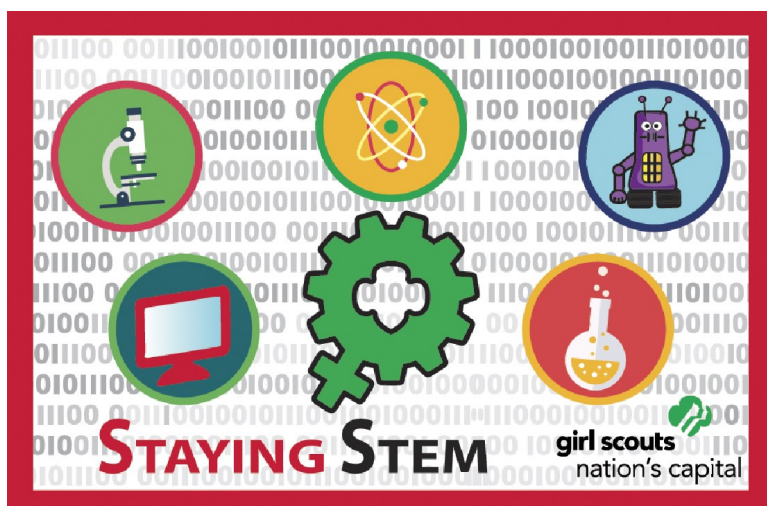


Staying STEM

A Girl Scouts Nation's Capital Fun Patch



Girl Scouts is about dabbling and trying new things! At Girl Scouts Nation's Capital, we are committed to STEM and have many resources available to introduce girls and troops to the basics of Science, Technology, Engineering, and Math while staying safe and having fun! This guide is intended to highlight some of the STEM opportunities around our Council, and offer ideas for how girls can explore STEM even further.

Girl Scouts of all ages have the opportunity to complete any of the included activities to become eligible to earn the Staying STEM fun patch. If a particular activity was really exciting, a girl can choose to do some research on her own and find another activity to try.

How do I Earn the Staying STEM Patch?

Once you try any of the activity ideas or experiments included in this guide, you can buy the Staying STEM fun patch from our Council Shop. These are just to get you started – you can always do more!

- ⇒ **Earn one of Girl Scouting's STEM-related badges.** Science has been a longstanding part of the Girl Scout experience, and the Girl Scout Journeys and skill-building badges reflect that today. A chart of the existing STEM badges and awards is on page 6 of this guide. More details on each badge can be found in the Girl's Guide to Girl Scouting for that level.



- ⇒ **Cook something!** Many of your favorite recipes are chemistry in action. Your kitchen can be a science lab. Discover why popcorn pops or what happens to the structure of pasta when it's boiled. Then, pretend you are on an educational cooking show and share the science you learned while you demonstrate the preparation of a favorite meal.

- ⇒ **Borrow one of our Council's 22 STEM program kits.** From light refraction to rockets, our kits cover a variety of exciting topics and come with supplies and activity instructions that make it easy to get going! These kits can be checked out at no cost, and are available for each level. Consider working with a program kit at your next troop meeting or even take it with you to camp. Find a list of STEM kits on page 4 of this guide.



- ⇒ **Complete one of the 8 experiments included in this guide.** Grow your own crystals or make sculptures out of milk! Each experiment uses common materials and contains directions and ideas of ways to further explore the topic.



How do I Earn the Staying STEM Patch?



- ⇒ **Take a field trip.** Not sure you want to tackle a STEM activity in a troop meeting? Participate in a STEM program offered by one of our wonderful community vendors. Program Partners are organizations that feature Girl Scout programming or offer a discount to Girl Scout members. You can visit the National Air and Space Museum on Girl Scout Day in March, or an aquarium or other science museums in your community. Many partners offer STEM activities for youth, including places you might not normally think of.

A laser tag venue could be a great place for you to learn about optics and sensors. Check out the STEM vendor section of our Council's Yellow Pages publications to see what events are coming up.

- ⇒ **Hold a STEM-themed troop meeting.** If your troop is interested in learning how to code, think about starting a robotics team. You can build your own robot using a components kit and then program it to do cool things! Websites such as www.madewithcode.com give you the opportunity to learn programming from a computer in your meeting space. Watching a STEM-themed movie or a TV show is also a fun way to bring science into your troop. Find a list in this guide. Robotics – form a team with your troop.
- ⇒ **Show off your Making mojo!** Our Council hosts an annual exhibit fair called Maker Day where troops showcase their tinkering abilities by coming up with hands-on science demonstrations and creative projects to share. Show off an invention you created or an experiment that you can show others how to do. Look for information to sign up to exhibit at or attend the next Maker Day.
- ⇒ **Become a citizen scientist.** Did you know that you can contribute to scientific research right now? Check out scistarter.com to find out about projects happening near you. Examples include counting birds in your backyard, taking a survey about your cat, or submitting photos of the clouds around you.



How do I Earn the Staying STEM Patch?

- ⇒ **Explore careers.** Find out how you can take your passion for science and turn it into something you can get paid to do. Visit a local lab or ask a scientist to come to a troop meeting and tell you about what they do. If you don't have a person in mind, you can use a directory to find a scientist in your community that you could invite to an upcoming meeting.

Girl Scout Juniors can take part in our Booz Allen Hamilton “Make the Connection” series in a special program just for them. At Make the Connection Jr. girls work side-by-side with Booz Allen employees to learn more about STEM careers while engaging in hands-on STEM activities. Because girls’ confidence and interest in STEM begins to decline between fourth and sixth grades, this program is designed to show girls all of the opportunities STEM can offer. Check out our Council’s program registration page to find out when the next event will take place.



- ⇒ **Use the stuff you know to run a science day for younger Girl Scouts.** You can help a troop earn the Brownie Home Scientist badge or read the girls a book about STEM. For a large group, you can set up stations that girls rotate through trying out new experiments and learning basic science principles. Not only will this help you share your knowledge of STEM, you may also be able to earn service hours for the time you put in! Book ideas and sample experiments for younger girls are located in this guide.



Looking for a starting point for the Council events and information mentioned? Start with our Council’s Activity webpage, <http://www.gscnc.org/councilactivities>. This webpage includes links to Yellow Pages, upcoming events such as Maker Day and information on our Make the Connection program and other STEM– related Council opportunities.

















STEM Program Kits

To reserve a kit, please use the reservation system information found on the Kits and Patches webpage at www.gscnc.org/kits

Theme	Kit or Resource	Appropriate Level					
		D	B	J	C	S	A
STEM—Bridging the Gap	Goggle Tub	✓	✓	✓	✓	✓	✓
	Daisy Color Wonders	✓					
	Real-World STEM Challenges	✓					
	Brownie Earth and Sky		✓				
	Brownie My Body		✓				
	Brownie Numbers and Shapes		✓				
	Brownie Science in Action		✓				
	Brownie Science Wonders		✓				
	Brownie Senses		✓				
	Junior Aerospace			✓			
	Junior Making it Matter			✓			
	Junior Rocks Rock			✓			
	Junior Science in Everyday Life			✓			
	Junior Science Sleuth			✓			
	Junior Weather Watch			✓			
	Design Time: Girls Go Techbridge			✓	✓		
	Teen Science Activities				✓	✓	✓
	Teen Build A Better Future				✓	✓	✓
	Teen Eco-Action				✓	✓	✓
	Teen Math, Maps and More				✓	✓	✓
	Teen Space Exploration				✓	✓	✓
	Robotics		✓	✓	✓	✓	✓

Girl Scouts of the USA

STEM-related Badges and Journeys

	Naturalist	Digital Arts	Science & Technology	Innovation	Journeys
Brownie	 Bugs	 Computer Expert	 Home Scientist	 Inventor	 WOW! wonders or Water
Junior	 Flowers	 Digital Photographer	 Entertainment Technology	 Product Designer	 Get Moving!
Cadette	 Trees	 Digital Movie Maker			 Breathe
Senior	 Sky	 Website Designer		 Social Innovator	
Ambassador	 Water				

All Financial Literacy badges fit under the Math in STEM.

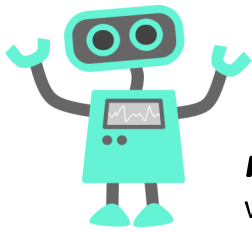
Between Earth and Sky Daisy Journey is a STEM-related Journey.

Other badges can have components of STEM weaved in.

Resources & Activity Ideas: Websites

Browse these websites to find activity ideas for a STEM themed troop meeting!
All of these resources are great for girls who want to explore STEM outside of their troop meeting!

National Girls Collaborative Project- Engaging Girls in STEM (<https://ngcproject.org/engaging-girls-stem>) -research focused on what works to engage and support girls in STEM. These publications present new and existing research and provide it in user-friendly formats to inform programming.



Engineer Girl (<http://www.engineergirl.org/>) – this website is a service of the National Academy of Engineering (NAE), it is designed to bring national attention to the exciting opportunities that engineering represents for girls and women.

FabFems Directory (<http://www.fabfems.org/about>) – a national database of women in STEM professions who are inspiring role models for young women. See if you can find someone in your area to come speak at a STEM themed troop meeting!

STEM-Works (<http://stem-works.com/>) – Web portal that supports volunteers that are working in their local communities to increase STEM skills in our nation's youth.



eGFI (<http://www.egfi-k12.org>) – Educational resources for both Adults and Girls from the American Society for Engineering Education.

Engineer Your Life (<http://www.engineeryourlife.org/>) – a guide to engineering careers for Girls

Science Kids (www.sciencekids.co.nz) – Educational resources for teachers and parents that help make science fun and engaging for kids, taking important concepts and putting them into a form that kids can not only understand but also enjoy.

Kinetic City (<http://www.kineticcity.com/>) – created by The American Association for the Advancement of Science, this website uses online games to familiarize children with STEM.



PBS Kids (<http://pbskids.org/games/all-topics/>) – Find online games from different STEM related topics for your Girls to play, whether at home on her own or during a troop meeting.

Science Bob (www.sciencebob.com) – Resources and experiments for Adults and Girls. Take a look at the ‘Science Fair Ideas’ webpage to find inspiration for a possible Maker Day experiment or activity.

Vermont Libraries and Makers: Spark a Culture of Innovation (<http://libraries.vermont.gov/services/projects/VTlibrariesandMakers>) – If your Girls loved the hands on aspect of the experiments and want more options, this website has 5 more innovative experiments to choose from.

Resources & Activity Ideas: Books, Movies, and TV (Most of these are available at Public Libraries)

These are great resources for girls who want to explore STEM outside of their troop meeting!

Watching a movie or television show with female characters who explore STEM is a wonderful way to show young girls that they can succeed in STEM.

Flatland - an award-winning animated film inspired by Edwin A. Abbott's classic 1884 novel, "Flatland." Set in a world of only two dimensions inhabited by sentient geometric shapes, the story follows Arthur Square and his ever-curious granddaughter Hex. When a mysterious visitor arrives from Spaceland, Arthur and Hex must come to terms with the truth of the third dimension, risking dire consequences from the evil Circles that have ruled Flatland for a thousand years.

Project MC² - A Netflix original series that follows a group of undercover teenage girl spies who use their STEM knowledge— from culinary chemistry to gadget engineering—to solve missions and save the world, all while proving smart is the new cool.



Underwater Dreams - a documentary about low-income teens who win a robotics competition.

These books are great for supplemental learning, or you can choose one to read to a younger troop! Some of these books have additional experiments and hands on activities that your troop may prefer to do instead of the ones provided in this guide.



Albert Einstein and Relativity for Kids: his Life and Ideas with 21 Activities and Thought Experiments by Jerome Pohlen - Learn all about Albert Einstein and his contributions to science!

Mistakes that Worked by Charlotte Jones - Cartoons illustrate the stories behind the invention of such everyday items as Silly Putty, trouser cuffs, popsicles and penicillin.

Head to Toe Science by Jim Wiese - More than 40 experiments and investigations will help Girls explore the body systems and basic scientific concepts. The activities range from simple (how to test the sense of smell) to more complex (calculating the amount of horsepower used to walk and then run upstairs).

Gizmos and Gadgets: Creating Science Contraptions That Work (& Knowing Why) by Jill Frankel Hauser - Use simple household items to create toys that spin, fling, collide, and whiz, kids will grasp the basics of concepts of gravity, inertia, balance, and energy.

What Make a Magnet? By Franklyn Mansfield Branley - This book smoothly describes how magnets work and includes a couple of experiments for making a magnet and a compass.

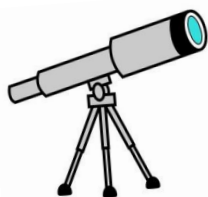
Girls Think of Everything by Catherine Thimmesh - Collective biographies of women and girls who changed the world with their inventions.



Resources & Activity Ideas: Books, Movies, and TV

(Most of these are available at Public Libraries)

IF: A Mind-Bending New Way of Looking at Big Ideas and Numbers by David J. Smith – This book scales down large concepts and numbers for young readers with a focus on worldly concepts. Topics ranging from our galaxy, solar system, world history, inventions, world population, and energy and food production are related to familiar everyday objects, so children can easily grasp the relationship between these big ideas.



Infinity and Me by Kate Hosford – This philosophical picture book makes this seemingly difficult concept approachable and interesting. Young Uma ponders the concept of infinity with the help of friends and family. She finds that the idea can be mind-boggling, but seems less scary when considered in loving company. The story effortlessly combines the enormity of the universe with the frankly personal.

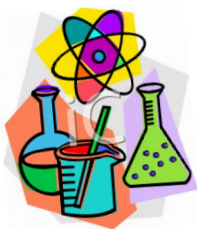
The Science Chef Travels Around the World: Fun Food Experiments and Recipes for Kids by Joan D'Amico – A fun combination of simple science experiments and international cooking, arranged by country. Whether you're a beginner or an experienced cook, you can become an International Science Chef, too. All experiments and recipes are kid-tested, include and require only common ingredients and kitchen utensils.

Math Fables: Lessons the Count by Greg Tang – Told in rhyme, this fable strives to help readers learn how to see a number as a combination of smaller groups of numbers in order to lay "the foundation for place value" and as a "first step to building strong computational skills."

Isaac Newton and Physics for Kids: His life and Ideas with 21 Activities by Kerrie Logan Hollihan – 21 hands-on projects that explore the scientific concepts Isaac Newton developed, this illuminating guide paints a rich portrait of the brilliant and complex man and provides young readers with a hands-on understanding of astronomy, physics, and mathematics.



What is Density by Joanne Barkan – Young readers will find out why the baseball is heavier than the popcorn ball and why they'd better hold on to the string of that balloon!



What Floats? What Sinks?: A look at Density by Jennifer Boothroyd – Learn all about matter, energy, and forces!

What is Matter? By Don L. Curry – Readers learn about different science tools, scientific properties, motion, gravity, and other forces they encounter every day.

Gravity is a Mystery by Franklyn Mansfield Branley – Nobody can say exactly what it is, but gravity is there, pulling on everything, all the time. With the help of an adventurous scientist and his fun-loving dog, you can read and find out about this mysterious force.

Forces Make Things Move by Kimberly Brubaker Bradley – This book starts with a common childhood experience, pushing toy cars across the floor--and gradually--introduces ideas such as forces, reactions, inertia, friction, and gravity.

Resources & Activity Ideas: Books, Movies, and TV (Most of these are available at Public Libraries)

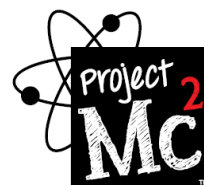
Physics: Why Matter Matters! By Simon Basher - Imagine physics as a community full of wacky characters--the building blocks of the universe each with a unique personality. This book throws open the doors and welcomes you into their amazing world. From gravity to the theory of relativity, this unique book provides visual interpretations of complex concepts, designed to make learning physics easier and a whole lot more fun!

The Kids' Book of simple Machines: Cool Projects and Activities the Make Science Fun! by Kelly Doudna - Through exciting science projects and activities kids can easily do at home or school, tomorrow's scientists and engineers will have a blast learning about simple machines and how they make daily life easier. This book is the perfect STEM companion for curious minds at home or in the classroom.

Girl Scouts of the USA STEM Partnerships and Resources

The *STEM Superstars Guide* provides Girl Scout volunteers nationwide with the tools they need to keep girls' passions and curiosity for STEM subjects alive. The guide shows just how easy it is to make STEM matter for young girls with conversation starters, troop activities and examples of STEM role models.

Girl Scouts of the USA and Netflix have joined forces to empower young girls to envision their futures in STEM fields. The new Netflix original series *Project Mc²* follows a group of girls who are under cover spies that use their STEM knowledge to save the day! By seeing female role models in STEM careers, girls are more inspired to follow in their footsteps.

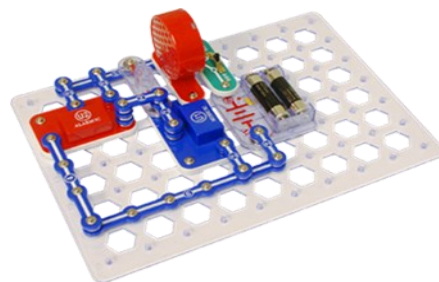


Girl Scouts of the USA is excited to be a part of Google's *Made with Code* which aims to change the way girls think about coding and inspire them to consider careers in computer science. Girls can try Blockly-based coding projects like designing a 3D-printed bracelet, learning to create animated GIFs, and even building beats for a music track. Use this special URL to help GSUSA count how many girls made with code: https://www.madewithcode.com/?utm_source=girl_scouts&utm_campaign=mwc_partners0614

STEM Games

These hands-on games can help you learn STEM principles through puzzles and problem-solving. Please note: these games are for sale via the vendors.

SNAP Circuits (<http://www.snapcircuits.net/>) - These activities will allow your Girls to create working circuit boards just like the ones found inside televisions, radios, and other electronic devices. With its easy-to-follow instructions, Snap Circuits gives your child a hands-on education in how electrical circuits work to run the everyday devices that they're familiar with.



GoldieBlox (<http://www.goldieblox.com/>) - Through the integration of storytelling and STEM principles, GoldieBlox creates toys, books, apps, videos, animation and merchandise; the tools that empower girls to build their confidence, dreams and ultimately, their future.

Roominate (<http://www.roominatetoy.com/>) - A unique blend of building, circuits, design, crafts, storytelling, and creativity teaches kids while they play. Using motor and light circuits, modular furniture building pieces and walls, Roominate empowers kids to build endless amazing creations!

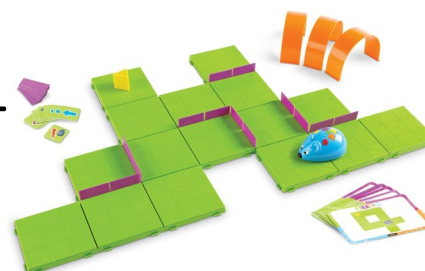


Think Fun Robot Turtles (<http://www.thinkfun.com/>) - Through simple commands used to program the Robot Turtle, kids learn what it means to write code, debug and use functions.

Learning Resources Code & Go Robot Mouse

Activity Set (<https://www.learningresources.com/>) -

Introduce children to the fun of coding and puzzle solving with this colorful, programmable mouse with maze! A great way to introduce young children to science, technology, engineering, and math!



Homemade Lava Lamp (D/B/J)

Materials

- Water
- A clear plastic bottle
- Food coloring
- Alka-Seltzer (or any other fizzing tablet)



Instructions:

1. Pour water into the plastic bottle until it is around 1/4 full.
2. Pour vegetable oil until the bottle is nearly full.
3. Wait until the water and oil have separated. *You should notice that the oil will sit on top of the water.*
4. Add a dozen drops of food coloring to the bottle. Feel free to play around with mixing colors. You'll notice the food coloring will fall through the oil and mix with the water.
5. Cut an Alka-Seltzer tablet into small pieces so that you have 5-6 pieces.
6. Drop the tablet pieces into the bottle one at a time. Each tablet will cause the mixture to move just like a real lava lamp!
7. **When one piece has worked all its magic add other one.**

Optional Extension:

What happens if you add more than one piece of Alka-Seltzer at a time? Will the lamp still work if you let the bottle sit for a while and then add more Alka-Seltzer? What happens if you screw the cap on the bottle and tip it back and forth?

How does it work?

Oil and water do not mix together. The oil sits on top of the water because it has a lower **density**. That means that with the same amount of oil and water, the oil will have less **mass** (weight). The food coloring has a similar density to water so it passes through the oil and mixes with water. The Alka-Seltzer pieces release small bubbles made of **carbon dioxide gas**. This gas is highly active and will rise to the top, where the oil is, while carrying some of the food coloring along with it. **When the water bubbles reach the oil, the gas escapes and the colored water falls back down because of its density.** By adding more Alka-Seltzer more **carbon dioxide** is created which makes the reaction last longer.

Make sure adults are supervising at all times!

The Incredible Invisible Ink (D/B/J)

Materials

- Half a Lemon
- Water
- A Spoon
- A Bowl
- Cotton Buds
- White Paper
- Lamp or other light bulb



Instructions:

1. Squeeze some lemon juice into your bowl and add a few drops of water.
2. Mix the water and lemon juice well with a spoon.
3. Dip the cotton bud into the mixture and write a message onto the white paper.
4. Wait for the juice to dry so it becomes completely invisible.
5. When you are ready to read your secret message or show it to someone else, heat the paper by holding it close to a light bulb.
6. Watch your message appear on paper.

Optional Extension:

What other substances do you think would be able to make secret messages? Try testing out some household items like milk, vinegar and honey to see what will work.

How does it work?

Lemon juice is an organic substance that oxidizes and turns brown when heated. Diluting the lemon juice in water makes it very hard to notice when you apply it to the paper. This means that no one will be aware that the message is there until the lemon juice is heated.

Make sure adults are supervising at all times!

Blow Up a Balloon with Yeast (D/B/J)

Materials

- A packet of yeast (available in the grocery store)
- A small, clean, clear, plastic soda bottle (16 oz. or smaller)
- 1 teaspoon of sugar
- Some warm water
- A small balloon

Instructions:

1. Fill the bottle up with about one inch of warm water. (*When yeast is cold or dry the micro-organisms are resting.*)
2. Add all of the yeast packet and gently swirl the bottle a few seconds. (*As the yeast dissolves, it becomes active – it comes to life! **Don't bother looking for movement, yeast is a microscopic fungus organism.***)
3. Add the sugar and swirl it around some more. Like people, yeast needs **energy** (food) to be active, so we will give it sugar. Now the yeast is “eating!”
4. Blow up the balloon a few times to stretch it out then place the neck of the balloon over the neck of the bottle.
5. Let the bottle sit in a warm place for about 20 minutes. If all goes well the balloon will begin to inflate!



Optional Extension:

The project above is a DEMONSTRATION. To make it a true experiment, you can try to answer these questions:

Does room temperature affect how much gas is created by the yeast?

Does the size of the container affect how much gas is created?

What water/room temperature helps the yeast create the most gas?

What “yeast food” helps the yeast create the most gas? (try sugar, syrup, honey, etc.)

How does it work?

As the yeast eats the sugar, it releases a gas called **carbon dioxide**. The gas fills the bottle and then fills the balloon as more gas is created. We all know that there are “holes” in bread, but how are they made? Most breads are made using yeast. Believe it or not, yeast is actually living microorganisms! When bread is made, the yeast becomes spread out in flour. Each bit of yeast makes tiny gas bubbles and that puts millions of bubbles (holes) in our bread before it gets baked. When the bread gets baked in the oven, the yeast dies and leaves all those holes in the bread. Yum.

Make sure adults are supervising at all times!

Make your own Crystal Candy (D/B/J)

Materials

- Piece of string, about 6 inches (kite string works great)
- A pencil or popsicle stick
- A paper clip (or large plastic bead)
- 1 cup of water
- 2 cups of sugar
- A glass jar (mason jars works good)



Instructions:

1. Tie one end of the string to the middle of the popsicle stick or pencil.
2. Tie the other end around bead or paper clip.
3. Next, lay the popsicle stick or pencil across the top of a jar so that the string hangs down the middle of the jar. *You want to make sure that it is not touching the bottom of the jar, but you do want it close. Make sure that it is not touching the sides of the jar either.* If it hangs down too far, just roll the string around the pencil a few times to shorten the string. **The string will act as a seed for the crystal.** Now that the string and pencil are ready remove them from the jar and set them aside.
4. Pour the water into a pan and bring it to boil. **Have an adult help you with this step.**
5. Add 1/4 cup of sugar to the boiling water, stir it until it dissolves. **Have an adult help you with this step.**
6. Repeat this step until all of the sugar is dissolved. This will take time and patience and it will take longer for the sugar to dissolve each time. Be sure you don't give up too soon. You are making a **supersaturated solution!**
7. Have an adult carefully pour the hot sugar solution into the jar and fill it almost all of the way to the top. Go ahead and put your pencil or popsicle back n top and lower the bead or paperclip back inside of the jar, just like you practiced before. Allow the jar to cool and put it someplace where it will not be disturbed.
8. Next comes the waiting part. Check on it everyday to see the crystals start to grow, but be very careful not to disturb it. The longer you wait the bigger it will get. You can also place a coffee filter or paper towel over the jar so nothing falls in

How does it work?

When you mixed the water and sugar you made a SUPER SATURATED SOLUTION. This means that the water could only hold the sugar if both were very hot. As the water cools the sugar “comes out” of the solution back into sugar crystals on your string. The string and paper clip act as a “seed” that they start to grow on. With some luck and patience you will have a tasty scientific treat! Enjoy!

Make sure adults are supervising at all times!

Balloon Hovercraft (C/S/A)

Materials

- An old CD or DVD disc
- A 9 inch balloon
- A pop-top cap from a liquid soap bottle or a water bottle
- A hot glue gun
- Push pin (only if using a water bottle cap)



Instructions:

1. If you are using a cap from a water bottle, cover the center hole of the CD with a piece of tape and poke about 6 holes in the tape with a small push pin.
2. Use the hot glue gun to glue the cap (right side up) to the center of the cd of dvd disc. Be sure to make a good seal around the cap so that the air does not escape. ***Have an adult help you with this step.***
3. Blow up the balloon all the way and pinch around the neck but do not tie it.
4. Make sure the pop-top is closed and fit the neck of the balloon over the pop up portion of the cap. You may need to work together to make sure you don't lose air in your balloon during this step.
5. When you are ready to start hovering, put the craft on a smooth surface and pop the top open. Be sure to keep the balloon fitted around the bottle opening. The top does not need to be completely open, just enough to have air flow.

Optional Extension:

Does the size of the balloon or the amount of air inside affect the CD's ability to move and hover? Do helium balloons work better than air-filled balloons? Do larger discs such as picnic plates or old record albums make better hovercrafts than CDs and DVD discs?

How does it work?

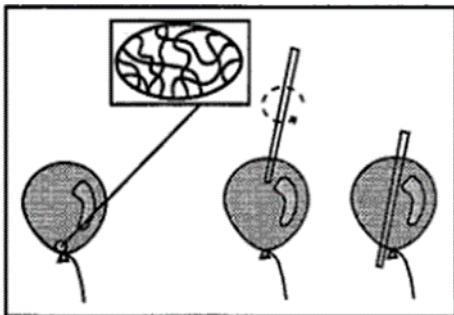
The air flow created by the balloon causes a **cushion of moving air** between the disc and the surface. This lifts the CD upward and reduces the friction between the CD and the surface, allowing the disc to hover freely. This is the same principle that large-scale hovercrafts follow. These types of crafts can travel on land, snow, and water.

Make sure adults are supervising at all times!

Skewer a Balloon (C/S/A)

Materials

- Several inexpensive 8 or 9 inch round balloons (Cheap balloons work better because they have thicker blobs of rubber on the ends)
- Bamboo Skewer
- Small amount of vegetable oil



Instructions:

1. Rub a small amount of vegetable oil on the bamboo skewer to lubricate it before you do the demonstration.
2. Blow up the balloon to its full size. Let some air out. Make sure the balloon is small enough for the skewer to go completely through it as seen in the photo above.. Tie balloon closed.
3. Look for the thick spot at the end of the balloon. Hold the balloon firmly and push the skewer in this thick spot with a *twisting* motion. Keep pushing until it pops through. Continue pushing the skewer through the balloon. Push the skewer out again at the thick spot near where you tied the knot. Remember to use a *twisting* motion. **These thick spots at the ends are the only two spots you can poke a hole into a balloon and it won't pop.** *If your balloon popped, you may need to practice some more or you might have better success with a different brand of balloon.*
4. To show the balloon can pop, take the skewer out and poke the balloon through the side where it is thin, opposite of what is seen in the photo. It should pop easily.

How does it work?

When balloons are made they have thicker spots of rubber at both ends. When a balloon is blown up, the thick spots at the ends don't stretch much, but the sides stretch a lot and are under stress.

A skewer or long needle will pass through the unstretched rubber molecules easily at the ends. However, when you poke the side of the balloon, stress on the stretched rubber molecules is too much and the balloon breaks.

**Experiment from: GSCNC Teen Science Activities Program Kit*

Make sure adults are supervising at all times!

Eggshell Geode (C/S/A)

Materials

- Clean eggshells
- Water
- A variety of soluble solids: table salt, rock salt, sugar, baking soda, Epsom salts, sea salt, borax, cream of tartar
- Small coffee cups or another heat proof container
- Spoons
- Food coloring
- Egg cartons and wax paper



Instructions:

1. Crack the eggs as close to the *narrow* end as possible. You want to have as much of the egg shell left as possible to grow your geode
2. Clean the eggshell using *hot* water. The hot water should allow you to pull the egg membrane out of the inside. Make sure to remove all the egg membrane, anything that is left can make the eggshell grow mold.
3. Place the eggshells upright in the lined egg carton.
4. Bring water to a boil.
5. Pour $\frac{1}{2}$ a cup of water in the heatproof container (coffee cup). Add $\frac{1}{4}$ cup of any solid to the $\frac{1}{2}$ cup of water and stir until dissolved.
6. Continue adding small amounts of the solid until the water is super- saturated. Super saturated means the water has absorbed all of the solid it will be able to handle so you cannot dissolve anymore solid.
7. Add food coloring of any choice to your solution.
8. *Carefully* pour the solution in the eggshell as much as possible without overflowing the shell.
9. Find a safe place to put your egg carton for an extended time. When the water evaporates crystals will form the inside of the eggshells.

How does it work?

By putting the soluble solid in the hot water a **super-saturated solution** was formed. The hot water has more energy than room temperature water. The solid's molecules took advantage of the extra energy to help them dissolve until there was no more space between all the molecules in the solution. When the eggs shells were left and the water evaporated, the water lost its extra energy and the crystals where squeezed together to form a solid again. Since evaporation is slow, the crystals had time to grow larger than they were in the beginning of the experiment. This is a lot like how natural geodes are formed. In nature mineralized water seeps into air pockets in rock and slowly form the geodes.

Make sure adults are supervising at all times!

Milk Sculptures (C/S/A)

Materials

- Microwave safe bowl
- Skim Milk (1 and ½ cups)
- White vinegar (4 teaspoons)
- Strainer
- Plate (paper plate is fine)

Instructions:

1. Pour 1 ½ cups of skim milk into the bowl. You can use whole milk, but skim works best.
2. Add 4 teaspoons of white vinegar and stir it for about 10 seconds.
3. Microwave this mixture for about 2 minutes. If you're not allowed to use a microwave, make sure you ask an adult to help you.
4. Carefully remove it from the microwave. Be careful because it can be hot. The milk should have separated into two parts, a liquid and a solid. The curds are the solid part and the whey is the liquid part.
5. Pour the curds and whey through a strainer.
6. Once you are sure it is not too hot, take the curds out and squish it into a ball. It will feel like rubber. You can even form shapes with the curds then leave it out to harden. *If you let it sit out for 1-2 days, it will harden just like plastic.*



Optional Extension:

Try changing the amount of vinegar that is added. Does this change the amount of properties of the casein that is made? Will low-fat or soy milk produce the same results as regular whole milk? Do all types of vinegar work? Try playing around with white vinegar, apple cider vinegar or white wine vinegar. What types of acid work besides vinegar? Maybe lemons or oranges would work. What happens if I use lemon juice instead? What happens if I don't heat it, but just let it sit out?

How does it work?

How can milk be plastic? The substance you created is called a **casein**. A **casein** is a little different than a true plastic but has many of the same properties. **casein** occurs when the protein in milk meets the acetic acid in vinegar. These two substances do not mix with each other so they form a blob. That blob is what you get to mold and have fun with!