



GIRL SCOUTS - DIAMONDS

ABB Girls in STEM patch

Girls are natural-born scientists! They look at the world around them with inquisitive eyes, experiment and push boundaries, and learn as they go. Throughout our 100-year-plus history, Girl Scouts have learned by doing. And because our program is girl-led, girls decide what they do together, often choosing to explore science, technology, engineering, and math (STEM). In fact, Girl Scouts are more likely to participate in STEM activities than non-Girl Scouts—and in the process, they become better problem-solvers and critical thinkers, and more effective leaders.

To be competitive in the global market, over the next decade the U.S. workforce will need **1 million** new STEM professionals.¹

ABB, a global technology leader, is teaming up with Girl Scouts - Diamonds to spark girls' interest in STEM. A new Girls in STEM patch is now available for girls who participate in select Girl Scout STEM Events.

ABB Cardboard Boat Regatta

September 18-20, 2020 at Camp Cahinnio

This annual event brings over 200 girls plus their families to this engineering and innovating experience where girls work in teams to design, build and race their cardboard and duct tape boats. Includes additional activities like archery and bb guns, outdoor cooking, astronomy/space science and more to engage girls' interest across a wide spectrum of fields.

ABB-hosted events

ABB has a team of employees in Fort Smith, Arkansas. At this facility, industrial electric motors are manufactured.

Interested in learning about manufacturing and a career in STEM? Join ABB for a STEM event at their Fort Smith facility. Dates and registration information to follow.



STEM activities

Girl Scouts can also earn ABB's Girls in STEM patch by working together within their troops to complete a STEM activity of their choice. Your troop can create a STEM activity or follow one of the activities on the following pages.

You can find additional activities here:

www.instructables.com/id/Project-Based-Engineering-for-Kids/

www.exploratorium.edu/explore/activities

www.thehomeschoolscientist.com/100-engineering-projects-kids/

¹ Girl Scout STEM Pledge.

Make a simple mini-motor

Materials:

- About 2 feet (60 cm) of solid (not stranded) enameled or insulated copper wire, 20-24 gauge
- Wire strippers (if you're using insulated wire) or sandpaper (if you're using enameled wire)
- A black permanent marking pen
- Plain paper, plastic foam, or plastic cup
- At least 2 disk or rectangular ceramic magnets
- Two large paper clips
- Masking tape
- Aluminum foil
- One or two batteries, C or D size



Instructions:

1. Wind the copper wire into a coil about 1 inch (2.5 cm) in diameter. Make four or five loops.
2. Wrap the ends of the wire around the coil a couple of times on opposite sides to hold the coil together. Leave approximately 2 inches (5 cm) projecting from each side of the coil, and cut off any extra.
3. Strip the insulation off the ends of the wire projecting from the coil with sandpaper.
4. Use the permanent marking pen to color one side of one of the projecting ends black.
5. Cut or tear two 1-inch-wide (2.5-cm-wide) strips of aluminum foil.
6. Unfold paper clip, hold the long end of the paperclip against bottom of cup, cover with one end of aluminum strip, and secure with tape. Repeat on the other side of cup.
7. Put one magnet on bottom of cup, insert other magnet on the inside of cup opposite the first magnet.
8. Adjust your wire coil so it is balanced on the paper clip loops.
9. Stand battery on one strip of foil. Touch other strip of foil to the battery. Give the coil a spin to get it started!



Source: <https://www.exploratorium.edu/snacks/stripped-down-motor>

Marshmallow Puff Tube

Experiment with cardboard tubes of different lengths to see how far you can blow a marshmallow.

Materials:

- One file folder (or other stiff paper or lightweight cardboard)
- Scissors
- Masking tape or transparent tape
- One or more full-sized marshmallows
- A few spoonfuls of flour



Instructions:

1. Cut a rectangle from the file folder, measuring about 11.5 x 7.5 inches (29.5 x 19 centimeters).
2. Place one of the long edges of the file folder inside the other and tighten to form a tube that fits around the circumference of a marshmallow. The tube should be snug around the marshmallow, but not so tight that the marshmallow isn't able to move. It may be easier to make the tube if you first pull the folder over the edge of a table to give the material a slight curve.
3. When the tube has been rolled to the appropriate size, tape it once so it stays rolled, then tape the entire length of the seam.

To Do and Notice:

Roll the marshmallow in flour, then shake it or tap it to remove any excess (this will help prevent the marshmallow from sticking to the tube).

Place the marshmallow in one end of the tube. Hold the other end of the tube up to your mouth, parallel to the floor, and blow hard into the tube. Notice how far the marshmallow goes.

Again place the marshmallow in one end of the tube, but this time put your mouth up to the same end of the tube where the marshmallow is located. Blow hard against the marshmallow itself, so that it has to travel the length of the tube before exiting. Be sure to keep the tube horizontal, and keep blowing the whole time the marshmallow is in the tube. Did the marshmallow go farther this time?

If you blow and the marshmallow won't move, check the diameter of the tube. It may either be too tight (in which case friction prevents it from moving) or too loose (in which case air blows right by the marshmallow instead of pushing it).

Source: <https://www.exploratorium.edu/snacks/marshmallow-puff-tube>

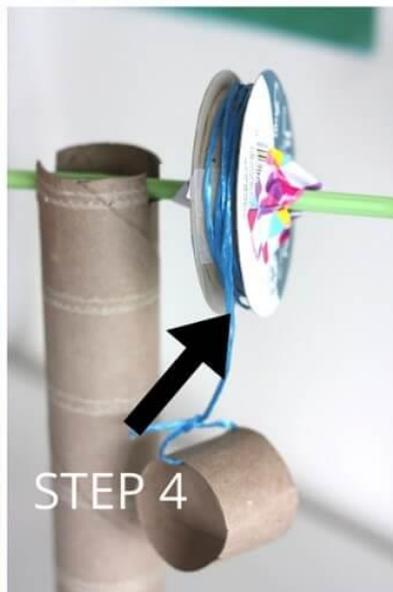
Build a CRANK

YOU WILL NEED:

- Cardboard Tubes
- Spool {can be optional, see below}
- Straw or Pencil
- String
- Tape, Scissors
- Small Basket {object to attach to string}

HOW TO BUILD A HAND CRANK

Here's the picture diagram of the four major steps to building this winch simple machine. I will describe the steps below the picture.



STEP 1

Tape 2 cardboard tubes to a solid surface. Use your straw as a reference tool for how far apart they should be placed from each other.

STEP 2

Make 2 cuts at the top of each cardboard tube just big enough of the straw or pencil to rest and be able to spin.

STEP 3

Put your spool on the straw or pencil. Now if you don't have a spool, you can simply secure your rope to the straw or pencil with a piece of tape. You still have a hand crank winch! If you do use a spool make sure to secure it with tape to the straw or pencil. What if you don't secure it? The spool just spins around the straw and there is no ending up of string!

STEP 4

Secure your rope or string to spool with a piece of tape {or to straw directly if you don't have a spool} and tie your basket or object to the bottom of the string.

Build a Paddle Boat

- Plastic Bottle (We used a plastic bottle that had four flat sides.)
- Two Wooden Chopsticks
- Plastic Milk Jug
- Scissors
- Duct Tape
- Rubber band (We used a thick medium sized rubber band)
- Ruler
- Pencil



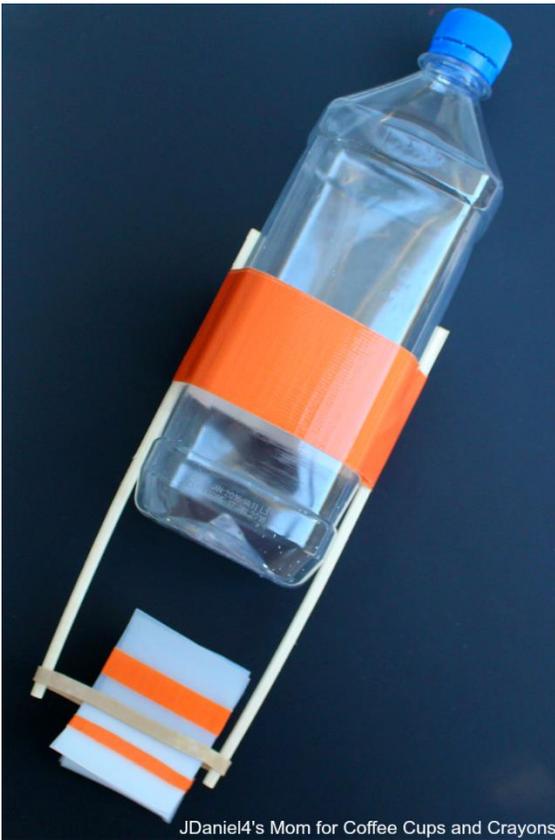
1. Build a Paddle Boat

Cut out four rectangular pieces out of the plastic milk jug. The pieces need to be 2 inches by 3 inches long. You will want to use a pencil to draw your squares onto the milk jug. That will help you cut out rectangles with straight sides. The pencil lines will be easy to erase once you have cut out your rectangles.

Each of the rectangles will then be folded in half. You will then duct tape one side a rectangle to the side of another rectangle to create a cross shape. You could create the cross shape and then tape the sides together. We found that taping one set of sides at a time worked for us.



2. Now you will be attaching the chopsticks to opposite sides of the bottle. You will attach the chopsticks about $\frac{3}{4}$ of the way down the bottle with packing tape. You will want at least 3 or 4 inches of each of the chopsticks to hang off the back of the bottle. When you have the chopsticks right where you want them to be, you will wrap duct tape around the area where the strapping tape is.



JDaniel4's Mom for Coffee Cups and Crayons

2. Attach the rubber band to the chopsticks. It should fit perfectly. You don't want it to be stretched out.

Finally you slide two blades of the paddle through the rubber band.



JDaniel4's Mom for Coffee Cups and Crayons

Science for Kids- Things to Observe

- See if winding the paddle forward makes it go forward.
- See if winding the paddle backwards makes it backward.
- See if moving the rubber band closer to the boat makes a difference in how it moves.
- See how many times you can wind up the paddle in the rubber band. Decide if it makes a difference in how long it moves.

Catapults!!

Steps:

1. Make a stack of popsicle sticks by stacking them one on top of each other. Start with five (5) sticks.



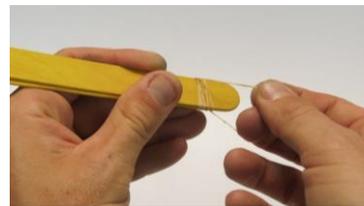
2. Wrap a rubber band around each end of the stack to hold the stack together.



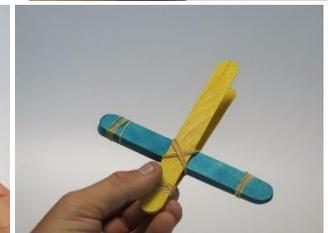
3. Take two popsicle sticks and stack them together. Wrap one rubber band around one end of these two sticks to hold them together.



4. Pull the two popsicle sticks slightly apart and place the larger stack of sticks in between the two.



5. Attach the larger stack to the stick on the top using a rubber band.



6. Set the spoon on the top popsicle stick and use a rubber band (or two) to lash it down.

7. The spoon should be facing cup side (scoop side) outwards.



8. Place a cookie on the spoon. Hold the catapult with one hand and use your other hand to pull down on the spoon. Release the spoon to watch the cookie launch!

****Where will the cookie go? How far will it go? What might make a difference in how far it travels? Try building the catapult with more popsicle sticks. What do you think will happen?***

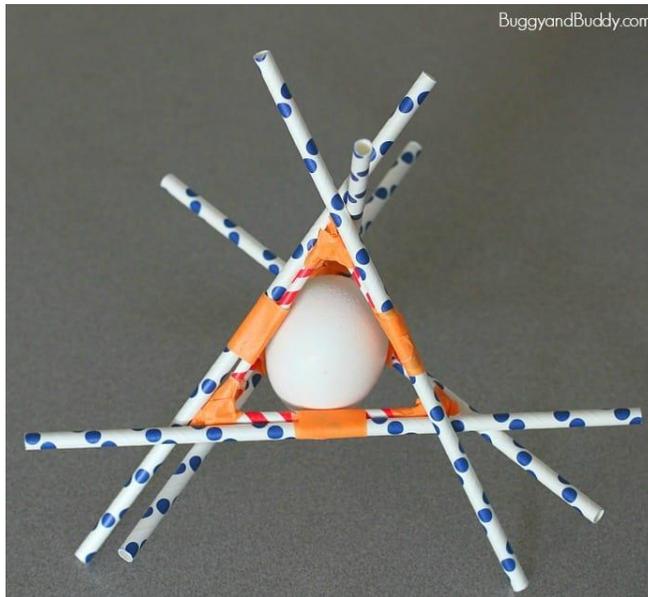
Egg Drop Challenge

Some Materials You Could Use:

- Toilet paper rolls
- Newspaper
- Shoebox
- Popsicle sticks
- Tape
- Rubberbands
- Plastic bag
- String
- Balloons
- Packing peanuts

Procedure for the Egg Drop Challenge

1. Design and make a container to protect an egg from a high fall.
2. Build your container and place the egg inside.
3. Drop the egg from somewhere high. (Be sure it's safe and an adult is with you.)
4. After you drop it look and see if your egg cracked or remained intact. (Remember to wash your hands after touching raw egg!)

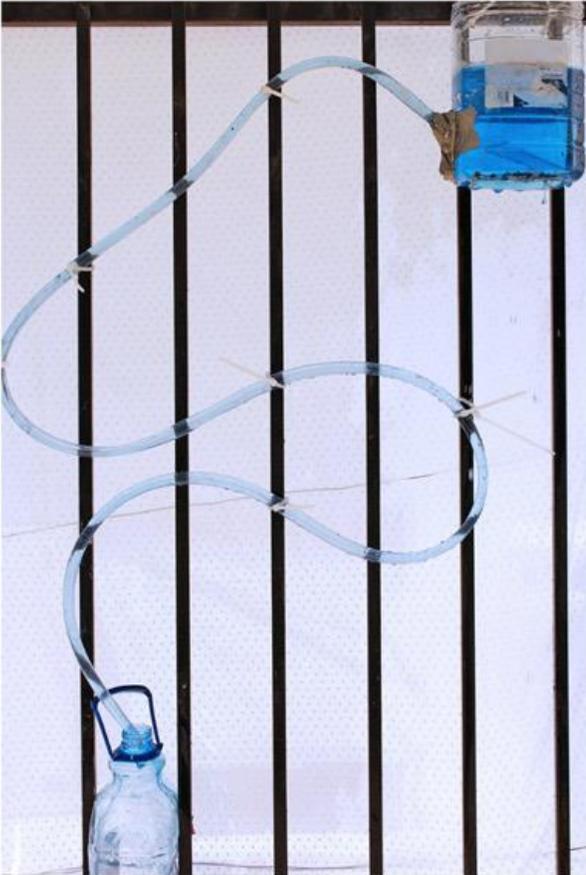


Siphon Water Coaster

Materials

8'-10' length of clear tubing, Water, Food coloring, (3) 1 Gallon water jugs, Zip Ties, Fence, Small colored gravel, Bulb Syringe, Utility Knife (ADULTS ONLY), duct tape

Instructions



Tips

- Don't make the upward climb too high or too loopy. The bulb syringe will not be able to create enough suction to pull water through a super steep incline.
- Don't put the zip ties too tightly around the tubing and make sure there are no kinks in your tubing that will restrict water flow.
- **Do make sure the siphon end is below the start point.** That is the number one rule of siphons!

1. Cut the top off one of your jugs. Poke a large hole near the bottom of the jug to insert the tubing. Poke two holes near the top to use to hang it on the fence. Place a zip tie through each of the top holes and secure the jug in place on the fence (it will be heavy when filled with water). This will be your starting point.
2. Place one end of the tubing into the top jug. **Seal the openings around the tubing/jug connection with duct tape.** Make sure the end of the tubing is touching the bottom of the jug interior.
3. Use zip ties to secure the tubing to the fence with in a slight downward position to create a "roller coaster" look. **Make sure that end of the tubing is lower than the tubing start point.** Add a jug at the end of the tubing to catch the water. Have a 2nd jug nearby to use when transferring water to the start point. Keep the tubing end loose enough to be able to lift it higher than the tubing start to stop the siphon.
4. Fill jug with water, add food coloring and some fine gravel.
5. Squeeze your bulb syringe and hold it in the squeezed position while you insert it into the end of the tubing. When you are ready to start, release the syringe and the suction will pull the water through the tubing. Try again if it doesn't work at first. Remove the bulb syringe and position the end of the tubing to dump into the jug at the siphon end.
6. Continue adding water to the top container to keep the siphon flowing. Suck up the fine gravel and watch it move through the tubing! To stop the siphon, lift the end of the tubing higher than the start point.