Science Wonders

Leader Guide
For Brownie Girl Scouts

BRIDGING
THE
GAP

A collaboration
Between
Discovery Place, Inc.
and Hornets' Nest Girl Scout Council.

Introduction

As Girl Scout leaders and professionals, it is our goal to provide quality programs designed to enable girls to meet the many challenges of the future. Bridging the Gap (BTG) does that by providing easy, fun, and inexpensive activities that build confidence, both in the girls who do them, and in the leaders who guide them. All BTG activities are designed to be hands-on explorations of science, engineering, and mathematics (SEM), where the only limits are the boundaries of the imagination. Here, there is rarely a right or wrong answer. Instead, there is a sense of accomplishment in discovering something new in every effort.

As leaders, BTG gives **you** the opportunity to provide a more successful SEM program for your girls. By providing simple activities in an easy-to-follow format, BTG will enable you to guide your troops with confidence in both the execution and the success of your SEM programming.

With the increasing importance of science and mathematics in our everyday lives, from balancing a checkbook, to surfing the Internet, as well as in the professional world of the future, building confidence and excitement in exploring SEM activities is essential to the success of our girls in the world of tomorrow. But beyond the immediate challenge of these specific activities, there is even a greater importance attached to motivating our girls to explore science, engineering, and mathematics.

Gender Equity and SEM

Girl Scout Councils across the country have done extensive research in the area of gender bias and how girls are affected by it, with a particular view toward science, engineering, and mathematics. In developing materials to be used by troop leaders, special attention has been given to the teaching methods and attitudes that our girls have been exposed to in the conventional classroom.

We know that in formal classroom settings, girls are not always encouraged to develop an interest in advanced science and mathematics studies. Research shows that both male and female teachers tend to expect more from boys, especially in the areas of science, engineering, and math, and, as a result, often unconsciously promote a learning bias. Sometimes this bias is a result of lower expectations for girls, and often reflects the teacher's personal lack of confidence in their own command of the material.

As Girl Scout adults, we need to encourage girls to explore their interests in science, not only for those who seek to become scientists, but also for those who want to become good parents, homemakers, businesswomen, and/or political leaders. Science and math are part of everyday life, from managing the household budget (accounting), to rearranging the furniture (geometry), and even while cooking dinner (chemistry).

The only way that we, as Girl Scout leaders and professionals, can implement a successful SEM program with our girls, is to motivate their natural excitement and curiosity, while reexamining our own perceptions as to what science is, and the role it plays in our lives.

We need to project an enthusiasm for the subject matter, a confidence in using the materials and in teaching the activity. We, the role models, must be *excited* at the opportunity to expand our knowledge through hands-on experiences in science, engineering and math, so that our girls will feed off that enthusiasm, and actively seek to gain the experiences that all of the data suggests they have been missing.

Bridging the Gap lets ***you and your girls*** explore, ask questions, take risks, and stretch your interests as far as your enthusiasm will allow. After all....

Learning is directly proportional to the amount of fun you have!!!

Why SEM is essential for your Girl Scouts

According to data from the Departments of Education and Labor:

- While girls score higher than boys in reading from the 4th grade on, they fall behind boys in science and math test scores as they move further through high school.
- Over the past few years women were awarded fewer than 25% of the degrees in chemistry, less than 20% of the degrees in physics and math, and less than 1 of every 10 degrees awarded in engineering.

This happens despite research that indicates:

- Engineering will be among the highest paying and fastest growing occupations over the next decade.
- Women with good math skills earn more than women without good math skills.
- The fastest growing occupations - computer technology, engineering, and statistical analysis - all require strong backgrounds in science, technology, math, and/or engineering.

Tips for Leaders Beginning SEM Activities

- Examine your own attitude about science and math before attempting the following activities.
- Practice the activities yourself.
- Take risks, get messy, explore, and observe.
- Have fun doing the activities.
- Develop a sense of confidence knowing that it works, it's easy, it's fun, and you can do it.
- Hold high expectations for the girls.
- Encourage the girls to take risks, get messy, explore, and observe.
- Invite the girls to have fun doing the activities.
- Don't readily give the girls answers. Instead, encourage them to discover on their own.
- Help the girls achieve a sense of accomplishment and confidence knowing they can do it.
- Whenever possible invite real role models, female engineers and scientists, to talk with your troop about their careers, and how the girls can start planning a career of their own.

How To Use This Guide

The activities in this guide are intended to be as user-friendly as possible. They were developed to be easy to do, easy to set up, and virtually always successful. Each refers to a corresponding section from an official Girl Scout Leader handbook, and that is noted on the 'Contents' page as well as in each activity. For your convenience, we have included an overview, the estimated amount of time you'll need in doing the activity with the troops, the materials needed, safety and clean-up suggestions, and planning suggestions in order to better prepare to do the activity with your girls.

The step-by-step instructions include tips, cautions, questions to challenge your girls, and explanations. Since trying the activities before the troop meeting is strongly encouraged, we have included instructions with most of the activities on how to do it by yourself first. Please read all sections of the activity before trying with your girls. With many of the activities we have included references and resources at the end of the section, or in the back of the Leader Guide, to direct you to areas where your girls may explore further, or where specialty items might be purchased.

You will also find various icons throughout the guide which are placed to draw special attention for the following reasons:

When you see this **pay close attention** to the instructions.

These are questions you may wish to use to challenge your girls.

Look here for an explanation of what is happening and why.

This icon indicates a more in-depth explanation of what is happening.

Here you will find hints on making an activity easier.

Science Wonders

Table of Contents

Synopsis
Inventory
Sample Leader Survey
Introduction
Crystals
Chemistry Magic
Magnet Fun- Optional Activity
Bubbles
Paper Making
Static Electricity
Magnet Hunt

Crystals– Satisfies Home Grown Crystals Activity

The girls will dissolve common household crystals in water and observe how the crystals grow back as the water evaporates. This activity has a strong emphasis on skills such as observing, classifying and comparing.

Tub Supplies:	You Supply:
❑ Crystalline mineral samples kit	❑ Pencils
❑ 30 magnifying lenses	❑ Copies of "Draw the Crystal"
❑ Sleeve of 1-ounce medicine cups	❑ Copies of "Everyday Crystals"
❑ *Rocks and Minerals* book	❑ 9-ounce clear plastic cups
❑ Goggles	❑ Salt (table and/or rock)
	❑ Epsom salt
	❑ Alum (Substitute sugar if unavailable)
	❑ Clear tape
	❑ Plastic spoons
	❑ Hot water
	❑ Colored cups
	❑ Table covering
	❑ Permanent markers to label cups

Chemistry Magic- Satisfies Presto Change-O Activity

In this activity, the girls will add vinegar to milk, which will separate into curds and whey. The milk curds will then be mixed with baking soda and water to make glue. The girls will learn that chemical reactions can change things into something new. They will also see that chemistry can be fun, and that is all right to get messy when you experiment.

Tub Supplies	You Supply
❑ Goggles	❑ Plastic spoons
❑ Sleeve of medicine cups	❑ Basket-type coffee filters (1 per girl)
	❑ 9-ounce clear, plastic cups (2 per girl)
	❑ 3-quart package of powdered non-fat milk
	❑ 1 1/2 cups of vinegar
	❑ Box of baking soda
	❑ Set of measuring spoons
	❑ Measuring cup
	❑ Hot water (1/3 to 1/2 per girl)
	❑ Paper
	❑ Table covering
	❑ Paper towels
	❑ Plastic wrap

Magnet Hunt- Satisfies Magnet Hunt Activity

Girls will find out what will stick to a magnet and what won't.

Tub Supplies	You Supply
❑ 2 examples plastic containers	❑ Pencils
❑ assortment of items in containers	❑ One copy of the magnet hunt chart per a girl
❑ 30 ring magnets	❑ Small items that are metal
❑ Master copy of Magnet Hunt Chart	❑ Small items that are not metal
	❑ 1 Plastic bag or clear plastic container per a girl

Magnet Fun – Optional Activity

In this activity, the girls will play with ring magnets and explore how magnets can attract and repel each other. With filaments of steel wool, the girls will make a visible "picture" of the lines of magnetic force to take home. In this way, they will also be introduced to the idea of force as either a push or a pull.

Tub Supplies	You Supply
❑ 60 ring magnets	❑ Pencils
❑ Package of steel wool #000	❑ Paper
❑ 30 clear containers with lids	❑ Adhesive nametags or glue sticks
❑ Goggles	❑ Cloves
❑ Container of Iron Filings	❑ 9-ounce plastic cups
❑ Funnel	❑ Newspaper to cover surface
	❑ Aluminum can and/or aluminum foil
	❑ Box of paper clips
	❑ Pennies (optional)

Bubbles - Satisfies Bubbles Activity

The girls will explore why bubbles are round and attempt to make bubbles that are round. In this activity, the girls will learn about air pressure, and that the reason that bubbles are round is because air pushes on them, with equal force on all sides.

Tub Supplies	You Supply
❑ 2 six-quart plastic tubs	❑ Distilled Water
❑ Sleeve of 1-ounce medicine cups	❑ Dishwashing detergent (1 cup)
❑ 60 plastic bubble wands	❑ 1/2 cup glycerin
	❑ Package of drinking straws
	❑ Ball of cotton string
	❑ Measuring cup
	❑ 4 or 5-ounce plastic cups
	❑ 8 or 9-ounce clear plastic cup
	❑ Piece of cardboard
	❑ Paper Towels (optional)
	❑ Access to clean water

Paper Making- Satisfies Homemade Recycled Paper Activity

The girls will recycle by making new paper from scraps of old paper, getting first-hand experience in recycling by making something useful from discarded scraps.

Tub Supplies	You Supply
❑ 2 six-quart plastic tubs	❑ Irons
❑ 30 4" x 6" plastic canvases	❑ Blender
❑ 60 felt squares	❑ Shredder paper
❑ 30 small sponges	❑ Hot water
	❑ Lots of newspaper
	❑ Box of reseal able plastic bags (optional)
	❑ Permanent markers (optional)

Static Electricity- Satisfies Static Activity

In this activity, girls will use simple materials to generate static electricity and explore its behavior. They will be introduced to the concept of energy and learn that energy is the ability to do work. Work is using force to move an object. The girls will use static electricity to do work by moving objects such as Instant Cream of Wheat. The girls will also be introduced to the ideas of positive and negative charges, and that opposite charges attract, while like charges repel.

Tub Supplies	You Supply
❑ 30 pieces of wool cloth	❑ Balloons
❑ 60 ring magnets	❑ Paper plates
	❑ Box of Instant Cream of Wheat or grits

Materials Checklist for Brownie Science Wonders

Tub Number BSW - _____	Borrower*		BTG*	Borrower*		BTG*	Borrower*		BTG*	Borrower*		BTG*	Borrower*		BTG*
	out	back	in	out	back	in	out	back	in	out	back	in	out	back	in
DATE															
INITIALS															
CONTENTS:															
Crystalline mineral samples kit – 8 samples															
30 magnifying lenses in a sandwich bag															
sleeve of 1-ounce medicine cups															
Rocks and Minerals Golden Guide book															
2 six-quart plastic tubs															
Package of steel wool #000															
30 4" x 6" 10 mesh plastic needlepoint canvases															
60 felt squares															
15 small sponges															
60 ring magnets in a quart bag															
30 safety goggles															
30 two-ounce clear plastic jars with lids															
2 examples - plastic containers for magnet hunt															
Container of metal filings															
Funnel															
30 plastic bubble wands in a quart bag															
30 pieces of wool in a gallon bag															
1 Science Wonders Leader Guide															
BTG Information Packet (red folder) with:															
Checklists, Leader's surveys & Master copies of:															
"Draw the Crystal"															
"Everyday Crystals"															
" Magnet Hunt"															

*Borrower - use columns to check tub contents - use "out" when you first get the tub and "back" to make sure everything is in the tub before returning it. *BTG - is for office use only. Borrowers are responsible for seeing that all items listed above are returned to the tub.

Please notify the BTG Distribution Center if something is missing, that is not already listed as missing.

rev. 8/02

Crystals

Overview

In this activity, girls will observe and compare crystals found in minerals to crystals that can be found in ordinary household items. The girls will dissolve common household crystals in water and observe how the crystals grow back as the water evaporates.

Big Ideas

This activity has a strong emphasis on skills such as observing, classifying, and comparing. "Right" answers are not the purpose of this activity. It is more important that each girl learn to observe, draw her conclusions, and be able to explain the reasons for her conclusions to others.

Estimated Activity Time

30 – 45 minutes

Materials Needed

Your VSC provides:

For each girl:

- ☐ 1-ounce medicine cups
- ☐ Magnifying lenses
- ☐ Goggles

Additional supplies:

- ☐ 1 *Rocks and Minerals* book
- ☐ 1 mineral samples kit

Items you provide:

For each girl:

- ☐ Pencil
- ☐ Copy of "Draw the Crystal" worksheet
- ☐ Copy of "Everyday Crystals" worksheet
- ☐ 9-ounce clear plastic cup

Additional supplies:

- ☐ Salt---table and/or rock salt
- ☐ Epsom salt
- ☐ Alum, substitute sugar if unavailable (on the above items, estimate 1-2 teaspoons per girl)
- ☐ Clear tape (one dispenser per 2-3 girls)
- ☐ Plastic spoons (one package should be enough)
- ☐ Hot water availability (either from tap or thermos)
- ☐ Colored cups to hold household crystals (set of 4 colors for each 3-4 girls)
- ☐ Table cover
- ☐ Permanent marker to label cups

NOTES

NOTES

Safety

The materials used in this activity are not hazardous when used correctly. Observe normal precautions and emphasize the following basic chemistry rules.

a. **Chemists always follow directions and work carefully.**
b. **Chemists never taste the chemicals in their experiments.**
c. **Chemists always wear safety glasses or goggles.**

Use of hot water requires you to be sure that the girls are aware the water is hot, and should be handled with care. While the water should be hot, it should not be hot enough to cause burns.

Clean-Up

Dispose of, or recycle, paper and plastic products.

How To Do It

Background Information

When most people think of crystals, they think of rocks. Rocks are made of minerals. Some rocks are made entirely of one kind of mineral, while others are made of mixtures of different minerals. Minerals, in turn, are pure, inorganic substances, and are made of crystals. Some mineral crystals are large enough to be easily seen and handled. Others can only be seen with a magnifying glass or a microscope.

All minerals are crystals, but not all crystals are minerals. Sometimes living things make chemicals that form crystals. Sugar is an example of a crystal that is organic, meaning it was made by a living organism.

All crystals, no matter how large or small, have a certain organized pattern, or structure, that repeats itself and stays the same in each repetition.

Crystals can also dissolve and then "grow" back. Rock candy is an example of dissolved sugar crystals that grew back. All crystals can do this under certain circumstances, even though it may require extreme heat, pressure, or chemicals for it to happen.

1. Explore the sample crystals yourself. Use the magnifying glass if you wish. As you read about each, refer to the sample and try to see the crystals. How would you describe them? What shapes are they? Is the whole specimen a crystal? You can use the *Rocks and Minerals* guide book to learn more about minerals and their crystal shape.

Quartz can be found in many forms. The specimen you have is a long, clear-white crystal with a distinctive six-sided shape that is pointed at one or both ends. Quartz is very hard and can come in many colors. Purple quartz crystals are gemstones called amethyst. Milky quartz is white, tiger eye is brownish, and agate is multicolored and striped.

NOTES

NOTES

Gypsum is a clear or white, soft mineral that is used to make plaster or tile, and other construction materials. The specimen you have is a crystal, which is flat on some sides, but not all. It can be glassy, and have long cracks in one direction. It is soft enough to scratch with your fingernail.

Copper is a pure metal. The sample of native copper you have is bumpy and heavy. Copper is rarely found as crystals, but forms in characteristic "trees".

Calcite in the form included in this sample kit is called Iceland spar. It is flat on all its sides in all three dimensions, and is slanted to one side. The sides look like parallelograms.

Optical calcite has an unusual property. Place the specimen over the printed words on this page and look through it. You will get a double image. Rotate the calcite, and you will see one line of print rotate around the other. This double image is called birefringence (pronounced bye-ri-frin-gents).

Dolomite has many fine-grained compact crystals that have grown into each other. You can see them with your eye or a magnifying glass. Dolomite is used as ornamental stone in gardens.

Pyrite is a shiny, heavy, brassy gold-colored mineral, that is also called fool's gold. Gold, itself, is actually yellow. Look at the sample and see the many flat-sided crystals.

Halite is the mineral name of table salt. Its crystal is shaped like a cube, and is flat on all sides.

Fluorite is a transparent or translucent mineral of many colors. The sample you have is octahedral, or eight-sided in shape.

2. Look at some samples of everyday crystals. Examine Epsom salt, rock salt or table salt, alum, and sugar. How would you describe the shape of these crystals?

   - The long needles of **Epsom salt** may remind you of quartz or gypsum.
   - **Salt** or **sugar** has the same cube shape as halite.
   - **Alum** could be similar to the shape of fluorite or the pointed tip of quartz.

3. Next, try growing some crystals of your own. But before you can grow crystals, you will need to dissolve them to make a solution.

*Crystals grow best if you have a **saturated** or a **supersaturated** solution. A saturated solution is formed when you have dissolved as much of a crystal as possible in a certain amount of liquid. If you add more crystals, they will not dissolve and will sit on the bottom. Let's make a saturated solution first, before supersaturating it.*

Experiment with dissolving crystals

1. Choose one of the crystals (salt, Epsom salt, alum, or sugar). Put one teaspoon of it into a labeled, clear 9-ounce cup or container.

2. Fill the 1-ounce medicine cup with hot tap water. (Remember, hot, but not hot enough to burn.)

3. Add some of the measured water to the crystals and stir with a spoon to dissolve. If the crystals will not dissolve, add more water and keep stirring. Continue stirring until all the crystals have dissolved. Note how much water it took.

4. Add a few more crystals and stir. Did they dissolve? If they dissolved, keep adding crystals a few at a time until they will not dissolve. You now have a saturated solution.

NOTES

NOTES

Write down how much water you needed to dissolve the teaspoon of crystals in the notes section of the leader guide. This will give you an idea of how much water you will need for the girls.

To dissolve crystals that have collected on the bottom, you need to add more water, or heat the solution. Hot solutions dissolve more crystals than cool ones. When a hot saturated solution cools down, it becomes supersaturated because more crystals are dissolved in it than is normal at the cooler temperature. Supersaturated solutions form crystals very easily compared to saturated solutions, and when this solution cools down, you will have a supersaturated solution.

These principles are used in making candy, syrup, and sweet tea. Hot tea will dissolve more sugar than ice cold tea. When you add sugar to ice tea, the sugar tends to sit on the bottom and will not dissolve. This is a saturated solution. Add more tea or warm it up and the sugar dissolves.

5. Follow the same procedure to make saturated solutions with other crystals. Record how much water each took to dissolve one teaspoon of crystals. Keeping a record of this information will help in planning your meeting.

6. Let the cups sit undisturbed for one week, and then check them to see if the crystals have started forming.

The crystals will grow as the water evaporates. If after one week your crystals have not started forming, allow a bit more time for the water to evaporate. Use this as a gauge for how long it will take for your troop's crystals to form after the activity.

Sugar crystals have the same shape as salt crystals but sugar does not grow crystals very easily. Alum has very different shaped crystals and grows large recognizable crystals.

Before the Meeting

1. With the permanent marker, label the colored cups to hold the salt, Epsom salt, alum, and/or sugar. Use a different color cup for each crystal – e.g. blue cups hold salt; red cups hold alum, etc.

If you put each crystal in a different color cup, it will keep the girls from getting confused. Even a young girl with beginning reading skills can remember that different color cups have different things in them.

2. Put about 1 tablespoon of the appropriate crystal into each cup. Make one set for every 3-4 girls.

The girls will use all the crystals in the cups, regardless of the amount. To prevent waste, start with this small amount. Be prepared to refill cups as necessary.

3. Make sure you have a source of hot tap water at your meeting site. If you do not, bring some from home in an insulated thermos. You will need at least 1/2 cup of water for each girl. Remember, the hotter the water, the more crystals can be dissolved.

Also, remember that Brownie Girl Scouts will be handling the cups containing this water, and that spills can occur. Keep safety in mind. The water should be hot, but <u>not</u> hot enough to cause burns.

4. Make copies of the worksheets, one per girl

5. Cover the tables and have paper towels handy. Also, set up stations to view the minerals, or have some way to distribute them quickly in advance. Keep one set to show the girls while you talk.

6. You may choose to label one clear, 9-ounce cup for each girl, with her name printed on the front.

NOTES

NOTES

7. Prepare the "Everyday Crystals" worksheet for younger Brownies by taping samples of household crystals to the sheets.

Doing the Activity With the Girls

This activity has three separate sections.

Activity #1 -- Crystals in Minerals

Ask the girls: **What is a crystal?** Let each girl share her ideas. Some girls may mention crystals they have at home or what they have learned about crystals in school.

1. Show the girls examples of different crystals. Start by showing them the quartz crystal. Tell them that while quartz crystals can be too small to see, very large, or even different colors, they will always form this shape. Pass the quartz around or let them see it up close.

2. Now show them the optical calcite. Tell them calcite will also do something special. Show them how to use the calcite to see the double image. If a mineral does that, it means it is calcite.

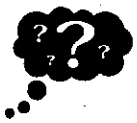
Ask them: **Does it have the same shape as quartz or a different shape?** Calcite breaks naturally into a different shape than quartz. Different minerals have different shapes. Some minerals have characteristic crystal shapes, while some minerals break into characteristic shapes.

3. Hand out magnifying glasses, pencils, and the "Draw the Crystal" worksheet. Name the different minerals and show the girls a sample of each, allowing them to pass around the samples, and carefully inspect them under the magnifying glass.

4. Have the girls draw what they think each shape looks like for each mineral. Tell the girls that for some minerals, such as copper and dolomite, crystals may be very hard to see. Tell them to draw what they think those crystals would look like.

Activity #2 -- Observing Crystals

Have the girls wear goggles for this activity. Also, remind the girls about not tasting their experiments.



Ask the girls: **Are all crystals minerals?** No. Some crystals can be made from living things. Sugar from plants is used to make sugar crystals.

1. Tell the girls that they are going to look at crystals that can be found at the grocery store. One such crystal is **Epsom salt**. Epsom salts are dissolved in water. People use them as bath salts and to soak sore muscles.

Hold up packages while you talk about the crystals.

Ordinary table **salt** is another kind of crystal. Table salt is used to season food. Another type of salt is rock salt, which is used to make ice cream or to melt ice off sidewalks.

Alum is used to make pickles crisp. Sugar is used to sweeten food.

Alum is found in the spice section of the grocery store and is more expensive than salt or sugar. However, it has a very different shape from Epsom salt or table salt, and grows large beautiful crystals. It is much more interesting to the girls. If you cannot get alum you can substitute sugar instead. It is difficult to grow large sugar crystals unless you have a piece of string or seed crystals. Sugar is cheaper and easier to get, but does not work as well.

NOTES

NOTES

2. Hand out the "Everyday Crystals" work sheets. Show the girls how to put a small amount of crystals on their sheet, and put tape over them to hold the crystals to the paper.

For younger Brownies, you may want to tape samples of the crystals to the "Everyday Crystals" worksheets in advance.

3. Have the girls examine the crystals with magnifying glasses and then draw what they think the crystals look like.

4. Next, have the girls compare these everyday crystals to the mineral samples. By examining the size, shape, how clear it is, etc., have each girl decide which sample mineral looks the most like their grocery store crystals.

There is no right or wrong answer in this comparison. Each girl is entitled to her opinion, as long as they have a reason for making their choice. Encourage the girls to share their opinions, and explain the reasons for making their choices.

Some girls may be uncomfortable because there is no obvious "right" answer. They need to be encouraged to observe and make their best guess.

Emphasize that real research scientists do not always agree with each other. Discussion and sharing why you made your decision is an important part of science.

Activity #3 - Growing Crystals

Goggles, again, are used for this activity. Also, remind the girls again not to taste their experiments.

1. Hand out the 9-ounce plastic cups, with each girl's name, that you had prepared earlier. Hand out one medicine cup per girl as well.

2. Have the girls choose their favorite grocery store crystal. Label each cup with the crystal of her choice. Have them put approximately 1 teaspoon (one level plastic spoonful) of their chosen crystal into the cup.

3. Fill the medicine cups with hot water.

Remind them to be careful because the water is hot.

4. Have the girls add the water to their crystals and stir.

Ask them: **What is happening to the crystals? Are the crystals disappearing, or are they still there?** The crystals are dissolving. When crystals dissolve, they get smaller and smaller until you cannot see them. They are mixing with the water but they are still there. **When you put sugar in tea or lemonade, does it look as if it disappears?** Yes, but when you drink it, you can taste that the sugar is still there.

5. Using what you have learned from your own experiments before the meeting, have the girls add either more water, or more crystals, until they make a saturated solution.

Tell the girls that when the crystals will not dissolve anymore, the solution is saturated. This means the water does not have room to dissolve any more crystals.

6. Have the girls put their solutions in a place where they will not be disturbed for one week. Ask them what they think will happen in that time, and what they think their cup will look like next week.

Check the cups at the next meeting. Again, ask the girls: **What happened? Where did the crystals come from? What are they made from? What caused them to form?**

NOTES

NOTES

The crystals were dissolved in the water. When the water evaporated, the crystals were left behind in the cup.

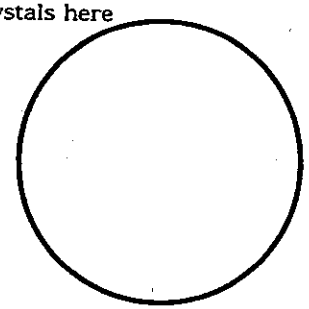
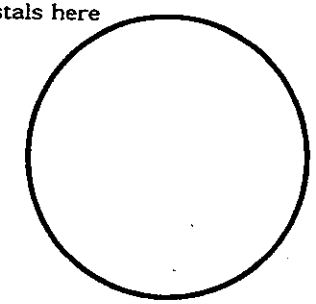
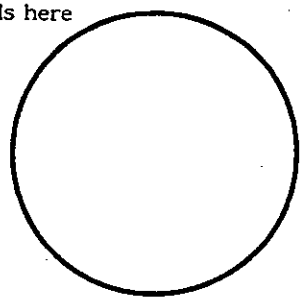
If there are little or no crystals in the cups, be patient. Check them at the following meeting. Eventually, the water will evaporate and crystals will grow.

Epsom salt can be bought at grocery stores or drug stores. Alum and salt can be bought in the spice section of the grocery store.

DRAW THE CRYSTAL

GYPSUM	QUARTZ
CALCITE	PYRITE
FLOURITE	HALITE
COPPER	DOLOMITE

EVERYDAY CRYSTALS

SALT	EPSOM SALT	ALUM OR SUGAR
Tape crystals here 	Tape crystals here 	Tape crystals here 
Draw a picture of the crystal.	**Draw a picture of the crystal.**	**Draw a picture of the crystal.**
What mineral does it look like?	**What mineral does it look like?**	**What mineral does it look like?**

Chemistry Magic

Corresponding Activity

Science Wonders Try-It, Presto Change-O
Brownie Girl Scout Handbook

Overview

In this activity, the girls will add vinegar to milk. This will separate into curds and whey. The milk curds will then be mixed with baking soda and water to make glue.

Big Ideas

The girls will learn that chemical reactions can change things into something new. In this activity, they will change powdered milk into a glue that really works. They will also see that chemistry can be fun, and that it is all right to get messy when you experiment.

Estimated Activity Time

45 - 60 minutes

Materials Needed

Your VSC provides:
For each girl:
- ☐1-ounce medicine cup (2 per girl)
- ☐Safety goggles

Items you provide
Makes enough for 20 girls):
For each girl:
- ☐Plastic spoon
- ☐Basket-type coffee filter
- ☐9-ounce clear plastic cups (2 per girl)

Additional supplies:
- ☐3-quart package of powdered non-fat milk
- ☐1-1/2 cups of vinegar
- ☐8-ounce box of baking soda
- ☐Set of measuring spoons
- ☐Measuring cup
- ☐Hot water availability (1/3 to 1/2 cup per girl)
- ☐Plastic or newspaper to cover tables
- ☐Paper for gluing (several sheets per girl)
- ☐Paper towels (for wiping up spills)
- ☐Plastic wrap

NOTES

NOTES

Safety

All the chemicals used are food items such as milk, vinegar, and baking soda. These materials are not hazardous when you use normal precautions. However, because this is a chemistry-based activity, you should reinforce the following basic chemistry safety skills:

a. **Chemists always follow directions and work carefully.**
b. **Chemists never taste the chemicals in their experiments.**
c. **Chemists always wear safety glasses or goggles**

Clean-Up

Dispose of spoons, used coffee filters, and paper scraps in trash.

How To Do It

1. Gather your materials first. For one batch of glue, you will need:
   - ☐ 1/4 cup hot tap water
   - ☐ 1 tablespoon of vinegar
   - ☐ 2 tablespoons of powdered non-fat milk
   - ☐ About 1/2 teaspoon baking soda
   - ☐ Water
   - ☐ 2 clear 9-ounce plastic cups
   - ☐ A spoon
   - ☐ And a basket-type coffee filter
2. To make the glue, measure 1/4 cup of hot water, and pour it into a clear 9-ounce cup. Add 2 tablespoons of powdered milk to the water, and stir until dissolved.
3. Add 1 tablespoon of vinegar to the mixture, and stir. You should see the milk begin to separate into solid chunks of **curd** and a watery liquid called **whey**. Stir until the milk is well separated.

This separation works best when the milk is very warm or hot. That is why powdered milk and hot water are used. If your milk does not separate well, try a little more vinegar or try heating it. If it still does not separate after a few minutes, try it again with warmer water.

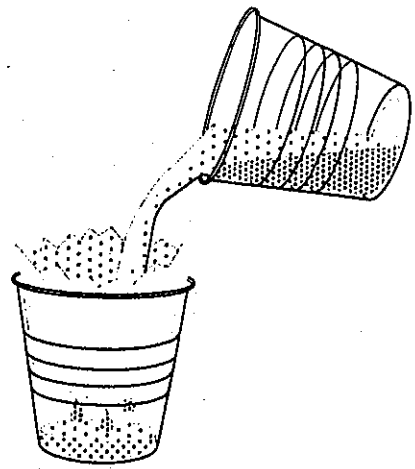
Milk has a special type of protein called **casein** (pronounced kay-seen) in it. When milk sours, or has an acid such as vinegar added to it, the casein clumps together to form curds. The watery liquid that remains is called whey.

These curds of casein protein are used to make cheese. In cheese making, an enzyme called **rennin** is used to separate the curd from the whey, instead of using an acid such as vinegar. The curd is then washed, salted, and active cultures are added. This mixture is then aged until it turns into cheese. The type of cheese it becomes depends on the specific cultures added, and how it is stored during the aging process.

NOTES

NOTES

4. Separate the curd from the whey. To do this, line the clean, empty second cup with the coffee filter, and then pour the curd and whey mixture into the filter.



5. Lift the filter slowly. The liquid whey should drain through the filter, leaving only the curd. The curd is what you want to keep.

6. Squeeze the filter containing the curd to remove as much of the whey (liquid) as possible. Drop the lump of curd back into the plastic cup that you first used. Dispose of the whey (liquid) by pouring it down the sink.

7. Use the spoon to break the curd into small pieces.

Breaking up the curd is important for making good glue.

8. Add one teaspoon of hot water and 1/8-1/4 teaspoon of baking soda to the chopped curd and mix thoroughly. You should see some slight foaming. Keep mixing until the curd becomes smoother and more liquid. The curd has now become glue.

If the mixture is too thick, add a few drops of water. If it is too lumpy, add another pinch of baking soda, and stir. You should see some foaming. Don't be afraid to experiment by adding more water or baking soda to improve the consistency of your glue. The finished product can vary from a thick liquid to a thick paste. This depends on how much curd there is, and how much water and baking soda are used.

The baking soda neutralizes the acid in the vinegar. When the curd no longer has acid in it, it returns to a more liquid form. The foaming you see when the baking soda is added to the curd is carbon dioxide gas, which is made when the baking soda reacts with the acid in the vinegar.

The liquefied casein protein is a natural glue. Casein is used in food products such as non-dairy creamers and as a raw material for some commercial glues and other products.

9. Use your new glue to paste together pieces of paper. It may take 15-30 minutes to dry depending on how much you use, but it should work as well as a traditional white school paste.

10. Cover your cup of glue with plastic wrap and let it sit for a few hours, or even overnight. The consistency should become smoother and clearer. Dispose of the wet glue in the trash within 24-48 hours or it will start to spoil and smell like spoiled milk.

Before the Meeting

1. Arrange to have an adult helper or two assist with distributing materials and working with the girls.

2. Make sure you have a source of hot tap water at your meeting site. If you do not, bring some hot water from home in an insulated container. You will need at least 1/3 to 1/2 cup per girl.

NOTES

NOTES

3. If possible, pre-measure the ingredients before the meeting, especially if you have a larger troop. The medicine cups are helpful in doing this.

   - 1 full medicine cup of powdered milk is equal to 2 tablespoons. Fill the medicine cups in advance, one for each girl.
   - Pre-fill another set of medicine cups with 1 tablespoon of vinegar in each, again one for each girl.
   - Line cups with coffee filters.
   - Put 1/4 cup hot tap water in a clear, 9-ounce plastic cup for each girl immediately before starting the activity.

Remember, hot water gives the best results

4. Cover the tables with plastic or newspaper to make clean-up easier. Have paper towels on hand to wipe up spills.

5. Make sure you have enough safety goggles and/or glasses for each girl.

6. Set your meeting place up in two areas if possible. Brownies learn hands-on activities best if they have an area where they can listen to you, watch you, and ask questions away from the work area. Use a Brownie circle format to tell the girls about the activity and show them what to do. Provide a separate work area around tables where they do the activity themselves.

Doing the Activity With the Girls

1. Have the girls sit in a circle, if possible in an area separate from the tables they will use for the activity. Ask the girls: **Who knows what *chemistry* is?** Try to call on everyone who has a guess, and be sure to listen to her answers. Getting them to think about what they are going to do, and sharing their thoughts is more important than correct text book answers.

Chemistry is a science. It is a study of substances, and how they change other substances. A big part of chemistry is using substances to create new substances. If the girls have any difficulty with this idea, encourage them to think about cooking. When cooking, you might take various ingredients, like flour, eggs, butter, milk, and sugar, mix them together, add heat, and create a new substance – cookies!

2. Now lead the girls into the next part of the discussion. Since chemistry deals with substances, have them think about what kind of substances they might deal with. Try to get them to focus on the idea of working with liquids, solids, and gases.

Ask them: **Does anyone know what matter is?** Again, encourage them to think of a good answer. Second and third graders may have studied matter in school. Explain that matter is anything that takes up space and can weigh something when it is put on a scale. Matter can be a solid, liquid, or a gas.

In the event you are asked, these three states of matter are the most widely known. Matter can also exist in a fourth state and a fifth state, although neither is commonly found on earth. Most Brownies do not need to know about this yet, but a very well read child might mention fourth and fifth states of matter.

3. Explain that chemists are scientists who study matter, and can change one kind of matter into another. We are going to be chemists today, and change milk into glue.

4. Tell the girls that chemists always follow safety rules when they do experiments, and we need to follow safety rules too. Review the safety rules with the girls:
   a. **Chemists always follow directions and work carefully.**
   b. **Chemists never taste the chemicals in their experiments.**
   c. **Chemists always wear safety goggles or safety glasses.**

NOTES

NOTES

At this point it is a good idea to run through the activity for the girls to watch, before moving to the tables for the girls to do this activity on their own. To make this easier, we have included the steps in a short form here to guide you, and then repeated them at length for doing the activity with the girls.

5. Put on a pair of goggles and demonstrate the process step-by-step. Talk them through each step as you demonstrate.
   a) Pour the medicine cup full of powdered milk into the hot water (which is in a 9-ounce plastic cup), and stir until the milk is dissolved.
   b) Pour the medicine cup with vinegar into the milk, and stir.

Ask the girls: **What happened to the milk when the vinegar was added?** This is a chemical reaction, or change. The milk split into 2 parts: the solid part is called **curds**, and the liquid part is the **whey**, just like in the Little Miss Muffett nursery rhyme.

   c) Pour the curds and whey mixture into the coffee filter and drain.

Show the girls how to drain the curd by slightly lifting the coffee filter, and squeezing out the excess liquid when finished. Tell them it's okay if it is a bit messy. You can reinforce this by touching the curds and whey yourself.

   d) Drop the lump of curd back into the original cup, and use the spoon to break it up into small pieces.

Emphasize how important it is to chop the curd into small pieces.

   e) Add one teaspoon of hot water and 1/8-1/4 teaspoon of baking soda to the chopped curd and mix thoroughly.

Tell the girls that adding the baking soda to the curd is another chemical reaction and changes the curd into glue.

6. If the girls are working in a separate area, have the girls put on their safety goggles/glasses and move to the tables you have previously set up with the materials needed for the activity.

Reinforce the safety rules before handing out the materials. Have the adult helpers help you distribute the pre-measured cups of hot water, powdered milk, and a plastic spoon to each girl. Tell them not to start until everyone gets their materials and you tell them what to do next.

7. Begin the activity by having the girls pour their medicine cup full of powdered milk into the hot water (which is in a 9-ounce plastic cup), and stirring until the milk is dissolved.

8. Now hand out the medicine cup with vinegar and have them pour it into the milk, and stir.

Ask the girls: **Is the milk changing? How is it changing? What does it smell like?** Let them share their observations.

9. While the girls are stirring, hand out the cups with the coffee filters in them. Tell them they will now separate the curds from the whey. Have them pour the curds and whey mixture into the coffee filter in the 9-ounce cup, that you had prepared before the meeting.

10. Tell them to slightly lift the filter, but not entirely out of the cup. The liquid whey should drain through the filter, leaving only the curd. The curd is what you want to keep.

NOTES

NOTES

If your girls are rowdy, emphasize that doing messy experiments is not the same as being silly. Chemists always follow safety rules which means that they follow directions, observe what happens, and do not engage in horseplay.

11. Have them squeeze the filter containing the curd to remove as much of the whey (liquid) as possible.

Younger girls will need help draining the curds.

12. Have them drop the lump of curd back into the original 9-ounce cup, and use their spoon to break it up into small pieces.

Emphasize how important it is to chop the curd into small pieces. You or an adult helper should check to see that it is well divided into small pieces.

13. Have an adult helper add the 1 teaspoon of water to each girls curd mixture.

14. Next add the baking soda to the mixture.

Have the baking soda nearby. Depending on the age and skills of the girls, they can add the 1/8-1/4 teaspoon of baking soda themselves (under adult supervision), or you or an adult helper can add it.

15. Have the girls stir the mixture to make the glue.

Ask them: **Do you see the foaming?** This is a chemical change taking place.

The girls will most likely want you or an adult helper to check the consistency of their glue. Assure them that their glue is fine and add either a little water or a little baking soda if necessary for consistency. Remember, if the mixture is too thick, add a few drops of water. If it is too lumpy, add another pinch of baking soda, and stir.

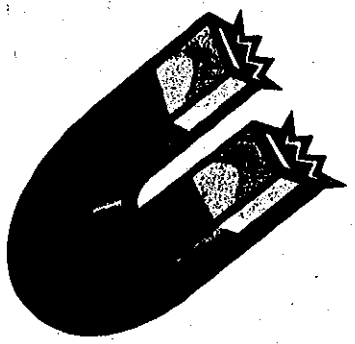
16. Have the girls write their names on the cups and take their glue to another table or area to try it out by gluing paper. They can use the spoons to spread the glue.

17. Cover each cup with plastic wrap and let the girls take their glue and their glued paper home at the end of the meeting.

Remind parents that the glue will only be good for 24-48 hours and that they can dispose of it in the garbage.

NOTES

Magnet Hunt



Corresponding Activity

Science Wonders Try-It,
Activity Number 5 Magnet Hunt,
Brownie Girl Scout Try-it Book. Page 132

Overview

Girls will find out what will stick to a magnet and what won't.

Estimated Activity Time

7 to 10 minutes

Materials Needed

<u>Your tub provides:</u>
two examples- plastic magnet hunt containers
30 ring magnets
Master copy of Magnet Hunt Chart

<u>You provide:</u>
One copy of the magnet hunt chart per a girl
Small items that are metal
Small items that are not metal
1 Plastic bag or clear plastic container per a girl

Safety

Caution the girls not to put any item in their mouths while doing the activity.

How to Do It

1. Direct the girls to take various small items and place them inside a clear container. The items should be things such as a safety pin, penny, bean, paper clip, acorn, etc.

2. Hand each girl a magnet, after they make their own magnet hunt box/ bag. Ask them to take their magnet and touch it to as many different things as they can find.

3. Direct them to check off on the chart all the things that are not pilled to the magnet and all those that are not.

4. Ask them to go around the room and find other items to write into their chart. (Warn them to stay away from electronics and screens.)

Optional

If your girls were interested in magnets, complete the *Magnet Fun Activity* in the Optional Activities Section.

MAGNET HUNT

Items	Magnet Attracts	Magnet Does Not Attract
Safety Pin		
Aluminum Nail		
Brass Screw		
Iron Tack		
Metal Washer		
Copper Wire		
Material		
Wood Bead		
Rubber Band		
Plastic Bead		

Magnets pull some things to them. Most magnets are made of iron and come in many different shapes. Get a magnet and find out what items will stick to it.

Check off on the chart all the things that are pulled to the magnet and all those that are not.

Touch the magnet to some other things around the room. Add them to the blank spaces in your chart.

For more fun things to do with magnets, you can visit the Magnet Man website at www.execpc.com/~rhoadley/magindex.htm.

NOTES

Magnet Fun

Corresponding Activity

Science Wonders Try-It, Magnet Hunt,
Brownie Girl Scout Handbook

Overview

In this activity, the girls will play with ring magnets and explore how the magnets can attract and repel each other. With filaments of steel wool, the girls will make a visible "picture" of the lines of magnetic force to take home.

Big Ideas

The girls will be introduced to the idea of force as either a push or a pull. They will also learn about magnets having north and south poles, and that like poles repel each other, while opposite poles attract.

Estimated Activity Time

30 – 60 minutes

Materials Needed

Your VSC provides:

For each girl:

- ☐ Ring magnets (2-3 per girl)
- ☐ #000 fine steel wool
- ☐ 2-ounce clear plastic jar
- ☐ Goggles (optional)

Additional materials:

- ☐ Container of Iron Filings
- ☐ Funnel

Items you provide:

For each girl:

- ☐ Pencil
- ☐ Paper
- ☐ Glue stick or adhesive name tags
- ☐ Gloves (optional)

Additional materials:

- ☐ 9-ounce plastic cups
- ☐ Newspaper (to cover work surface)
- ☐ Aluminum can or aluminum foil
- ☐ Box of paper clips
- ☐ Pennies (optional)

Safety

The girls should wear goggles when doing this activity.

Clean Up

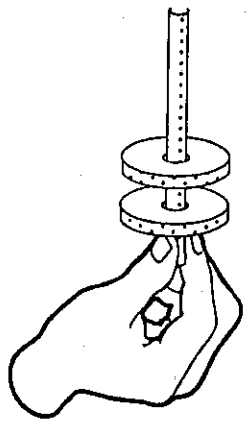
Dispose of any scrap paper.

NOTES

How To Do It

1. Play with the ring magnets yourself. Magnets will stick to metals that are made of naturally magnetic elements such as iron, cobalt, and nickel. Magnets will not stick to metals that are made from other elements.

2. Take 2 of the ring magnets and place them so that they attract each other and stick together. Slide the attached magnets onto a pencil. Take the top magnet off, turn it over, and put it back on the pencil. The magnets should now repel each other. Push the top magnet down towards the bottom magnet. You should feel the magnetic force pushing against your finger. Let go and watch the magnet bounce as it pushes away from the bottom magnet.



All magnets, regardless of their size, have both a north and a south pole. The Earth has a magnetic field, and, as a result, also has a north and south pole.

When the north pole of one magnet, is near the south pole of another, the magnets attract each other. Opposites attract. When similar poles are near each other (south near south, or north near north), the magnets repel, or push away from one another.

3. Stack three, four, or more magnets on the pencil, all with similar poles near each other so that they repel. The weight of the magnets pushes them closer to each other, but they do not touch until the pull of gravity (on the 'group' of magnets) is stronger than the push of the magnetic force separating them.

NOTES

Release the top magnet and it will pop into the air. Practice catching it with the other hand.

A slight upward movement of the hand holding the magnets when you release the top one makes it fly higher into the air. This makes a great demonstration for Brownies.

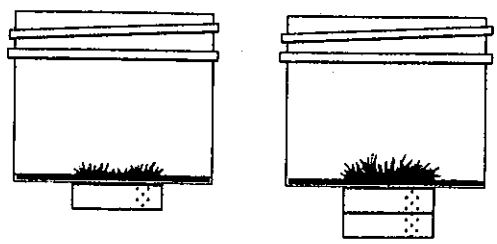
6. Use magnetic force to push magnets around a flat surface such as a table top. Arrange a pair of magnets so the same poles are near each other (That means they will repel each other. If they attract, flip one over).

Push one magnet toward the other slowly. As they get close, the second magnet pushes away when the magnetic force becomes strong enough.

7. Try it again. Start with the magnets about 6 to 9 inches apart and quickly move one toward the other. The second magnet will be pushed even further. The magnets can get closer together when you move one quickly. The magnetic force gets stronger when the magnets get closer. The more force, the farther the magnets move.

8. You can utilize the container of iron filings to see the lines of used magnetic force.

Pour a thin layer of iron filings into the bottom of a clear plastic jar. Hold a ring magnet underneath the outside of the jar. The particles take the shape of part of the magnetic field and show where some of the lines of magnetic force are. To make the force stronger, add another magnet to the bottom.



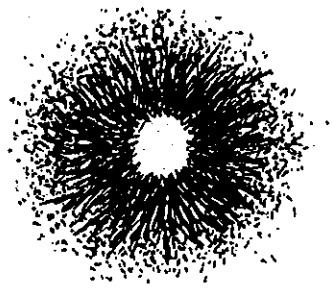
9. Move the magnets around. Add more magnets, and use different patterns. Remember, the developer is made of tiny uniform bits of magnetic metal that are coated. These bits are light and move easily, which is why they can easily show where the magnetic force is.

Be careful not to spill the container of iron filings

it can still be hard to clean up (or remove from fabrics) and is almost impossible to remove from the surface of a magnet.

10. To make a "picture" of what part of the magnetic force lines look like, you need a sticky surface, a magnet, and some steel wool. Before beginning, cover the work surface with newspaper.

    First, to create a suitable "sticky surface", peel off the back of an adhesive name tag, or rub a glue stick over the surface of a piece of paper. Now, with the sticky side facing up, place the adhesive name tag or sticky paper on top of the ring magnet. Next, hold a piece of steel wool over the sticky surface, and rub or shake it to break off little pieces that will fall and stick to the paper. Keep doing this until you see a pattern form on the paper above the magnet.



NOTES

- First, make the magnets "fall up" and stick together.
  a. Take two of the magnets and "stick" them together.
  b. Now, pull them apart and hold them flat, separating them by about an inch, with one magnet positioned over the other.
  c. Let go of the bottom magnet and watch it "fall" up.

- Next, flip one of the magnets over, put them on a pencil, and have them push away and bounce into the air.

Magnets push and pull because they have a kind of force called magnetic force. Sometimes the magnetic force pulls the magnets together (Demonstrate this by having them attract each other) and sometimes the force pushes the magnets apart (Reverse one of the magnets).

If you have older Brownies, you may want to go into the concept of magnetic poles. Ask them: **Have you ever heard that magnets have north and south poles? Do they know of anything else that has a north and south pole?** Try to encourage them to relate the idea of the Earth to a magnet. Magnets have poles because of the way they line up with the north pole and the south pole of the earth, which is like a big magnet itself.

Ask them: **Have you ever heard the phrase "opposites attract"?** That is true for magnets. When a north pole of a magnet is near a south pole of a magnet, the two magnets attract each other and stick together (You can demonstrate this as you are explaining). When you have the same poles together, north to north, or south to south, they repel or push away (Reverse one of the magnets).

3. Also tell the girls that magnets are attracted to (or stick to) some metals, such as iron or steel, but that they are not attracted to all metals. Tell them you are going to let them test this information.

NOTES

NOTES

4. Pass out two or three magnets to each girl. Make sure there are some paper clips and sheets of paper on the table, as well as some pieces of aluminum foil, aluminum cans, and, perhaps, a few pennies. Do not put pencils out at this point. Let the girls do some free play exploration of the magnets and show off what they know or have learned.

If no one has discovered it on their own, encourage them to find how the magnet would work through paper by putting a paper clip on top of a sheet of paper and then pulling it around while holding the magnet under the paper. Also, make sure they explore things such as what the magnet would and would not stick to, how many paper clips a magnet could hold, and how many more paper clips could be held if they used two or more magnets stuck together.

5. After a few minutes of free play, pull them back together as a group and let them share what they have learned.

This is a very important part of being a scientist. It is as important to share results as it is to do experiments.

6. Tell them that even though magnetic force is invisible, you have a way of showing where it is. Demonstrate how you can use the magnets and clear jars with the iron filings to show where the magnetic force is.

7. Pass out the prepared jars and let the girls try it. Collect the jars before you proceed further.

Ask them: **Would you like to make a picture of some of the magnetic force lines to take home?**

8. Tell the girls that they can make a picture of some of the magnetic force lines of their magnet to take home. Demonstrate how to do this for them.
   a) Take an adhesive name tag, and tear off the backing. Place the name tag, sticky side up, on top of a magnet. You can also use a piece of paper and rub one side of it with a glue stick.
   b) Next, hold a piece of steel wool over the sticky surface and rub and shake it to break off little pieces that will fall and stick to the paper. Keep doing this until you see a pattern form on the paper above the magnet.

Have the girls put on goggles to do this next part. Gloves are optional.

9. Before the girls start this part of the activity, have them write their name on the name tag or piece of paper.

10. Have them remove the backing from the name tag, and place it, adhesive side up, over a ring magnet.

11. Now, have them shake steel wool over the adhesive backing until a clear shape of the magnet appears.

12. After doing this activity, the girls can try the bouncing magnets trick on the pencils.

Magnets and magnetic forces have fascinated people for centuries. Magnetism is still not fully understood by scientists and how magnetism relates to matter, energy, and other types of force in the universe is still being studied by physicists. They do not know all the answers either. The main purpose here is to have some fun.

NOTES

NOTES

Bubbles

Corresponding Activity

Science Wonders Try-It,
Brownie Girl Scout Handbook

Overview

The girls will explore why bubbles are round, and attempt to make bubbles that are not round.

Big Ideas

The girls will learn about air pressure, and that the reason bubbles are round is because air pushes on them, with equal force, from all sides.

Estimated Activity Time

30 - 50 minutes

Materials Needed

Your VSC provides:

- ☐ Plastic bubble wands
- ☐ 1-ounce medicine cups

Items you provide:

- ☐ One quart or gallon of distilled water (One gallon is enough for 15 girls)
- ☐ 1 cup of dishwashing detergent (recommended: Dawn or Joy)
- ☐ 1/2 cup of glycerin
- ☐ 1-2 packages of chenille stems (each girl will need at least one, but you may wish to have extras on hand for the girls to make additional wands)
- ☐ 1 package of drinking straws
- ☐ Ball of cotton string
- ☐ Measuring cup
- ☐ 1 package of 4- or 5-ounce plastic cups
- ☐ 1 large (8- or 9-ounce) clear plastic cup
- ☐ 1 piece of cardboard (larger than the opening on the large plastic cup)
- ☐ Paper towels (optional-for cleaning)
- ☐ Access to clean water to rinse hands
- ☐ Small pans or tubs (1 for every 4-5 girls)

Safety

Keep the bubble solution away from eyes.

Clean-Up

This activity is very messy and best done outside. Have the girls wash hands carefully when finished. Dispose of paper towels, empty cups, chenille stems, etc. in the trash.

Note: The bubble wands included in the 'Bubbles' tub are for the girls to experiment with after making their chenille stem bubble blowers.

How To Do It

1. First, you will need to make some bubble solution. The following is a good basic recipe.

Small Batch
1 quart distilled water
2 ounces dishwashing detergent
1 ounce glycerin

Large Batch
1 gallon distilled water
1 cup dishwashing detergent
1/2 cup glycerin

Distilled water makes the best, most reliable bubbles. Well or tap water can be used, but these types of water often have minerals in them that can affect the strength and durability of your bubbles.

Joy and Dawn are two brands of dishwashing detergent that make good bubbles. Avoid using the bargain brands.

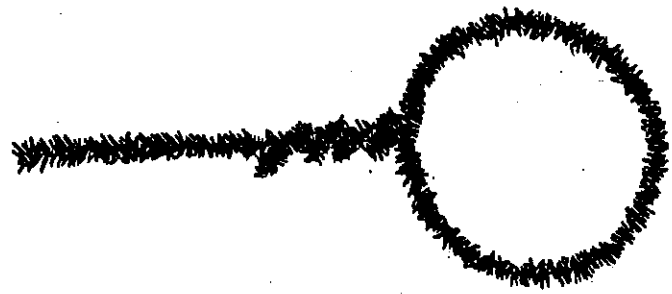
Glycerin can be purchased at a drug store and is necessary for large bubbles. It keeps the water from evaporating quickly, making the bubble film strong and longer lasting. Your bubbles will be smaller and will break much quicker without it. If necessary, you can cut the amount of glycerin in half. If you want stronger, larger bubbles, double or triple the amount of detergent and glycerin you use. Experiment. There are many different bubble recipes.

Bubble solution improves with age and keeps well, even if it sits for weeks before you use it. Store the bubble solution in a closed plastic container.

NOTES

NOTES

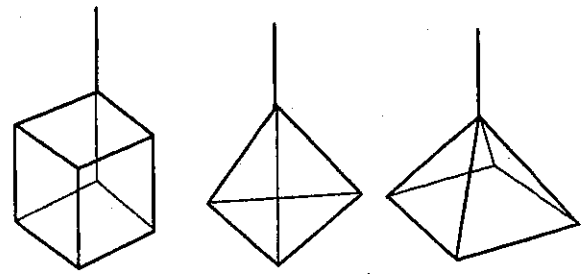
2. Experiment using the chenille stems as bubble blowers. Take one end and bend it into a loop. Twist the looped end around the stem to make a bubble blower. This can be shaped into a circle, a square, a triangle, or other shapes.



Since this activity can be very messy, it works best outside. Put enough bubble solution in a small plastic cup so it is deep enough to dip the loop into it. Dip the loop and blow a bubble. Regardless of what shape the single loop is, the bubble that emerges from the loop will always be shaped like a sphere.

The chenille loops make good bubble blowers because the fuzzy covering over the wire holds a lot of bubble solution.

3. If you wish to experiment with this further, you can make three-dimensional shapes with the chenille stems such as cubes, tetrahedrons, or pyramids. Dip these into the bubble solution and see what shape the bubble films take.



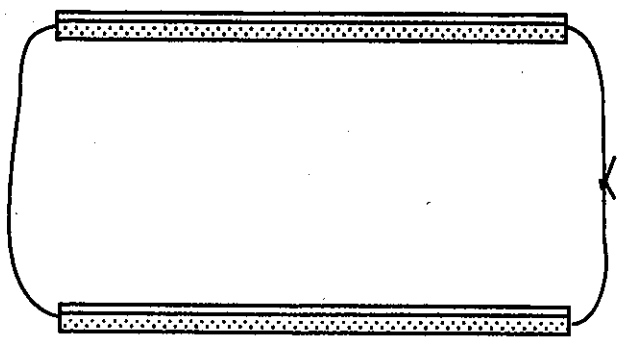
Cube Tetrahedron Pyramid

Bubble films will take the shape of the frame that holds them, but once you blow the bubble free of the frame it will always be shaped like a sphere. Bubbles in the air are always spherical because of the pressure from the air around us. The bubble takes the shape that gives it the smallest possible surface area, which, when free-floating, will always be a sphere.

4. To make large bubbles, you need to make a bubble frame from straws and medium-weight string.

Cotton string works well, and should be absorbent enough to hold a sufficient amount of bubble solution.

Thread a 2-3 foot piece of string through two straws. Tie the string in a loop so the finished bubble frame is square or slightly rectangular in shape. Trim the string if you have excess.



5. Pour the bubble solution into the six-quart tub, until it is at least 1/2 to 1 inch deep. Put the bubble frame into the bubble solution and completely submerge it, using two hands, one on each straw. The straws can be close together.

6. Lift the frame and stretch it out to its full size. Gently blow into the large bubble film that forms in the frame, wave it through the air, or let the wind catch it to blow a really large bubble. This will take a little practice.

NOTES

NOTES

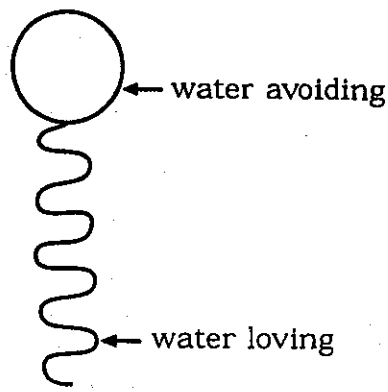
Avoid doing this on very windy days. The air should be very calm, and for the best lasting bubbles, try doing this on a humid day. Doing this activity in higher humidity, and not in direct sunlight will cause the water to evaporate more slowly, allowing your bubbles to last longer.

If your bubbles break easily, add more glycerin or try using a thicker string.

7. See what else you can invent to use as a bubble blower. Try straws, plastic produce baskets, or even your hand. Be creative.

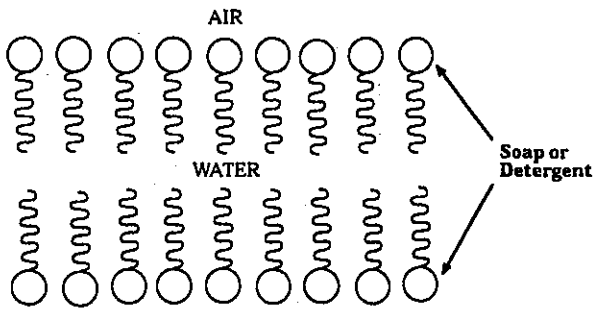
Can you catch your bubbles? If your hands are wet with bubble soap, you may be able to do this.

Bubble film forms when water is trapped between layers of soap or detergent. One end of a soap or detergent molecule is attracted to water and the other end avoids water and is attracted to grease and oil. This is why soap cleans so well.



Soap or Detergent Molecule

When soap bubbles form, the soap or detergent molecules line up so the water-loving ends and the water-avoiding ends are lined up next to each other in a double layer with water trapped between them. This makes a simple membrane similar to cell membranes. Glycerin makes this membrane stronger.



8. Practice a simple **air pressure demonstration** before the meeting.

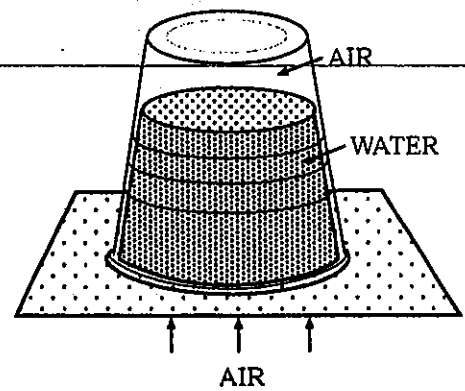
   a) Fill a large 8-9 ounce clear plastic cup-full of water. Cover the top of the cup with a square piece of cardboard slightly larger than the cup.
   b) Hold the cardboard tightly against the top of the cup with your palm, and turn the cup upside down. Holding the cardboard tight will prevent the water from leaking.
   c) Gently remove your hand. The card-board should stay in place, and the water will stay in the cup. Air pressure from the atmosphere around you is pressing on the cardboard hard enough to hold it in place.
   d) As long as the seal remains air-tight between the cup and the cardboard, this will work. Now break the seal so air can get into the cup. The water falls out with a splash.

The principle is the same as when you put a straw into a drink, cover the top of the straw with one finger, and lift with liquid trapped in the straw. The liquid inside the straw stays there because the pressure of the air pushing up is the same or greater than the air pressure in the top of the straw.

NOTES

NOTES

When you remove your finger, air gets into the top of the straw and the balance is broken, and the liquid is released.



Before the Meeting

1. Pick a good outside area for the activity, ideally a shady area.
2. Mix plenty of bubble soap in advance. One gallon is enough for 15 girls. You can store this while you wait for a day with good weather for an outside activity. The best type of day for this activity is a humid day with little or no breeze.
3. The girls will need help making their bubble frames. You might choose to make bubble frames in advance instead of having the girls make them.
4. You will need one small pan or tub of bubble solution for each group of five girls to use bubble frames. Each girl should have her own small cup of bubble solution to use with a chenille stem bubble blower.
5. Have clean water accessible for the girls to rinse their hands, even if they have facilities nearby. Paper towels for drying are optional.

Doing the Activity with the Girls

1. Gather the girls together and tell them that they are going to do science with bubbles. Tell that you have made bubble solution using chemicals you can find in a drugstore. Show them the bottles and tell them that the bubble solution is made from very pure water called distilled water, dishwashing detergent, and another chemical called **glycerin.** Glycerin is a moisturizer used in hand lotion and some oil-free skin conditioners. Bubbles "pop" because the water in them evaporates. Glycerin helps keep the moisture (the water) in the bubbles so they do not pop as quickly.

For this activity, we will explore what's really happening early in the activity. It is important that they understand how bubbles are formed so that they can gain more from observing what happens. The science is how and why bubbles do what they do, not just that they are fun to play with.

An easy way to explain bubbles to the girls is to call a bubble a "water sandwich". A bubble is nothing more than a slice of water between 2 slices of soap, with an air-filled center.

2. Show them how to make bubble wands from the chenille stems. Dip the wand into a cup of bubble solution and blow a bubble. Have them notice what shape the bubble is. They will say "round" or "circle". Tell them it is round, and that it has a special name called a "sphere".

A circle is a 2-dimensional (or a flat surface, like a paper) drawing, while a sphere is a 3-dimensional (with length, width, and height) object. The bubbles have length, width, and height and so they are 'spheres'.

Challenge them to blow a bubble that is not shaped like a sphere. They can use chenille stems to make bubble wands in different shapes. Suggest some.

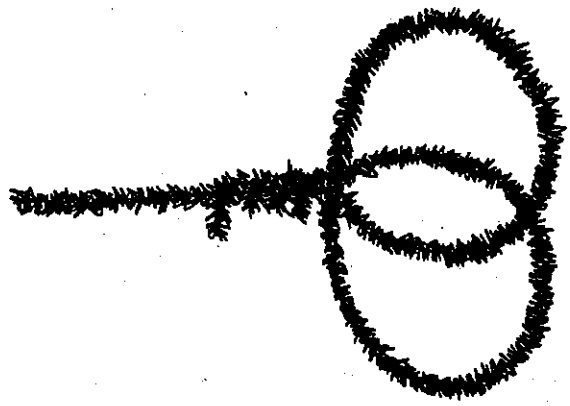
NOTES

NOTES

3. Give the girls their bubble solution and some chenille stems, and let them experiment on their own. Keep asking if someone had created a bubble in a shape other than a sphere.

Write the girls' names on their cups of bubble solution.

If someone gets creative and makes a double loop or 3-D shape with their chenille stems, encourage them. A double loop will make two or three bubbles joined together. Most girls will only get single sphere-shaped bubbles.



4. Have the girls put the bubble wands and solution down, and gather them in a circle.

Ask them: **Why are bubbles always round or sphere-shaped when they float freely in the air?** They may not have any answer, but still encourage them to think about what might have an effect on the shape that the bubble takes as it comes out of the wand. Tell them you will give them a hint, and proceed with the demonstration.

5. Demonstrate the effects of air pressure for them.
   a) Fill a large clear, plastic cup with water, and cover the top with a piece of cardboard.
   b) Hold the cardboard tight against the top of the cup with your palm, and turn the cup upside down. Gently remove your hand.

Ask the girls: **Why is the water staying in the cup?** They probably will not know the answer, but you can guide them to it. Explain that air is all around us, and is pushing on things all the time. We are so used to it, we do not notice it. The air pushing on the outside of the cardboard balances the air and water pushing out from the inside of the cup. The air pressure from the atmosphere around you is pressing on the cardboard hard enough to hold it in place.

6. All this time hold the cup very still in the upside down position. As long as the seal remains air tight between the cup and the cardboard, this will work. You will have their undivided attention. Tell them you will break the balance by letting the outside air get in, then break the seal and let the water splash out.

You can also use a straw and show how the liquid stays in it when you cover it with your finger. Air pressure is the reason this happens.

Go back to your original question: **Why are bubbles always round or sphere-shaped when they float freely in the air?** Bubbles are shaped like a sphere because of air pressure. **Do bubbles have air on the inside? Do they have air on the outside?** Yes. When the air pushing on the inside and outside are balanced, the bubble takes up the smallest space it can, which is usually a sphere. Since no one part is being pushed any harder by the air than any other part, all the parts of the bubble are the same distance from the center.

If two bubbles stick together are they both spheres? No, the air pressures pushes them together so they are flat where they meet and rounded elsewhere. Air pressure pushes bubbles to take up the smallest amount of space that they can.

NOTES

NOTES

7. While you have them gathered together, show them how to use the bubble frames to blow large bubbles.
   a) Thread a 2-3 foot piece of string through two straws. Tie the string in a loop so the finished bubble frame is square, or slightly rectangular in shape. Trim the string if you have excess.
   b) Pour the bubble solution into the six-quart tub, until it is at least 1/2 to 1-inch deep. Put the bubble frame into the bubble solution and completely submerge it, using two hands, one on each straw. The straws can be close together.
   c) Lift the frame and stretch it out to its full size. Blow gently into the large bubble film that forms in the frame, wave it through the air, or let the wind catch it, to blow a really large bubble.

8. If you have not pre-assembled the frames, distribute straws and string to the girls and show them how to make their bubble frames. If you did make them before the meeting, pass them out to the girls now. Give them time to experiment with blowing bubbles different ways.

More To Explore

There are two easy and fun activities with bubbles that you may wish to incorporate. Have the girls think about what it must be like inside of a bubble. They have already learned that a bubble is filled with air, but if they have seen "The Wizard of Oz" and noticed that Glinda travelled inside a bubble, they may be interested in going inside one as well.

To do this, you will need a small plastic wading pool, a block of wood, a hula hoop that can fit inside the bottom of the pool, and about 3-5 gallons of bubble solution. Cover the bottom of the pool with about 1/2 to 1-inch of bubble solution, placing the wood block in the center of the pool (if possible, on a non-skid mat), and the hula hoop in the pool in the solution. The block is for the girls to stand on, and keep their shoes dry.

Have an adult stationed to assist the girls in getting into and out of the pool. Have a girl stand on the block in the center. Make sure your hands and the hula hoop are wet from the solution. Grab the hula hoop at the pool bottom in the bubble solution, and quickly raise the hula hoop straight up around the girl in the center. With a good bubble solution, and the right humidity, you can make bubbles that are as high as you can reach (6-7 feet in height). They will only last a couple of seconds so you must be quick in raising the hula hoop from the bottom of the pool to above the girl's head. A good idea is to practice this before the meeting. Take turns and allow each of the girls to be "inside the bubble".

A second activity you might try involves putting your hand through a bubble without breaking it. Ask the girls: **Can you put your hand through a bubble without having it pop?** Most will say that you can't, but tell them that you will show them a way to allow them to put their arm through a bubble without breaking it.

The only tool you will need to try is the bubble frame you made earlier. Again, have two girls soak the frame, and carefully lift it out of the bubble solution. Once out, have them spread it open so that the frame is filled with bubble film. Now, roll up your sleeves to above the elbow, and thoroughly wet your arm with bubble soultion. Once its wet, slowly stick your fingers, then hand, then wrist, and then lower arm through the bubble film. As long as your skin is wet, it will pass through the film without breaking it. And if you remove your arm from the bubble before your arm dries, and before the water in the bubble film evaporates, the bubble film should remain intact. Give each of the girls a chance to see who can put their arm the farthest through the bubble, and pull it out, without breaking it.

There are two excellent books on bubbles. *Bubbles* by Bernie Zubrowski, is full of easy and fun experiments with bubbles, while *Experimenting with Surface Tension and Bubbles* by Alan Ward provides a number of inexpensive experiments, although written on a more formal level than *Bubbles.*

NOTES

NOTES

Paper Making

Corresponding Activity

Science Wonders Try-It, Homemade Recycled Paper , Brownie Girl Scout Handbook

Overview

The girls will recycle by making new paper from scraps of old paper.

Big Ideas

The girls get first-hand experience in recycling, by making something useful from discarded paper scraps.

Estimated Activity Time

Approximately 60 minutes

Materials Needed

Your VSC provides:

- ☐Thirty 4"x 6" 10 mesh plastic needlepoint canvas
- ☐Sixty felt squares
- ☐Thirty small sponges

Items you provide:

- ☐Several irons
- ☐Blender
- ☐Shredded paper
- ☐Hot water
- ☐Lots of newspaper
- ☐1 box of gallon resealable plastic bags
- ☐Permanent markers

Four 6- quart plastic containers

Note: Minimum supplies for each girl are:

1. A screen
2. Two pieces of felt
3. A sponge
4. Thick layer of newspaper

Safety

Irons are hot, and the girls need close adult supervision. If the girls want to try ironing the paper themselves, have them hold one hand behind their back to avoid burning their fingers.

Clean-Up

Pulp can clog sinks, so do not put pulp down the drain. To clean the tubs, remove as much of the soaked paper pulp as you can with your hands or one of the mesh screens. Dispose of the water outside, by pouring it through one of the mesh screens--the screen will catch any pulp left in the water. Dispose of pulp in the trash.

How to Do It

1. Collect scrap paper. Any kind of paper will do, but used white copier paper works particularly well. If you have access to a paper shredder, shred the paper into long, thin strips. If not, just cut or tear up the scrap paper into small pieces.

2. Soak the torn or shredded paper for a least 15 minutes in hot tap water.

It is important that the water is hot when you start soaking the paper scraps, but you will not have to reheat the water once it cools.

3. Fill the blender half full of warm water. Add a handful of soaked paper scraps.

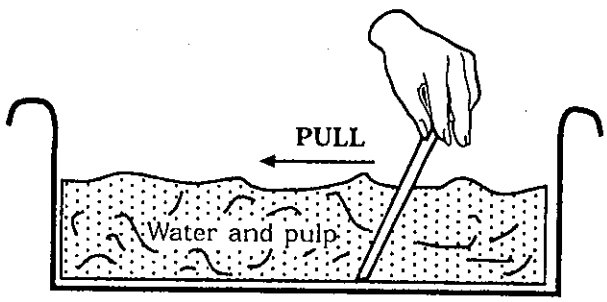
Be careful not to put too much paper into the blender or it will be too thick to blend well and may overwork the blender motor.

4. Pulse the blender on and off until the paper breaks up and blends to form a smooth pulp. This should happen within a minute or two.

5. Pour an inch-deep layer of warm water into a 6-quart container, and pour the pulp into it. Add more warm water if necessary to fill the tub at least half full. Mix the pulp and water with your hand.

6. Prepare your work area. You will need lots of newspaper to soak up excess water. Also, make sure you have 2 pieces of felt, a sponge, and a warm iron available.

7. Use the 4"x 6" piece of plastic needlepoint canvas as a screen. Holding the screen by one edge, place it into the pulp mixture. Drag it down the length of the plastic container, and lift an even layer of pulp out of the water.



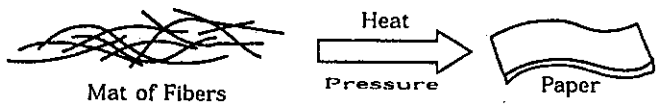
NOTES

NOTES

8. First, let the water drip off the screen and your hands. Put the sponge under the screen, and quickly turn the screen over on to the felt, so that the pulp-side is down.

9. Place the felt on a thick layer of newspaper to help soak up any excess water. Blot the excess water with the sponge, then remove the sponge and lift the plastic screen off, leaving the layer of wet pulp stuck to the felt.

Paper was first made by using old rags as a fiber source. Later wood pulp was used. To make paper, fibers are suspended in liquid to make a pulp. Then a uniform mat of fibers is lifted from the pulp by using a screen. Heat and pressure are used to lock the tangled mat of fibers together to make the finished paper.



You can repeat the above to make multiple pieces of paper.

10. Move the felt holding the mat of pulp to a dry layer of newspaper. Cover it with another piece of felt, and iron it with a dry iron to evaporate the wetness in the pulp. The iron should be set on the wool setting.

Do not use the steam setting. The purpose of this is to dry out the mat of fibers and turn it into paper.

11. Keep ironing, until the paper dries and becomes firm enough to peel off the bottom piece of the felt. You can lift the felt to check the progress. If you want to speed up this process, keep changing the newspaper under the wet felt. Dry newspaper is better able to soak up the water.

When the paper starts to firm up, you can also remove the top layer of felt and iron the paper directly to dry it faster, however doing this may cause paper fibers to stick to your iron. Do not worry. These can be easily removed by rubbing your iron with a towel or cloth after the iron cools.

12. Admire your new piece of paper. You may want to give it a final pressing once you have peeled it off the felt. If you want to make additional sheets, do it now, and put this sheet aside while you make your next piece of paper.

13. You can try variations to make your paper more interesting.
    a) Use different shapes of needlepoint canvas (stars, circles, squares) to make different paper shapes.
    b) Make larger pieces of paper by using a larger tub and screen.
    c) Add bits of colored paper, old wrapping paper, flower petals, or glitter to your soaked paper before you mix it into pulp.
    d) Cut out small pictures from gift wrap or comics. Put them on the mat of wet pulp before you invert it on the felt, in order to bond these into your finished paper.

Before the Meeting

1. Younger Brownie Girl Scouts can easily do this activity, except for the ironing. Ideally, you should have many adult helpers available to assist both with ironing and the paper making in general. This activity can be very time consuming if you not have adequate adult help.

If you cannot have one helper for every four girls, consider having one of two adults do the ironing part while the girls are elsewhere playing a game or doing another activity.

2. You will need access to hot water and enough electrical outlets for your blender and irons. A table covered with newspaper placed next to the wall and an electrical outlet make a good ironing station.

NOTES

NOTES

3. Blend enough pulp in advance so it is ready for the girls to start using. It is okay if it has to sit for a while.

Remember, the pulp can be diluted a lot and still work well. Most problems are caused by the pulp being too thick rather than too thin.

4. Decide if you want one big tub of pulp for all the girls to use, or do you want to set up stations with several tubs of pulp, and then arrange your supplies and set-up accordingly.

Doing the Activity with the Girls

1. Gather the girls together and ask them: **What is recycling?** Let them share their ideas, but be sure to emphasize that recycling is taking stuff that would have been thrown out as trash, and using it to make a new product.

   Tell them that today they are going to do some recycling. They will use old paper to make new paper.

2. Show them some of the paper scraps you used to make the pulp. Next, show them the containers of soaked scraps and tell them how, before the meeting, you soaked the old paper in hot water, and then ground up the paper scraps in the blender with water to make the tub of pulp.

3. Tell them they are going to use this pulp to make new paper.

   Demonstrate the technique of separating the pulp from the water.
   a)Use the 4"x 6" piece of plastic needlepoint canvas as a screen. Holding the screen by one edge, place it into the pulp mixture. Drag it down the length of the plastic container, and lift an even layer of pulp out of the water.
   b)First, let the water drip off the screen and your hands. Then put the sponge under the screen, and quickly turn the screen over on to the felt, so that the pulp-side is down.

c) Place the felt on a thick layer of newspaper to help soak up any excess water. Blot the excess water with the sponge, then remove the sponge and lift the plastic screen off, leaving the layer of wet pulp stuck to the felt.
d) Move the felt holding the mat of pulp to a dry layer of newspaper, and place another piece of felt on top of it.

After you have the second piece of felt on top, tell the girls that the layer of pulp fibers is now ready to be ironed and turned into paper. Show them a finished piece of paper.

4. Tell the girls in what order you want them to gather their supplies. Explain the order they should work as well.

This will be different depending on whether you have just one tub of pulp, or several stations. You must decide if they will work at a station in groups of four with an older girl or adult helper, or if they will wait in line, and each girl use the same large tub of pulp. How you decide to organize this activity depends on the size of your troop, the resources available, and the number of helpers.

Do you want the girls to iron their paper? Brownies love doing this but need close adult supervision and enough irons. If you choose to let the girls iron, they should have one hand on the iron and the other behind their back with an adult assisting and watching. When the girls have one hand behind their backs, it helps them to resist the temptation of holding the felt with their free hand, which puts it dangerously close to the hot iron.

5. Make sure each girl's paper is identified. Have the girls write their names on a large resealable bag with a permanent marker. Put the finished paper inside the bag after ironing.

NOTES

NOTES

Static Electricity

Corresponding Activity

Science Wonders Try-It,
Brownie Girl Scout Handbook

Overview

In this activity, girls will use simple materials to generate static electricity and explore its behavior.

Big Ideas

The girls will be introduced to the concept of **energy** and learn that energy is the ability to do **work**. Work is using a **force** to move an object. The girls will use static electricity to do work moving objects such as instant Cream of Wheat. The girls will also be introduced to the ideas of positive and negative charges, and that opposite charges attract, and like charges repel.

Estimated Activity Time

45 - 60 minutes

Materials Needed

Your VSC provides:

For each girl:

- ☐Piece of wool

Additional Supplies:

- ☐Magnets for demonstration

Items you provide:

For each girl:

- ☐Balloon
- ☐Paper plate
- ☐Instant Cream of Wheat or grits (about 1 teaspoon each)

Safety

Follow normal safety precautions.

Clean-Up

Dispose of used cereal and paper plates in trash.

How to Do It

Static electricity experiments work best when the humidity is very low and the air is dry. You will know conditions are excellent if your clothes are full of static and it's easy to get shocked when you touch a door knob after walking on a carpet.

While this activity is designed to be as simple and dramatic as possible, it will not work on a hot, muggy day.

1. Pour a small amount (1/2 to 1 teaspoon) of instant Cream of Wheat on to a paper plate. Spread the Cream of Wheat across the plate in an even layer.
2. Blow up and tie off a rubber balloon. Nine-inch balloons work well for this activity.
3. Holding the balloon still with one hand, vigorously rub the balloon with the cloth. The part of the balloon you rubbed should become charged, and you may have bits of fuzz sticking to it.

Static electricity is made when two objects are rubbed against each other, and electrons move from one object to the other. When the objects do not conduct electricity, those electrons do not move easily, and the electrons tend to stay where they are until a conductor touches the surface and gives the electrons an escape route.

Do not touch the charged part of the balloon with your hand at this time. Electricity likes to go towards the ground, and if you touch the charged section of the balloon with your hand, it would give the electricity a path to leave the balloon and move through your body towards the ground.

4. Hold the charged part of the balloon 2-3 inches above the layer of Cream of Wheat. The kernels of cereal should immediately "jump" up and hit the balloon. You should be able to hear them hitting the balloon.

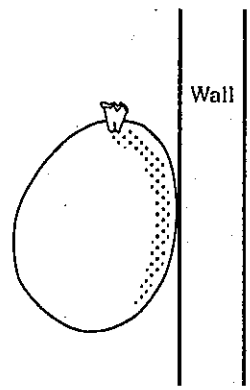
NOTES

NOTES

If it does not work, try rubbing the balloon longer with the cloth and hold it closer to the cereal

5. Brush the cereal off the balloon and back onto the plate, and repeat the experiment. As you brush the cereal off, your hand touches the charged area, causing the electrons to leave the surface of the balloon and move over your body towards the ground.
6. Charge the balloon with the wool cloth again and try attracting other things such as your hair.
7. Charge the balloon and see if it will stick to the wall.

This takes practice. It's easier if the wider part of the balloon points down.



8. Feel free to experiment. What things can the charged balloon attract? Can you charge the balloon by rubbing it with things other than wool or cashmere?

Before the Meeting

1. Check that the humidity is not too high by trying the activity beforehand to insure that it works under the conditions.
2. Prepare a plate with approximately 1 teaspoon of instant Cream of Wheat on it for each girl.

Doing the Activity With the Girl

1. Ask the girls: **What is energy?** They may have trouble with this, but encourage them to come to a definition by thinking how they have heard the word energy used.

Energy is the ability to do **work**. When you push or pull something and move it, you do work.

2. Demonstrate energy and work for the girls.
   a. Place a chair in front of the girls and ask for a volunteer to sit on it.
   b. Ask them: **If I try to lift this chair, am doing work?**
   c. Pretend to try to lift the chair, but say you can't...it's too hard, and you don't have enough energy to do it.
   d. Now if you prop your foot at the bottom o f one of the chair legs, and lean the chair back...**did I still move the chair?** Yes. **How?** I leaned it (pulled it) toward me. **Did I use more or less energy to move it?** Less, it was easier.

It required a lot of energy to lift the chair. Lifting the chair was moving the chair, and that was work. Work simply was pushing or pulling something and making it move. I pull the chair up, it moves, and that is work, in this case, hard work. **Work** is using a push or pull to move something, and you need energy to do the work.

Energy can make things move or do work. **Where do you get energy?** From the food you eat. **Where does the food get energy?** From the sun. **Can you name different kinds of energy?** This will be a difficult question for the girls, and they may need some help in discovering the answers.

There are different kinds of energy. Light energy, heat energy, sound energy, electricity, chemical energy, kinetic energy, potential energy, and nuclear energy are all different kinds of energy.

NOTES

NOTES

3. Tell the girls that they are going to make static electricity to do work. Demonstrate how to make static electricity with a balloon and wool.
   a) Vigorously rub the balloon with the cloth.
   b) Hold the charged part of the balloon 2-3 inches above the layer of cereal. The cereal should immediately "jump" up and hit the balloon.

Have the girls watch closely to what happens to the cereal. Ask them: **What happened to the cereal?** The cereal moved from the plate to the balloon. Tell them you made static electricity, which did some 'work' on the cereal.

4. With 2 or 3 of the magnets, show how they attract each other or repel each other. Encourage them to remember how magnets work. Remind them that opposites attract and the similar poles repel each other. Static electricity works the same way except that instead of north poles and south poles, electricity has charges--a positive charge and a negative charge.

Explain that when you rub the balloon it puts negative charges on it called **electrons**. The negative charges on the balloon attract the positive charges on the cereal causing the cereal to jump up and stick to the balloon.

5. Demonstrate that when you rub the cereal off the balloon with your hand, the negative charges also come off and the balloon will not do work on the cereal anymore.

6. Then show them that when you rub the balloon again with the cloth, you put more negative charges on it, and the static electricity will again attract the cereal.

7. Hand out the balloons to the girls. Have them blow them up and tie them.

Some girls, especially younger ones, may need help. Tell the girls if they are not absolutely sure they can blow up the balloon, not to try it. Let an adult do it.

8. Give them a piece of wool cloth and a paper plate with cereal on it. Let them experiment. They should soon start discovering things on their own and varying the experiment. Encourage this kind of free play and let the girls have fun.

9. Show the girls how the balloon can stick to the wall or share other tricks you have discovered and practiced.

More To Explore

1. Suspend a balloon from a string and charge it. Charge another balloon and hold the charged sections of the two balloons close to each other. Do the balloons push away from each other? Make sure not to touch the charged sections with your hand.

2. You can also try attracting a very thin stream of water with a charged balloon. Make sure the charged section of the balloon gets close to, but does not touch the water, because this removes the static electricity from the balloon.

If the girls are interested in further exploring the ideas of energy, work, and force, there are several good books to guide them. Bernie Zubrowski has written several books in this area including *Blinkers and Buzzers, Building and Experimenting with Electricity and Magnetism*; *Wheels at Work*; *Messing Around With Drinking Straw Construction*. Neil Ardley is another author who has taken an in-depth look at machines and how they do work in his book *The Science Book of Machines*. Ardley was one of the contributors to David Macaulay's excellent *The Way Things Work*.

NOTES

NOTES

Program Links for *Science Wonders*

Brownie Try-It
Science in Action, Water Everywhere

Contemporary Issues:
Leading Girls into Mathematics, Science, and Technology, Into the World of Today and Tomorrow

How Science Works, by Judith Hann

Resources:
The Institute for Chemical Education
Department of Chemistry
University of Wisconsin--Madison
1101 University Avenue
Madison, WI 53706-1396
(608) 262-0381

The Science Resource Center
Bridging the Gap
Hornets' Nest Girl Scout Council
7007 Idlewild Road
Charlotte, NC 28212

Discovery Place, Inc.
301 North Tryon Street
Charlotte, NC 28202

References:
Kids and Chemistry
Available from:
American Chemical Society
11155 16th Street, NW
Washington, DC 20036
(800) 227-5558

Sarquis, Maud J. *Fun with Chemistry: A Guidebook of K-12 Activities from the Institute for Chemical Education*. Volume 2 pp. 77-80. Madison, WI: Institute for Chemical Education. 1993.

Zim, Herbert S., Paul R. Shaffer. *A Golden Guide, Rocks and Minerals*. New York: Golden Press. 1957.

Bridging the Gap
Science Wonders
Troop Leader Survey

Today's Date: _____ Number of Girls Participating: _____

1. Approximately how long did you spend on each of the following activities?

Crystals	**_____ minutes**	**Bubbles**	**_____ minutes**
Chemistry Magic	**_____ minutes**	**Paper Making**	**_____ minutes**
Magnet Fun	**_____ minutes**	**Static Electricity**	**_____ minutes**

2. What activity did you or your girls enjoy the most, and why?

3. What activity did you or your girls like the least, and why?

4. Were your girls interested in exploring any of the activities further? ❒Yes ❒ No

5. Which one(s)?

6. What did you do to fulfill that interest?

7. What can be done to make this more successful for your girls?

Thank you for your help and for your opinions!!!

Please return all forms to: _____

_____

_____