Science In Action

Leader Guide
For Brownie Girl Scouts

Set I

BRIDGING
THE
GAP

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

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The activities described in this Leader Guide are intended to be used under the direct supervision of adults. Discovery Place, Inc. and Hornets' Nest Girl Scout Council cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from failing to follow the supplied directions, or from ignoring the cautions contained in the text.

Science In Action

Table of Contents

These activities are designed to simplify the activities found on pages 255-257 in the "Brownie Girl Scout" handbook. They are designed to be fun, easy, and inexpensive. The layout of each activity contains simple instructions for preparation, as well as for sampling the activity before presenting with the Girl Scouts. All GSUSA guidelines should be followed when doing these activities.

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.

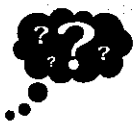
How To Use This Guide

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 yourself 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.

Pixel Pictures

Corresponding Activity

Science in Action Try-It, Computer Fun Fair, p. 255, Brownie Girl Scout Handbook

Overview

The girls will color designated spots on graph paper to create recognizable patterns. From this they will better understand how pictures are created on television screens, video game screens, computer screens, and in newsprint.

Big Ideas

The girls will learn that the small bits of color that make up a picture on a computer or television screen are called pixels. They will also learn that more pixels create a higher quality image.

Estimated Activity Time

30 – 50 minutes

Materials Needed

Your VSC provides:

- ☐Magnifying lenses

Items you provide:

For each girl:

- ☐Copies of Sunday comics
- ☐Copy of "Large-Square Worksheet"
- ☐Copy of "Small-Square Worksheet"
- ☐Colored pencils or fine-tip markers
- ☐Several copies of 'Large Squares' and 'Small Squares' (optional)

Safety

No special precautions are necessary.

Clean-Up

Dispose of paper in trash as necessary.

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How to Do It

1. Make a copy of each worksheet for yourself. Color in the dotted squares with a pencil or pen. Notice that the star and the heart patterns become much easier to see when they are colored in. Note that the small squares make the most accurate picture.

The pictures on TV screens, computer screens, hand-held games, even in the Sunday comics are made up of small squares, or dots of color, called **pixels**. The logic used to draw a picture on a computer screen is the same logic used to produce a picture in needlepoint or cross-stitch.

In this activity, you have a certain size and number of squares to work with. By coloring or not coloring each square, you make a picture. If you use smaller squares on your grid, you will get more squares within a designated area, meaning that you can make a higher quality picture.

This is similar to the way a finer canvas with smaller squares gives you a more detailed piece of needlework, or the way a more expensive computer screen will give you a better quality picture. Better quality monitors (with higher definition) have more pixels, and, as a result, will give you more accurate picture detail.

2. With a magnifying glass, look closely at your TV, computer monitor, or the Sunday comics. Can you see the pixels?

Before the Meeting

Make photocopies of the two worksheets, one set for each girl, and 2-3 copies of the "Large Squares" and "Small Squares" sheets for each girl if you wish to give them the chance to create, and possibly exchange, their own pixel pictures.

Doing the Activity With the Girls

1. Begin this activity by asking the girls if they have ever played with toys such as a "Lite Brite", that used lighted pegs or dots to make pictures. Encourage them to discuss what they liked or didn't like about making pictures that way.

If they have used a "Lite Brite" or similar toy, ask them: **Did you ever have trouble making a picture turn out the way you wanted it to? If so, why?** Encourage them to discuss how difficult it was to make something round when working on a square grid. They couldn't always put the pegs where they wanted them to go.

2. Pass out the comics and the magnifying lenses. Have the girls look at the color comics. Lead them to notice that the pictures are made up of small dots or squares of color. Small dots or squares of color used to make a picture are called **pixels**. Each colored peg used to make a picture on a "Lite Brite" is similar to a pixel.

Television, computer, and video game screens are also made up of pixels. Have the girls look at one or more of those, if available.

3. Hand out the "Large-Square Worksheet". Tell the girls that they are going to make pixel pictures. Have them color in only the squares with the dots in them.

Ask the girls: **What shapes do you see?** A heart and a star. **Are they very good pictures?** Have them discuss why or why not--let the girls express their opinions, and suggest what might make their pictures better.

4. Next, pass out the "Small-Square Worksheet". Again, have the girls color in only the squares with the dots in them.

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Ask them: **What shapes do you have?** They have the same two shapes as in the previous worksheet--a heart and a star. **Which size squares resulted in a better picture?** They will usually choose the page with small squares. **Why?** The easiest way to figure out why is to have them compare the sheets. Since the paper is the same size, the difference is what's on the paper—the squares. In addition, two things are different about the squares-—one sheet has smaller squares, and with smaller squares, that same sheet has more squares. More squares or pixels produce a better image. **If you were shopping for a computer screen, would you want to buy one that had a few pixels or lots of pixels on its screen?** More pixels.

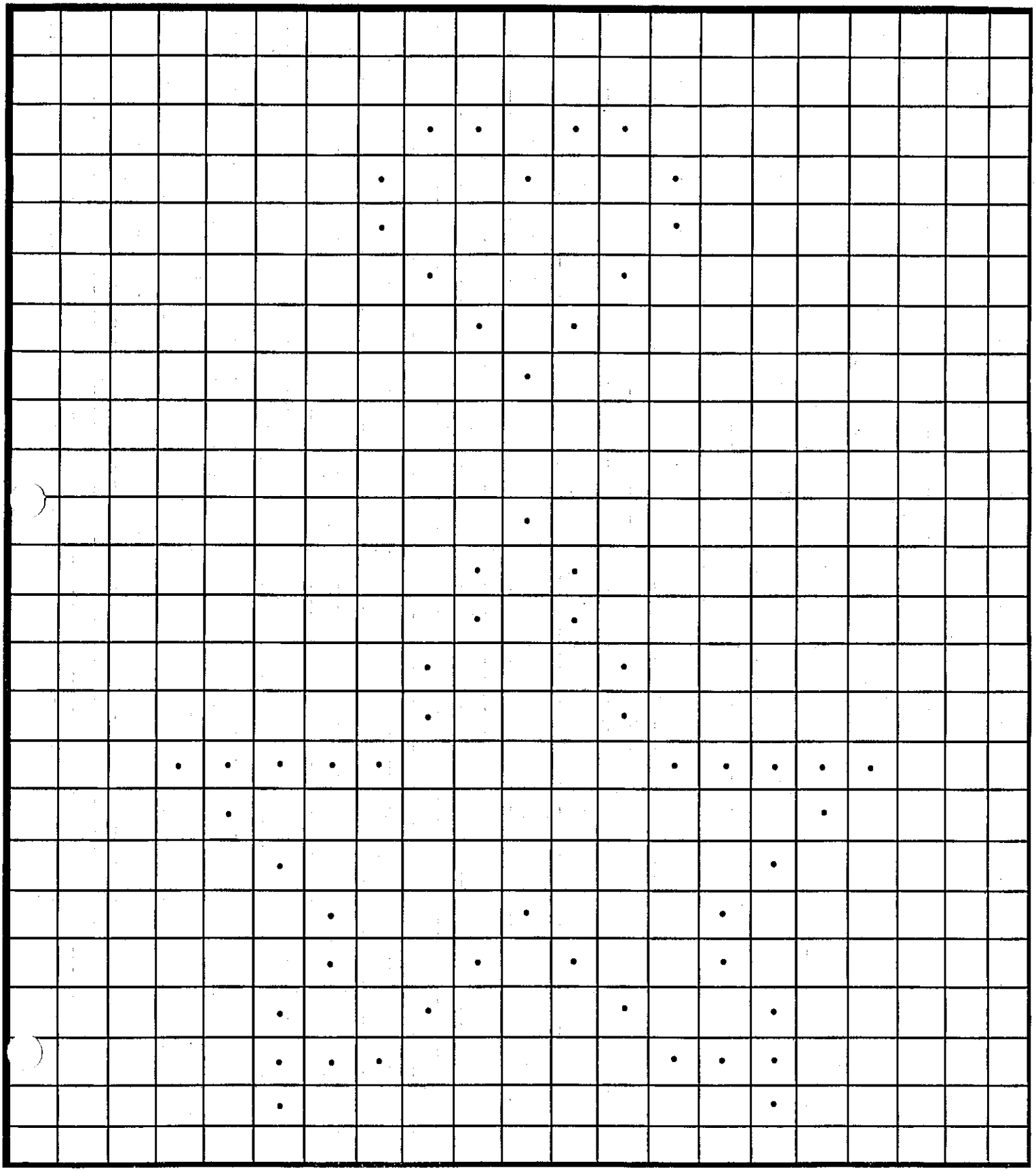
Ask them: **Is the better computer picture worth paying a lot of money for, or would you enjoy watching an older model that is a lot cheaper?**

What do you think makes a good video game or game system? Do the number of pixels and the quality of the screen really make a big difference to you? Let the girls discuss this and explore their own ideas.

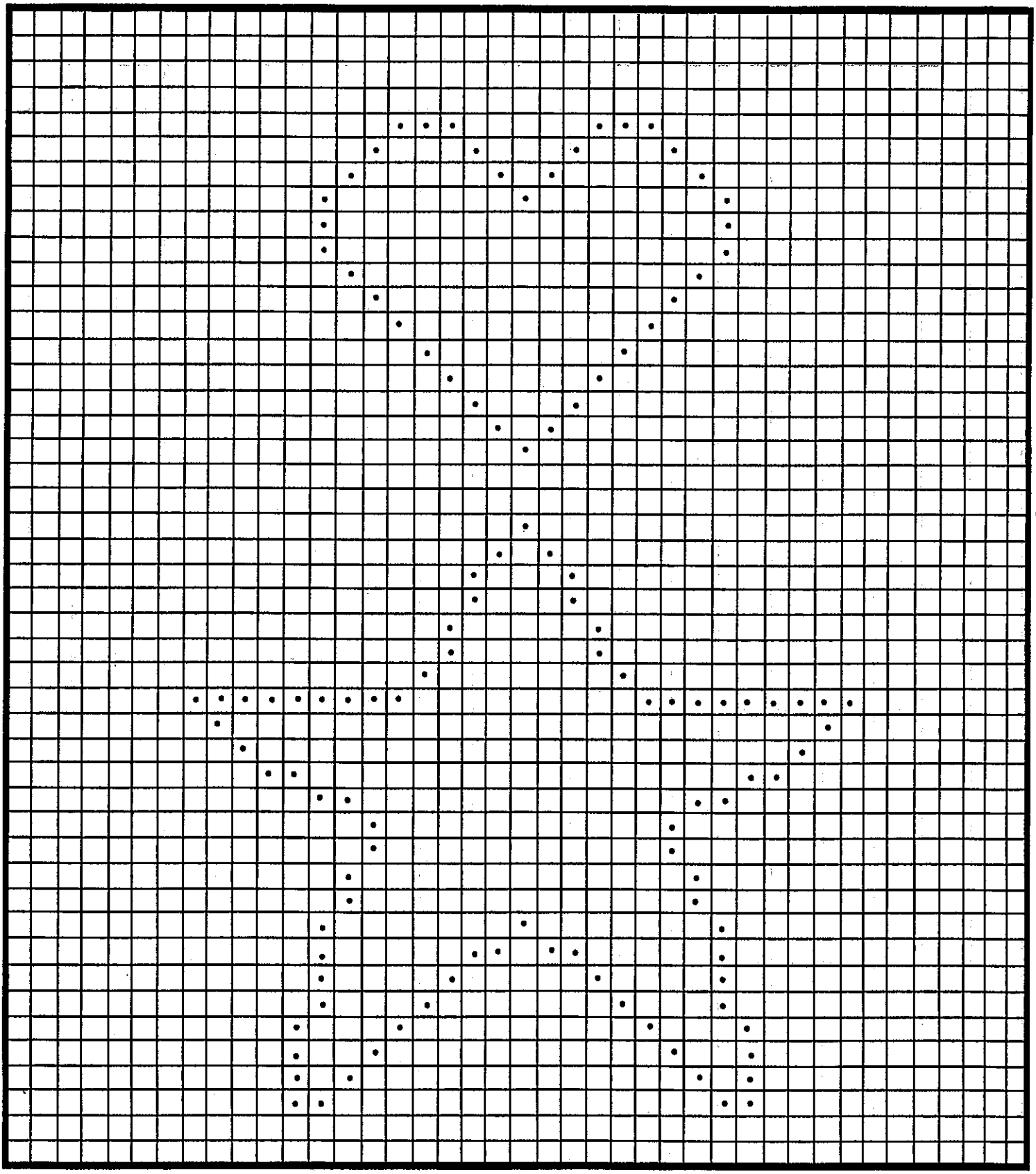
Also, older girls may want to try making different patterns on the blank sheets. Allow them to explore making their own pixel pictures, which they can keep themselves, share with their parents, or challenge their fellow Brownies to color and solve.

Very young Brownies may have difficulty with this.

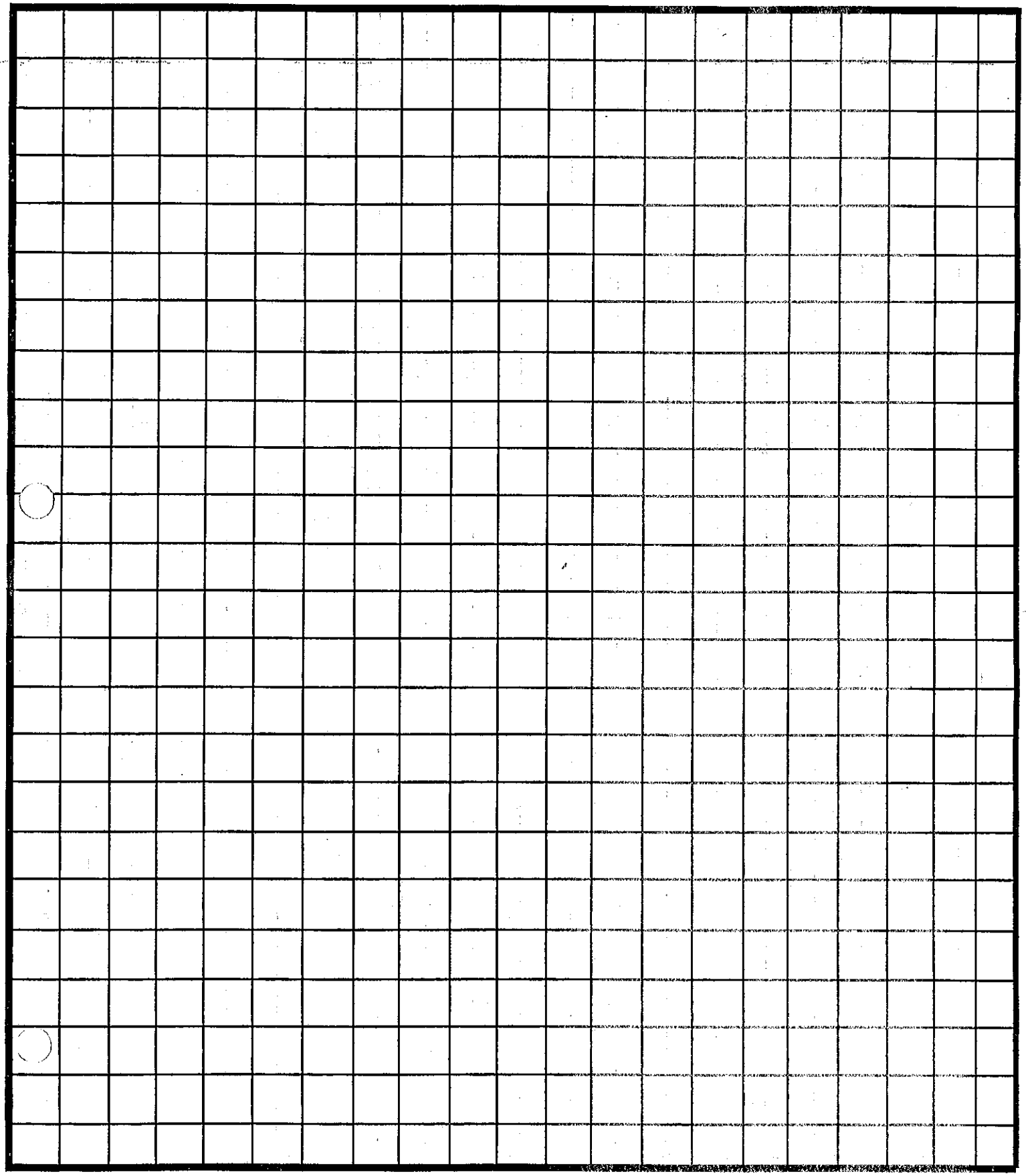
Large Square Worksheet



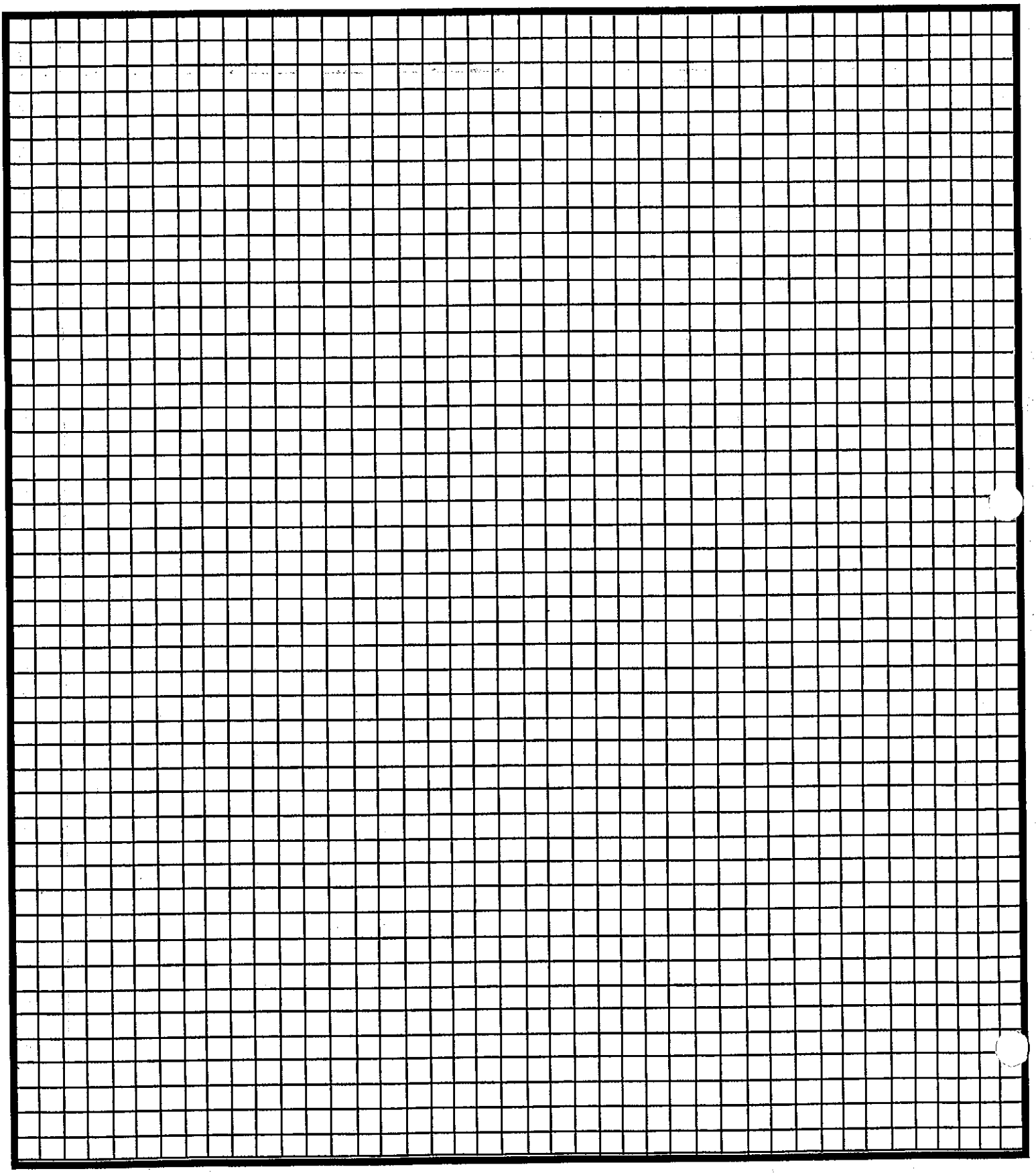
Small Square Worksheet



Large Squares



Small Squares



Energy Sleuth

Corresponding Activity

Science in Action Try-It,
p. 255, Brownie Girl Scout Handbook

Overview

The girls will put objects of various sizes and weights into plastic grocery bags, and then twist the bags to see how the weight and size of the objects affect how fast and long the bags spin.

Big Ideas

The girls will be introduced to the concepts of energy and work. They will do informal experimenting with a lot of play. The idea is to introduce the girls to basic concepts of physics, and emphasize physics as an explanation of what happens in the everyday world. Once the girls have a basic idea that energy can do work, they can discuss what kinds of energy they use daily with greater understanding.

Estimated Activity Time

20 – 30 minutes

Materials Needed

Your VSC provides:

No items for this activity.

Items you provide:

For each girl:

- ☐Plastic grocery bag

Additional supplies:

- ☐A watch with a second hand
- ☐Numerous items for use in the bag
  (Vary the weight and size of the items; have at least 2-3 total items for each girl; items might include:
  - Canned goods
  - Various sizes and types of balls
  - Large blocks
  - Stuffed animals
  - Pick an item to start with, and have one of that item for each girl.)

Safety

No special precautions are necessary.

Clean-Up

Gather materials when finished. Recycle plastic bags.

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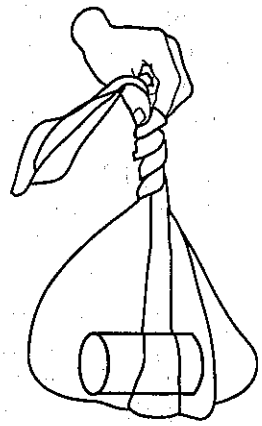
How to Do It

1. Put one of the items, such as one of the canned goods, into the empty plastic grocery bag.



2. Holding the bag by the handles, twist it five times. Release it so it can spin, and time how long it takes for the bag to stop spinning.
3. Add a second item of the same size and weight to the bag. Again, twist it five times and let it spin. Once again, time how long it takes for the bag to stop spinning. It can take more than twice as long to stop spinning. Try it again after putting a third can into the bag. It will take even longer to stop.

As the bag gets heavier, it takes more **energy** from you to twist the bag, because you must **work** harder to move the extra weight. That extra **energy** is released when you let go of the bag, and it spins longer as a result.

Physicists define **energy** as the ability to do **work. Work** is defined as using a **force** to move an object a certain distance. When you pick up an object and move it, you are doing **work**. The **energy** needed to do **work** comes from your body.

Energy doesn't have mass, meaning that it doesn't weigh anything or take up space. However, energy can move things by applying a **force**. There are different kinds of energy. The kinds that most often come to mind are: chemical, nuclear, electrical, solar, light, heat, and sound.

Two additional types of energy are **potential energy** and **kinetic energy**. Potential energy is stored energy waiting to be released. Kinetic energy is the energy of a moving object. When you twist the bag, you are transferring energy from your body to the bag. Before you let go of the bag, after it has been twisted, it has that energy stored in the twists as potential energy. After you let go, that **potential energy** is released. The potential energy turns into **kinetic energy**, which moves the cans in the bag.

The more potential energy you put into the bag, the more it will spin. The bag spins longer when it has heavy items in it because you had to use more energy to move them in the first place.

4. Try different objects in the bag. Experiment. See what happens when using different sizes and weights of objects.

Before the Meeting

Pick out items to bring to the meeting for the girls to use, and practice with them to gain an idea of how they will work. These types of items work well:

- canned drinks (but don't open them immediately afterwards!)
- stuffed animals
- sports balls

Use household items, especially if you have a large quantity of them. Have the girls bring balls and stuffed animals from home if necessary, but make sure those items are labeled so they can be returned to their owner.

Doing the Activity With the Girls

1. Gather the girls together in a circle. Tell the girls that they are going to experiment with physics. **Physicists study energy. Does any one know what energy is?** Encourage them to exchange their ideas of what energy is, and what it does.

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Tell them that **energy** is the ability to do work. In physics, **work** happens when you push or pull something and move it. Ask for a volunteer. Push her gently on one shoulder, until she moves sideways. Ask the girls: **Did I do some work on her?** Yes. If I push or pull something and I move it, I have done work, and I need energy to push or pull.

Ask them: **Where do people get energy?** From the food they eat. **Where does the food get its energy?** From the sun. Food comes from plants and animals, and both get their energy from the sun. Most energy can be traced to the sun. Some energy, like nuclear energy, comes from atoms.

Can you name different kinds of energy? The girls will need help listing different kinds of energy. Don't worry about defining all of them. Just learning what energy is, and that there are different kinds of energy is a big conceptual step for girls this age. The following are some different kinds of energy:

1. solar energy from the sun.
2. sound energy from vibrations.
3. heat energy and light energy from the sun.
4. chemical energy from the food we eat; we also get chemical energy from burning fuel like gasoline or coal.
5. electrical energy runs all kinds of appliances in our home.
6. nuclear energy comes from splitting atoms apart.

What kind of energy do you use at home? Let the girls share and discuss this. Point out that one kind of energy can change to another. For example, burning coal makes electricity. Electrical energy turns into light energy when you turn on a light switch.

2. Tell the girls that you are going to be physicists and experiment with two kinds of energy called **potential energy** and **kinetic energy**.

Potential energy is stored energy. That means an object that has potential energy has energy that is not being used at the moment, but that has the potential to do work (push or pull something). When the energy actually moves something, it becomes **kinetic energy**.

3. Put a can in a grocery bag and twist it.

Ask the girls: **Am I putting energy into the bag?** Yes, you are. Hold the bag, with five twists in the handle, with both hands so that it doesn't spin. Tell them that you have put energy into the bag, and that the bag has potential energy.

Tell them that when you let the bag spin, (let the bottom of the bag go) the **potential energy** turns into **kinetic energy** and the bag moves.

4. Have the girls work with a buddy. Give each pair of girls a bag and, for the first try, give them similar items.

5. Place the items in the bag. Tell the girls to twist the bag handles exactly five times and then wait for your signal before letting them spin. Have them let go at the same time, and see how long the bags spin.

6. Encourage the girls to use different objects, or more than one object at a time. See who can keep their bag spinning the longest with only five twists.

Remember to use the same number of twists when comparing. A bag is counted as spinning until it stops completely.

7. As you end this activity, gather the girls together and have them share their discoveries, and demonstrate what worked particularly well.

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Making Rainbows

Corresponding Activity

Science in Action Try-It, Make a Color Spectrum, p. 255-256, Brownie Girl Scout Handbook

Overview

The girls will use a special tool called a diffraction grating to look at different light sources and see white light separated to form a rainbow.

Big Ideas

The girls will see that white light is made up of different colors. The sequence of these colors is called a **light spectrum**, or rainbow, and the colors always appear in the same order: *red, orange, yellow, green, blue, indigo, and violet.* An easy way to remember the sequence is the mnemonic **ROY G. BIV**--the first letter of each color in sequence makes up the name.

Estimated Activity Time

15 minutes

Materials Needed

Your VSC provides:

- ☐Clear light bulb
- ☐Diffraction gratings

Items you provide:

For each girl:

- ☐Crayons
- ☐Copies of "Colors of a Rainbow" worksheet

Additional supplies:

- ☐Small Lamp
- ☐Access to an electrical outlet

Safety

No special precautions are necessary.

Clean-Up

None.

How to Do It

1. Pick up the diffraction grating and hold it by the edges, keeping fingers away from the film. Hold it up to your eye and look through it towards white light. You should notice the rainbow effect. The scientific name for a rainbow is a **light spectrum**. Toy stores and gift shops often sell rainbow glasses that have this same type of diffraction grating material in it.

Made up of thousands of tiny, clear slits, diffraction gratings separate white light into the different colors of the rainbow and are much easier to use than prisms. The tiny slits are drawn on a piece of plastic by a laser. When light passes through these slits it bends, producing rainbow-like patterns.

Sir Isaac Newton, with his prism experiments, was the first scientist to show that white light is composed of different colors. He used the word **spectrum** to describe the rainbow pattern of colors and discovered that the order of colors in a light spectrum is always in the same order: *red, orange, yellow, green, blue, indigo, and violet.* Newton also discovered that the objects we see have color because they reflect one color of light more than another. For example, a red object is red because it reflects red light and absorbs all other colors.

2. Look at many different light sources and see if you can tell differences in the spectrum you see each time. Sunlight coming through a window, outside sunlight (Never look directly at the sun!), a clear incandescent bulb, a soft-white incandescent bulb, and a fluorescent light are examples of light to use.

An incandescent bulb is a common light bulb. Light fixtures and lamps often have soft-white bulbs. A fluorescent light or a regular soft-white incandescent bulb will not give you exactly the same spectrum as sunlight or a clear incandescent bulb. This is because fluorescent bulbs and coated bulbs do not give off pure white light like sunlight. Some of the colors are missing or not very strong. You only get a complete spectrum from pure white light. Sunlight is the source of white light that Newton used and still works best.

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Ask them: **How do you think rainbows are made?** Encourage them to look at the conditions when rainbows form—bright sunlight, just after rain. Rainbows are caused by sunlight shining through tiny raindrops in the air. Sunlight is a mixture of all the different colors of light. The raindrops bend the light and expose all the different colors. A man named Isaac Newton discovered this a long time ago. He was curious about rainbows too. He came up with another name for a rainbow. He called it a **light spectrum**.

2. Hand out the diffraction gratings, telling the girls that these will take certain types of light and break them down into a rainbow. When you look at a light through the diffraction grating, you will see lots of light spectra that look like tiny rainbows.

Remind them to hold the diffraction grating by the edges only. The clear plastic in the center is what makes the rainbows. Ask the girls not to touch this. It has lots of tiny clear lines on it which are too small to see and fingerprints can ruin them.

3. Darken the room and turn on the lamp. Have the girls look at the clear bulb first. Make sure that each girl is satisfied that she has seen the spectrum. Once they have done this, you may re-light the room and let the girls look at other light sources and explore with their rainbow makers.

4. Bring the girls back together. Ask them if they saw all the colors of the spectrum. Repeat **ROY G. BIV**.

5. Gather the diffraction gratings and put them away, but have one or two available in case someone needs to check what a spectra looks like during the next part of the activity.

6. Hand out the light spectrum worksheet and crayons.

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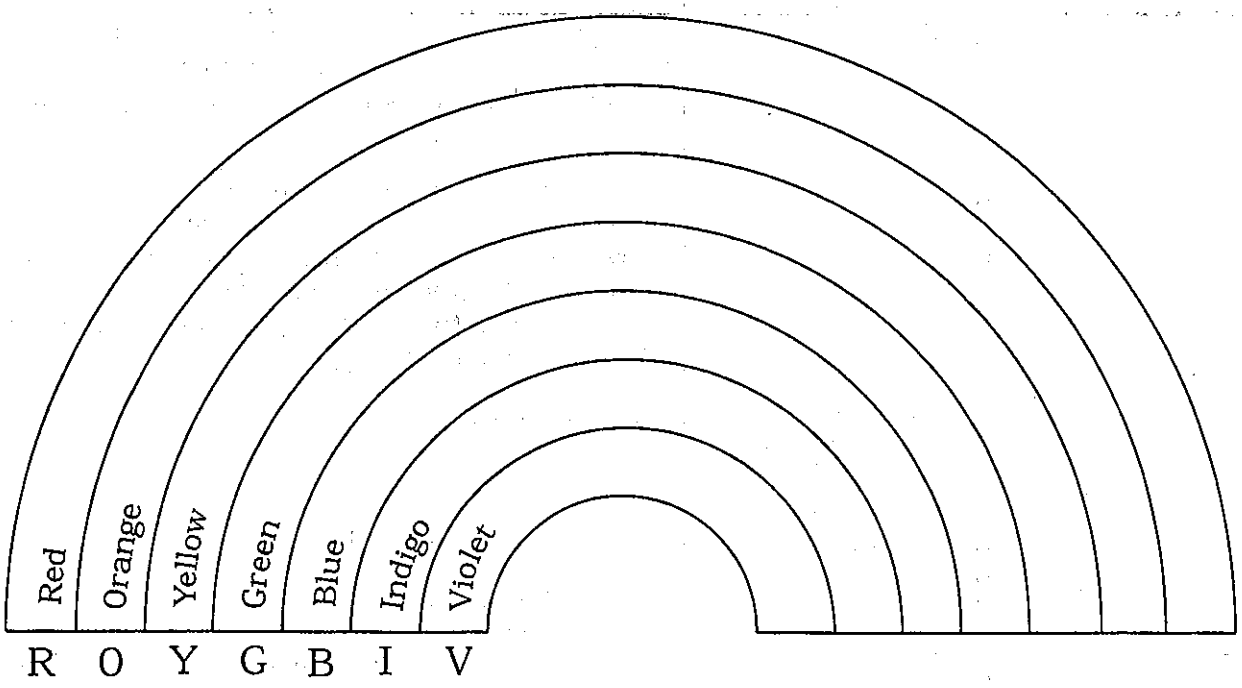
7. Have the girls first color the rainbow in the correct order. Then have them draw their own version of what they think the light spectrum they saw through their diffraction gratings looked like.

Don't worry about the accuracy of the girls' drawings. Documenting what they saw, in their own way, is what is important.

Be careful that the crayon doesn't get on the diffraction gratings. It is impossible to remove and will ruin them.

Colors of a Rainbow



Draw a light spectrum

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Computers in Your Life

Corresponding Activity

Science in Action Try-It,
p. 256, Brownie Girl Scout Handbook

Overview

The girls will learn about bar codes and how they are used. The girls will write a message using the bar code alphabet and compare how people read to how computers read.

Big Ideas

Computers use a special kind of alphabet to read information. Girls see lasers scan bar codes in stores on an everyday basis but may not understand the technology they see. The purpose of this activity is to help the girls understand a part of the technology being used.

Estimated Activity Time

15 - 30 minutes

Materials Needed

Your VSC provides:

No items for this activity.

Items you provide:

For each girl:

- ☐2-3 copies of "Bar Code Alphabet" sheet
- ☐(1 copy minimum)
- ☐Copy of "Write in Bar Code" worksheet
- ☐Glue sticks or glue
- ☐Scissors

Additional supplies:

- ☐An assortment of items with bar codes

Safety

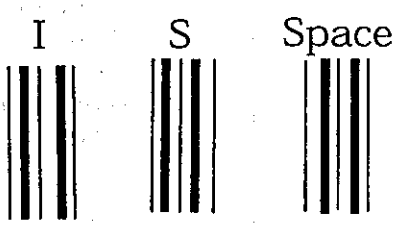
No special precautions are necessary.

Clean-Up

Dispose of paper in the trash.

How to Do It

1. Look at the "Bar Code Alphabet" Sheet. Each letter is a series of five thick or thin lines with spaces between them. There are codes for start, space, and end which act as punctuation marks. Some of these are very similar. Look at the code for I, S, and SPACE. Each has a line sequence of thin, thick, thin, thick, thin.



The only differences are in the size of the spaces between the lines. Several letters have very similar patterns with the only difference being in the spacing. Examples are:

L, B, and V;
E, O, and Y;
R and H;
and U, A, and K.

Our eyes and brains can recognize letters and process them easily. A computer can not. However, a computer can, by using an optical scanner, read a series of light and dark bands. The white spaces are as important to the computer as the black bands. Because computers can't read our alphabet, the bar code alphabet was developed. It is difficult to just look at bar codes and read them. Remember, they are written for computers, not people, to read with a laser scanner.

2. Look at the worksheet. It has "*a great big brownie*" written out in bar code. The bar code for the word "*smile*" is left out. The letters match the bar code alphabet. 'Start' is at the beginning of the message; 'end' is at the completion, and 'space' is in between the words. These three codes act as punctuation.

To complete the worksheet, cut out the appropriate bar code letters (S,M,I,L,E) and glue into place to spell "smile".

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Before the Meeting

Make one copy of the worksheet and several copies of the bar code alphabet for each girl.

Doing the Activity With the Girls

1. Gather the girls together. Ask them: **How do people read?** Help them to break the process down step-by-step:

   - We look at letters with our eyes.
   - Our eyes send the message to the brain.
   - The brain recognizes words and we remember what the word is.

Ask them: **You can read books, but what sort of things would a computer read?** Let them toss around some ideas on this before proceeding.

2. Hold up one of the canned goods or another item with bar code on it.

Ask the girls: **How do computers read bar codes? Do computers have eyes like us?** Let the girls think about this and discuss their ideas.

Ask the girls if they have ever noticed a red light by the cash register at the grocery store, as the cashier 'scans' an item. The checkout person has to pass the bar code by this light on the cash register's scanner. The light is a laser and acts as the computer's eyes.

Sometimes this laser is hand-held and the checkout person holds the laser scanner up to the bar code. After the laser reads the bar code, it sends a signal, through wires, to the computer. The computer recognizes the bar code and tells the cash register the price of the item.

Computers have trouble reading words that people use, but they can read a special computer alphabet called a bar code. **What are bar codes used for?** The most common answer you will get will probably be that it's a "price sticker". Girls recognize that the bar codes ring up a price on a cash register. Bar codes also appear on library cards, packages, mail, and many other things that people want to keep track of, or will need information about. A bar code is a way to get information in the computer.

Someone may call it a UPC code, which is also correct. UPC stands for 'Universal Product Code' which is a sort of international computer language for identifying any product (a retail item or an inventory item) with a code consisting of numbers. This code is like a fingerprint, since no two items should have the same UPC.

The bar code (or, in this case, UPC code) on the canned item you are holding will tell the store computer what the item is. The computer then locates the file on that item and can tell you the price, the name of the item, who the manufacturer was, who sold it to the store, how many of the item have sold over a period of time (day, week, month, year), how many are in the store, and any other information the file might have on that item.

3. This is one way people use computers at work. Start a discussion on any other way people use computers. Let the girls share their ideas on how people use computers.

4. Move to a work area set up with scissors and glue. Tell the girls they are going to see a message written in bar code.

Ask them: **Do you know the words to the Brownie Smile Song? What does the song say the Brownie has in her pocket?** Hand out the "Write in Bar Code" worksheets.

Tell them that this is how you write '*a great big brownie smile*' in bar code. Encourage them to see if anything is missing. They should notice that the word 'smile' is blank. Challenge them to finish the message.

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The girls will want to start cutting and gluing at this point. Let them finish the message.

More To Explore

1. If you have older girls, you may want to let them have a fresh bar code alphabet sheet and have them find letters that look alike. Point out A and see if they can find two more letters like it (K and U).

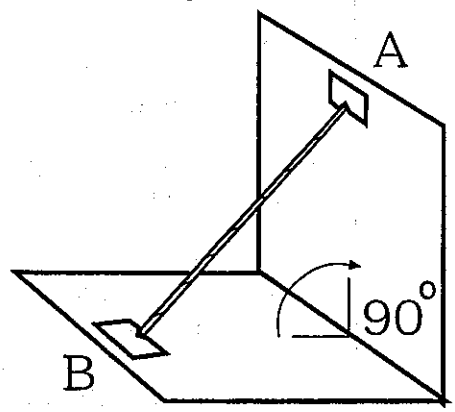
   Have them examine the letters A, K, and U and see if they can determine what makes them different. Point out the spacing differences if they don't see it.

2. If the girls remain interested, you can have them cut and paste to write their own messages. To do this have plenty of alphabet sheets available. Point out the 'space', 'end', and 'start' codes used as punctuation.

NOTES

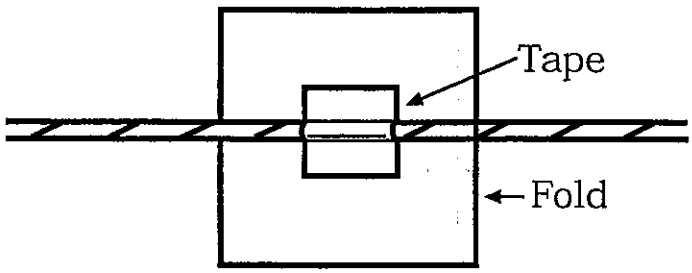
How To Do It

1. Make a copy of the sundial on card stock. If you don't have card stock, glue a paper copy to a piece of light cardboard. It will be a bit harder to cut and fold, but should work just as well. Start by cutting out the sundial.
2. Fold the sundial along the fold line. Use a ruler or another straightedge to make it easier to fold.
3. Cut a two-inch piece of crochet thread. Use the tape to attach the string from point A to point B (see diagram below), so that when the sundial is open at a 90-degree angle, the string is pulled tight.



Open and close the sundial to make sure the string is secure.

4. Fold the sundial closed. Cut a length of ribbon, about 18-20 inches, and tape the ribbon to the back of the wrist sundial.



You can decorate the top cover if you wish.

Your wrist sundial is now ready to use. Sundials are only useful on clear sunny days. This is one of the reasons people developed water clocks and other ways of telling time.

Sundials

Corresponding Activity

Science in Action Try-It, Time Check, p. 256, Brownie Girl Scout Handbook

Overview

The girls will learn how to read a sundial, and make a wrist sundial to take home.

Big Ideas

The purpose of this activity is to help the girls understand how people kept track of time before clocks were invented, and to learn that there is a relationship between the position of the sun in the sky and the time of day.

Estimated Activity Time

30 – 45 minutes

Materials Needed

Your VSC provides:

- ☐Sundial
- ☐Compass

Items you provide:

For each girl:

- ☐Card stock copy of wrist sundial
- ☐Scissors

Additional supplies:

- ☐Several rolls of tape
- ☐One roll crochet thread
- ☐One roll curling ribbon
- ☐Flashlight
- ☐Globe (optional)

Safety

Exercise normal caution while allowing the girls to use scissors.

Clean-Up

Dispose of ribbon and paper scraps.

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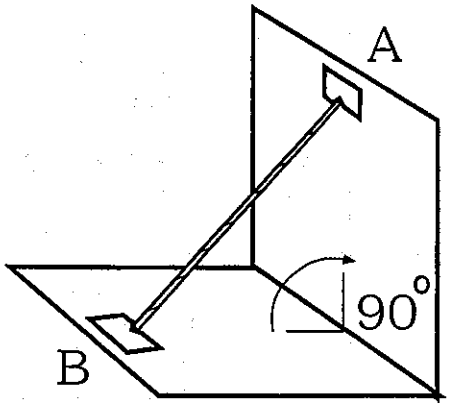
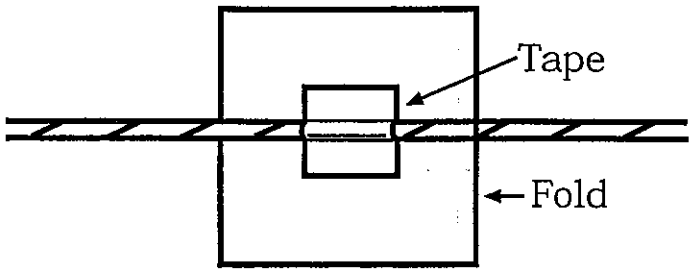
How To Do It

1. Make a copy of the sundial on card stock. If you don't have card stock, glue a paper copy to a piece of light cardboard. It will be a bit harder to cut and fold, but should work just as well. Start by cutting out the sundial.
2. Fold the sundial along the fold line. Use a ruler or another straightedge to make it easier to fold.
3. Cut a two-inch piece of crochet thread. Use the tape to attach the string from point A to point B (see diagram below), so that when the sundial is open at a 90-degree angle, the string is pulled tight.



Open and close the sundial to make sure the string is secure.

4. Fold the sundial closed. Cut a length of ribbon, about 18-20 inches, and tape the ribbon to the back of the wrist sundial.



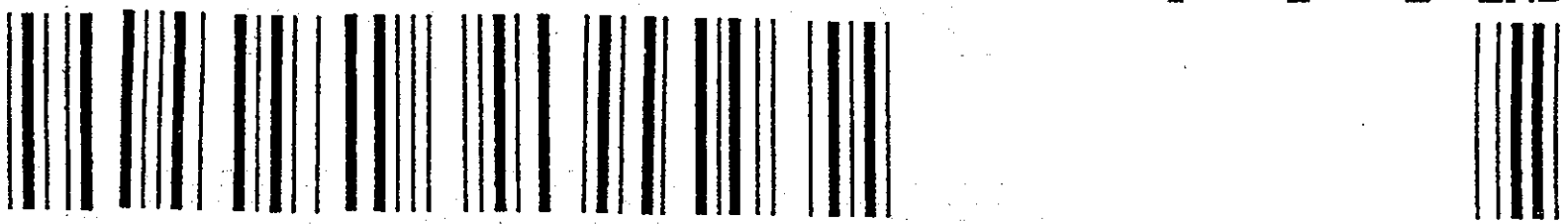
You can decorate the top cover if you wish.

Your wrist sundial is now ready to use. Sundials are only useful on clear sunny days. This is one of the reasons people developed water clocks and other ways of telling time.

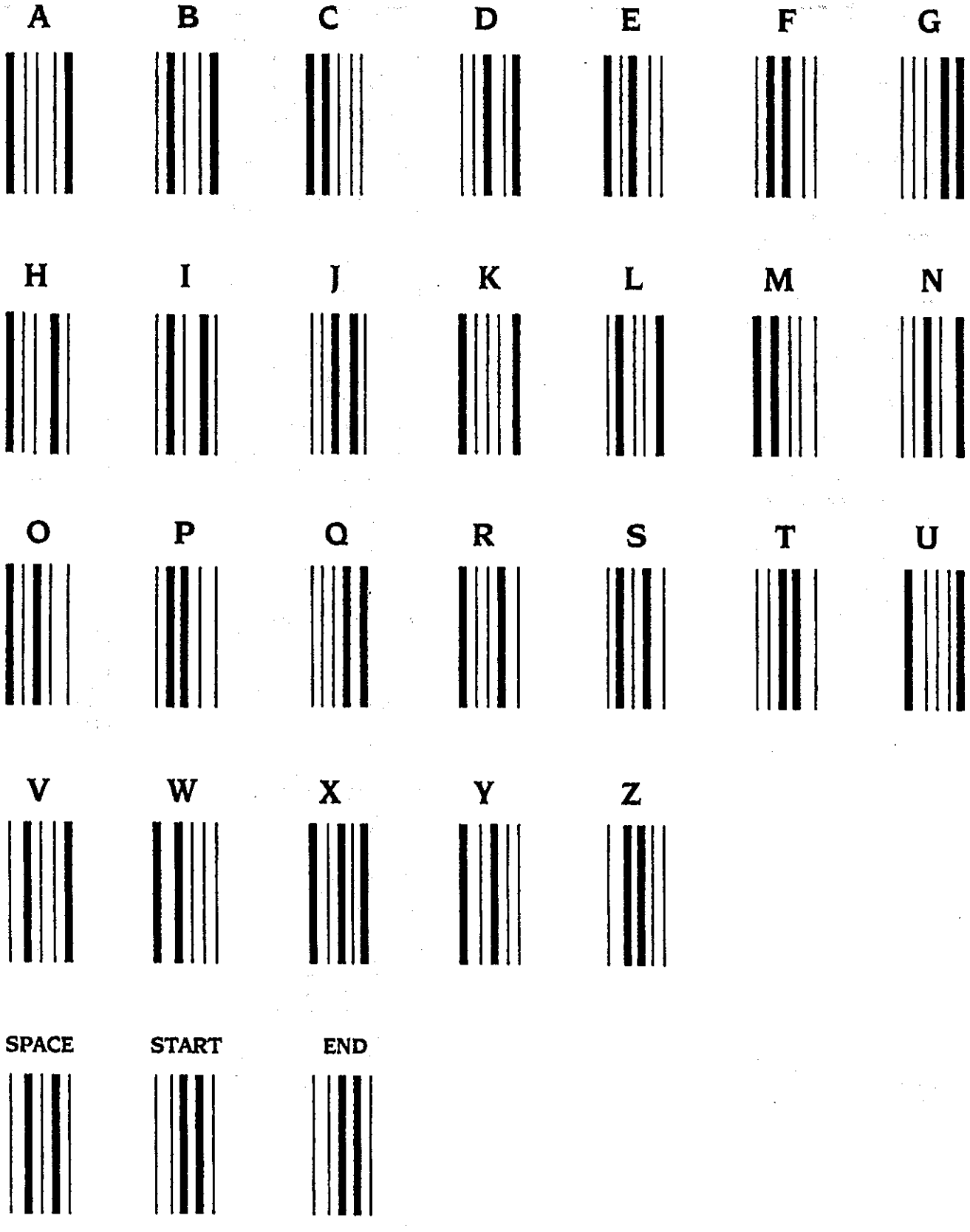
Write In Bar Code

START A SPACE G R E A T SPACE B I G SPACE

B R O W N I E SPACE S M I L E END



Bar Code Alphabet



Sundials can tell the actual solar time for a particular spot. The actual time needs to be adjusted by as much as 16 minutes, depending on the time of year, to compensate for the sun rising and setting in different locations throughout the year. When properly set for a location (adjusting for the latitude and longitude), and read properly, sundials are very accurate for the **real sun time** at that location.

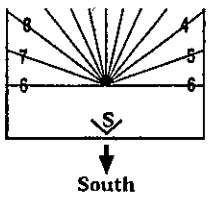
Real sun time doesn't always agree with modern clocks. We have time zones that give the **mean solar time**, or the average time, for an entire area. Sundials in areas on the western half of a time zone will appear to run slow, while sundials on the eastern half of a time zone will appear to run fast.

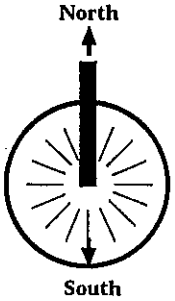
Daylight savings time will also cause sundials to differ from clock time. We may adjust our watches to "spring ahead" one hour in the spring but we cannot change how the sun appears to move through the sky. Sundials will appear to be one hour behind during daylight savings time.

The string that holds your sundial together serves as the **gnomon** (pronounced "no-men"). On conventional sundials, the gnomon is the angled indicator that casts the shadow to tell the time. This particular sundial should work well at most North American latitudes.

5. To use your sundial, you need bright sunshine to cast a clear shadow, and you must have it pointed in the right direction.

Look at the bottom of your wrist sundial. Pointing towards you is a small arrow with the letter "S" in it. This arrow must be pointing due south for the sundial to be accurate. The bottom point of the gnomon always points south and the angle of the top needs to open up from the north.





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6. Go outside on a sunny day. Take the compass, the large sundial, and your wrist sundial with you.

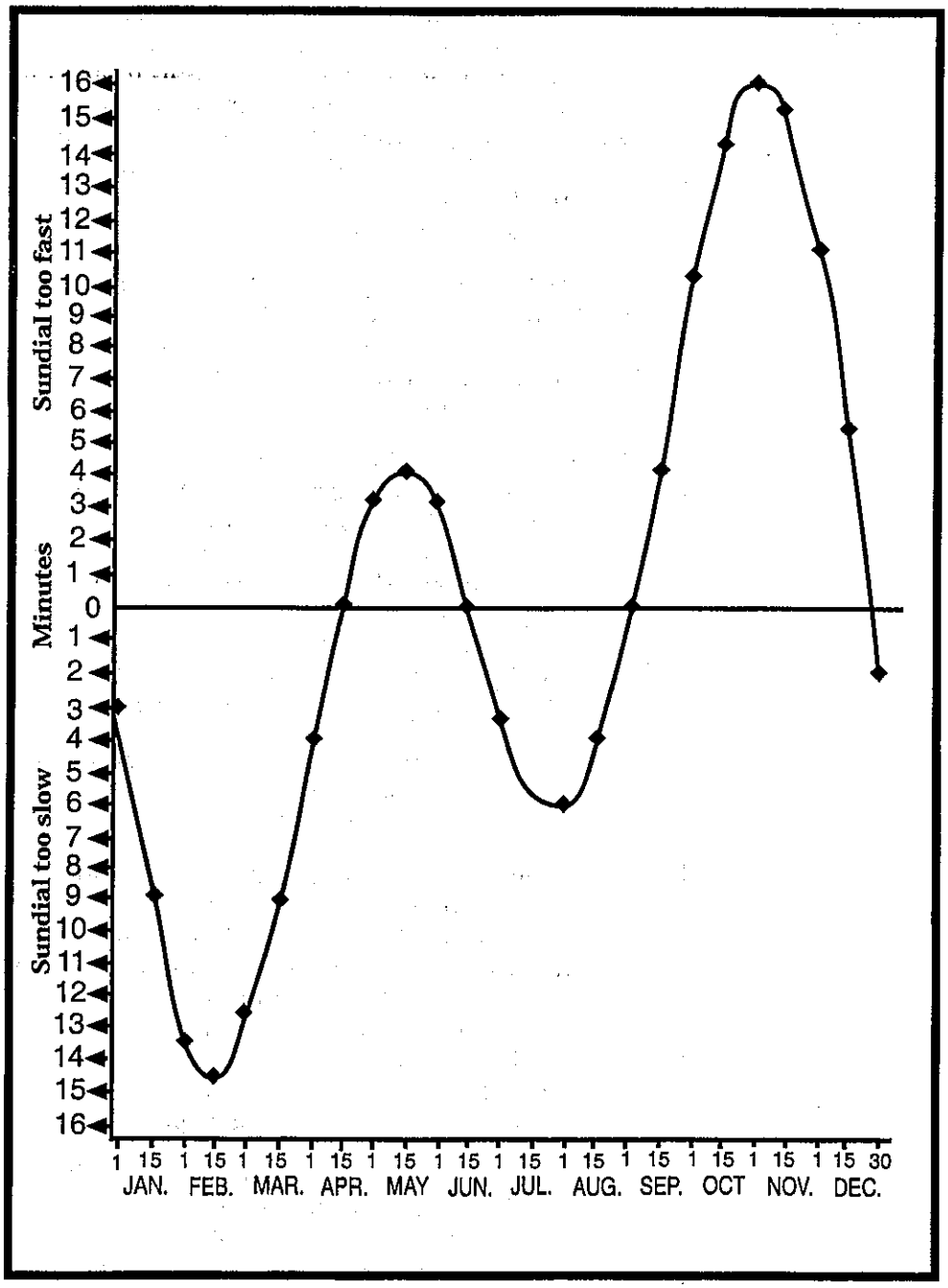
7. Use your compass to locate which direction is south. Place the large sundial on a flat level surface and line it up properly. Make sure the gnomon is not bent. Where is the shadow? Does it agree with the current 'clock' time?

To find out just how accurate your sundial is there are several adjustments you can make to 'correct' the time on sundial.

1) Using the chart on the next page, you may add or subtract minutes to compensate for the season. Find the approximate location on the graph for the date you are using the sundial, then add the appropriate amount of minutes if your sundial is too slow, or subtract the minutes that your sundial is running too fast.
2) Add one hour if you are in daylight savings time.
3) Obtain a picture of the time zone you are in. If you are located in the middle of the time zone, do nothing. If you are on the far eastern end of the time zone you are probably running fast by as much as 30 minutes. If you are on the western end, your sundial could be as slow as 30 minutes. Make a reasonable guess based on how far east (or west) of the center of the time zone you are located.

Check and see how accurate your sundial is.

Your homemade sundial will probably not be quite this accurate. This type of adjustment works best if you are using a garden sundial.



8. Open your wrist sundial. Line it up so the arrow is pointing south. The piece of crochet thread should cast a sharp shadow on the face of the sundial. How well does your wrist sundial compare to the larger one? How does it compare to your watch when it is adjusted for date, location, and daylight savings time?

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Before The Meeting

1. Pre-make the wrist sundials in advance. Cut the sundials out, fold, and tape the string gnomons in place. This is hard for Brownies to do accurately, particularly younger Brownie Girl Scouts. You may also want to pre-cut lengths of ribbon for the girls. At minimum, pre-cut the crochet thread for the girls to insure their being the proper length.

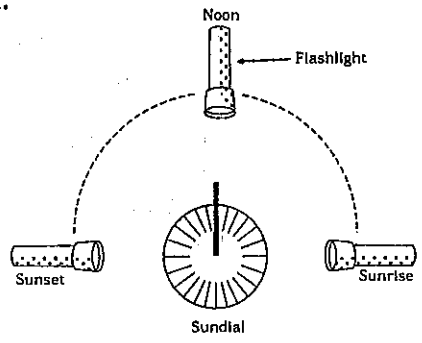
2. Be flexible in your planning since this activity needs to be done on a bright, sunny day. You may want to keep pre-made sundials on hand in order to have them ready on short notice for use on an appropriate day.

3. Practice using a flashlight to show how the sun casts a shadow on a sundial.
   a) Place the large sundial on a table indoors. (A darkened room works best.) Line the sundial up so the bottom pointed part of the gnomon points to you. This will be "south". To your right will be "east", and to your left will be "west". The flashlight serves as the sun.

   b) Turn the flashlight on. Hold it about a foot above the sundial and shine the light directly over the gnomon.

   c) Move the flashlight slightly left and right. Do you see a shadow falling over the number? Move the flashlight in an arc to the right, still pointing at the gnomon, and watch the shadow move. Position the flashlight so that the shadow falls on 7 or 8 o'clock in the morning. The flashlight should be far to the right. This is the "sunrise" position.

   d) Move the flashlight in a half-circle from right to left. Watch the shadow change from 8 AM to noon to 5 in the afternoon. This far-left position is the "sunset" position.



e) Practice this right to left arc so you can do it smoothly, and cast clear shadows on the sun dial.

Doing the Activity With the Girls

1. Ask the girls: **How did people tell time before they had watches and clocks?** Give them a chance to express their thoughts on this.

You might try having them pretend to be in ancient Egypt. Tell them you want to meet them at the Great Pyramid at a certain time, but since watches haven't been invented yet, how would all of you know when to meet? Encourage them to think of things that would be available to an ancient people, without using electricity and mechanical devices that could be used to measure time throughout the day.

One of the earliest means invented to tell time was by watching the position of the sun in the sky. To track the sun's movement people invented sundials. A sundial takes the steady movement of the sun across the sky, and divides it up into specific segments (hours), which told the ancient Greeks and Egyptians how much of the daylight had already passed in a day, and how much remained. The early Babylonians were among the first people to invent a sundial.

2. Bring the large sundial out and show it to them. The girls may be unfamiliar with what a sundial is, or how to read one.

See if the girls know the four basic directions of north, south, east, and west. If not, you may wish to have a globe handy to visually explain the idea. Now see if they know from which direction the sun rises, and which direction it sets. Explain that the sun rises in the east and sets in the west. At noon, it is straight overhead (or at its highest point in the sky).

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Ask the girls: **Does the sun really move around the earth?** No. The earth moves around the sun and when it spins, it makes it appear that the sun is moving. The earth spins around one time in a whole day. When we see the sun rising again in the morning, the earth has spun around one time.

3. Have the girls try the following exercise to demonstrate this point.

   Ask for a volunteer. Have her choose a spot on the wall, such as a light switch, and look at it. Make sure the chosen spot is directly in front of her (high noon). Have her pretend to be the "earth" and spin around slowly counterclockwise, and stop when she sees the spot again straight in front of her. How many times did she spin around? Exactly one time, just like the earth.

4. Have the girls gather around the sundial, and perform the flashlight demonstration.
   a) Mention that for everyone to get the same "time" on her sundial, everyone must hold it in the same position. Refer back to your discussion about directions. Remember, north? The open end of the point must always face north; the pointy end facing south.
   b) Ask them to pretend that the flash light is the sun. The sun is coming up in the east. Have them note the shadow. **What time does the sundial say it is?**

Begin this part by stopping the flashlight around 8AM. Continue moving slowly, asking them:
What time does the sundial have? *Do this at 8AM, noon, and sunset.*
What is happening to the shadow as the sun moves across the sky?
Does it get longer or shorter, darker or lighter?
Can you see the shadow after the sun sets?

5. Let the girls design their own wrist sundials. If you have pre-assembled them and cut ribbon in advance, they will just need to
   a) color the cover, and
   b) tape the ribbon to the back

   If you have done no pre-assembly, follow all of the steps
   a) Give each girl a copy of the sundial.
   b) Have each girl fold her sundial along the fold line.
   c) Hand out the pre-cut pieces of crochet thread. Have them use the tape to attach the string from point A to point B, so that when the sundial is open at a 90-degree angle, the string is pulled tight.
   d) Have them fold their sundial closed. Hand out the pre-cut length of ribbon, and help them tape the ribbon to the back of the wrist sundial.

6. Show the girls how their wrist sundial works, making sure to show them where the arrow for 'south' is located.

7. Remind the girls that the sundial only works when pointed in the right direction.

Demonstrate this by using the large sundial and flashlight to show how the "time" the sundial reads, depends on what direction it points in. For accurate time, the gnomon always needs to point south, with the open end of the angle facing to the north.

8. Have the girls tie on their wrist sundials. They will probably need an adult or buddy to help with this. Move the girls to a sunny place out side.

9. Show the girls how to use a compass to find out which way south is. Using the compass as a guide, assist the girls in positioning them selves so that as they look at their wrist sun dial, the "S" arrow is actually pointing to the south.

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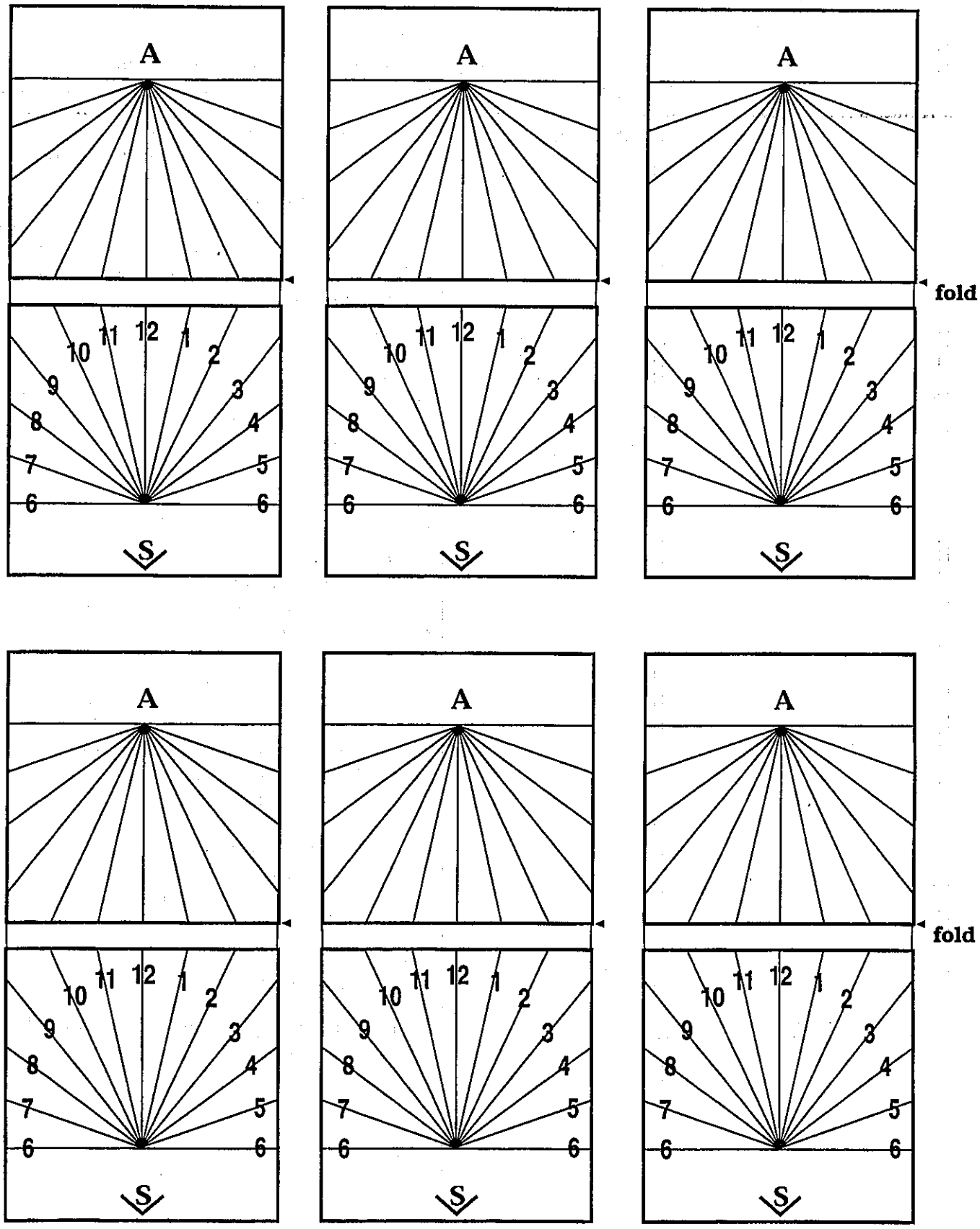
One way to do this is to first use the compass to locate 'south'. Then position the large sundial so it is lined up correctly. Finally, have the girls use the large sundial as a reference to correctly position themselves.

Have the girls compare the sundial to a watch. They can position the sundial to match the position of their watch. Brownie Girl Scouts aren't very interested in the finer points of adjustment charts. They just want to see what time the sundials read.

10. Let each girl read her sundial, and compare what is says with the actual time. If you are in daylight savings time, tell them that their sundial will be an hour off, and mention that this is because a sundial shows <u>real</u> sun time, not daylight savings time.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Growing Yeast

Corresponding Activity

Science in Action Try-It, Breadmaking, p. 256-257, Brownie Girl Scout Handbook

Overview

The girls will add sugar and warm water to dry yeast, and watch it foam while it grows.

Big Ideas

The girls will learn that dry yeast is a living organism. With water, food, and a warm temperature, it will grow. While it grows, it makes a gas called carbon dioxide, which is what causes bread to rise.

Estimated Activity Time

30 – 45 minutes

Materials Needed

Your VSC provides:

For each girl:

- ☐Magnifying lens
- ☐Thermometer

Items you provide:

For each girl:

- ☐Sheet of paper
- ☐2 spoons or stirring sticks

Additional supplies:

- ☐1 package of three-ounce plastic cups 2 cups per girl)
- ☐Fast-rising, dry yeast (approx. 2 teaspoons per girl)
- ☐Box of sugar (2 teaspoons per girl)
- ☐Measuring spoons
- ☐1/4 cup measure
- ☐1 Box of small re-sealable plastic bags
- ☐Box of matches
- ☐Cup to pour water
- ☐Container for warm water (110-120 degrees)

Safety

Check for any allergies before having the girls handle the yeast.

Clean-Up

Dispose of yeast, spoons, used matches, cups, and scrap paper.

How to Do It

1. Put 1 teaspoon of yeast into each of two 3-ounce cups.
2. Label one 3-ounce cup with an "S" for sugar and put 2 teaspoons of sugar into that cup with the yeast, so that you have one cup with yeast and sugar, and one with just yeast.
3. Pour some warm water from the tap. With the thermometer, check the temperature of the warm water. It should be between 110-120 degrees Fahrenheit. Add 1/4 cup (2-ounces) of warm tap water to each 3-ounce cup.
4. Stir each cup with a different spoon (or stir ring stick) to dissolve the yeast. Make a note of the time it takes. Let the cups sit for five minutes.

The experiment works better if the mixtures stay warm (no less than room temperature). You should notice a distinct 'yeasty' smell, and foam forming in the cup with the sugar in it.

Within 10-15 minutes, there should be a large layer of foam growing in the cup with the sugar. The cup without the sugar will not be foaming.

When yeast grows, it produces by-products that are useful in making different foods. One of these by-products is a gas called carbon dioxide. Just as we give off carbon dioxide when we breathe, yeast gives off carbon dioxide when it grows. The millions of yeast organisms in dough use flour and sugar as food and release bubbles of carbon dioxide. These bubbles make the dough rise. Baking the dough kills the yeast but the bubbles of gas remain and expand in the hot oven making bread light and fluffy.

Most bakers know that yeast needs sugar or flour, moisture, and a warm place to grow in order to make good yeast bread. The reason yeast needs this is because it is a type of fungi; a living organism. Dry yeast is in a dormant state. When you supply moisture, food, and warmth, the yeast will grow.

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Carbon Dioxide Demonstration

The following is a demonstration showing that yeast really does give off carbon dioxide. Practice this before the meeting and demonstrate it for the girls. Steps C through G are optional. Skip them if you aren't comfortable with them.

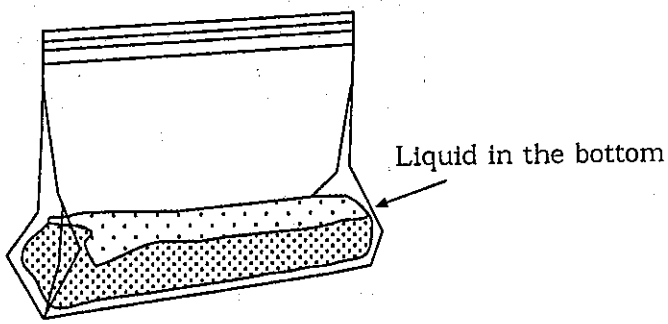
A. Put one teaspoon of yeast, and two teaspoons of sugar into a small resealable plastic bag. Add 1/4 cup of warm water. Mix the sugar and yeast to dissolve.

B. Push out all excess air and zip the bag closed. Place the bag in a cup or container of hot (120 degrees) water. It should begin foaming within five minutes. Let the yeast grow until the bag puffs up with carbon dioxide gas.

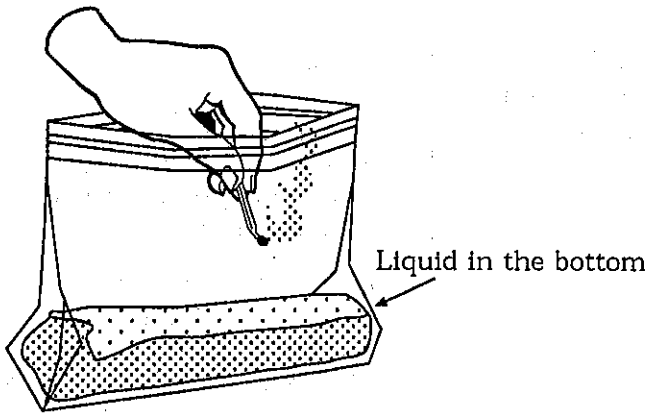
C. Take the bag out of the warm water. Shake it to break up the foam, but don't open the bag yet.

Carbon dioxide is heavier than air and fire cannot burn in it. A common test for carbon dioxide gas is to see if it puts out a match or other flame.

D. Set the bag on a flat surface in an upright position. Have some matches handy (wooden ones work well).



E. Open the bag carefully. Be careful not to push any of the carbon dioxide gas out. Light a match and put it down into the open bag. Be careful not to touch the plastic bag with the lit match. When the match reaches the carbon dioxide, it will go out.



F. Repeat with another match if you wish. It will keep going out as long as the bag has carbon dioxide in it.

G. Carefully flatten the bag, without spilling the contents, to empty all of the carbon dioxide out of the bag. Open the bag again in an upright position. The bag is now full of regular air. Lower another match into the bag and this time it will continue to burn.

Brownie Girl Scouts love this demonstration. It is a concrete way of showing that the yeast makes a gas that is <u>not</u> air. A match will burn in air but it won't burn in carbon dioxide. When the carbon dioxide is gone, the match will burn again.

Before the Meeting

1. Cover the work area with plastic or newspaper.
2. Plan a short activity the girls can do for 10-15 minutes while the yeast is growing.
3. Prepare the 3-ounce cups ahead of time, two per girl, by putting 1 teaspoon of yeast into each one. Label half the cups with an "S".

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If you have a large troop, or younger Brownies, you may want to go ahead and add the 2 teaspoons of sugar to the cups labeled with an "S".

4. Secure adult helpers for a large troop, and be sure to practice the "Carbon Dioxide Demonstration".

Doing the Activity With the Girls

1. Show the girls a package of dry yeast. Ask them: **Can anyone tell me what yeast is, or what it is used for?** Some may recognize it as something their parents use in cooking. Tell them that yeast is used in making bread, rolls, some pizza crusts, and in baking.

2. Tell the girls that yeast is a living organism and can eat food, grow, and make other products as a result. At this point, begin the **"Carbon Dioxide Demonstration"**.

   a) Mention that yeast is a type of fungi; a relative of mushrooms. Put one teaspoon of yeast into a resealable plastic bag.

   b) **What do living things need to stay alive?** Have the girls focus on what they need to live. First, they need food. Now, give the yeast some food. **What do they think yeast likes to eat?** Put two teaspoons of sugar into the bag.

   c) **What else do living things need?** Water. Add 1/4 cup of 120-degree water.

   d) The yeast also needs a place to live with just the right temperature. Close the bag, pushing out as much air as you can. Show the girls that there is no air in the bag and put the bag into a container of warm 120-degree water. Now, move on to the next step, and let the yeast grow.

3. Hand out paper and magnifying lenses. Put a small amount of yeast, about 1/8 teaspoon, on each girl's paper. Have the girls look at the yeast.

Ask them: **Does it look like it is alive?** Tell them that the yeast is dormant, or not active, right now, but if you give it food, water, and a warm temperature, it will start to grow.

4. Give each girl two 3-ounce cups of dry yeast, one labeled "S" for sugar and two spoons (or stirring sticks). If the sugar hasn't been added in advance, use adult helpers to go around and put 2 teaspoons of sugar into the "S" labeled cups.
5. Use the adult helpers again to add 1/4 cup of warm water to each cup, and have the girls stir to dissolve the mixture.
6. At this point, tell them to put aside the mixture, and return to the "Carbon Dioxide Demonstration" you started earlier. The bag should be full of carbon dioxide at this point.

Ask the girls: **What happened to the bag?** What do they think caused it? Let them speculate on what they think happened before telling them. Yeast makes a gas called carbon dioxide when it grows. When the yeast grew, it made enough carbon dioxide to blow up the bag.

Optional Steps

A. Mention that you can test to see if the gas is air, or carbon dioxide. Show them that if you light a match, it will burn in the air.

Perform the match test. Repeat it. If you have older Brownies, you can have one of them hold the bag open so everyone can see.

Carbon dioxide is heavier than air so it stays in the bag. Matches burn in air but not in carbon dioxide.

B. Now remove all the carbon dioxide from the bag. Squeeze the bag shut to remove the gas. Show the girls that the gas is gone. Now open the bag. Ask if anything is in the bags now with the yeast mixture. Of course, air is, and because of that, the match will burn when you repeat the match test.

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7. Enough time has passed to have foam appear in the cups with the sugar added. Have the girls check their cups, and observe what happened to their yeast.

Ask them: **Did the yeast without food grow?** Let them discuss how it looks, and what they think has happened. Yeast needs food to grow and make bubbles.

8. If you wish, the girls can add sugar to the inactive cup of yeast to see if it starts growing when it gets food. When doing this, make sure it stays warm.

9. Complete your other planned activity and then let the girls come back. If you added sugar to inactive cups, they should be foaming at this point.

More To Explore

1. Have the girls try different ingredients as yeast food such as flour, corn syrup, honey, etc.

2. Try growing the yeast at different temperatures.

Program Links for *Science in Action*

Brownie Try-Its

Science Wonders, Career Hobbies, How and Why?

Contemporary Issues:

Leading Girls into the World of Today and Tomorrow

Resources:

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

The Nature Company
Carolina Place Mall
Charlotte, NC

NOTES

Materials List for *Science in Action* activities

Pixel Pictures

Tub Contents:

- ☐30 magnifying lenses in a sandwich bag

You provide:

For each girl:

- ☐Copy of Sunday Comics (in color)
- ☐Copy of "Large Square Worksheet"
- ☐Copy of "Small Square Worksheet" (extra copies of both worksheets recommended)
- ☐Color pencils or fine-tip markers
- ☐Copies of "Large Squares" and "Small Squares" sheets (several recommended for each)

Energy Sleuth

Tub Contents:

None

You provide:

For each girl:

- ☐Plastic grocery bag

Additional supplies:

- ☐A watch with a second hand
- ☐Numerous items for use in the bag 2-3 total items of various sizes and weights for each girl. One item the same for each girl (Item examples: canned goods, balls, large blocks, stuffed animals, etc.)

Making Rainbows

Tub Contents:

- ☐1 clear light bulb in a cardboard box
- ☐1 plastic box of 30 diffraction gratings

You provide:

For each girl:

- ☐Crayons
- ☐Copy of "Colors of a Rainbow" worksheet

Additional supplies:

- ☐Small lamp
- ☐Access to an electrical outlet

Computers in Your Life

Tub Contents:

None

You provide:

For each girl:

- ☐2-3 copies of "Bar Code Alphabet"
- ☐1 copy of "Write In Bar Code" worksheet
- ☐Glue sticks or glue
- ☐Scissors

Additional supplies:

- ☐Assortment of items with bar codes

Sundials

Tub Contents:

- ☐1 sundial
- ☐1 compass

You provide:

For each girl:

- ☐Card stock copy of wrist sundial
- ☐Scissors

Additional supplies:

- ☐Several rolls of cellophane tape
- ☐1 roll of crochet thread
- ☐1 roll of curling ribbon
- ☐Flashlight
- ☐Globe (optional)

Growing Yeast

Tub Contents:

- ☐30 magnifying lenses in a sandwich bag
- ☐30 thermometers in a quart bag

You provide:

For each girl:

- ☐Sheet of paper

Additional supplies:

- ☐Box of plastic spoons or stirring sticks
- ☐Fast-rising, dry yeast (one tri-fold container per 3 girls)
- ☐1 box of sugar
- ☐Measuring spoons
- ☐Measuring cup (to measure 1/4cup)
- ☐1 box of small resealable plastic sandwich bags
- ☐Cup to pour water
- ☐1 box of matches
- ☐Container for warm water (110-120 degrees)

Bridging the Gap
Science in Action
Troop Leader Survey

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

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

Pixel Pictures	**_____ minutes**	**Energy Sleuth**	**_____ minutes**
Making Rainbows	**_____ minutes**	**Computers in Your Life**	**_____ minutes**
Sundials	**_____ minutes**	**Growing Yeast**	**_____ 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: _____

_____

_____