



## Curiosity Box PATCH PROGRAM

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## **CURIOSITY BOX HISTORY**

According to GSUSA, "Girls today need support and encouragement to become active participants in the scientific, mathematical, and technological work that will shape their future." To encourage girls to pursue math, science, and technology in the 21<sup>st</sup> Century, Girl Scouts of Nassau County secured a grant from the New York State Division for Youth to develop materials introducing these concepts in an informal learning environment. A Volunteer Committee along with a Staff Advisor created the Curiosity Box Patch Program activities and a kit containing materials to implement the program. The Curiosity Box Kits (one or more per Association) were assembled and distributed to all thirty-six GSNC Associations, for use at their events and Troop meetings.

## **CURIOSITY BOX PROGRAM ACTIVITIES**

The Curiosity Box activities are divided into 5 sections: *COLOR, EXPLORING MATH CONCEPTS, AIR, WATER,* and *GAMES & OTHER THINGS TO THINK ABOUT.* The Color and Math sections were designed as stations in a wide game but can easily be completed at Troop meetings. If you would like to do the activities in the original wide game format, instructions for running such an event are included.

## **THE CURIOSITY BOX PROGRAM KIT**

The Curiosity Box Kit contains materials to help you do the program activities. It includes measuring tapes, tangrams, hand lenses, toothpicks and prisms. A notebook is also included to record Troop activities and make comments regarding the material. The Curiosity Box Kit can be borrowed from your GSNC Association Resource Liaison or the GSNC Resource Room.

## **EVALUATION AND PATCHES**

An evaluation is included with the patch program. Please complete the evaluation with input from your girls, and bring it to the Girl Scout Shop when you purchase patches. There are both large and small patches, available for first-time (large) and subsequent participation (small).

## **PROGRAM LINKS, 2012**

### **Girl Scout Daisy**

*The Girl's Guide to Girl Scouting*

Leadership Journeys:

*Welcome to the Daisy Flower Garden*

*Between Earth and Sky*

*5 Flowers, 4 Stories, 3 Cheers for Animals!*

### **Girl Scout Brownie**

*The Girl's Guide to Girl Scouting* and Skill-Building Badge Activity Sets

Leadership Journeys:

*Brownie Quest*

*WOW! Wonders of Water*

*A World of Girls*

### **Girl Scout Junior**

*The Girl's Guide to Girl Scouting* and Skill-Building Badge Activity Sets

Leadership Journeys:

*Agent of Change*

*Get Moving!*

*aMUSE*

### **Girl Scout Cadette**

*The Girl's Guide to Girl Scouting* and Skill-Building Badge Activity Sets

Leadership Journeys:

*aMAZE: The Twists and Turns of Getting Along*

*Breathe*

*MEdia*

### **Girl Scout Senior**

*The Girl's Guide to Girl Scouting* and Skill-Building Badge Activity Sets

Leadership Journeys:

*GIRLtopia*

*Sow What?*

*MISSION: SISTERHOOD!*

### **Girl Scout Ambassador**

*The Girl's Guide to Girl Scouting*

Leadership Journeys:

*Your Voice, Your World: The Power of Advocacy*

*Justice*

*BLISS: Live It! Give It!*

Visit [www.gsnc.org](http://www.gsnc.org) and [www.girlscouts.org](http://www.girlscouts.org) for additional Science/Math (STEM) program information.

## WIDE GAME INSTRUCTIONS

You will need:

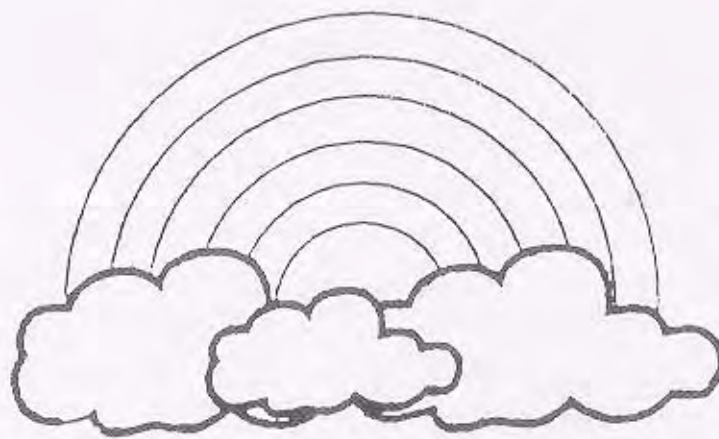
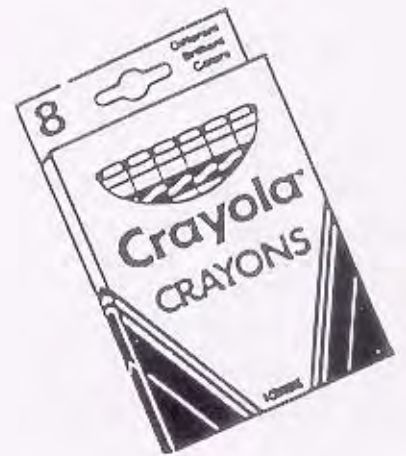
- ☺ An adult or Senior Girl Scout at each station who is familiar with the activities.
- ☺ The list of supplies needed to do the activity at each station.
- ☺ Review the concepts to be learned at each station with the girls before you begin the activities.

i.e. Today we are going to explore . . . . .  
(whichever concept you have chosen). Introduce the adults who are there to help you. (Senior Girl Scouts are also helpful for these activities.)

- ☺ Divide the troop into smaller groups of four, six or eight. Even numbers are best because they may be working in pairs on some of the activities. Each station should take approximately 15 or 20 minutes.
- ☺ Each group will rotate in turn to each of the stations.
- ☺ When the game is finished, ask the questions:  
Did you find working as a team was important?  
Did you learn something you didn't know before?  
Would you like to do something similar to this on another day?
- ☺ Have the girls thank the adults who helped you.



*Color*





## **STATION I**

## MIXING COLORS

### Materials needed:

6 clear plastic cups for each group  
Large container of water & empty container for used water  
Crayons  
Food coloring - red, yellow, blue  
Spoon

1. Fill 3 cups 2/3 full of water.
2. Put several drops of red food coloring in one cup.
3. Put several drops of blue food coloring in one cup.
4. Put several drops of yellow food coloring in one cup.
5. Leave 3 cups empty.

### Object:

Girls must mix colors in empty cups to get orange, green, purple.

Take colors from cup with spoon and mix --

Red & Yellow = Orange

Yellow & Blue = Green

Blue & Red = Purple

If there is time, have girls mix colors and try to make Brown & Black.

Make a Color Wheel - Use master and copy one for each girl.

Girls can color the Color Wheel with primary and secondary colors. See if the girls know where they go in rainbow order.

Discuss & correct if necessary.

Cut out wheel. Punch hole in middle of circle. Spin on pencil.

### Large Group -

Discuss colors

Rainbow

## **STATION II**

### **SEPARATING COLORS**

#### **Materials needed:**

Prisms (in Curiosity Box)  
Hand lens  
White paper  
3 Flashlights  
Crayons

#### **Girls --**

1. Hold prism in path of light.
2. Roll prism around until you see a rainbow on the wall.
3. Tape white paper on the wall under the colors and color the colors.
4. Repeat steps 1 to 3 but now place a hand lens between the wall. Move the lens around until the colors disappear.

Light is made up of colors which can be separated.



## STATION III

### THE SHADOW

#### Materials needed:

3 Flashlights  
Mirror  
White Paper  
Pencils

1. Shine a light at the white paper taped on the wall.
2. Put various objects - one at a time in the beam of light and trace the patterns on the white paper.
3. Compare drawings. Do they look like the objects? Are they bigger? Smaller? Are they the same shape?
4. Shine the light at a mirror. Put an object in the beam of light before it strikes the mirror. What happens? (A shadow can be reflected.)
5. Experiment with more than one object and/or mirror.

Shadows are produced when light is stopped by an opaque\* object that will not allow light to pass through.

\*Opaque objects will not allow light to shine through.

## STATION IV

### A FLOATING PENNY

Materials needed:

Shallow saucer

Penny

Water

Paper Towels

Vinegar

Alcohol

1. Put penny in the saucer on top of table.
2. Have girl kneel - watch penny - bend down until penny disappears.
3. Second girl pours water slowly into saucer. The penny will reappear and seem to rise in the water.
4. Do steps 2 to 3 using vinegar and then alcohol.

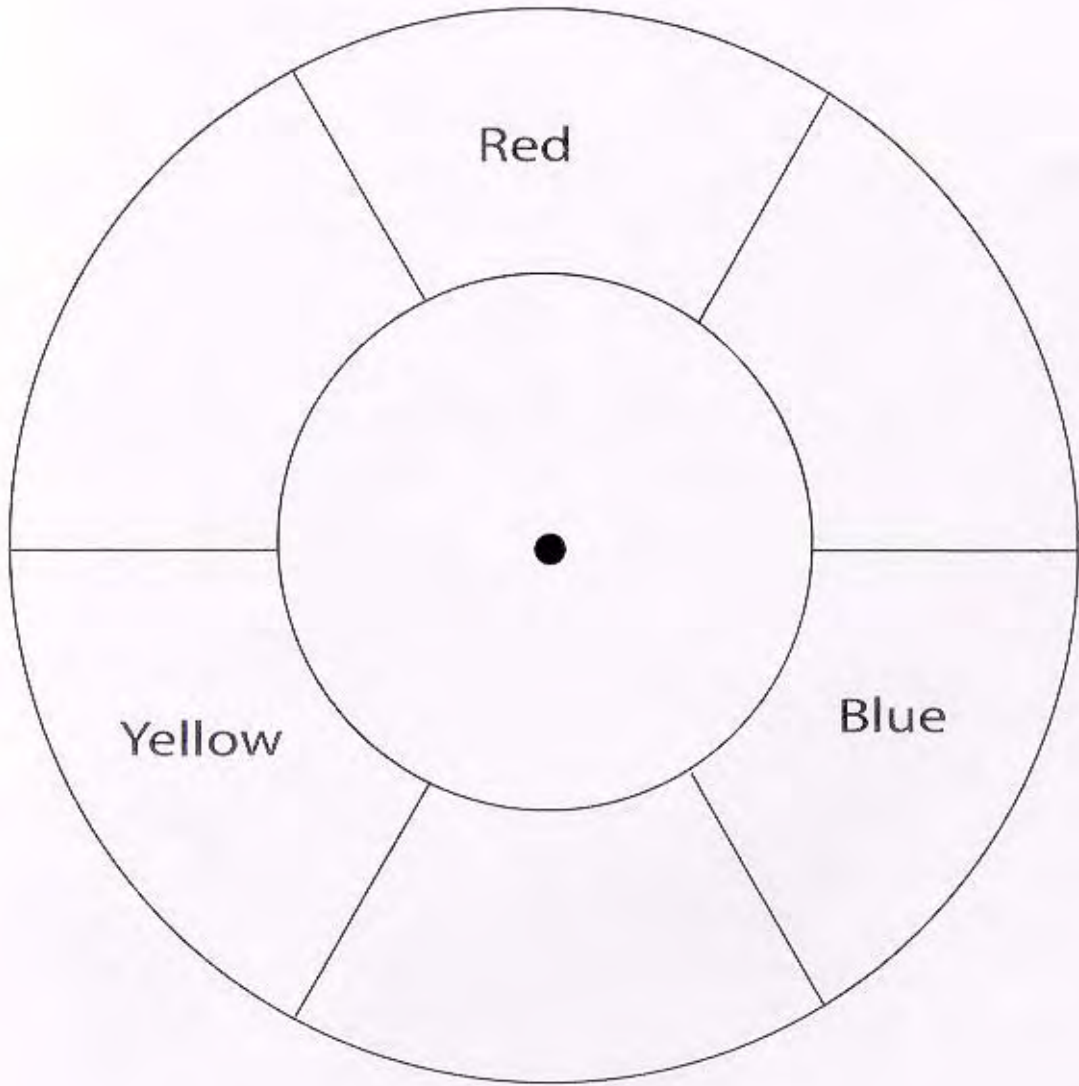
Light rays bend as they pass from one medium to another.

## TIE-UP

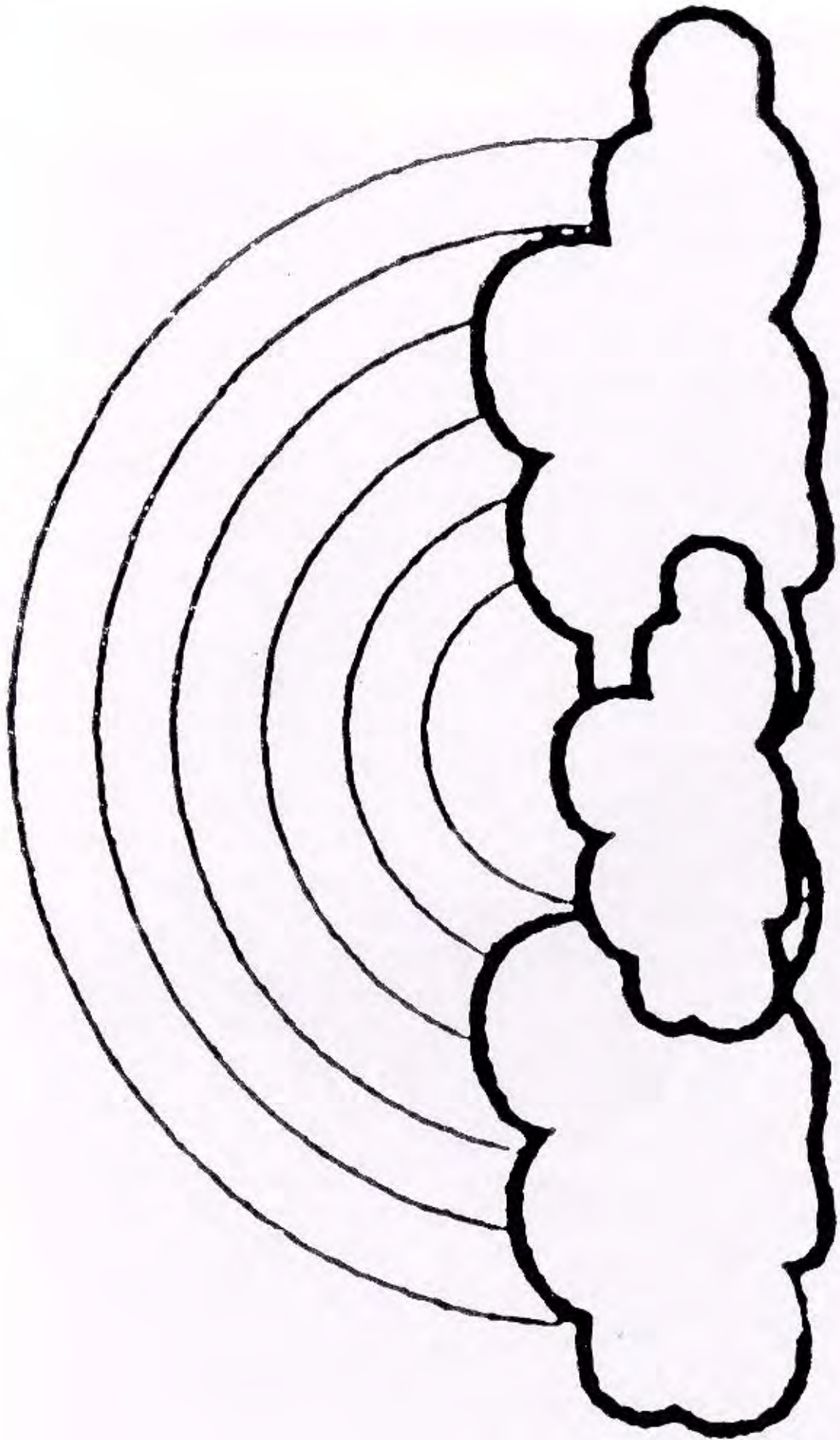
1. Girls get back into one group.
2. Give out rainbow picture.
3. Girls can color both sides - string a ribbon through hole at top to hang up at home.

Brainstorm what careers might use this information -- i.e. beautician, fashion designer, fiber optics decorator, illustrator, etc.

# Color Wheel









***Exploring***

***Math***

***Concepts***



Girl Scouts of Nassau County, Inc.

## EXPLORING MATH CONCEPTS

**PRE-OPENER:** *KIM'S GAME.* Set out "Tools of the Trade"\* - equipment that a mathematician and/or a scientist might use. (Do not tell the girls that it's *KIM'S GAME.*) Allow the girls to touch, if they want, with an adult standing by for assistance. Cover the equipment.

**OPENER:** Whatever the troop usually does and have the leader explain that the troop's meeting will focus on math and/or science. Proceed with *KIM'S GAME* (allow 5 - 10 minutes).

### DEPENDING ON THE LEVEL OF THE GIRLS FOR *KIM'S GAME:*

**DAISIES** call out (while the leader lists on graffiti paper) the items on the table. Count the number of items on the list; count, compare and check off the items on the table with the items on the list. Girls can talk about what items are used for.

**BROWNIES** can do the above or work in groups to list what was on the table - spelling doesn't count and drawings are okay. Count the items on each list. Did each group have the same number of items? If some had different numbers of things, ask the girls why. Count, compare and check off the items on the table with the items on their lists. Girls can talk about what the items are used for.

**JUNIORS** can do the above as patrols or work in pairs to list what is on the table. Count the items on each list. Did each group have the same number of items? If some had different numbers of things, ask the girls why. Count, compare and check off the items on the table with the items on their lists. Girls can talk about what the items are used for.

**CADETTES & SENIORS** can work individually or in pairs. Count the items on each list. Did each group have the same number of items? If some had different numbers of things, ask the girls why. Count, compare and check off the items on the table with the items on their lists. What is each item used for and who might use that equipment.

*\*The items on the table might include: Ruler, measuring tape (in kit), scale, geometric shapes, different size containers, pen, pencil, notebook, calculator, magnifying glass, pictures of computers, protractor, math compass, money, paper airplane, salt, water, sugar, soap, etc.*



## STATION I -- Measurement and Probability

*Equipment:* Measuring tape, rulers, record book (note book), pencils, newspapers, stop watch (a watch that counts seconds) or watch with a second hand, 5 coins, a "playground" ball.

**DAISY, BROWNIE, JUNIOR, CADETTE & SENIORS** -- Give each girl a sheet of newspaper. Have each girl estimate how long the longest piece of paper will be that is torn from that sheet. Compare the torn pieces and measure the 3 longest (or all the pieces if they like). How did it compare with their estimates? Can anyone tear a piece that is even longer? How? Let the girls try. Record the length of the longest three pieces.

Have each girl crumple up a piece of newspaper. Ask the girls to estimate the distance of their throws if they were to throw their paper in a forward direction. (For Daisy Girl Scout and younger Brownies, let them walk out the distance to show you how far it might go, e.g. the child might not have any idea what an inch or a yard is; so, if the girl walks out how far she thinks the paper will go, the leader can measure the distance with the girls and then measure the actual throws and compare.)

### **DAISY GIRL SCOUTS & BROWNIES** --

1. Have the girls estimate how long six feet is on the floor. (Or a shorter length if there aren't enough girls in each group to do the following.)
2. Measure out six feet on the floor.
3. Have the girls estimate how many girls it would take to measure out six feet if they stood shoulder to shoulder to shoulder.
4. Test their estimate by having them stand shoulder to shoulder to shoulder.
5. Estimate how many girls it would take if the girls spread out holding hands. Would it take more or fewer girls? Why?
6. Test their estimate. (Measure the girls spread out holding hands.)
7. How long would it be if all the girls spread out holding hands?
8. Test their estimate by measuring it.
9. While everyone is still holding hands, have the girls form a circle facing inward. (Brownies may do this as a whole troop after all three stations are completed so that there are at least 8 girls in the group.) Play the *EGG GAME* (p. 309 ~~Brownie Leader Guide~~). Girls drop hands but spread feet apart. One girl has a ball and tries to roll it between another girl's legs. Girls may not put their feet together to stop the ball. They can only use their hands. Whoever stops the ball tries to roll it between someone else's legs but the girl with the ball may not move from her spot.

### **JUNIORS & CADETTES** --

1. If a coin is flipped 20 times, estimate how often it will land heads up?
2. Test your estimates in pairs.
3. Flip the coin 10 more times. Is there a pattern?
4. Have the girls compare their results. Are the results similar? Why?
5. Have the girls divide into two groups; one is "heads", the heads laugh and act silly while the "tails" must keep a straight face. The heads try to make the tails laugh. All "tails" who laugh must join the other side. The coin is tossed again. Allow approximately a half a minute per turn.



## CIRCUMFERENCE/DIAMETER :

Materials needed:

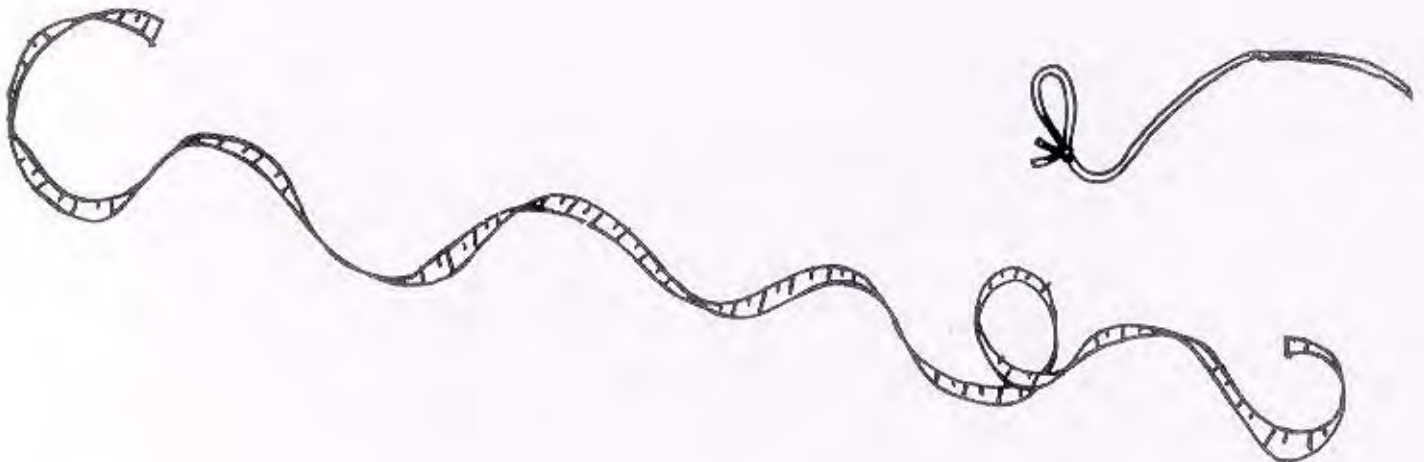
Different size jar lids

String

Tape measure

1. Use string to measure around the jar lid (circumference).
2. Mark or measure string where they meet.
3. Use string or tape to measure across center (diameter).  
(If using string, the girls can see how many times the string goes back and forth across the center – a little more than 3 times [  $\pi = 3.1416$  ].) If using a tape measurement, divide the circumference (distance around) by the diameter (distance across center).

The answer will always be a little more than 3 no matter what size the lid is!



## PREDICT & CHECK

	Estimate	Actual
1. How far can you throw a crumpled piece of paper?		
2. How far can you throw a bean bag?		
3. Which will go farther?		
4. Why?		
5. Make up a game to play with the bean bag and paper.		
6. Teach it to your buddy.		





## PROBABILITY

1. If you flip a penny 20 times, how often will it land heads up?

2. Test your guess.

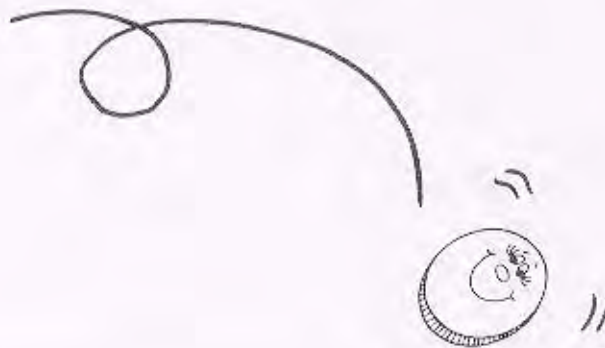


3. Flip 10 more times. Is there a pattern?

4. Have girls compare their results.

5. Are the results similar?

6. Divide the girls into two teams - one team is "**Heads**" and the other is "**Tails**". The game leader tosses a coin and calls out the sign that comes up. If it comes up heads, the Heads laugh and act silly, while the Tails must keep a straight face. The Heads try to make the Tails laugh. All Tails who laugh must join the other team. The coin is tossed again. Allow approximately one-half minute per turn.



## STATION II – Geometry

*Equipment:* Tangrams, measuring tape, paper, string, jar lids, instructions for boxes, crayons or markers.

**BROWNIE, JUNIOR, CADETTE SENIORS** -- Follow instructions and make an **Origami Box**. Have the girls decorate the square piece of paper first.

**DAISY GIRL SCOUTS & BROWNIES** can make the polygons. Each shape printed on the "polygon" sheet takes up the same area (surface space). Give each girl a square and the pieces that make up another of the polygons (a closed figure made up of straight lines). Have each girl try to place her polygon over the square so that it is covered completely without hanging over. Once the girl has succeeded, have the girls exchange polygons and try again.

**JUNIORS, CADETTES, SENIORS** – Using tangram pieces, make a square using only 2 pieces, 3 pieces, 4 pieces, 5 pieces. Make a rectangle using only 3 pieces, only 4 pieces, only 5 pieces, only 6 pieces, all 7 pieces. Make a triangle using 2 pieces, 3 pieces, 4 pieces, 5 pieces, 7 pieces. Make a regular trapezoid using 2 pieces, 3 pieces, 4 pieces, 5 pieces, 7 pieces. Make a parallelogram using 2 pieces, 3 pieces, 4 pieces, 5 pieces, 6 pieces, 7 pieces.

**BROWNIE, JUNIOR, CADETTE, SENIORS** – Circumference/Diameter.

1. Using different size jar lids and pieces of string, have the girls measure around the jar lid (circumference).
2. Mark or measure the string where they meet.
3. Use string or tape measurer to measure across the center (diameter). (If using a string, the girls can see how many times the string goes back and forth across the center - a little more than 3 times [=3.14 ]). If using tape measurements, divide the circumference (distance around) by the diameter (distance across the center). The answer will always be a little more than 3 - no matter what size the lid is! Have the girls test this by using different size lids.

How would they know what the circumference of a 9 inch in diameter plate is? Do they know how much fencing to put around an 18 foot in diameter swimming pool?



# Origami Box

---

- Symmetry
- Non-standard measurement
- Visualization of 3-dimensional objects from 2-dimensional diagrams

## MATERIALS

- Square sheet of paper for each student (wallpaper scraps are nice!)
- Ditto of diagrammed instructions for each group

In this activity each student constructs a box using only symmetric paper-folding to design and measure her box.

**PEOPLE:** Small groups (2 or 3)

## ACTION:

Give each group a copy of the instructions. Have them work together to decipher the instructions and construct their boxes.

## IF YOU LIKE:

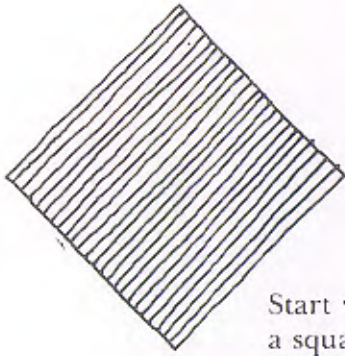
Have one leader attempt to give the paper folding instructions to the whole group or to a small group.



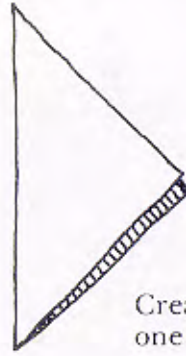
*Reprinted from "Math for Girls and Other Problem Solvers"  
Math/Science Network, Lawrence Hall of Science, University of California*

# ORIGAMI BOX

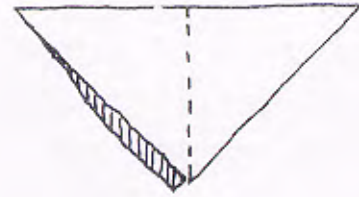
(ditto sheet)



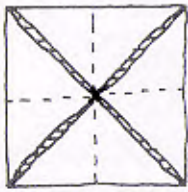
Start with a square piece of paper.



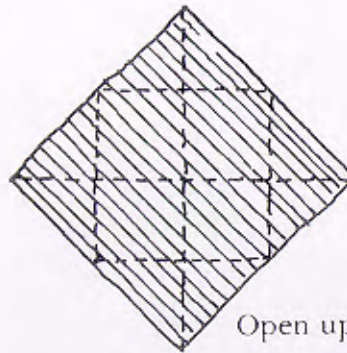
Crease it one way.



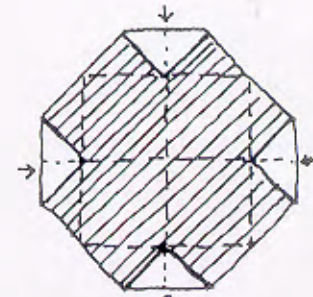
Crease it the other way.



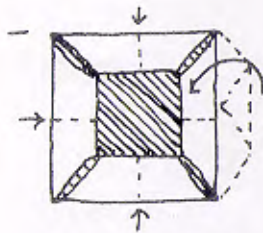
Fold all four points in to center.



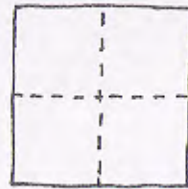
Open up again.



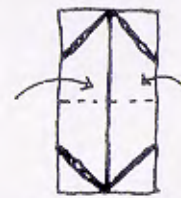
Fold in the points to the first fold line.



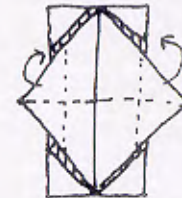
Fold in the sides where you just folded in the points — fold on the fold lines already there.



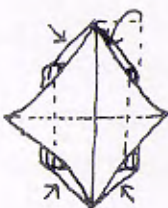
Turn it over.



Fold right and left sides up so they meet in the center on top.



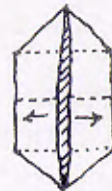
Lift those flaps up in the air.



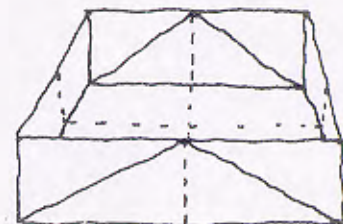
Fold all four corners up and in.



Tuck flaps to inside and flatten entire figure.



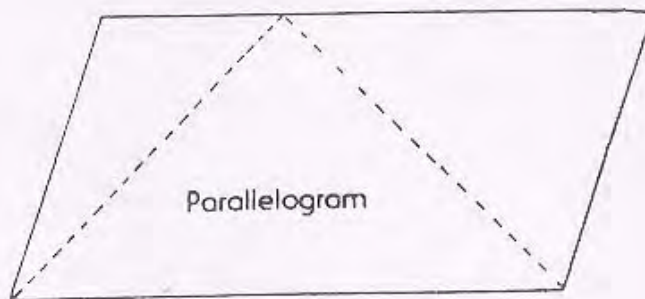
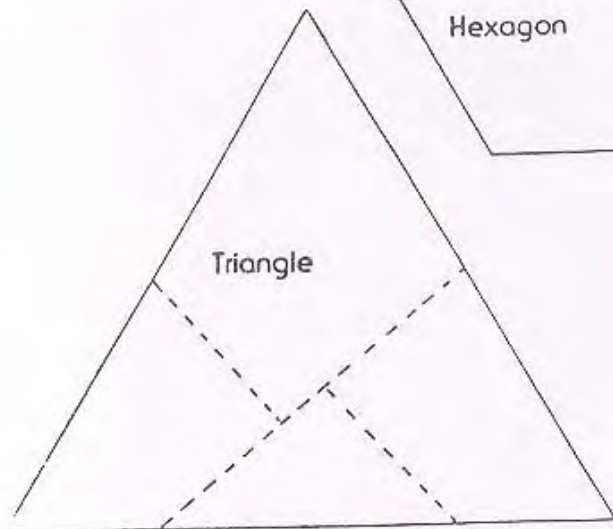
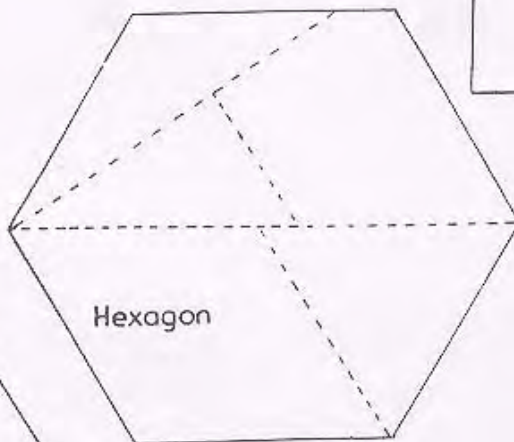
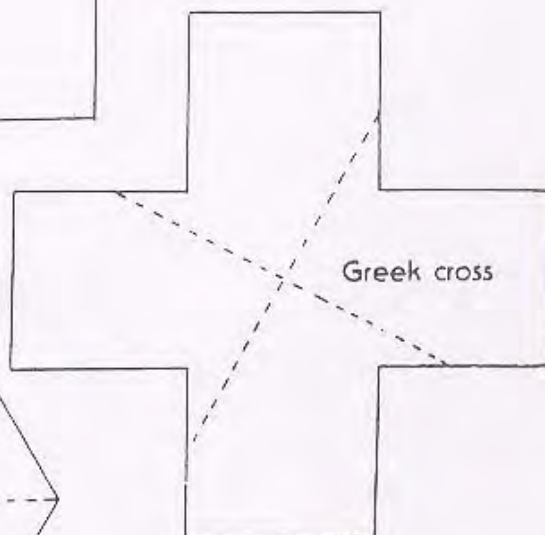
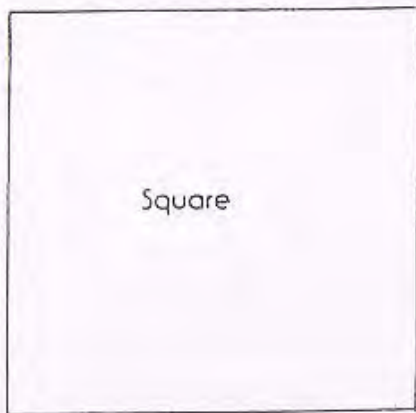
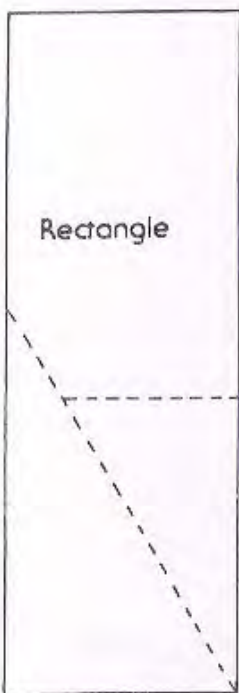
Open the center slot. Pull the two sides apart to form a box, sharpening folds as needed.





# Polygons

Cut out each polygon on the dotted lines and reassemble each one so as to form a square that will fit in this square.



Compliments of



GOUDREAU MUSEUM OF MATHEMATICS  
IN ART AND SCIENCE "The Math Museum"

Herrick's Community Center, Herrick's Road, New Hyde Park, New York 11040

(516) 747-0777

M-9



### STATION III -- Games

Equipment: Tangrams, toothpicks, instruction sheets, found objects.

**DAISY GIRL SCOUTS, BROWNIES** -- Do the people sorting activity.

**DAISY GIRL SCOUTS** -- Have the girls gather in an open area of the room. Tell everyone to close her eyes. The first task is to form one large circle keeping their eyes closed until they've made a circle and you tell them to open their eyes. Have them open their eyes and see their circle. Ask them whether or not it was hard. Why? Now ask them to make two circles with their eyes closed. (You may help by dividing the girls into two groups.) When they have two circles, have them open their eyes. Now ask them to close their eyes again and see if one circle can go inside the other. What was hard? How come they were able to do it. Now that they're in a circle, play a circle game like *LAP SIT*.

**DAISIES, BROWNIES** -- Using a variety of different things such as buttons, stones, crayon bits, fabric pieces, bottle caps, etc. have the girls sort them into groups and explain why the objects were put into the groups they were put in. Could an object go into a different group? Many different groups? Have the girls take turns at the following games:

**OLDER BROWNIES, JUNIORS, CADETTES, SENIORS** -- Do the toothpick puzzles.

**BROWNIE, JUNIOR, CADETTE, SENIOR** -- Give the girls a set of tangrams. See if they can make the shapes of people, things, animals, etc. Have them try to make an original design and see if someone else can guess what it is.

**JUNIOR, CADETTE, SENIOR** -- In pairs, play "*DAISY*". The two players take turns to pluck from the daisy either one petal or two adjacent petals. The player taking the last petal wins. Make a daisy out of thirteen toothpicks. On a piece of paper make 13 marks (around a circle) where the petals (toothpicks) grow from because, in order to play the game, the players need to know whether there is a space between petals or whether the petals are next to one another. (Remember you can not take two petals if there is a space between them.)

**JUNIOR, CADETTE, SENIOR** -- Begin with 3 coins with a "head" showing between two "tails". Each move consists of turning over two coins next to each other. Can you get all the coins showing heads in just two moves?

Three coins --	TAILS	HEAD	TAILS
Move 1	HEAD	TAILS	TAILS
Move 2	HEAD	HEAD	HEAD

Begin with 3 coins showing a head placed between two tails. Each move consists of turning over two coins next to each other. Can you get all the coins showing heads in just 2 moves?



TAILS



HEADS



TAILS

THREE COINS:

BEGIN --



TAILS



HEADS



TAILS

MOVE 1 --



HEADS



TAILS



TAILS

MOVE 2 --



HEADS



HEADS



HEADS



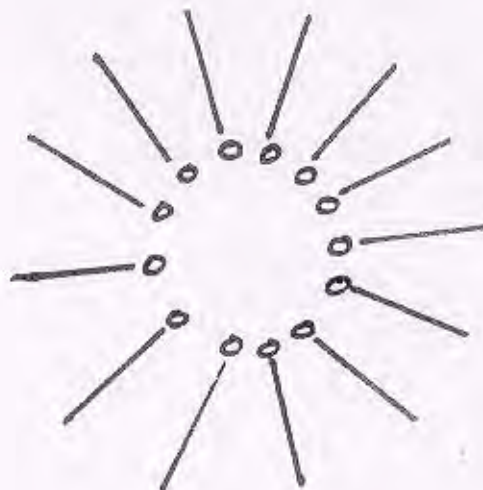
## DAISY -- A Game for Two

### **Using Real Daisy Flowers --**

The two players take turns to pluck from the Daisy either one petal or two adjacent petals. The player taking the last petal wins.

### **Make Your Own "Daisy" --**








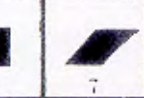
Make a Daisy with 13 petals out of matches, like the one below. On a piece of paper, mark little circles where the petals (matches) grow from. You need to know whether there is a space between petals or whether the petals are next to each other. (**Remember** -- you cannot take two petals if there is a space between them.)



## Fractions With The Tangram

To illustrate the fractional relationships of the tangram pieces, place the smallest triangle (piece no. 4 or 5) on top of the square (piece 6), parallelogram (piece 7), and the medium sized triangle (piece 3). You will see that the size of the small triangle is equal to half of each of the other pieces.

You can prove that the smallest triangle is  $\frac{1}{4}$  of the largest triangle (piece no. 1 or 2) by putting together pieces 3, 4, and 5, to make piece no. 1. Using the grid below, discover the value of each piece in relationship to the value of the entire tangram.

								
	1	2	3	4	5	6	7	
1								
$\frac{1}{2}$								
2								
$\frac{1}{4}$								

## Shapes You Can Make - Can You Make Others?

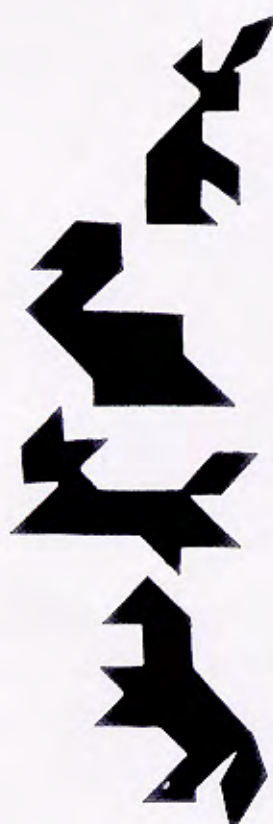
PEOPLE



FISH & BOATS



ANIMALS



HOUSEHOLD ITEMS



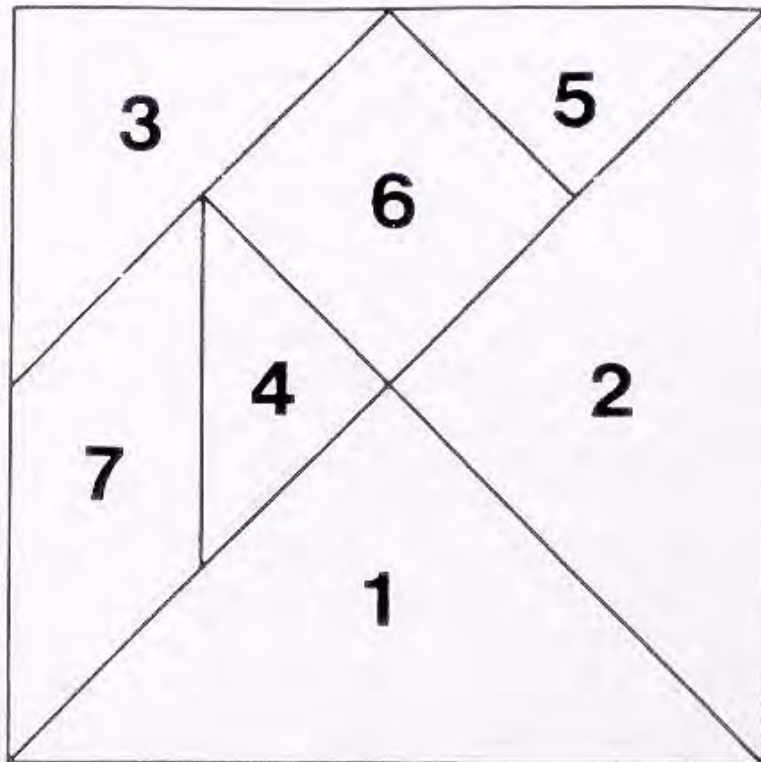


## The Tangram

The Tangram is a unique puzzle that illustrates many geometric relationships. By just playing with the seven pieces, a child of any age will discover the secrets inherent in the "ingenious seven piece plan." Thousands of designs, some created thousands of years ago, are available to puzzle enthusiasts. A sample of these are found in this article. It is in these designs that the challenge of the Tangram begins. Upon first attempts at solving the puzzle figures, one might find much difficulty. In order to avoid frustration, it is advised that one follow these instructions before attempting to solve the small pictures and designs.

In the illustration to the right you will see a diagram of the Tangram pieces formed into a square. Each piece is numbered. It is important that you learn the numbers. Note that piece number 7 is actually two shapes. When flipped over, number 7 becomes a completely different shape.

The grid on this page shows shapes that can be made and the quantity of pieces needed to make the shape. The solutions are the numbers shown in the squares. Start with the row using only two pieces and work your way across.




Use this many pieces	Square	Rectangle	Triangle	Trapezoid	Trapezoid	Parallelogram	Make this shape
2	(1, 2) (4, 5)		(1, 2) (4, 5)	(3, 7) (5, 7)	(4, 6)	(1, 2) (4, 5)	
3	(3, 4, 5)	(4, 5, 7) (4, 5, 6) (3, 4, 5)	(4, 5, 6) (4, 5, 7) (3, 4, 5)	(4, 5, 6) (3, 6, 5)	(1, 2, 3) (4, 6, 7)	(4, 5, 6) (4, 5, 7) (3, 4, 5)	
4	(1, 3, 4, 5) (1, 4, 5, 7)	(4, 5, 6, 7) (3, 6, 5, 7)	(1, 5, 6, 7) (2, 4, 5, 7) (1, 3, 4, 5) (1, 3, 4, 7) (1, 4, 5, 6)	(1, 3, 4, 5) (4, 5, 6, 7) (3, 4, 5, 7) (1, 4, 5, 7)	(1, 4, 5, 6) (3, 4, 6, 7) (3, 4, 5, 7) (1, 3, 4, 5) (1, 4, 5, 7)	(1, 3, 4, 5) (4, 5, 6, 7) (3, 4, 5, 7) (3, 4, 5, 7)	
5	(3, 4, 5, 6, 7)	(1, 2, 3, 4, 5) (1, 2, 4, 5, 6) (3, 4, 5, 6, 7)	(3, 6, 5, 6, 7)	(1, 2, 3, 4, 5) (1, 2, 4, 5, 6)	(1, 2, 4, 5, 6) (1, 2, 3, 4, 5)	(1, 2, 4, 5, 6)	
6		(1, 3, 4, 5, 6, 7) (1, 2, 4, 5, 6, 7)			(1, 2, 3, 4, 5, 6) (1, 2, 4, 5, 6, 7)	(1, 3, 4, 5, 6, 7)	
7	(1, 2, 3, 4, 5, 6, 7)	(1, 2, 3, 4, 5, 6, 7)	(1, 2, 3, 4, 5, 6, 7)	(1, 2, 3, 4, 5, 6, 7)	(1, 2, 3, 4, 5, 6, 7)	(1, 2, 3, 4, 5, 6, 7)	

SOLUTION GRID

Compliments of

The Goudreau Museum of Mathematics  
in Art and Science



- The Math Museum -

The Herricks Community Center  
Herricks Road  
New Hyde Park, New York 11040  
516 747-0777



# People Sorting

- Logic
- Sorting
- Attribute identification

## MATERIALS

- One large loop of yarn

This activity introduces the concept of an attribute and sets the stage for development of logic skills through work with attribute blocks and spatial creatures. Everyone gets involved.

**PEOPLE:** Whole class

## ACTION:

Put a large loop of yarn on one side of the room. Name a characteristic such as "wearing something green" and have all those who fit that description stand inside the loop. Repeat the activity with several other characteristics such as: having green eyes, wearing a belt, liking dogs. Let the students think of some of the characteristics.

Think of a secret characteristic. Without telling the characteristic, the leader has each person with that characteristic step inside the loop. The challenge is for the group to guess the mystery attribute.

Ask the group what attributes are shared by everyone in the room.

## IF YOU LIKE:

Seated in a circle, ask each person to name an attribute she has that is different from anyone else in the group. Point out when appropriate that to say, "I have glasses," might not be enough to distinguish one person from everyone else. Several people may be wearing glasses.

Have one student leave the room. The group sorts itself according to any rule chosen by the group. The "Outsider" comes in and tries to guess the rule.



## BLIND CIRCLES

1. Have everyone gather in an open area of the room. Tell everyone to close their eyes. The first task is to form one large circle keeping their eyes closed until they have made a circle and you tell them to open their eyes.
2. Now have them make two circles with their eyes closed. When they have succeeded, have them look. Without breaking up the 2 circles, have them close their eyes again. Ask one circle to get inside the other.
4. What made the activity difficult? Why could they do it?
5. Play a circle game or have them close their eyes and form a line . . . or parallel lines, etc.





# TOOTHPICK PUZZLES

(ditto sheet)

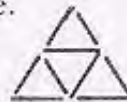
1. Use 17 toothpicks to construct this figure



- Remove 5 toothpicks and leave 3 squares.
  - Remove 6 toothpicks and leave 2 squares.
2. Make this figure with 12 toothpicks.



- Remove 4 toothpicks and leave 3 triangles.
  - Move 4 toothpicks and form 3 triangles.
3. With 9 toothpicks, make this figure.



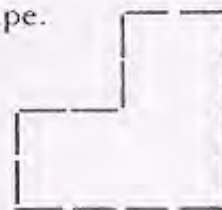
- Remove 2 toothpicks and leave 3 triangles.
- Remove 3 toothpicks and leave 1 triangle.
- Remove 6 toothpicks and get 1 triangle.
- Remove 4 toothpicks and get 2 triangles.
- Remove 2 toothpicks and get 2 triangles.

4. Use 8 toothpicks and 1 button to form a fish.



Move 3 toothpicks and button to make this fish swim the opposite direction.

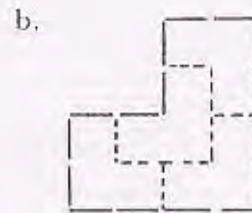
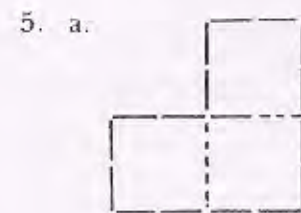
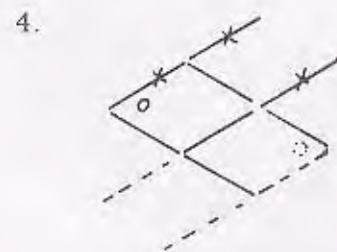
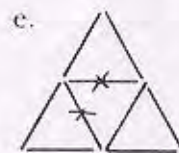
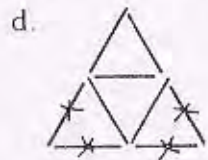
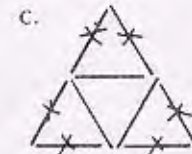
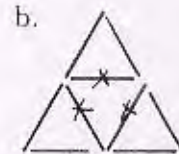
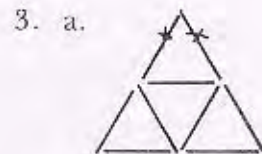
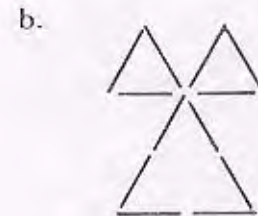
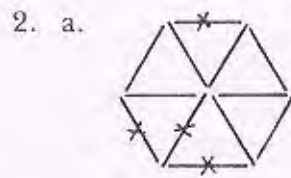
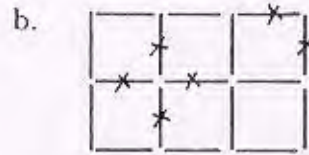
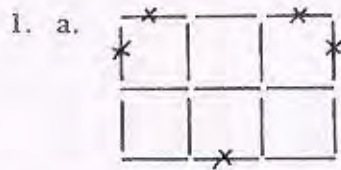
5. Two farmers have land this shape.



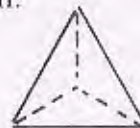
- The first farmer wants to divide her land evenly among her three daughters. Add 4 toothpicks to form three parcels of equal size and identical shape.
  - The second farmer wants to divide her land evenly among her 4 daughters. Use 8 toothpicks to form four parcels of equal size and identical shape.
6. Use 6 toothpicks to form 4 equilateral triangles.

## TOOTHPICK PUZZLES - Solutions

There is an "X" on each toothpick to be removed. In most cases there are several possible solutions. Only one is indicated.



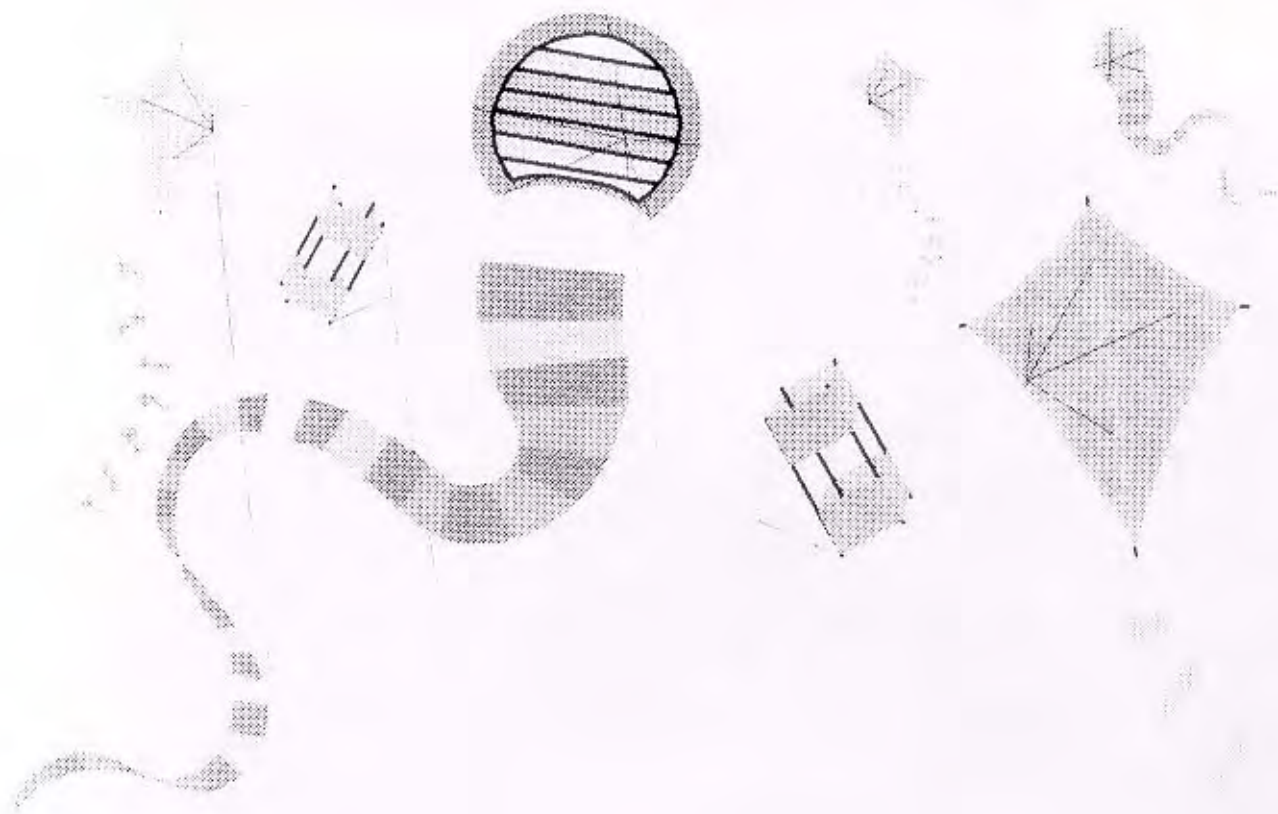
6. Make a 3-dimensional tetrahedron.





## Exploring Math Concepts Wide Game

1. Combine the girls from the three stations into one group.
2. Brainstorm what careers might use math- i.e., computer programmers, builders, doctors, nurses, scientists, carpenters, architects, cooks, designers and pilots, etc.
3. Ask how any of the professions named might use math.



*Air*

## INVESTIGATING HOT AIR

Air takes up space but did you know that hot air takes up more space than cold air? Prove it for yourself in this experiment. (Ask an adult to help you.)

### Materials needed:

A plastic bottle

A deep bowl

Ice

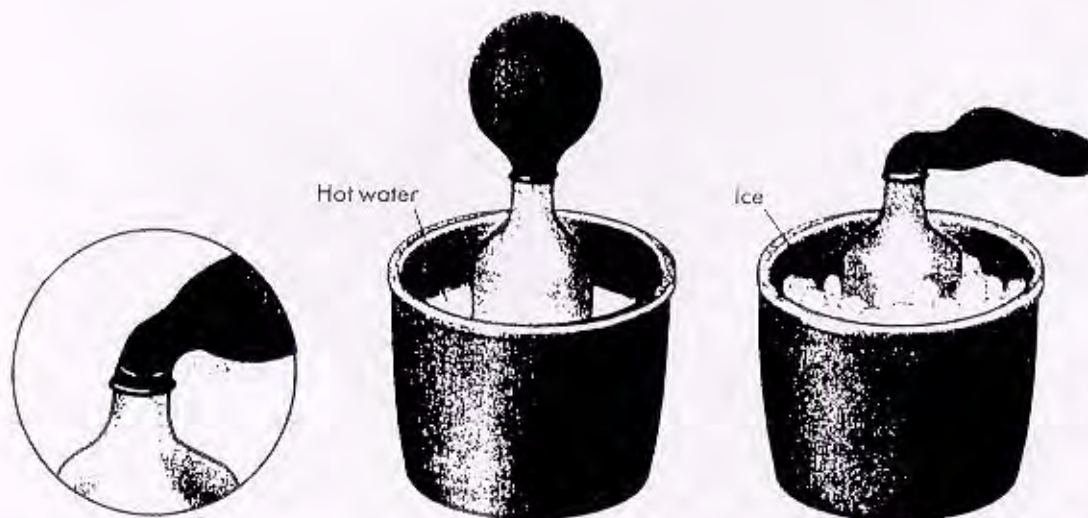
A balloon

Hot water

1. Fit the balloon over the mouth of the bottle.
2. Stand the bottle in the bowl and fill the bowl with hot water. After a few minutes you will see the balloon start to inflate.
3. Tip away the water and fill the bowl with ice. What happens?

### How it works

When the air is warmed by the hot water, it expands and needs more space, so it stretches out the balloon. When the air is cooled by the ice, it contracts and needs less space, so the balloon goes down.



### Balloon Trick

*Blow up a balloon as hard as you can. Put it into a warm place, such as on top of a radiator (NOT the oven). What do you think will happen? There might be a bang!*



## AS LIGHT AS AIR

Air takes up space all around us but how much does it weigh? Scientists use complex and delicate instruments to measure the weight of very light substances. You can weigh air by making a simple balance like the one in the diagram below.

### WEIGHING AIR

#### Materials needed:

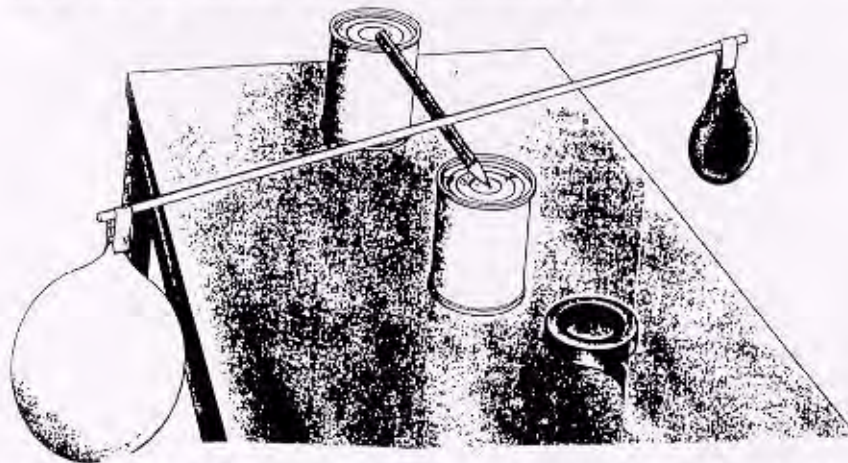
2 identical balloons  
a long stick  
2 cans

string  
sticky tape  
a pencil with flat sides

1. Mark the middle of your stick.
2. Rest the pencil between the cans and place the middle of the stick across the pencil so the stick is level.
3. Use a small piece of sticky tape to fix a balloon onto each end of the stick. Check that the stick remains level - this means that the balloons weigh the same.
4. Unstick one of the balloons and blow as much air into it as you can.
5. Fix it back onto the end of the stick and replace the stick on its center spot. Does the stick still balance?

#### How it works

When you stick the full balloon back on, it makes the stick dip down. This shows it is heavier than the empty balloon and the air that you blew into the balloon does weigh something.



**Did You Know???** *The air in a large room in your house weighs about as much as a person (160 pounds).*



## AIR PRESSURE

When you swim underwater you can feel water pushing on your body. The air all around you does the same thing but your body is used to it so you do not even notice. This pressure is caused by a layer of air called the atmosphere, which surrounds the earth.

The pushing power of air can even keep water in a glass that is upside down.

### Materials needed:

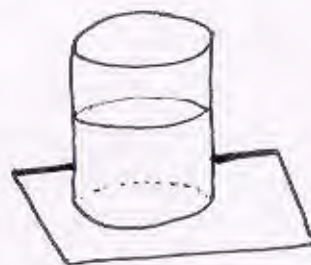
A glass with a smooth rim

Water

A piece of stiff smooth posterboard slightly larger than the mouth of the glass

This experiment should be done over a sink or large container.

Fill the glass right up to the top with water and wet the rim slightly. Lay the card on top of the glass. Hold the card firmly in place (your hand should be dry) and turn the glass over. Now take away your hand. The water should stay in the glass. If it doesn't work the first time, try again.



### Questions

1. Why does the paper have to be stiff?
2. Why do we have to be sure that the hand holding the posterboard is dry? What will a wet hand do?
3. What is keeping the water in the inverted cup?
4. Can we hold the cup slanted without letting the water pour out?
5. Will this work with other liquids? (Juice, soda?) Try it with soda. Why doesn't it work?

### WHY IT WORKS

When the cup is completely filled with water, there is no air left in the cup and thus no air pressure. The inverted cup can, therefore, hold the water up because the atmospheric pressure is working against the underside of the cup.

In the case of the 1/2 filled cup of water, the water stays in the cup because during the process of inverting, some of the water dripped out increasing the volume of the air pocket without increasing the amount of air, thus decreasing the pressure of the air pocket above the water. Again, the atmospheric pressure is larger and holds the water inside the cup.

Juice will also be held up inside the inverted cup. Soda will not because the bubbles make pressure inside the glass above the liquid and prevents a vacuum from forming.

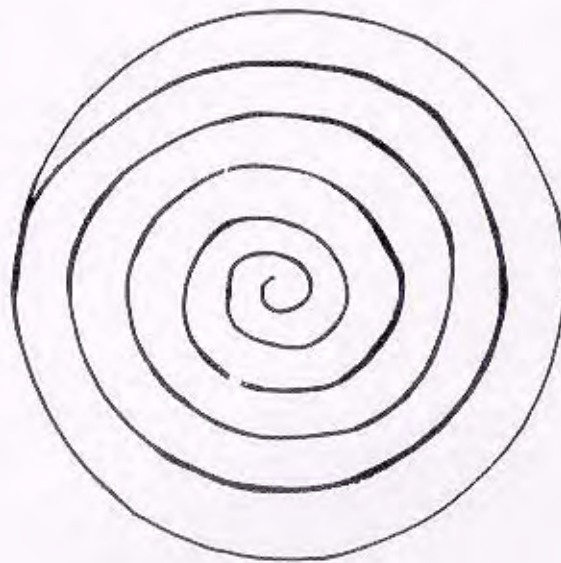
## WARM AIR RISES

Warm air is lighter than cold air so air rises as it gets warm and cold air moves in to take its place. This causes currents of air to move around inside buildings as well as outdoors. Birds float upward on rising currents of hot air.

### Make a Spinning Snake

**Materials needed:**

A square of paper  
Pencil  
Scissors  
Thread



The spinning snake is a good way to observe rising air and have some fun. Draw a spiral like this on the square of paper. Decorate the snake and then carefully cut along the line of the spiral. Hang the snake above a radiator using a piece of thread and watch it spin as the warm air rises.





**Water**

## SURFACE TENSION

Take a good look at raindrops or the drops of water falling from a faucet. What shape are the water drops? You should see that the smallest drops are nearly perfect spheres. This is because the surface of the water is held together by a strong force called surface tension, which makes the water look as if has a thin elastic "skin" all over it.

### FLOAT THE NEEDLE

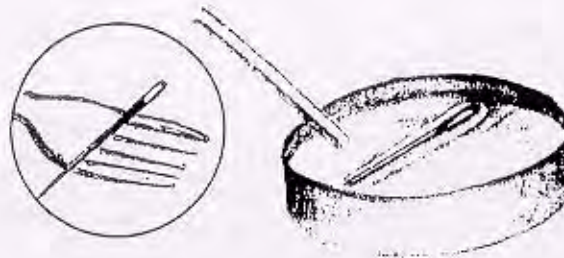
Can you make metal float on water?

**Materials needed:**

A clean bowl  
A fork  
A needle



1. Fill the bowl with fresh water.
2. Rest the needle across the prongs of the fork and gently break the surface of the water with the fork. If you are careful, the needle will float when you take the fork away.



**How it works**

The fork breaks the "skin" on the surface of the water but it quickly forms again under the needle. The "skin" supports the needle and stops it from sinking. If you look closely, you may be able to see the "skin" bending under the weight of the needle.

## KEEP THE WATER OUT

Is the handkerchief waterproof? You may be surprised by this trick.

### Materials needed:

Jar filled with water  
Rubber band or string

Handkerchief

1. Fill a jar with water and soak your handkerchief.



2. Stretch the handkerchief over the mouth of the jar and hold it in place with string or a rubber band.



3. Turn the jar upside down. Does the water pour out?



### How it works

The handkerchief is made of fibers of cloth with tiny holes in between them. Surface tension acts like a "skin" and stops water pushing down through the holes. Umbrellas stop water getting through for the same reason. Next time you are sheltering under one, think of surface tension.





## SOAP POWER

Soap weakens the surface tension that makes the "skin" form on the surface of water. This stretches the "skin" and makes it possible to blow bubbles. It also makes enough pulling power to drive small boats. On these two pages are some tricks to try and things to make using this soap power.

### SOAP BOATS

#### Materials needed:

Cardboard or wood  
Small pieces of soap

Scissors  
Bowl of water

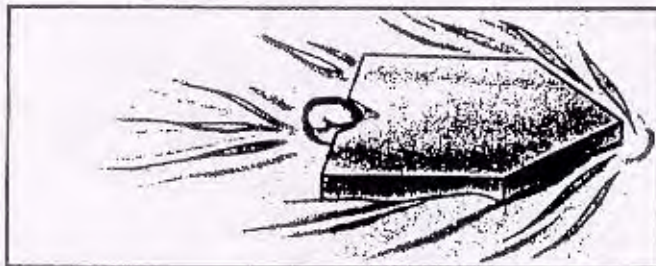
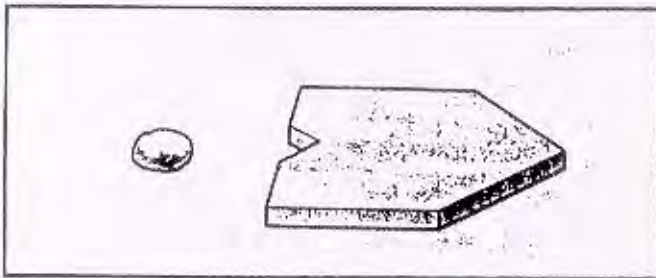
1. Make a boat shape out of cardboard or wood and cut a notch at the back. Fit a tiny piece of soap in the notch.
2. Fill a clean bowl or sink with water and let the water settle. Put your boat on the water and watch it move.

#### How it works

The soap weakens the surface tension behind the boat and it is pulled forward by the stronger surface tension in front.

#### More Things to Try

- ▶ Make a notch for the soap to one side of the back of the boat - what happens?
- ▶ Try adding a rudder of paper clips to steer the boat.



## SOAP POWER (continued)

### MAGIC MATCHES

#### Materials needed:

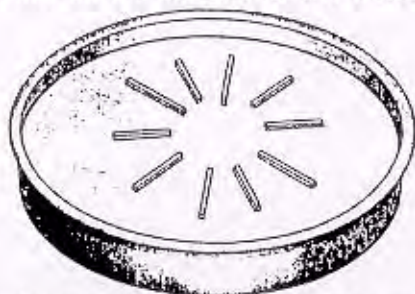
Matches

Soap

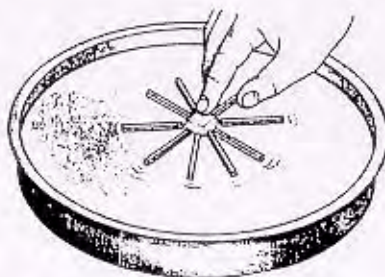
Bowl of clean water

Lump of sugar

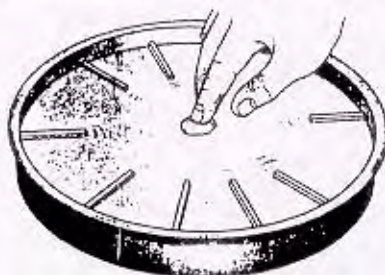
1. Carefully lay the matches on the surface of the water.



2. Dip the sugar lump in the middle of the bowl. The matches should move toward the sugar.



3. Now dip the soap in the middle of the bowl. The matches should move away from the soap.



#### How it works

When you put the sugar lump in the middle of the bowl, it absorbs some of the water. A small current of water flows toward the sugar and pulls the matches with it. But when you hold the soap in the middle of the bowl, the stronger surface tension around the edge of the bowl pulls the matches outward.



## SOAP POWER (continued)

Soap weakens the surface tension that makes the "skin" form on the surface of the water. This stretches the "skin" and makes it possible to blow bubbles.

### BLOWING BUBBLES

You can see how stretchy the "skin" on the surface of water can be by blowing bubbles. You can buy bubble mixture with a wand or make your own. Do this outside.

#### Materials Needed

36" Wooden dowels (1/4" wide) precut into 12" pieces  
Duct tape  
Wire cutters

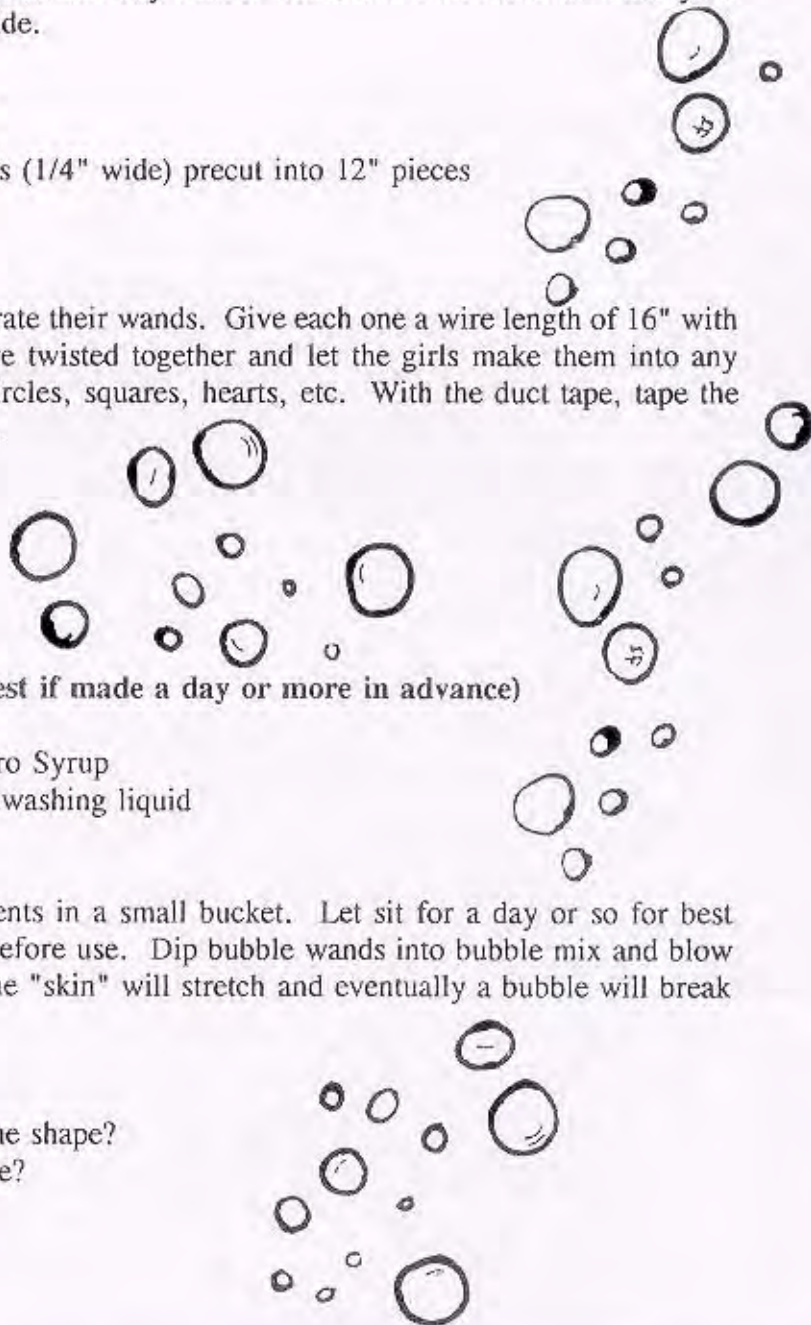
Allow girls to decorate their wands. Give each one a wire length of 16" with the ends of the wire twisted together and let the girls make them into any shape they want, circles, squares, hearts, etc. With the duct tape, tape the wires to the wands.

#### Bubble Recipe (best if made a day or more in advance)

3/4 cup of light Karo Syrup  
2 cups of JOY dishwashing liquid  
6 cups of water

Gently mix ingredients in a small bucket. Let sit for a day or so for best bubbles. Stir just before use. Dip bubble wands into bubble mix and blow or wave gently. The "skin" will stretch and eventually a bubble will break free.

Are all the bubbles the same shape?  
How big can the bubbles be?  
How long do they last?  
What makes them pop?





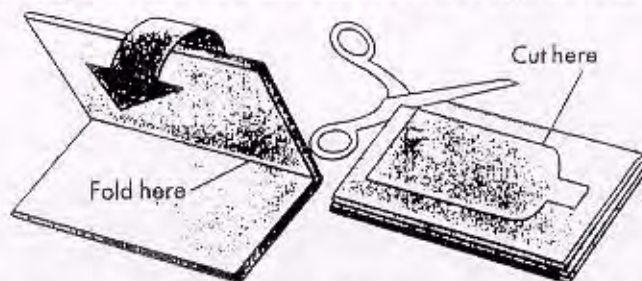
## ON THE LEVEL

Water (and everything else on earth) is pulled toward the center of the earth by an invisible force called **gravity**. In some places, the water gets no further than the surface because certain types of rock stop it from draining through. This water forms rivers, lakes, and oceans. In other places, different types of rock let the water soak through. All water on earth eventually settles at the lowest level it can possibly reach.

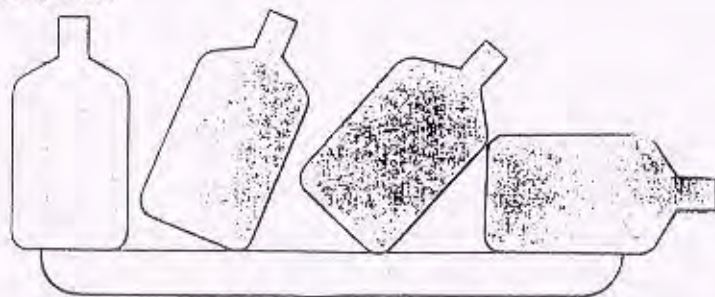
### GUESS THE LEVEL

All you need is paper, pencil, and scissors.

1. Fold a large sheet of paper in half and then in half again.
2. Draw a bottle shape on one side and cut it out through all four thicknesses of paper.



3. Put your four "bottles" in the same positions as the bottles in the illustration below. Draw a line on each one to show where you think the water level would come if the bottles were  $\frac{3}{4}$ 's full.



4. Then repeat the experiment with a real bottle of water. (Make sure you hold it over a bath or go outside when you tip it up.) Did you guess the water levels correctly?
  - ▶ The surface of the water in any container is always horizontal - however much you tip the container. Try this for yourself using different shaped containers.
  - ▶ Waterfalls provide spectacular evidence of how water is pulled down to earth and always finds its own level.



## MEASURING WATER (Volume) -- PROBLEMS

1. Daisy wanted a quart of water. She had two cans for measuring the water. One held 5 quarts and the other 3 quarts. She found she could measure out a quart with the two cans. She filled the 3 quart can and then poured it into the 5 quart can. What did she do next to measure out just one quart?
2. Daisy decided she wanted 2 quarts of water. She only had the two cans, a 5 quart and a 3 quart can. How did she do it?
3. Daisy wanted to measure 6 pints using only a 9 pint can and a 4 pint can. How did she do it?

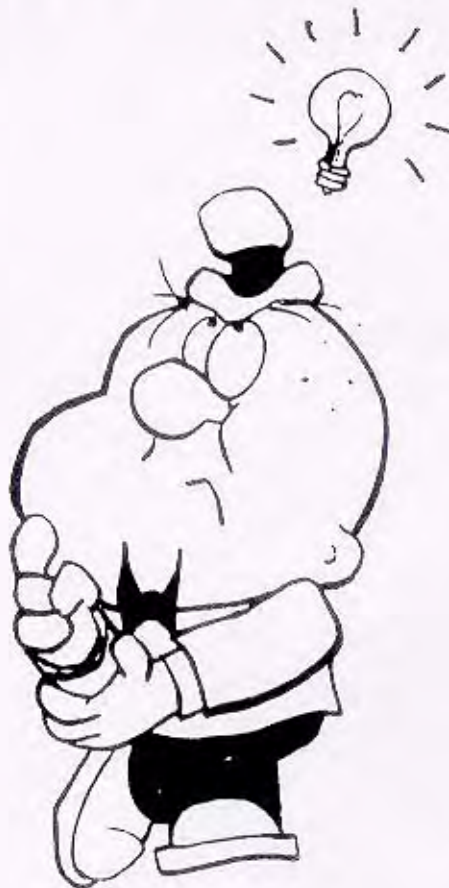


## MEASURING WATER (Volume) -- ANSWERS

1. Daisy refilled the 3 quart can and poured 2 quarts of water into the 5 quart can until it was full, leaving 1 quart in the 3 quart can.
2. Daisy fills the 5 quart can and pours the water into the 3 quart can, leaving 2 quarts of water in the 5 quart can.
3. Daisy filled the 9 pint can and then poured off 4 pints to fill the 4 pint can, which she then emptied. This left 5 pints in the 9 pint can. She then poured 4 of these pints into the 4 pint can, leaving 1 pint in the 9 pint can. She emptied the 4 pint can again and then poured the 1 pint from the bigger can into it. She filled the 9 pint can again and poured 3 pints from it to fill the 4 pint can. This left Daisy with 6 pints in the bigger can.



# GAMES AND OTHER THINGS TO THINK ABOUT



Girl Scouts of Nassau County, Inc.





	Prediction	Results
How many M & M's are in the bag?		
How many RED M & M's are in the bag?		
How many GREEN M & M's are in the bag?		
How many ORANGE M & M's are in the bag?		
How many YELLOW M & M's are in the bag?		
How many BLUE M & M's are in the bag?		
How many BROWN M & M's are in the bag?		

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## MORE PREDICTING....

### PENNY PREDICTION

Break the troop into small groups. Give each a glass that is absolutely full of water, resting on a plate or shallow bowl to catch the overflow. Let them predict how many pennies can be added to the glass before the water overflows. A recorder should record all predictions before pennies are added. (Tally sheet attached.)

### GUESS THE WATER LEVEL

#### Materials needed:

1 bottle worksheet for each participant  
pencils  
a bottle 3/4 full of water

Draw a line on each bottle to show where you think the water level would come if the bottles were three-quarters full. Repeat the experiment with a real bottle of water. Did you guess the water levels correctly?

(Note: The surface of the water in any container is always horizontal no matter how you tip the bottle.)

### WHAT GOES DOWN WILL COME UP?

Predict what will happen to raisins dropped into a glass of ginger ale.

#### Materials needed:

Small clear plastic cups  
Small boxes of raisins  
Enough ginger ale to go around

Pour out ginger ale into the cups. Each participant should think for a moment about what will happen, write down the responses. Add the raisins to the cup. What happens?

### HOW MANY IS....

Give each participant a 2 quart zip lock bag. Have them take the bags home and put in 100 of something and bring it back to the next meeting. Compare size, weight, and appearance of 100s.



PENNY PREDICTION

NAME	PREDICTION	ACTUAL

PENNY PREDICTION

NAME	PREDICTION	ACTUAL

PENNY PREDICTION

NAME	PREDICTION	ACTUAL

PENNY PREDICTION

NAME	PREDICTION	ACTUAL

PENNY PREDICTION

NAME	PREDICTION	ACTUAL

## BUZZ

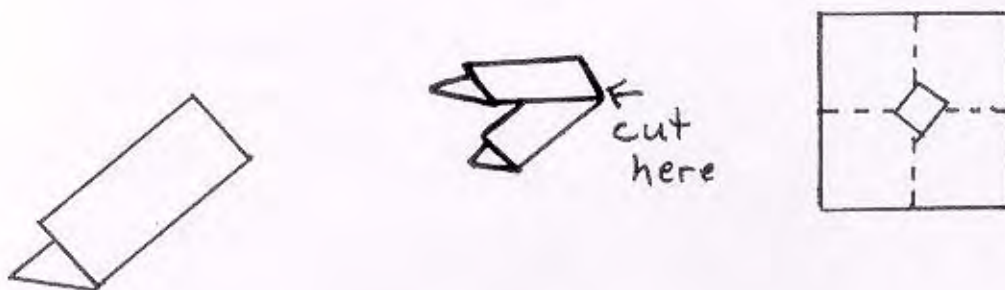
Girls are seated in a circle. Count in numerical order around the circle. When a girl comes to a number that is a multiple of 5 or 7, she must say "**BUZZ**" instead of the number.

If she says "**BUZZ**" in the wrong place or doesn't say "**BUZZ**" when she should, she is out of the circle until someone else misses and is out, or the game can be played until only one player remains.



## FOLD & CUT

Fold a sheet of paper once in half, then again the opposite way. Cut the corner as shown. Open the folded sheet out -- there is one hole in the middle.



Now guess what happens when you fold it 3 times and cut off the corner. How many holes will there be now?



## REAL WATER

On Long Island, water is literally, all around us.



Ask the girls to guess how many words the troop can come up with to describe water. Write down the number and then have girls discuss some things they've done with water. Have a scribe write down all the uses and descriptions of water? For example... **SHOWER** -- wet, cold, hot, sparkley, refreshing, soothing, cleansing, clean. **SWIMMING** --, **WADING** -- , etc.

After they have finished, count all the words. How does it compare with their estimate? Why? Why so many words for uses/descriptions of water?



## EARTH, AIR, FIRE & WATER

(For 5 or more players)

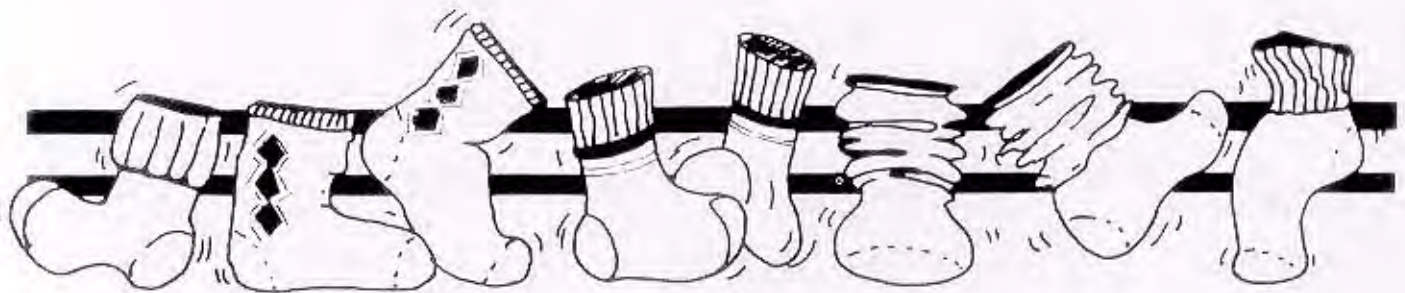
A rolled-up sock or beanbag to toss)

The players sit in a circle.

One stands in the center, holding the sock. She tosses the bag into another player's lap, calling out either, *"Earth"*, *"Air"*, *"Fire"*, or *"Water"*.

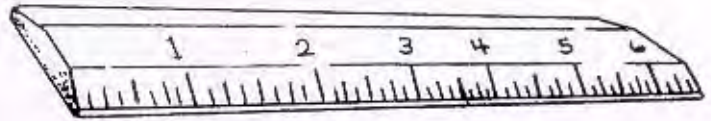
If she calls *"Air"*, the person who receives the sock must immediately name some kind of bird. If she call *Earth"*, the player must call the name of a land-dwelling animal. *"Water"* means that a fish must be named. The player who receives the ball must answer before the tosser can count to 10. The animal names cannot be repeated. If the player answers correctly, she returns the ball to the middle. A player who can't answer correctly or in time becomes the new tosser.

If the tosser calls *"Fire"*, the player receiving the sock must immediately toss the ball to another player and call out, *"Earth"*, *"Air"*, *"Water"*, or *"Fire"*.





## MEASUREMENT



(Requires Tape Measure and Basketball Size Ball)

1. Estimate how long 6 feet is on the floor.
2. Measure out 6 feet on the floor.
3. How many girls would it take to measure out 6 feet if they stand shoulder to shoulder (estimate)?
4. Test your answer by having the girls stand shoulder to shoulder.
5. How many girls will it take if they spread-out but hold hands?
6. Test your answer (measure it).
7. How long is it if all the girls hold hands in a line?
8. Test your answer (measure it).
9. While everyone is still holding hands, have the girls form a circle facing inward. Play the Egg Game (~~pg. 309 Brownie Leader Guide~~). Girls drop hands but spread feet apart. One girl has a ball and tries to roll the ball between someone's legs. Girls can not put their feet together to stop the ball. They can only use their hands. Who ever stops the ball tries to roll it between someone else's legs but she cannot move from her place.

