but it will eventually settle on top.
10. Using the same pipette, fill it with vegetable oil until the tube is ~5/7 full, and add it on top of the water layer.
11. Wait for the liquid to settle.
12. Add the rubbing alcohol on top of the oil layer until the tube is almost full.
13. Wait for all of the liquids to settle.
14. You now have a 6-layer liquid! Avoid shaking the tube as it will take some time for the liquids to settle back into place.

What Happened?

This experiment works because the various liquids each have different densities. Density is the measure of how compact something is. For example, a blown-up balloon has a very small density since it's mostly air but takes up a large amount of space. Furthermore, the more dense a substance, the more likely it is to sink, so the honey, the densest liquid, stayed on the bottom while the rubbing alcohol rested on top.

Sources

Cover Page Image
https://dawsonpower.com/connect/stem-scholarship/

Coiling Snake
https://www.education.com/activity/article/Create_Coiling_Snake/
https://kids.nationalgeographic.com/explore/nature/super-snakes/

Snake Template
www.firstpalette.com

Elephant Toothpaste
https://www.scholastic.com/parents/kids-activities-and-printables/activities-for-kids/math-and-science-ideas/home-science-experiments-elephants-toothpaste.html

Floating Paper Clip
https://sciencebob.com/make-a-paperclip-float/

Lava Lamp
https://sciencebob.com/blobs-in-a-bottle-2/

Non-Newtonian Fluid
http://scifun.chem.wisc.edu/homeexpts/lumpyliquids.htm

Tornado in a Bottle
https://www.stevespanglerscience.com/lab/experiments/soda-bottle-tornado/
https://www.history.com/topics/us-states/tennessee
https://www.nationalgeographic.com/environment/natural-disasters/tornadoes/

6-Layer Liquid
https://www.stevespanglerscience.com/lab/experiments/seven-layer-density-column/