girl scouts
of eastern
pennsylvania

imagineer series

grades 2-5

Series Overview

The focus of this program is for girls to explore and learn more about the fields of science through fun, hands-on activities and experiments.

There are 4 90-minute sessions in this program that are age appropriate for girls in grades 2-5. Some of the activities involve more complex concepts and will require hands-on assistance from adults especially for younger girls. It is recommended that you practice each activity before facilitating with a group so you are aware of any issues/problems the girls might encounter.

Each activity fulfills national leadership outcomes from the Girl Scout Leadership Experience, where girls Discover, Connect, and Take Action. Girls achieve these outcomes through the three Girl Scout processes: Girl Led, Learning by Doing, and Cooperative Learning. An important piece of the activities is the reflection that you do with the girls at the end. Doing the reflection in an enjoyable way helps girls process and retain what they have learned through their Girl Scout experience.

Session 1: Imagine Yourself as a Scientist

Supplies:
Start-up Activity:

- Lab Notebooks
- Pencils

Activity 1:

- A tall glass, 1 per group
- 4 tablespoons salt, per group
- 2 cups water, per group
- Food coloring
- 1 egg, per group
- Can of lemon-lime soda
- Small box of raisins

Activity 2:

- Baby soda bottles, 1 per girl
- Vegetable oil
- Water
- Alka Seltzer tablet, ½ tablet per girl
- Food coloring
- Measuring cup
- Beads, 1 few per girl

Closing Activity:

- Ice cubes
- 1 cup half and half, per girl
- ½ cup rock salt, per girl
- 2 tablespoons sugar, per girl
- ½ teaspoon vanilla extract, per girl
- 1 pint-size bag, per girl
- 1 gallon-size bag, per girl
- Toppings such as chocolate chips, sprinkles, caramel, etc.
- Spoons, 1 per girl
- Measuring cups/spoons

Start-up Activity: What Does a Scientist Look Like?
15 minutes

1. Introduce yourself! Let the girls know why you're excited to guide them through the experience.
2. Gather the girls and ask them to pull out their lab notebooks and draw a "scientist." Give only this guidance; this is an exercise of assumptions! After a few minutes or so, have the girls share their sketches. Most often, girls will sketch some variation of a man in a white lab coat.
3. **Say:** *Throw out that stereotype of a man in a white lab coat! Researchers have found that women and men don't differ on math and science abilities. You are just as capable as a man of making the world a better place through science- and making a great salary, too.*
4. Wrap up with an open discussion with the girls by **asking** the following questions:
    a. *What do scientists do?*
    b. *How do you become scientists?*
    c. *What role do scientists play in our everyday lives?*

Activity 1: Dive into Density
**Completes Step 3 of Home Scientist Badge*
20 minutes

1. **Ask:** *How come some things float, while others don't? (Answer: It's all about density. Density is not weight, but it's related. For example, if you swim in the pool with blow-up floaties or a raft, you won't sink because the air inside the floaties is less dense than the water around you. So the air helps hold you up!)*
2. **Say:** *Now are going to work in small groups to do two experiments all about density.*
3. *Break the girls into small groups.*
4. **Say:** *During this first experiment, we are going to see if we can keep an egg suspended in the middle of a glass.*
5. Give the girls these instructions to follow:
    a. Mix the salt and one cup of water in the glass, then add a few drops of food coloring.
    b. Mix to dissolve the salt.
    c. Then slowly pour the remaining cup of plain water down the side of the glass.
    d. Carefully lower your egg into the glass.
6. **Ask:** What happens? *(Answer: The egg should sink until it hits the layer of salt water- the food coloring is to help you see the boundary between the salt water and plain water.)* Why does the egg stop sinking? *(Answer: Because the salt water is denser than the egg!)*
7. Have the girls clean up their first experiment.
8. **Ask:** *How many of you think you can make raisins move without touching them?*
9. Give each group a tall glass from the earlier experiment, a can of soda, and 6-7 raisins.
10. Give the girls these instructions to follow:
    a. Pour the soda into the glass.
    b. Drop 6 or 7 raisins into the soda.
    c. Watch them for a few seconds.
11. **Ask:** What happens? *(Answer: Raisins are denser than the soda so at first they sink. But then the bubbles from the soda fill the wrinkles in the raisins, lifting them up. When the bubbles reach the top of the glass, they pop, and the raisins sink again.)*

Activity 2: Lava Lamps
20 minutes

1. Give each girl a baby soda bottle with the caps off. Do not have the girls put the cap on their soda bottle.
2. Have one girl pour vegetable oil into a smaller container and pour enough vegetable oil into everybody's soda bottle so it is at least 2/3 full.
3. Next, have a girl add one soda bottle full of water in the bottle.
4. Have the girls watch what happens! **Ask:** *Do the oil and water mix?*
5. After the girls have determined if the oil and water mix, have each girl drop a few drops of food coloring into the soda bottle. Make sure the girls notice that the food coloring does not mix with the oil but mixes with the water. **Ask** them why they think this is.
6. After putting in the food coloring, give each girl 1-2 beads and ask her to make a hypothesis about what she thinks will happen to the bead and where it will stop.
7. Next, provide each girl with ½ an Alka Seltzer tablet and drop it into the soda bottle.
8. **Ask:** *What happens? (Answer: The Alka Seltzer will float through oil and start to bubble when it hits the water.)*
9. After the bubbles have stopped, each girl should put the cap on her soda bottle and seal it tightly.
10. Once the caps are on tightly, the girls can tip the bottle back and forth to watch the tiny droplets of liquid join together to make one big lava blob!

Closing Activity: Now You're the Food Scientist
15 minutes

1. Tell the girls that now they have become scientists, they are going to become a food scientist and make their own sweet treat: ice cream!
2. Give each girl a pint-size Ziploc bag and a gallon-size Ziploc bag. Then have them combine their ingredients to make their ice cream.
    a. Mix 2 tablespoons sugar, 1 cup half and half, and ½ teaspoon vanilla extract in the pint-size bag and seal it tightly.
    b. Place ½ cup salt and ice in the gallon-size bag, then place the sealed smaller bag inside as well. Seal the larger bag. Now shake the bags until the mixture hardens.
    c. Take the small bag out of the larger one, add mix-ins, and eat the ice cream!

Clean-up
10 minutes

Session 2: Imagine Yourself as an Inventor

Supplies:
Start-Up Activity:

- A few hula hoops

Activity 1:

- Think in Circles handout, 1 per girl
- Colored pencils

Activity 2:

- Bingo cards
- Pencils

Activity 3:

- 8 marshmallows, per group
- 18 pieces of raw spaghetti, per group
- 4 pieces of raw linguine (spaghetti and linguine should be same diameter), per group
- 1 paper clip, per group
- 1 envelope and a scissors (to make hanging basket for coins), per group
- approximately 40 coins, per group
- paper and pencil to record observations, per group

Closing Actvity:

- Paper
- Bingo markers (i.e. pieces of paper, buttons)

Start-up Activity: What's Going On?

10 minutes

1. Ask each girl to think of items in their home that scientists help create and shout them out.
2. **Say:** *Now we are going to think about one item and what role scientists may have had in developing that item. The item we are going to think about is a hula hoop.*
3. **Ask:** *what is a hula hoop made out of? And how does it work?* (Answers: *Creating a hoop out of light weight plastic that is rounded and hollow in the middle ensures that the object will be easy to keep off the ground if used properly. If the hoop had sharp edges, it would bounce off of hip bones or other parts of the body and become uneven, which would cause it to fall. If the hoop was made out of a more solid plastic instead of being hollow, it would be too heavy to keep off the ground for long periods of time. Keeping a hula hoop in the air takes a little effort. Moving your hips from side to side is not enough to get the job done. The first thing to do is to step inside the hoop and lift it up to your waist. Holding it lightly on either side, you push the hoop and let go, so that it*

spins around you on its own. Do this with as much force as you can. Once the hoop is spinning, you must move your hips in a circular motion as fast as you can manage. The speed that you move keeps the hula hoop moving at a constant rate. That, coupled with the rounded plastic that rolls over smoothly, and the lightness of the object, keep the hoop in motion until you tire.)

Activity 1: Think in Circles
**Completes Step 1 of Inventor Badge.*
20 minutes

1. **Say:** *Inventors warm up their minds so they can be creative! One way to do that is to find different ways to use cool things. If you've ever found a new way to use a tool or toy, you're already an inventor!*
2. **Say:** *During this activity you are going to come up with fun and different things you can make from circles.*
3. Give each girl a circle template and give them about 10 minutes to draw as many as they can.
4. When time is up have the girls share either in small groups or all together some of their ideas.
5. Wrap up by **asking:**
    a. *Was it difficult to think of things using a circle?*
    b. *How did you get started? Did you think about things you already know about to help you?*

Activity 2: Invention Bingo
15 minutes

1. Give each girl a bingo board which is filled with items created by women inventors and small markers (i.e. pieces of paper, buttons).
2. Tell the girls you are going to yell out one of the women inventors and her invention. They should mark that woman with one of the markers. The first person to get bingo yells, "Bingo."
3. Randomly, yell out each woman inventor and give the girls time to mark their bingo cards.
4. If time allows, you can play a few rounds of the game.
5. Once you are done, have a short discussion with the girls. **Ask:**
    a. Are you surprised about any of the inventions these women created?

Activity 3: Marshmallow/Spaghetti Challenge
20 minutes

1. Tell the girls that during this activity they are going to investigate the difference between the strength of bridges. Divide the girls into small groups. Then distribute the materials to each group and **give** them the following directions:
    a. *Cut off the lower corner of the envelope for your coin basket.*
    b. *Unbend one end of the paper clip to make a hanger and poke it through the top of your coin basket.*
    c. *Construct two pyramids of equal size with your marshmallows and spaghetti.*
    d. *Connect the pyramids with a single strand of spaghetti.*
    e. *Hang your coin basket from the bridging piece of spaghetti.*

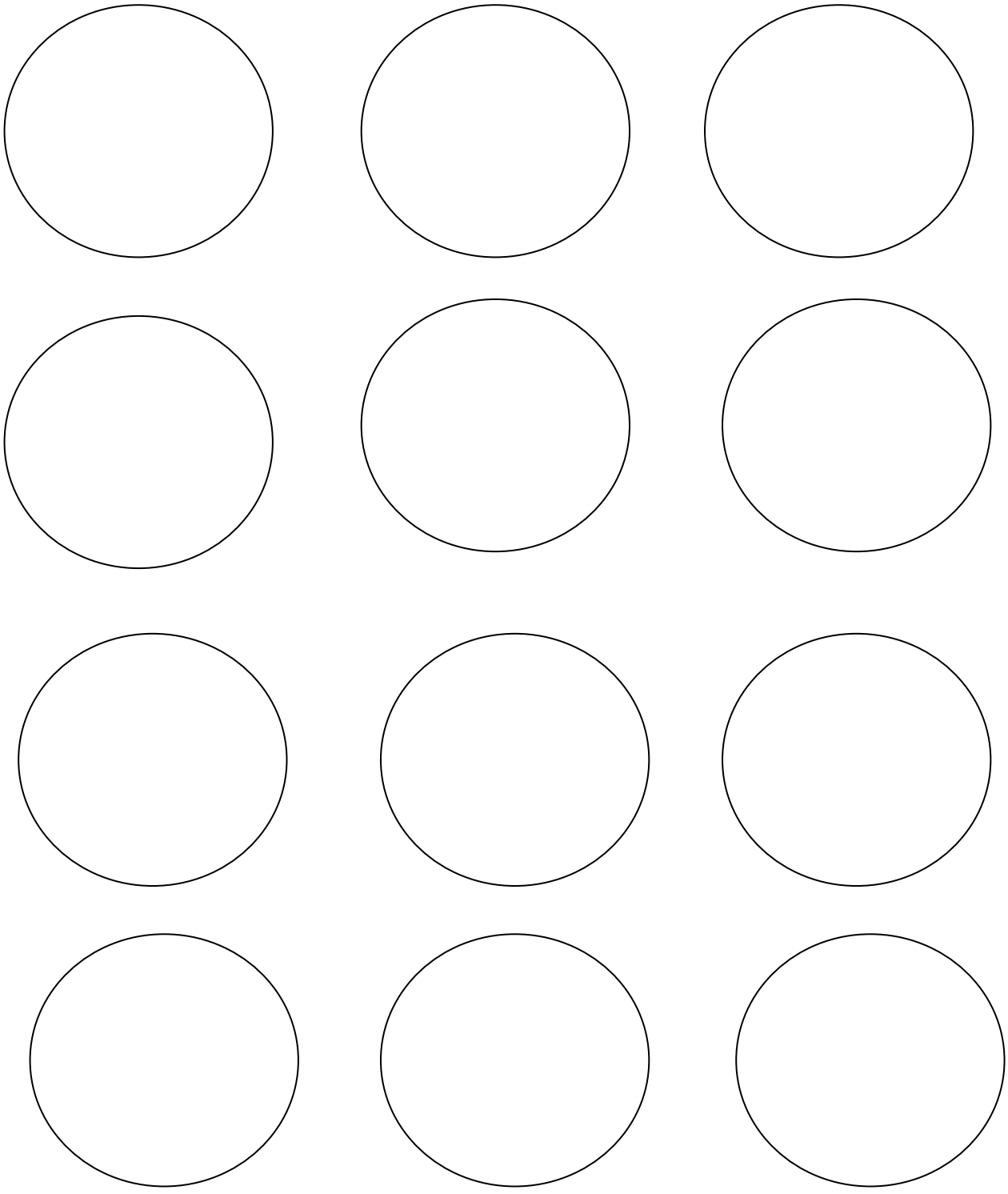
    f. *Add coins one at a time to the basket.*
    g. *Record the number of coins in the basket at the time the bridging spaghetti breaks.*
    h. *Repeat the experiment three more times to get an average number of pennies needed to break the spaghetti bridge.*
2. Then **ask:** How do you think the results will change if you use linguine for the bridge instead?
3. **Say:** *Now test your hypothesis by repeating the experiment with the linguine as the bridge.*
4. **Ask:** Was the round (spaghetti) or flat (linguine) shape stronger? *(*Answer: *Circles are among the strongest shapes in nature. External and internal stress distributes itself evenly throughout a round structure. Spaghetti has a shape like a cylinder, while linguini is shaped like a flattened rectangle. A piece of spaghetti has the same strength in any direction it is bent. Linguini will bend more easily in one orientation than another.)*

Closing Activity: "Needy" Inventor
**Completes Step 3 of Inventor Badge.*
15 minutes

1. **Say:** *To come up with new ideas, inventors have to see and understand people's needs. Now it's your turn to make a "needs list."Think about your getting ready for school routine. On your paper, write/draw five needs.*
2. **Give** the girls this example: *On my Getting-Ready-for-School Needs List, I have:*
    a. *My alarm clock is too loud.*
    b. *My cereal spills every time I pour it.*
    c. *My shoelaces take a long time to tie.*
    d. *The bus stop is too sunny.*
    e. *My backpack slips off my back.*
3. Give each girl paper and a pencil to create her list. Give them about 7 minutes and then ask for volunteers to share with the group. Wrap up by saying they could continue their invention work by watching a family member get ready in the morning or see what happens in the cafeteria during lunch.

Clean-up
10 minutes

Think in Circles



Session 3: Imagine Yourself in a Lab

Supplies:
Start-Up Activity:

- Variety of lab tools

Activity 1:

- One 16 ounce container of non-dairy whipped topping
- One container each of red, yellow, and blue food coloring
- One roll of wax or freezer paper (1 piece per girl)
- Table covering
- 3 bowls for mixing
- Scoop or spoon

Activity 2:

- Gloves/tongs
- Clear cups or beakers
- Warm and cold water
- Dry ice

Activity 3:

- Food coloring
- ¾ cup glue, per girl
- ¼ cup liquid starch or borax, per girl
- Mixing bowl(s)
- Water
- Ziploc sandwich bags

Start-Up Activity: In the Lab
10 minutes

1. Borrow some lab supplies from the science teachers and show the girls each item. Ask the girls if they know what each item is and what it is used for (i.e. Pipette, beaker, Petri dish, lab coats, goggles, etc.)

Activity 1: Whipped Topping Painting
20 minutes

1. Tell the girls that during this fun art activity, they are going to experiment like scientists in labs do. Ask the girls what an experiment is and why scientists do them.
2. Separate the non-dairy whipped topping into three equal parts, one part in each of the three different containers.
3. Add a few drops of each color of food coloring to the whipped topping.
4. Give each girl a piece of wax or freezer paper.
5. Place one spoon of each color whipped topping at the top of each girl's piece of paper.
6. Encourage the girls to use their fingers to take small amounts of the different colors and mix them in various combinations on the paper to see if they can make new colors.

7. While they work, ask them to think about what is happening. **Ask** what colors they have created and what color combinations created them. (Answer: *When primary colors (red, yellow, and blue) are mixed together, they create secondary colors. Red and blue create purple, red and yellow create orange and yellow and blue create green.)*

Activity 2: Bubbling Mixtures
15 minutes

1. Ask the girls if they know what dry ice is. Give them some of the following information about dry ice:
    a. Dry ice is frozen carbon dioxide, or CO2(s). Carbon dioxide is normally a gas at room temperature and is found in small amounts in our atmosphere. Animals breathe out carbon dioxide and plants use carbon dioxide to grow.
    b. Water freezes into ice cubes at 32oF (0oC). Carbon dioxide freezes at about -110oF (-79oC), so it is very cold. At normal air pressure, frozen carbon dioxide does not melt; it changes directly from a solid to a gas, leaving no puddle of carbon dioxide. When something changes directly from a solid to a gas, we say that it sublimes.
    c. Because dry ice is so cold and because it skips being a liquid under normal air pressure, lots of really fun experiments can be done with dry ice.
2. Place a small amount of dry ice into a small cup/beaker of cold water and a small cup/beaker of warm water side-by-side.
3. Have the girls compare their observations and offer an explanation as to why one may look different from the other. (Answer: *The warm water causes the dry ice to sublime much faster. The "cloud" or "smoke" is caused by water condensing inside of the bubble to form tiny droplets of water. The "cloud" is released when the bubble makes it to the top of the water and bursts. The "cloud"/CO2 mixture cascades down because the water droplets and CO2 are denser than air.)*
4. Then add one drop of food coloring to the water and see if that color is incorporated into the fog.

Activity 3: Homemade Silly Putty (**Completes Step 5 of Home Scientist Badge)*
30 minutes

1. **Say:** *Silly putty is fun goo that you can stretch, stamp, and play with. We're going to make our own silly putty her in our lab today.*
2. Give the girls the materials they need and the following directions:
    a. In the bowl, mix 8 drops of food coloring, the glue, and 1 cup water.
    b. Mix the borax with 1 1/3 cups water.
    c. Slowly add the liquid starch or borax mixture until you can stretch it but it isn't too mushy.
    d. Store in plastic bag.
3. Wrap up by asking the girls if the silly putty is a solid, liquid, or gas. (Answer: *Sometimes, something isn't all one way or all another. Take putty, for example. It is both a solid and liquid! Putty is colloid-a mixture of one substance suspended in another. The suspended bits are so tiny that they don't sink in the second substance. A few examples of other colloids are smoke, fog, mayonnaise, and butter.)*

Clean-up
10 minutes

Session 4: Imagine Saving the Planet

Supplies:
Activity 1:

- Dirty water (add cooking oil, food coloring, pieces of paper, and tiny pieces of Styrofoam to water)
- 2-liter soda bottle cut in half (by an adult)
- Gravel
- Course sand
- Fine sand
- Cotton balls

Activity 2:

- Plastic Bags, 12 per group
- Duct Tape
- Scissors

Activity 3:

- Fabric markers or permanent markers
- Reusable canvas shopping bags

Start-Up Activity: Environmental Issues
5 minutes

1. Have a brief discussion with the girls about environmental issues. Ask what they think are some environment issues (i.e. global warming, water pollution, extinction of animals, etc.)
2. Then **ask** the girls: How do you think scientists are working to solve these issues?

Activity 1: Water Filter Challenge
20 minutes

1. Put the top half of the soda bottle upside-down (like a funnel) inside the bottom half. The top half will be where you build your filter; the bottom half will hold the filtered water.
2. Layer the filter materials inside the top half of the bottle. Think about what each material might remove from the dirty water and in what order you should layer the materials. For an added challenge, use only two of materials to build your filter.
3. Pour the dirty water through the filter. What does the filtered water look like?
4. Take the filter apart and look at the different layers. Can you tell what each material removed from the water?
5. Wipe the bottle clean and try again. Try putting materials in different layers or using different amounts of materials
6. Wrap up by asking: are there better materials for cleaning water?

Activity 2: Plastic Bag Jump Rope
30 minutes

1. Introduce the activity by letting the girls know that there a lots of ways to turn old stuff into new stuff, and making a jump rope out of plastic bags in one of them..
2. Tell the girls that making the jump rope allows the plastic bags to be used over again. The girls will use their own energy in the jump rope making. Using their own energy helps save Earth' energy.
3. **Ask:** *By making our own jump ropes and saving other resources, what part of the Girl Scout law are we living? (Using resources wisely.)*
4. Ask the girls to work in teams of two or three to make their jump ropes.
5. Collect a bundle of plastic bags and cut each one open so it becomes one flat piece. (Note: Use different colors of bags to give your jump rope extra splashes of color.)
6. Cut off the handles of each bag and any extra pieces, leaving one large rectangle of plastic.
7. Next, cut each rectangle into long strips**.** There needn't be specific lengths or widths; it doesn't matter in the braiding process.
8. After cutting a few bags' worth of strips, tie the strips together. Make sure the length of the strips is a little longer then the length you want the jump rope to be. I made a total of 12 long strips.
9. Take six of the strips and tape them together at one end. Then tape the whole group to the back of a chair as a placeholder (if you ever made friendship bracelets as a kid, you know exactly what I am talking about).
10. Braid the six strips together into one very long, jump rope-sized braid. When you're finished, repeat this step with the second 6 strips so that you have two long plastic braids.
11. Twist the two braids together tightly so that the jump rope has enough weight to swing when jumping.
12. Tape the ends with duct tape to create handles.

Activity 3: "Green Bags"
20 minutes

1. **Say:** *Each year thousands and thousands of materials are thrown away which end up in landfills. One item that can be recycled that ends up in landfills, is plastic bags. During this activity, the girls are going to decorate their own canvas bags that can be used instead of a plastic bag.*
2. Give each girl her own canvas bag.
3. Have each girl decorate their canvas bag any way they would like.
4. Explain to the girls: *Plastic bags are from the same source as all plastic: crude oil. Like everything else manufactured from this non-renewable resource, it has two major drawbacks: manufacturing it emits considerable amounts of pollution, and the product is not biodegradable. In other words, it is difficult to produce, and nearly impossible to get rid of once produced. According to the Natural Environment website, 60 to 100 million barrels of oil are required to manufacture a year's worth of plastic bags worldwide, and it takes approximately 400 years at least for a bag to biodegrade. The impact of plastic bags on the environment is enormous. According to the Environmental Protection Agency, over 380 billion plastic bags, sacks and*

wraps are consumed in the U.S. each year. According to The Wall Street Journal, the U.S. goes through 100 billion plastic shopping bags annually. (Estimated cost to retailers is $4 billion). By using reusable bags instead of plastic bags, you can help cut down on the production and waste of plastic bags.

5. Wrap up by asking the girls other ways they think they can help reuse materials/items around them and how they can share this important message with their family and friends.

Clean-up
10 minutes