



Dear Girl Scout,

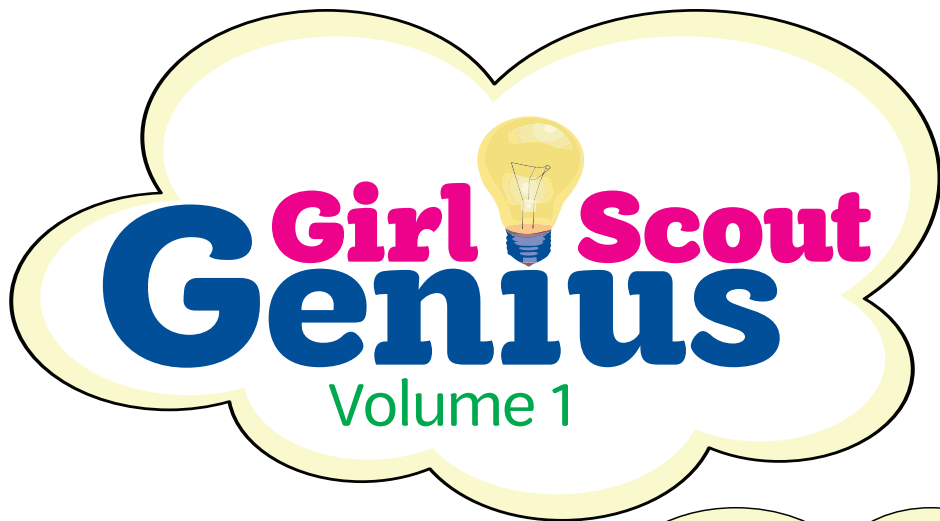
Thanks for wanting to keep your brain fresh and active this summer! We're going to try cool experiments that will be interesting, will make you smarter, and will definitely create something to show your friends or family.

Trying experiments with things you find around your house is a good way to learn what happens when you mix things together. It's science in action!

Because you're reading this I know you're a G.I.R.L. (Go-getter, Innovator, Risk-taker, Leader)TM—You're ready to try new things and find solutions, you're not afraid of failing and trying again, and you know how to get the job done. So let's do this!

Look at the experiments and the lists of what you'll need to decide what to try first. Have an adult or older friend help you gather your supplies and then get ready to create. Congratulations scientist, you're on your way!

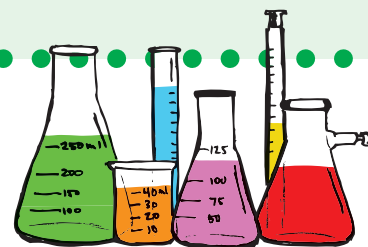
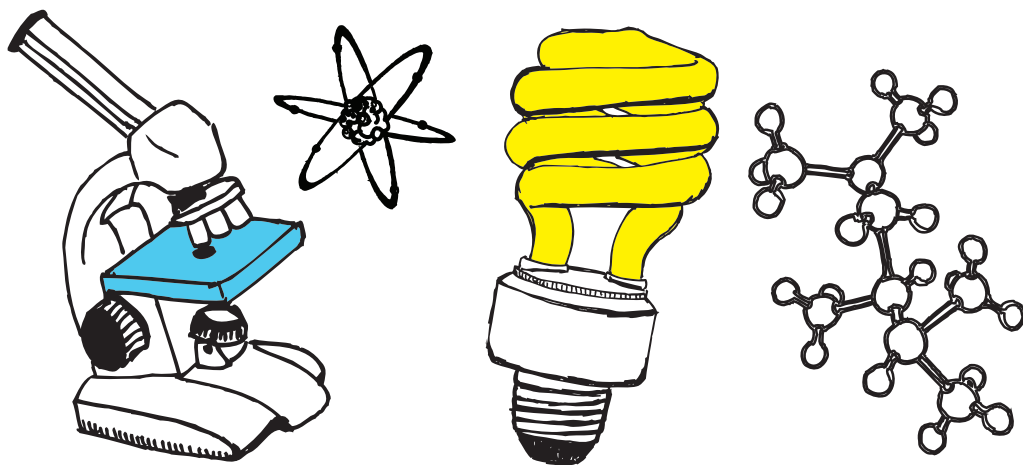
Your friend,
The Girl Scout Genius Guide



A Note to Parents

Thank you for subscribing to the Girl Scout Genius series where Girl Scouting comes alive through science, technology, engineering, and math (STEM) activities. The series includes three packets, mailed directly to your Girl Scout from June to August.

We know that every minute you spend with your daughter is precious, so dig in and make the time count! With these booklets, a little planning, and a few household items, you and your daughter can have a summer of learning and fun together.



Grow Rock Candy

Making your own rock candy is a fun and tasty way to grow crystals and see the structure of sugar on a big scale.

What you'll need:

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

Instructions:

1. With an adult's help, boil the water.
2. 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 food coloring.
3. Pour this liquid into the jar, but don't let any undissolved sugar get into the jar.
4. Put skewers into the solution or tie string to a pencil and lay the pencil across the top of the jar so the string hangs into the solution.
5. After about an hour use a magnifying glass to see what happens.



What's happening?

Sugar is actually made of tiny crystals. As they grow, they clump together. This makes the crystals attach to the string or skewer.



NOW TRY THIS!

- Check the rock candy over time:
 - Four hours
 - One day
 - One week
 - Three weeks
- Look closely at salt crystals. Do they look different than sugar crystals?

Write or draw a picture of what happened below!

Static Electricity Experiment

Find out about positively and negatively charged particles using a few basic items. Can you control if they will be attracted or not attracted to each other? Try the experiments below to find out.

What you'll need:

- Two inflated balloons with string attached
- Your hair
- Empty aluminum can
- Wool fabric

Experiment #1

One at a time, rub the two balloons against the woolen fabric. Try moving the balloons together. Do they want to stick together or stay apart?

Experiment #2

Stand in front of a mirror and rub one of the balloons back and forth on your hair. Then slowly pull it away. What happens to your hair?

Experiment #3

Put the aluminum can on its side on a table. After rubbing the balloon on your hair again, hold the balloon close to the can and watch as the can rolls towards the balloon. Slowly move the balloon away from the can and it will follow.

What's happening?

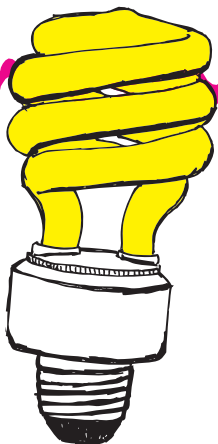
Rubbing the balloons against the wool fabric or your hair creates an electrical charge. The scientific term for this is **static electricity**. This can make objects stick together or stay apart.

These experiments involve **negatively charged** particles (electrons) jumping to **positively charged** objects.

In the first experiment both the balloons were **negatively charged** after rubbing them against the woolen fabric. Because of this they were not attracted to each other and therefore didn't stick together.

Your hair is **positively charged** so it was attracted to the **negatively charged** balloon and stuck to it.

This is similar to the aluminum can which is drawn to the **negatively charged** balloon as the area near it becomes **positively charged**. Once again, opposites attract.



$$\sum_j M_{ij} C_j$$

Make Lava

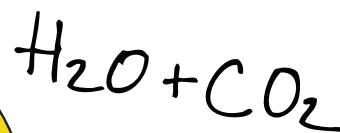
Use the properties of oil and salt to make lava. Of course it won't be real lava but it will look a bit like a lava lamp your parents may have had.

What you'll need:

- A clear drinking glass
- 1/4 cup vegetable oil
- 1 teaspoon salt
- Water
- Food coloring (optional)

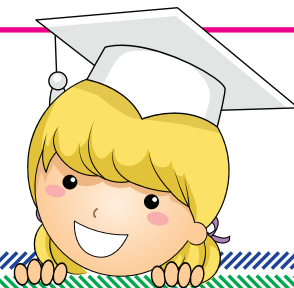
Instructions:

1. Fill the glass about 3/4 full of water.
2. Add about 5 drops of food coloring - we suggest red for the lava look.
3. Slowly pour the vegetable oil into the glass.
4. Observe how the oil floats on top - cool huh? It gets better.
5. Sprinkle the salt on top of the oil.
6. Watch what happens in your glass!
7. Add another teaspoon of salt and watch what happens now.



What's happening?

First of all, the oil floats on top of the water because it is lighter than the water. Since the salt is heavier than oil, it sinks down into the water and takes some oil with it, but then the salt dissolves and back up goes the oil!



NOW TRY THIS!

- How long will the effect go on if you keep adding salt?
- Do different kinds of food oil give different effects? (ex. sunflower oil or olive oil)
- Will other substances (sand, sugar, etc.) work the same as salt?
- Does the height or shape of the glass affect the experiment?

Write or draw a picture of what happened below.

MAKE AN EGG FLOAT IN SALT WATER

An egg sinks to the bottom if you drop it into a glass of ordinary drinking water but what happens if you add salt?

Write or draw a picture of your prediction below.

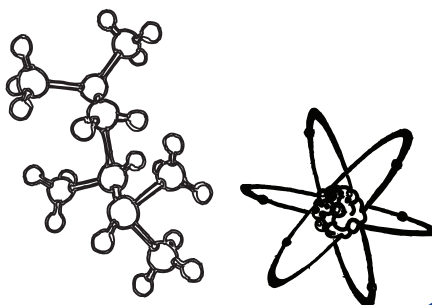


What's happening?

You're discovering some fun facts about **density**! Density is a term scientists use to explain how heavy an object is. It is the measurement of an object's mass or weight per unit of volume. Salt water is denser, or heavier, than ordinary tap water. The denser the liquid the easier it is for an object to float in it. Therefore, when you lower the egg into the liquid it sinks through the tap water until it reaches the salt water. The salt water is dense enough to support the egg so the egg is able to float in the middle of the glass. Amazing!

What you'll need:

- One raw egg
- Water
- 6 tablespoons of salt
- Food coloring
- A tall drinking glass



Instructions:

1. Pour water into the glass until it is about half full.
2. Stir in the salt then add a few drops of food coloring.
3. Carefully pour plain water down the side of the glass until the glass is nearly full. If you are careful, the tap water and salt water won't mix and the food coloring will let you see the boundary between the two types of water.
4. Gently lower the egg into the water and watch what happens.

Make a Tornado (in a Bottle)

You can make your own mini tornado that's a lot safer than one you might see on the weather channel!

What you'll need:

- Water
- A clear plastic bottle with a cap (that won't leak)
- Glitter
- Dish washing liquid

Instructions:

1. Fill the plastic bottle with water until it reaches around three quarters full.
2. Add a few drops of dish washing liquid.
3. Sprinkle in a few pinches of glitter (this will make your tornado easier to see). If you don't have glitter, you could try cutting up a plastic grocery bag into tiny pieces.
4. Put the cap on tightly.
5. Turn the bottle upside down and hold it by the neck. Quickly spin the bottle in a circular motion for a few seconds.
6. Stop and look inside to check if you can see a mini tornado forming in the water. You might need to try it a few times before you get it working properly.



What's happening?

Spinning the bottle in a circular motion creates a **water vortex** that looks like a mini tornado. The water is rapidly spinning around the center of the vortex due to **centripetal force** (an inward force directing an object or fluid towards the center of its circular path).

What else in nature would be considered a vortex? Write or draw a picture below.



Dissolving Sugar at

Different Heats

Learn about solutions as you add more and more sugar cubes to water heated to different temperatures. This experiment shows that you can only dissolve a certain amount and that this changes as the water temperature changes.

What's your prediction... what temperature water do you think you will be able to dissolve more sugar cubes in?

Circle your prediction below.

Cold water Hot water

What you'll need:

- Sugar cubes
- Cold water in a clear glass
- Hot water in a clear glass (be careful with the hot water)
- Spoon for stirring

Instructions:

1. Make sure the glasses have an equal amount of water.
2. Put a sugar cube into the cold water and stir with the spoon until the sugar disappears.
3. Repeat this process until the sugar stops dissolving and gathers on the bottom of the glass rather than disappearing into the liquid. Remember to count the amount of sugar cubes you put into the water!
4. Write down how many sugar cubes you could dissolve in the cold water.
5. Repeat the same process for the hot water.
6. Compare the number of sugar cubes dissolved in each liquid, which dissolved more?

Number of sugar cubes in cold water _____

Number of sugar cubes in hot water _____



What's happening?

The cold water isn't able to dissolve as much sugar as the hot water, but why? In scientific terms, the name for the liquids inside the cups is a **solution**. When this sugar and water solution can no longer dissolve the sugar it becomes a **saturated solution**. That's when the sugar started forming on the bottom of the cup.

The reason the hot water dissolves more sugar is because it has faster moving molecules which are spread further apart than the molecules in the cold water. With bigger gaps between the molecules in the hot water, more sugar molecules can fit in between and help the sugar dissolve.



BLOWING UP BALLOONS...

SAVE YOUR BREATH!

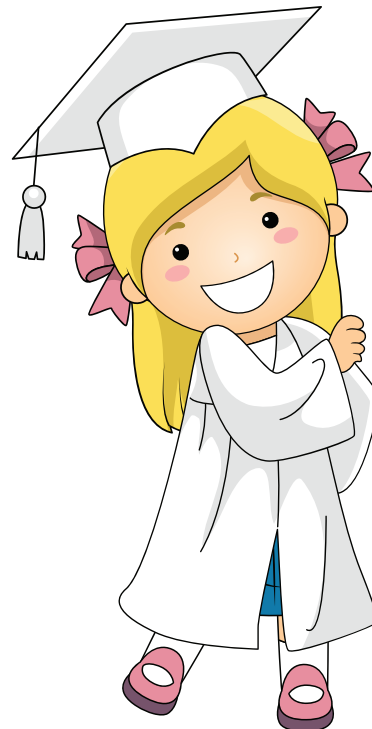
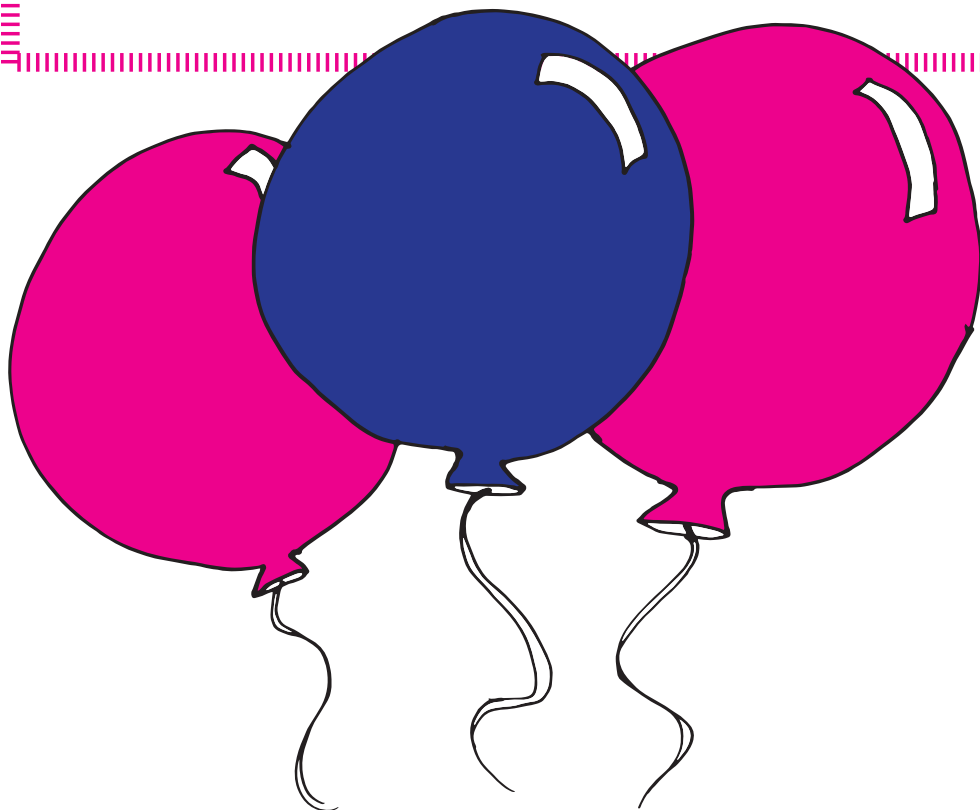
Chemical reactions make for some great experiments. Discover a creative way to make use of the carbon dioxide given off by a baking soda and lemon juice reaction.

What you'll need:

- Balloon
- Measuring cup
- About 40 ml of water (just over an ounce)
- Soft drink bottle
- Drinking straw
- Juice from a fresh lemon (or lemon juice or vinegar)
- 1 teaspoon of baking soda

Instructions:

1. Before you begin, make sure that you stretch out the balloon to make it as easy as possible to inflate.
2. Pour the 40 ml of water into the soft drink bottle.
3. Add the teaspoon of baking soda and stir it around with the straw until it has dissolved.
4. Pour the lemon juice in and quickly put the stretched balloon over the mouth of the bottle.



If all goes well then your balloon should inflate! Adding the lemon juice to the baking soda creates a **chemical reaction**. The baking soda is a base, while the lemon juice is an acid. When the two combine they create a gas called carbon dioxide (CO₂). The gas rises up and escapes through the soft drink bottle and into the balloon, pushing it outwards and blowing it up.



Raw or Boiled?



Two eggs look and feel the same but there is a big difference, one is raw and the other hard boiled, find out which is which with this fun experiment.

What you'll need:

- One raw egg
- One hard-boiled egg (Make sure both eggs are the same temperature.)

Instructions:

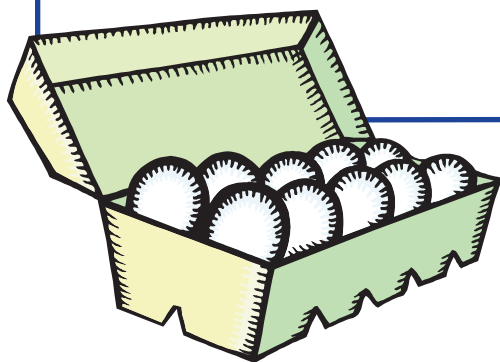
1. Spin the eggs and watch what happens, one egg should spin while the other wobbles.
2. You can also lightly touch each of the eggs while they are spinning, one should stop quickly while the other keeps moving after you have touched it.

The raw egg's center of gravity changes as the egg white and yolk move around inside the shell, causing the wobbling motion. Even after you touch the shell it continues moving. This is because of **inertia**, the same type of force you feel when you stop suddenly in a car - your body wants to continue to move forward while the car stays in place. Inertia causes the raw egg to spin even after you have touched it. In contrast, the solid egg white and yolk of the hard boiled egg does not move around the inside of the shell so it creates less inertia and therefore responds much quicker when you touch it.

NOW TRY THIS!

Are there other ways you can tell the two eggs apart? Be creative and make your own experiment to find out.

Write or draw a picture of your findings below.



This is a good experiment to do to test a friend or someone in your family. See if they can figure out how to tell the difference between the eggs (without smashing them of course). Then show them your nifty trick and what you now know about inertia and the center of gravity.

Homemade Silly Putty®

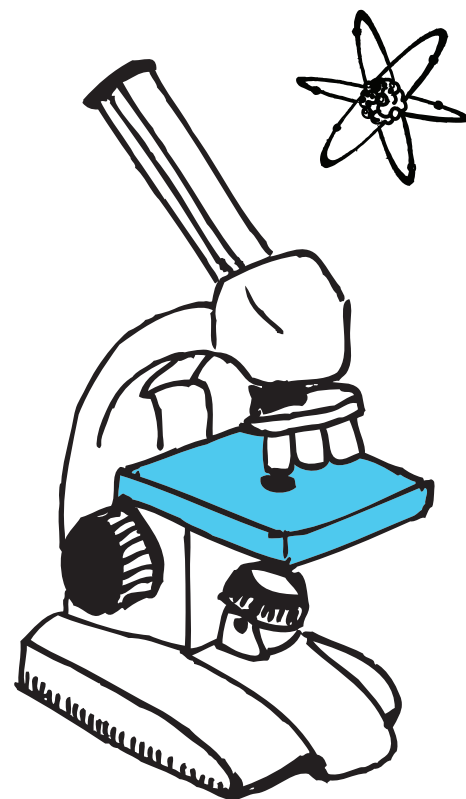
Make some crazy putty that you can squish in your hands, mold into shapes or even bounce on the ground.

What you'll need:

- A medium size bowl
- Water
- Food coloring
- 1/4 cup Elmer's glue (or other PVA glue)
- Borax solution (About 1 tablespoon of Borax dissolved into a cup of water)
- Plastic bag or covered container

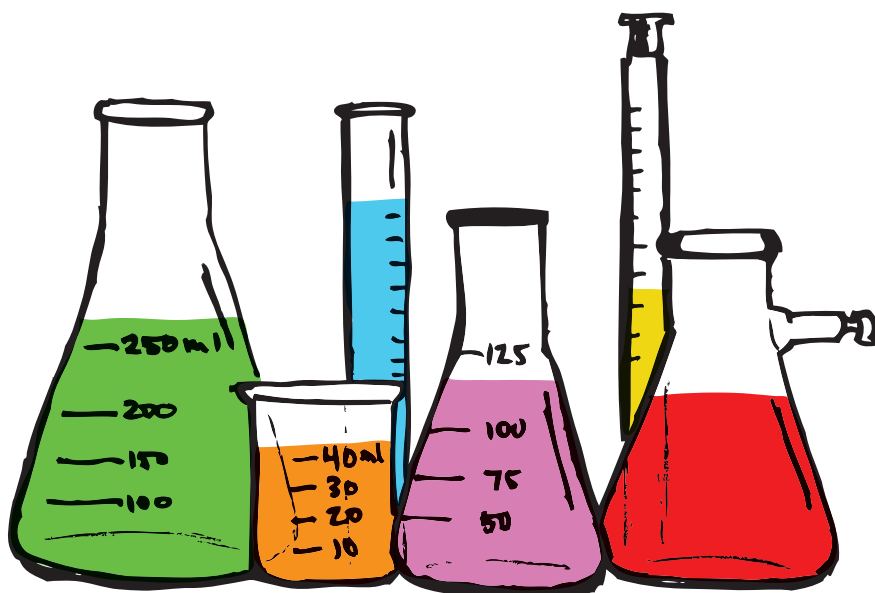
Instructions:

1. Pour the glue into a bowl.
2. Add 2 or 3 drops of food coloring and stir.
3. Add 2 tablespoons of the Borax solution.
4. Stir the mixture until it starts to join together.
5. Finish mixing using your hands.
6. Store in a plastic bag or covered container.
(If it's out in the air for more than two hours it will harden.)



What's happening?

The PVA glue you use is a type of **polymer** (a long chain of molecules) called polyvinyl acetate (PVA for short). The Borax is made of a chemical called sodium borate. When you combine the two in a water solution, the Borax reacts with the glue molecules, joining them together into one giant molecule. This new compound is able to absorb large amounts of water, producing a putty-like substance that you can squish in your hands or even bounce.



Fantastic Foaming Fountain

What you'll need:

- A clean 16 ounce plastic soda bottle
- 1/2 cup 20-volume hydrogen peroxide liquid (20-volume is a 6% solution, ask an adult to get this from a beauty supply store or hair salon)
- 1 tablespoon (one packet) of dry yeast
- 3 tablespoons of warm water
- Liquid dish washing soap
- Food coloring
- Small cup
- Safety goggles (or sunglasses)

Be sure to partner with an adult on this messy, but really cool, activity!

Instructions:

1. Do this activity on a washable surface or place the bottle on a tray.
2. Hydrogen peroxide can irritate skin and eyes, so put on those safety goggles and ask an adult to carefully pour the hydrogen peroxide into the bottle.
3. Add 8 drops of your favorite food coloring into the bottle.
4. Add about 1 tablespoon of liquid dish soap into the bottle and swish the bottle around a bit to combine ingredients.
5. In a separate small cup, combine the warm water and the yeast together and mix for about 30 seconds.
6. Now the adventure starts! Pour the yeast water mixture into the bottle (a funnel helps here) and watch the foaminess begin!

NOW TRY THIS!



- Does the amount of yeast change the amount of foam produced?
- Does the experiment work as well if you add the dry yeast without mixing it with water?
- Does the size of the bottle affect the amount of foam produced?

Write or draw a picture of your findings below.



What's happening?

The foam you made is special because each tiny foam bubble is filled with oxygen. The yeast acted as a **catalyst** (a helper) to remove the oxygen from the hydrogen peroxide. Since it did this very fast, it created lots and lots of bubbles. Did you notice the bottle got warm? Your experiment created a reaction called an **exothermic reaction** - that means it not only created foam, it also created heat! The foam produced is just water, soap and oxygen so you can clean it up with a sponge and pour any extra liquid left in the bottle down the drain.

A Taste of Camp Life

You don't have to be a great adventurer or outdoor expert to enjoy Girl Scout camp. At camp girls participate in a wide variety of activities, from cooking over a campfire and creating art projects to playing group games and singing silly songs. The best part of camp is making new friends and having a ton of fun. Go to gswise.org to find information on summer camp and events.

Try cooking a campfire meal using the sun!

Learn about solar energy by making a solar cooker.

What you'll need:

- Shoebox
- Aluminum foil
- Glue
- Scissors or knife
- Hot dogs
- Stick
- Clear plastic wrap
- Black construction paper or fabric

Instructions:

1. Cover the outside of the box with black construction paper, fabric or paint. (Making the box black will help the solar oven absorb more energy from the sun than any other color.)
2. With help from an adult, cut a rectangular flap out of the top of the box lid by making three cuts - two short ones parallel to the short ends of the box and one long one parallel to the long edge of the box. Put a small crease in it so that the flap sticks up.
3. Glue aluminum foil to the inside of the bottom of the shoe box. Make sure it is shiny side up so it reflects the most light.
4. Glue aluminum foil to the inside of the flap you made in the lid as well.
5. On the inside of the box lid, lay a sheet or two of plastic wrap down and glue it in place. This will trap the heat inside the box.
6. Put your items to cook inside the box, and put the lid on. (Hot dogs work well for this experiment.)
7. Prop the flap up so that it reflects sunlight into the hole in the box top, and set it out on a spot where the sun shines. Depending on the brightness of the day and the quantity of food you're cooking, it may take anywhere from 20 minutes to two to three hours to cook something.



What's happening?

The black box attracts the sun's rays. Those rays reflect off of the foil and get trapped inside the box. With the help of the plastic wrap, the sun's heat gets trapped inside the box which cooks the hot dog. Scientists call this type of heat **solar heat**.

WANT DESSERT?

Place a clean piece of foil in the bottom of the box and add chocolate or butterscotch chips. Stick a toothpick onto a marshmallow or piece of apple. Once the chips are melted, dip the marshmallow or apple into the chips.

