

The background of the entire page is a light gray grid of thin lines. Scattered throughout the composition are several abstract geometric elements: a large white sphere in the top right, a smaller white sphere in the top center, a large white sphere in the bottom center, and a smaller white sphere in the bottom right. There are also several angular, multi-colored shapes: a pink and black zigzag shape in the top left, an orange and white speckled shape in the top center, a red and gray dotted shape in the top right, a green and gray speckled shape in the bottom left, a red and black striped shape in the bottom center, a yellow and pink shape in the bottom right, and a gray and black zigzag shape in the bottom right. The main title is centered in the middle of the page.

SCIENCE IN QUARANTINE: EXPERIMENTING FROM HOME

AN INTERACTIVE WALKTHROUGH OF SCIENCE EXPERIMENTS AT HOME

BY NOAH GILKES

Lava Lamp in a Bottle



What you will need:

- 1 empty, disposable bottle with the lid
- 1 cup or 8 ounces of tap water
- 1 cup or 8 ounces of oil (such as vegetable oil or baby oil)
- Food coloring (you pick the color!)
- 1 empty drinking glass

How does it work?

In science, liquids have different weights, called **density**. The density of water is less than the density of oil, which means that oil is heavier than water under the same conditions. Thus, the water separates from the oil, and now two layers exist: the colored water layer, and the clear oil layer.

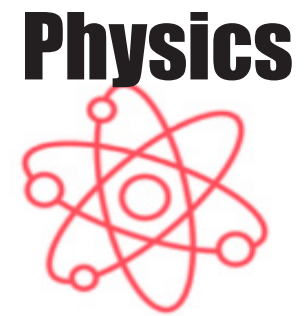
The Experiment Steps:

1. In an empty plastic bottle, fill it half way with about 8 ounces of oil.
2. In an empty drinking glass, measure out about 8 ounces of water. You can use the same amount of water as you did oil.
3. Add a few drops of food coloring to the glass of water, making sure to mix it up and create a colored mixture.
4. Combine the water mixture and oil by slowly pouring the colored water into the plastic bottle with oil on it.
5. Carefully, put the cap on (making sure it's on tight), shake it up, and watch what happens!

Science Concepts:

Chemistry, Density, Mixtures





Buoyancy Boats

What you will need:

- One 12 inch x 12 inch piece of aluminium foil or tin foil
- 1 large bowl, pan, or sink filled with at least 2 inches of water (sink is preferred)
- Water (from sink)
- Pennies! Or any type of coin

How does it work?

In science, an important property of water is **surface tension**. Surface tension is the reason that boats can float. In the foil boat, the tension of the water is strong enough to hold the boat above water, causing it to float. In fact, surface tension is strong enough to hold the boat when you add more weight to it, such as coins.

The Experiment Steps:

1. Fill a large bowl, pan, or sink with water, until it is about 2 inches deep.
2. Using the sheet of aluminum foil or tin foil, fold the sheet into a “boat.” A few folds, but not too many, makes a strong boat. Make sure to also fold up your edges so the coins don’t fall out.
3. Slowly add your coins to the boat, making sure to keep the boat upright and prevent water spills. How many coins can you add?

Challenge:

When first trying to stack the coins on the boat, Try stacking the coins on top of each other. Record how many coins you can fit on the boat. Then try spreading the coins evenly over the foil boat, and record how many coins fit. Why can more coins fit when they are spread out evenly? (hint: how does density change when the coins are spread out?)



Walking Water with Colors



How does it work?

Water is a key part of life. One unique quality of water is the ability to “walk” and move on its own. In this experiment, the water climbs up the paper towels because the water is attracted to the paper towel.

This process is called **capillary action**, and because of it, the water is able to ignore gravity and travel upwards!

What you will need:

- 2 drinking glasses or cups of equal size
- Paper towels
- Water (sink water is perfect)
- Food coloring (optional, but can enhance the experiment)

The Experiment Steps:

1. Position each cup such that they are about 2-3 inches apart from each, in a straight line.
2. Using the water, fill one of the cups to about half-full. If you have food coloring, you can add a few drops of your preferred color to this cup with the water, and give it a stir to combine.
3. Fold your paper towel twice in a “hot dog” style, such that it is about 2 inches wide and still very long.
4. Carefully take the paper towel and put one end of it into the cup with the water (and food coloring, if you added it) and then put the other end of the paper towel into the second, empty cup.
5. Wait anywhere from 30 minutes to one hour, then look and see what happened?



Homemade Tornado

What you will need:

- 2 empty plastic bottles of equal size (2-liter size is preferred - but smaller bottle size will also work).
- Duct tape or regular tape
- Water
- Food coloring (optional)

How does it work?

Gravity causes things to fall. When liquids are pulled towards the ground, they can “vortex,” or experience a movement where the liquid spins rapidly as it falls. In these bottles, swirling the water causes the water to vortex. Then, gravity pulls the water from the top bottle to the bottom, causing a tornado effect in the bottle!

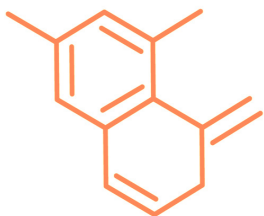


The Experiment Steps:

1. Fill one of the empty bottles with water until it is about 3/4 full. If you have food coloring, you can add a few drops to this and mix it together.
2. Align the second, empty bottle on top of the first bottle such that their two nozzles are touching.
3. Tape the two bottle together, by their nozzles, so that water can flow through. Double check that there is enough tape on the two bottles so no water can escape.
4. When secure, flip the bottles over, swirl the water, and see what happens -- did you get a tornado?

Science Concepts:

Physics, Gravity



The Rubber Egg

What you will need:

- 3 standard size eggs
- 3 empty, clear drinking glasses or cups
- 1 cup (8 ounces) of white vinegar
- 1 cup or 8 ounces of oil (such as vegetable oil or olive oil)
- 1 can of soda (any flavor)
- Food coloring (optional)

Science Concepts:

Chemistry, Biology, Food science

Did you know?

Each person in the United States is estimated to eat almost 300 eggs each year.



The Experiment Steps:

1. Very carefully, place each fragile egg into its own empty glass.
2. In each glass, pour enough of its respective liquid to fully cover the egg (vinegar, oil, or soda).
3. If you have food coloring, add a different color to each glass. Make sure to keep track of the colors and liquids!
4. Place each glass or cup in a safe place and let it rest for one week.
5. After the time has passed, take each egg out and observe it. What do they feel like? How does the egg change in the vinegar, oil, or soda solutions?

How does it work?

Eggs are very popular food, and have many different chemical properties. When eggs are combined with different solutions, such as vinegar or soda, the **chemical reactions** that occur in each egg are different. Because the chemical reactions are different, the eggs turn out differently. Some eggs might turn into bouncy balls, but some might only change in color.

Many foods, like eggs, have unique chemical properties that make them unique!

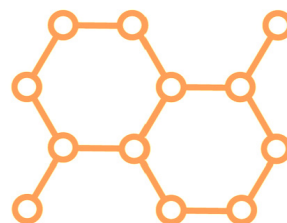


The Magic Water Bag

What you will need:

- Multiple empty, clear storage bag (sandwich size). Quart-sized or sized will work
- Sharpened wood pencils
- Water (from the sink)
- Sink or large bowl, in case of a spill

How does it work?



Solid materials are made of many small particles called atoms. Atoms make up large chains called molecules. **Polymers** are a specific type of molecule that clear storage bags, like the one in our experiment, is made of.

When the pencils are pushed through the bags, the polymers in the bag change shape to fit around the pencil, preventing the water from leaving!

The Experiment Steps:

1. In the clear, empty storage bag, fill it with water until it is about 3/4 full, and tightly close the bag.
2. Sharpen the pencils (if not done already), and lay them down near the bag filled with water.
3. Carefully, over the sink or large bowl, quickly poke the pencils into the bag one by one. If your bag rips open, make sure to construct another bag filled with water.
4. Slowly add more pencils inside the bag, and see how many can fit through. Why does this happen?



Battery-Powered Lightbulb



What you will need:

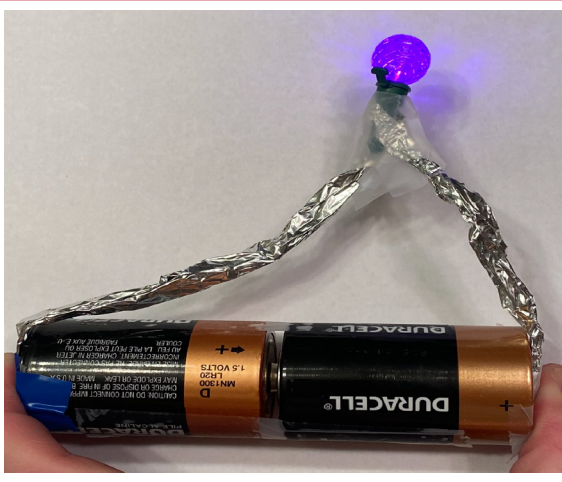
- 2 pieces of aluminum foil, 5 inches x 1 inch
- 1 small lightbulb (can be found from a flashlight or holiday lights for example)
- Scissors and tape
- 2 D-Cell or 9V batteries

Science Concepts:

Physics, Electricity, Circuits

The Experiment Steps:

1. Using the aluminum foil, cut two strips about 4-5 inches long and 1 inch wide, then roll it up using your hands.
2. Tape the batteries together so the positive (+) end of one battery touches the negative (-) end of the other battery.
3. Tape one piece of the aluminum foil to the positive (+) end of the battery, and tape the other piece of aluminum foil to the negative (-) end of the large, taped battery.
4. Now, tape the other end of one aluminum foil strip to the bottom of the lightbulb. Tape the other strip to the metal, grooved part of the lightbulb. Make sure the aluminum foil pieces are touching the batteries, and watch the lightbulb light up!

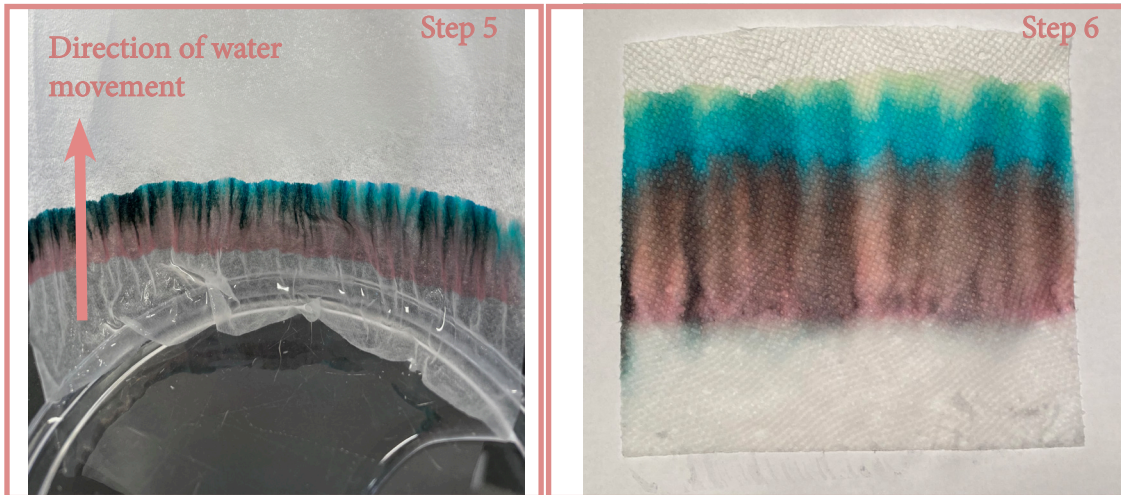


How does it work?

Electricity powers almost everything we use. Electricity is the movement of electrons from one source to another. In the experiment, the electrons from the batteries move through the aluminum foil. The foil **conducts** the electrons to the lightbulb, where they are received. Because electrons carry energy, they reach the lightbulb and give it power, causing it to light up.



Chromatography



What you will need:

- A few sheets of coffee filter paper or paper towels
- Washable markers (darker colors, such as green and blue, work the best)
- Empty drinking glasses slightly filled with water

The Experiment Steps:

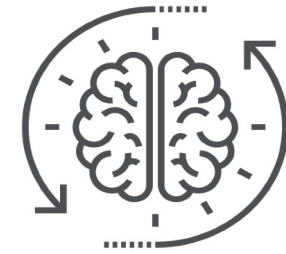
1. Gather a few colors of marker (blue, green, and other dark colors are preferred).
2. For each marker color, use one sheet of coffee filter paper. In case you want to combine colors, grab a few extra sheets. Make sure that the sides of each coffee filter are upright so it looks like a bowl.
3. Using the markers, draw a circle inside of each coffee filter. The circle should go around the base of the filter paper.
4. Fold the paper in half, then half again two more times.
5. Fill up a drinking glass with about one-half inch of water, and place the pointy end of the coffee filter in the water. Use one glass per coffee filter.
6. Let each glass rest and observe how the marker line changes!

Chromatography: what is it, and how does it work?

Chromatography can sound confusing. But, it's a simple process used by scientists to separate a mixture into its individual components. The ink in markers is actually a mixture of different dyes. In this experiment, chromatography is used to separate the marker color into the dyes used to make that color.

When the marker lines we drew on the coffee filter paper are placed in a cup with water, the water is attracted to the colored dyes in the mixture. But, each color of dye is attracted to water differently. Thus, each dye color streaks down the filter paper attempting to reach the water. With some dyes moving faster than others, we are left with a colorful presentation of dyes!

The Smiling Dollar Bill



What you will need:

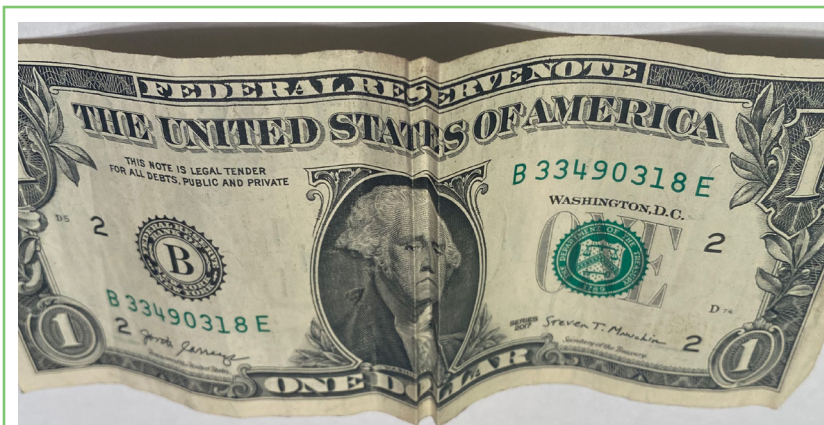
- A few dollar bills (any dollar amount will work, but \$1 bills work great)

The Experiment Steps:

1. Take the dollar bill and lay it down in front, so the portrait faces you.
2. Fold the dollar bill hamburger-style over the figure's left eye, making sure that the fold is creased.
3. Now, fold the dollar bill in the same way over the right eye. Now, you should have two individual folds that go over both of the eyes.
4. Between the two folds, there is a small section of the dollar bill that shows the mouth. Pinch the dollar bill between the two creases on the eyes.
5. Now, if you tilt the dollar bill towards you, or away from you, the figure will have emotions!

How does it work?

Optical illusions happen when our brain has a difficult time identifying images. In this dollar bill, the smile (or frown) happens because our brain is trying to figure out what is going on. Optical illusions are the reason people see the same things differently.



Science Concepts:

Psychology, Optical illusions



Extract Your Own DNA *

What you will need:

- 1 plastic water bottle, full
- 70% isopropyl alcohol (rubbing alcohol)
- Empty, clear plastic cups
- Dishwashing soap
- Measuring spoons (1 tbsp and 1 tsp)
- Food coloring
- Optional: toppings!
- Salt

The Experiment Steps:

1. Pour out the full water bottle into a tall plastic cup.
2. Using the measuring device, add 1 tablespoon (1 tbsp) of salt to the water. Make sure to stir the solution for about one minute until all the salt is dissolved.
3. When the solution is ready, transfer 2-3 tablespoons of the saltwater to the a small, clear plastic cup. When you are ready, swish the saltwater around in your mouth for about one minute (like mouthwash). When the minute is over, spit the salt water back into the same small plastic cup.
4. Now, your DNA is successfully in the solution. Because this experiment is longer than the others, the rest of the instructions are found on the next page!

What is DNA?

DNA is the blueprint for cells in our body. DNA contains the genetic instructions which make all of us unique from one another. Our genes come from DNA. In fact, the DNA molecule is in the upper left corner of the page!

What happened here?

To extract DNA, we first swished around saltwater, which took some of your cheek cells and put them in the solution. Then, the dish soap helped break down the cell walls and reach the nucleus, where DNA is found in the cell. Once our cheek cell DNA was in the cup, the alcohol and food coloring mixture helped the DNA group together and made it visible for us to see.

* Due to the sensitive and complex nature of this experiment and materials, it should be performed under adult supervision.



Extract Your Own DNA *



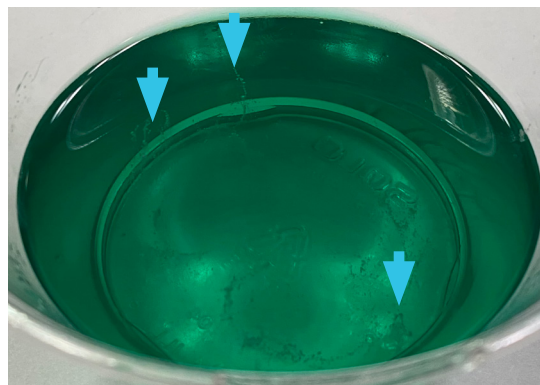
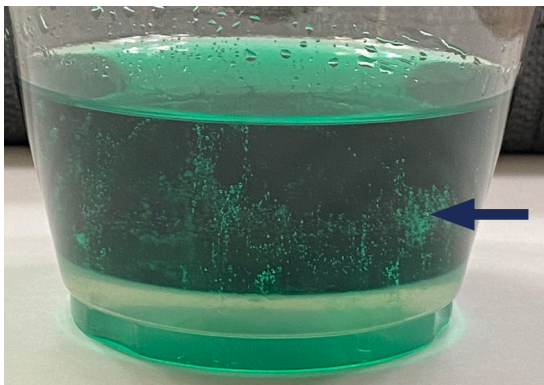
The Experiment Steps, part 2:

5. In the plastic cup that has your DNA in it, add about one drop (equivalent to 1 mL) of dishsoap to the mixture. Carefully stir the mixture so the soap can get to all of the DNA in the cup.
6. In a separate plastic cup, combine about 3-4 ounces of rubbing alcohol and 2 drops of dark food coloring. Make sure to mix the solution until the food coloring is dissolved.
7. Very carefully, add the alcohol mixture to the soap and DNA mixture. If you tilt the cup, you should see the alcohol form a layer on top of the water layer that contains the DNA.
8. After adding the alcohol, let the cup rest for about 5 minutes. When the time is up, your DNA should appear as white streaks in the liquid. Now you can see your very own DNA!

How did we extract our own DNA?

To extract DNA, we first swished around saltwater, which took some of your cheek cells and put them in the solution. Then, the dish soap helped break down the cell walls and reach the nucleus, where DNA is found in the cell. Once our cheek cell DNA was in the cup, the alcohol and food coloring mixture helped the DNA group together and made it visible for us to see.

Almost every living thing on Earth has DNA. Because of this, this simple procedure to extract DNA is very important for scientists to better understand other living things.



Left image: side view of the cup, dark blue arrow indicates visible DNA

Right image: top view of the cup, light blue arrow indicates visible DNA

Homemade Ice Cream



What you will need:

- 1/4 cup of salt
- 1 teaspoon of vanilla extract
- 4 cups of ice cubes, crushed
- Optional: toppings!
- 1 cup of whole milk
- 2 tablespoons of sugar
- 1 gallon-sized storage bag
- 1 quart-sized (sandwich size) storage bag

How to make your own ice cream:

1. In the quart-sized bag (the smaller one), pour in the milk, sugar, and vanilla. These are the ice cream ingredients.
2. Tightly zip up this bag, making sure it is closed, and place it inside the larger bag.
3. In the gallon bag (the bigger one), add in your ice cubes and salt. Make sure to tightly zip it up.
4. Now that the bags are together, shake them consistently for 10 minutes, or until your ice cream in the smaller bag has hardened.
5. When the ice cream is ready, move it from the small bag and place it in a bowl or cone.

