



There really
is science
everywhere!



Home Scientist

By paying careful attention during experiments, scientists learn new things—even if they've done the test before. That means you don't have to grow up to be a scientist. You're a scientist every time you do an experiment! In this badge, find out where science has been hiding in your own home.

Steps

1. Be a kitchen chemist
2. Create static electricity
3. Dive into density
4. Make something bubble up
5. Play with science

Purpose

When I've earned this badge, I'll be able to see the science all around me.

FUN FACT

Making toast is a science in action! Some of the brown crust on toast comes from sugars that burn—or caramelize—when the surface of the bread heats up.



Tip Before Takeoff

Have an adult help you with every single experiment. It's also best to wear some old clothes—science can get messy!

Every step has three choices. Do ONE choice to complete each step. Inspired? Do more!

STEP

1 Be a kitchen chemist

Start your experimenting in the coolest place for science in your house—the kitchen! Science is responsible for making lots of different foods. Try one of these experiments, then enjoy the food when you're done!

CHOICES – DO ONE:

Make a salad dressing. Salad dressing is science in action! A vinaigrette is made with two liquids that don't want to blend. They need the help of an "emulsifier" to come together. Here, use mustard as your emulsifier to get vinegar and oil to mix into something yummy for your salad.

Instructions: Put the mustard in the bowl. Add the vinegar and whisk, whisk, whisk! Slowly add the oil while continuing to whisk. Watch closely as the dressing gets smooth.

What happens? Look really closely—your dressing is not a mixture (like vinegar and water would be), but actually tiny oil bubbles floating in vinegar, with the help of mustard. It's an **emulsion!**

You'll need:

- 1 teaspoon mustard
- 1 tablespoon vinegar
- ½ cup olive oil
- Salt and pepper
- Medium-size bowl
- Whisk



OR

- **Grow rock candy.** Make your own candy from sugar crystals.

Instructions: With an adult's help, boil the water. Slowly pour in the sugar, letting it dissolve as you pour. When the sugar won't dissolve anymore and begins building up on the bottom of the pan, add a few drops of the food coloring. (You can also add fruit flavoring now.) Pour this liquid into the jar, but don't let any undissolved sugar get into the jar. Put skewers into the solution or tie string to a pencil and place the pencil across the jar.



You'll need:

- 1 cup water
- 4 cups sugar
- Food coloring
- Jar
- Wooden skewers or string

What happens? Crystals should start to form after about an hour, but if you wait several days or weeks, your rock candy will form large crystals. Sugar is actually made of tiny crystals that clump together.

The same idea is used to make rock candy.

FOR MORE FUN: Use a hand lens or magnifying glass to look really closely at how the crystals grow. Do they look different than salt crystals?

OR

- **Make your own ice cream.** With the help of salt, ice cream stays creamy instead of turning into a block of ice.

Instructions: Fill the pint-size bag with sugar, milk, and vanilla, then seal it. Fill the gallon-size bag halfway with ice, then add the salt. Place the pint bag inside the gallon bag and seal. Shake the bags for about 10 minutes, until you see ice cream forming in the small bag. (Wear gloves—your hands will get cold.) Then open it up and dig in!

Tip: Double-bag both bags in case something leaks.

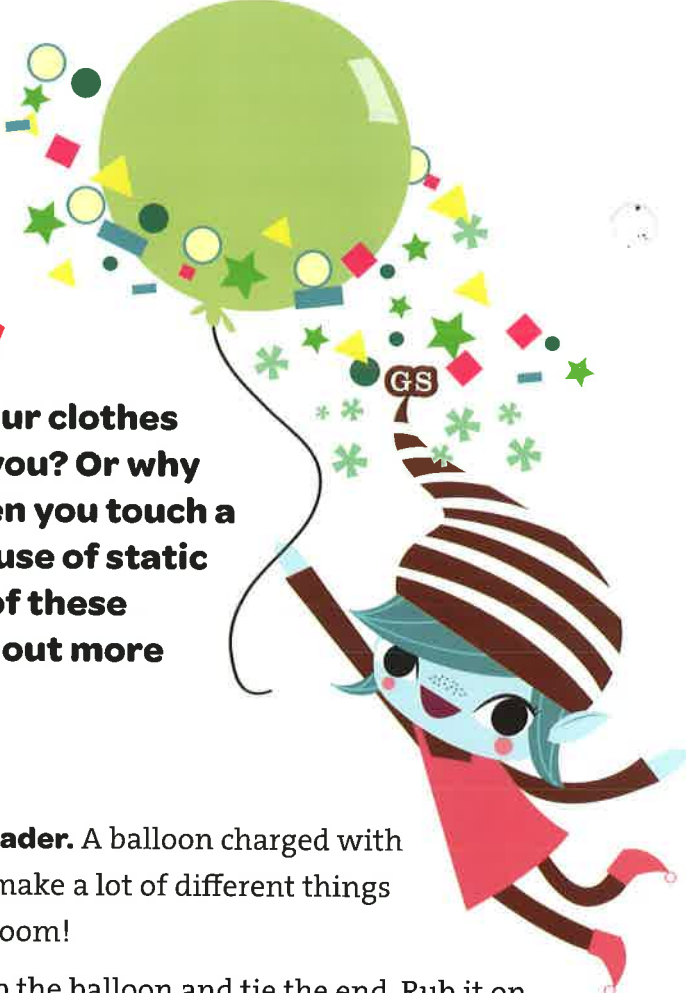
What happens? Salt helps keep the ice cream temperature low enough to freeze milk, and sugar helps keep the ice cream from freezing solid! (There's more cool science in ice cream—with an adult, find out more online.)

Salty Roads

If you live in an area where it snows during the winter, you've probably seen a truck dropping salt on the road after a storm. Your family may even put salt on your driveway when it's icy. Salt helps ice melt and also adds a little bit of traction, which means the grains help tires (or shoes) grip the ice to keep from slipping. Sand is often mixed with salt for even better traction.

You'll need:

- 1 tablespoon sugar
- ½ cup whipping cream or half & half
- ¼ teaspoon vanilla
- 6 tablespoons rock salt or kosher salt
- 1 pint-size ziplock bag
- 1 gallon-size ziplock bag
- Ice



FUN FACT

The saying “opposites attract” is true in both static electricity and magnetism!

Words Worth Knowing

A **PARTICLE** is a very tiny piece.

To **ATTRACT** means to pull closer.

To **REPEL** means to push away.

STEP 2 Create static electricity

Ever wonder why your clothes sometimes cling to you? Or why you feel a shock when you touch a doorknob? It’s because of static electricity. Try one of these experiments to find out more about how it works.

CHOICES – DO ONE:

- Follow the balloon leader.** A balloon charged with static electricity can make a lot of different things follow it around the room!

Instructions: Blow up the balloon and tie the end. Rub it on your hair. Then hold it close to a Ping-Pong ball. When you move the balloon, watch the science magic.

What happens? When you rub the balloon against your hair, you give it a negative charge. The balloon takes some of the electrons from your hair, which leaves your hair positively charged.

Your positively charged hair is now attracted to the negatively charged balloon, so your hair starts to rise up to meet it. This is similar to the Ping-Pong ball, which is drawn to the negatively charged balloon as the area near it becomes positively charged—opposite charges attract. You also see how same charges repel here—after you rub the balloon, the strands of your hair repel each other!

FOR MORE FUN: Try the experiment again with small bits of paper, or blow some bubbles and see if they’ll follow the balloon.

You’ll need:

A balloon
A Ping-Pong ball
Paper
Bubbles (optional)

OR

- Make pepper dance.** See what happens when electric charges jump back and forth.

You'll need:

Salt
Pepper
A sheet of paper
A balloon

Instructions: Pour some salt and pepper on the sheet of paper. Blow up the balloon and tie it, and then rub it on your hair. Hold it over the salt and pepper and watch a “dance”!

What happens? After you rub the balloon on your hair, it gets a negative charge. When you bring it close to the salt and pepper, the charge attracts the pepper first because it’s lighter than salt. The pepper moves to the balloon, where it gets a negative charge, which repels it back to the paper. There, it loses the charge, and the “dance” starts again.

OR

- Bend water.** See if you can bend water with static electricity.

Instructions: Turn the water on in a very thin stream. Rub the comb very quickly on the sweater. Then bring the teeth of the comb near the water, about 3-4 inches below the faucet. Watch closely!

What happens? The water bends toward the comb! By rubbing the comb against the sweater, you gave it a positive charge. This caused the water to be attracted to the charged item.

FOR MORE FUN: Try moving the comb different distances from the water. Then try running it through your hair more times. You could also try different kinds of combs.

You'll need:

Running water from a tap
A plastic comb
A wool sweater



How Static Electricity Works

Static electricity is created when objects get an electrical charge. They get this charge when two objects are rubbed together. Rubbing causes tiny particles called electrons to move from one object to another. The object that loses electrons gets a positive charge, and the one that gains them gets a negative charge.

Objects with the same charge repel each other. Objects with opposite charges attract. How many electrons move—and how much charge each object gets—depends on what the objects are. Look for more on how static electricity works in each experiment in the “What happens?” note.



STEP 3 Dive into density

How come some things float, while others don't? It's all about density. Density is not weight, but it's related. For example, if you swim in the pool with blow-up floaties or a raft, you won't sink because the air inside the floaties is less dense than the water around you. So the air helps hold you up! Try one of these to find out more about density.

CHOICES – DO ONE:

- Egg in salt water.** See if you can keep an egg suspended in the middle of a glass with this experiment.

Instructions: Mix the salt and one cup of water in the glass, then add a few drops of food coloring. Mix to dissolve the salt. Then slowly pour the remaining cup of plain water down the side of the glass. Carefully lower your egg into the glass.

What happens? The egg should sink until it hits the layer of salt water. (The food coloring is to help you see the boundary between the salt water and plain water.) Why does the egg stop sinking? Because the salt water is denser than the egg!

You'll need:

A tall glass or clear pitcher
4 tablespoons salt
2 cups water
Food coloring
An egg



OR

Dancing raisins. Can you make raisins move without touching them? Try this experiment.

Instructions: Pour the soda into the glass. Drop 6 or 7 raisins into the soda. Watch them for a few seconds.

What happens? Raisins are denser than the soda so at first they sink.

But then the bubbles from the soda fill the wrinkles in the raisins, lifting them up. When the bubbles reach the top of the glass, they pop, and the raisins sink again.

You'll need:

Can of lemon-lime soda (like Sprite or 7Up)

Tall glass

A small box of raisins

OR

Lemons vs. limes. Lemons and limes seem very alike. But are they really?

You'll need:

A deep container

A lemon

A lime

Instructions: Fill a deep container with water. Add the lemon and lime.

What happens? Usually the lemon will float and the lime won't. This is because a lime is denser than water, but a lemon is not.

FOR MORE FUN: Try the experiment again with different juicy fruits. You could use an orange with peel and one without, and then add more fruits with and without peels. Which float and which sink? Are any of them in the middle?



STEP 4 Make something bubble up

When mixed with a gas called carbon dioxide, some household items can have a fun reaction. Check out how carbon dioxide reacts with different elements.

IMPORTANT TIP: Make sure you wear sunglasses or safety glasses for these experiments!

CHOICES – DO ONE:

Soda geyser. A geyser is a hole in the earth that sprays out hot water and steam. So making your own is definitely an *outside* experiment!

Instructions: Take the top off the soda bottle and set the bottle on the ground somewhere outside with nothing else around. Open the package of Mentos candy, and stick them along a piece of tape so you can drop them all into the soda at once. When you are ready to make the drop, be ready to run and stand back!

What happens? A soda geyser will erupt because of the carbon dioxide gas created by the rapid reaction between the candy and soda.

You'll need:

- 2-liter bottle of Diet Coke
- Roll of Mentos candy (mint works best)
- Long piece of Scotch tape



OR

- Film-canister rockets.** If a gas like carbon dioxide builds up, it can create a strong force.

Instructions: Fill the film canister half-full with water. Cut the Alka Seltzer tablet into 4 pieces, then drop the pieces into the canister, and snap on the lid. Time the reaction!

What happens? The carbon dioxide created by the reaction in the canister should pop the top off the canister.

FOR MORE FUN: Try again, changing the amount of water or Alka-Seltzer. Is there a best combination?

OR

- Blow up a balloon without using your breath.** Gases like carbon dioxide will try to find a place to go when they are expanding in confined spaces. Test this out by showing your friends how to blow up a balloon without using your breath. Be careful—the balloon might pop!

You'll need:

- 2 spoons
- 2 tablespoons vinegar
- A clean, empty plastic bottle
- A balloon
- 1 teaspoon baking soda

Instructions: With one of the spoons, add the vinegar to the bottle. Ask a friend or an adult to hold open the mouth of the balloon, and, using the other spoon, pour baking soda into the

balloon. Then stretch the balloon's opening over the mouth of the bottle. Make sure the baking soda inside the balloon falls into the vinegar.

What happens? The baking soda and vinegar create carbon dioxide when they mix. There is not enough room inside the bottle for the extra gas, so it expands into the balloon, blowing it up!

You'll need:

An old film canister with a pop-in lid (it's important that the lid is *pop-in*, not pop-on. Pop-in canisters are usually clear, while pop-ons are usually black with a grey or black lids. Canisters are available at photo stores or science-supply stores)

Water

Alka-Seltzer tablets



STEP 5 Play with science

Science can also be used to make things that are just plain fun. Use science to make one of these homemade “toys” and amaze your friends!

CHOICES – DO ONE:

Giant bubbles. These are even *more* fun than the small ones from the standard bubble wand.

Instructions: To make your bubble blower, cut a long piece of string and thread it through two straws. Tie the ends of the string together, and then slide the knot into the middle of one of the straws. You can adjust the blower size by making the length of string shorter or longer before tying ends. Pour the liquids into the tub and mix. Dip your blower into the tub. Holding the straws, slowly spin around. With some practice, you should create huge bubbles!

You'll need:

- Cotton string
- A large plastic tub
- 2 plastic straws
- 1 cup dishwashing soap
- 4 cups water
- ½ cup light-colored corn syrup or glycerin



OR

Homemade Silly Putty. Silly Putty is fun goo that you can stretch, stamp, and play with. Instead of buying some, why not make your own?

Instructions: In the bowl, mix 8 drops of food coloring, the glue, and 1 cup water. Mix the borax with 1 1/3 cups water. Slowly add the liquid starch or borax mixture to the colored glue and water mixture. Knead the mixture until you can stretch it but it isn't too mushy. Store in a plastic bag or covered container. (If it's out in the air for more than two hours it will harden!)

You'll need:

Food coloring
3/4 cup glue
1/4 cup liquid starch or borax
Mixing bowl
Water

OR



Make dinosaur sn_t. Okay, so maybe it isn't real... but it sure looks like it!

You'll need:

A mixing bowl
1 1/2 cups cornstarch
1 cup water
Yellow and green food coloring

Instructions: In the bowl, mix the cornstarch and water. Add a few drops of yellow and green food coloring to the mixture. Use your hands to make sure it has really combined. After about a minute, you'll have stretchy slime that looks like it came from a dinosaur. *Achoo!*

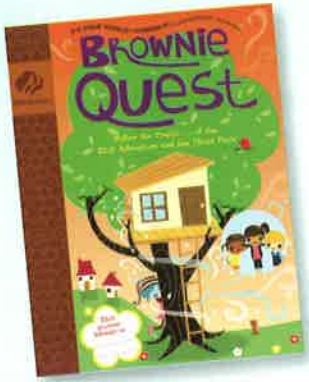


What's the Matter?

Matter is what everything is made of, and it exists in one of three states: solid, liquid, and gas. Sometimes, something isn't all one way or all another. Take putty, for example. Is it a solid or a liquid? Actually, it's both! Putty is a **COLLOID**—a mixture of one substance suspended (or floating) in another. The suspended bits are so tiny that they don't sink in the second substance. A few examples of colloids are smoke, fog, mayonnaise, and butter.

FUN FACT

Did you make the salad dressing in step 1? If so, you know that's an **EMULSION**. An **EMULSION** is a type of **COLLOID**.



Add the Badge to Your Journey

Now that you are having fun with the science all around you, how about adding a little fun with haiku. Check out the examples on page 28 in your *Brownie Quest* and make up a haiku to go with one of the science experiments in this badge!

Now that I've earned this badge, I can give service by:

- Helping Daisies make giant bubbles
- Sharing the science of ice cream with my friends
- Making a healthy salad for my family and explaining the science behind the dressing



I'm inspired to: