

Fling Flyer Design Challenge 2

Overview:

In the Fling Flyer Design Challenge, Brownies explore the forces that affect flight as they design, build, and test a Fling Flyer. Brownies learn how to design an investigation—and fine-tune their designs after testing it.

Step One: Learn about forces that affect flight. *(Completed in Fling Flyer Design Challenge 1.)*

Step Two: Design and build a Fling Flyer. *(Completed in Fling Flyer Design Challenge 1.)*

Step Three: Test your Fling Flyer.

Step Four: Analyze and share your results.

Step Five: Brainstorm ways to improve your design.

This meeting, Brownies test, record, and analyze data, and improve their Fling Flyers. They complete Steps Three, Four, and Five, earning the Fling Flyer Design Challenge badge.

Note to Volunteers:

Use the Talking Points (But Make Them Your Own): In each session, you'll find suggested talking points under the heading "SAY." Some volunteers, especially new ones, find it helpful to follow the script. Others use the talking points as a guide and deliver the information in their own words. Either way is just fine.

Be Prepared (It's What Girl Scouts Do!): Each meeting includes a "Prepare Ahead" section that includes a materials list and what kind of set-up is required. Read it in advance so you have enough time to gather supplies and enlist help, if needed.

If your troop has the GoldieBlox Making Things Zoom kit, you can find a set of Activity Instructions for the badge in the Meeting Aids section of this badge meeting under "Activities for the Making Things Zoom Kit."

Use Girl Scouts' Three Processes: Girl-led, learning by doing, cooperative learning—these three processes are the key to making sure Brownies have fun in Girl Scouts and keep coming back.

"Learning by doing" and "cooperative learning" are built into this Badge, thanks to the hands-on activities and tips. You'll also find specific "keep it girl-led" tips in the meeting plans. They'll help you create an experience where Brownies know they can make choices and have their voices heard.

Fail Fast. Succeed Sooner: That's how engineers solve problems. In this badge, Brownies will learn about engineering through hands-on activities. They'll learn to: Brainstorm ways to solve a problem, design prototypes, test them to see what does and doesn't work, then improve their designs. To engineers, failure is a good thing because every time a design fails, you learn something and can make it better.

You can help Brownies think this way. When her prototype doesn't work, ask questions like, "Why do you think it didn't work? How can you change your design? Try again—that's what engineers do!" ~~This approach also keeps the activity girl-led and fun because Brownies are free to invent things~~

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without feeling the pressure to make them perfect.

Leave Time for the Closing Ceremony: If Brownies are having fun doing a Design Challenge, you may be tempted to skip the Closing Ceremony so they can keep going—but the Closing Ceremony is absolutely key to their learning. Here's why:

When Brownies leave a meeting, they'll remember how much fun it was to build a Leap Bot or to make a car speed down a ramp. However, they may not realize that they just learned how engineers solve problems or that they're good at engineering—unless you tell them.

That's why the Closing Ceremony is so important. It's where you can connect the dots for Brownies by:

- Pointing out how they acted as engineers. (**For example:** They did rapid prototyping. When one of their prototypes didn't work, they saw that "failure" as helpful feedback and tried something else. They worked together to find solutions. They shared their designs and offered suggestions.)
- Reminding Brownies that they are *already* engineers—and that it's fun to solve problems using engineering.
- Letting them know that they have what it takes to continue exploring STEM.

These simple messages can boost Brownies' confidence and interest in STEM—and end the meeting on an upbeat note!

Tell Your Troop Story: As a Girl Scout leader, you're designing experiences that Brownies will remember their whole lives. Try to capture those memories with photos or videos. Brownies love remembering all they did—and it's a great way for parents to see how Girl Scouting helps their Brownies!

And please do share your photos and videos with GSUSA by emailing them to STEM@girlscouts.org (with photo releases if at all possible!).

Prepare Ahead (Roughly 50 minutes)

1. Go over new words Brownies can learn (2 minutes)

This meeting includes the following words Brownies may not know:

- **Engineers** – People who like to know how things work. They design and build things people use every day, like computers, phones, roads, bridges, and cars.
- **Force** – The strength or energy that creates movement. Push and pull are examples of forces.
- **Thrust** – The force that pushes something through the air.
- **Drag** – The force (air molecules) that acts against something in flight.
- **Gravity** – A force that pulls objects toward each other and towards the earth.
- **Lift** – A force that pushes back up on the wings during flight.

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- **Balanced forces** – When forces are equal on an object, it does not move.
- **Unbalanced forces** – When forces are unequal on an object, it moves in the direction of the greater force.
- **Data** – Information that engineers receive, collect, or observe during testing of their designs.

See the **Glossary for Brownie Design Challenge Badges** for more vocabulary and examples.

2. Read through this guide and handouts (15 minutes)

This will help you get familiar with the flow of the meeting.

The following handouts can be found in Meeting Aids.

- **Brownie Design Challenge Badges: Materials List:** Each meeting has its own materials list, but you can use this handout if you like to do all your supply shopping at one time. It includes the materials needed for all three Brownie Design Challenge badges.
- **Glossary for Brownie Design Challenge Badges:** This is a list of words that Brownies may not know and how to define them.
- **Think, Pair, Share:** These facilitation tips will help you to make sure that every girl's voice is heard during brainstorming activities.

3. Gather materials (30 minutes)

Gather materials using the Materials List for this meeting. If your meeting location doesn't have a flag, bring a small one that Brownies can take turns holding or hang in the room.

If your troop has the GoldieBlox Making Things Zoom kit, you can find a set of Activity Instructions for the badge in the Meeting Aids section of this badge meeting under "Activities for the Making Things Zoom Kit."

Get Help from Your Family and Friends Network

Your Friends and Family Network can include:

- Brownies' parents, aunts, uncles, older siblings, cousins, and friends
- Other volunteers who have offered to help with the meeting

Ask your Network to help:

- Bring materials
- Assist with Design Challenge activities

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Award Connection

Brownies will earn one award:

- Fling Flyer Design Challenge badge

Brownies receive the award following the completion of the final three steps of the badge this meeting.

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Meeting Length

90 minutes

- The times given for each activity will be different depending on how many Brownies are in your troop.
- There is no snack time scheduled in these meetings, but there are 15 minutes of “wiggle room” built in for snacks or activities that run long.
- Give Brownies 10- and 5-minute warnings before they need to wrap up the last activity so you'll have time for the Closing Ceremony.

Materials List:

Activity 1: As Girls Arrive: Prepare for Testing

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)
- Materials for girls to redesign or decorate their Flyers, like craft sticks, paper, markers, stickers, etc.

Activity 2: Opening Ceremony: Forces that Affect Flight

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Test Your Fling Flyer

- Fling Flyers created by girls in Activity 1: As Girls Arrive: Prepare for Testing
- Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Activity 4: Analyze and Share Your Results

- None

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Activity 5: Brainstorm Ways to Improve your Design

- Fling Flyers from Activity 3: Test Your Fling Flyer
- Optional: Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.

Activity 6: Closing Ceremony: Awards

- Fling Flyer Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Detailed Activity Plan

Activity 1: As Girls Arrive: Prepare for Testing (10 minutes)

Materials

- Fling Flyers created by girls in Fling Flyer Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)
- Materials for girls to redesign or decorate their Flyers, like craft sticks, paper, markers, stickers, etc.

Steps

Welcome Brownies and have them decorate, rebuild, and practice with their Fling Flyers before the Troop Fling Flyer Competition.

Optional: If you were unable to save the Fling Flyers between meetings, Brownies can rebuild them. This will take additional time.

SAY:

Today, we're going to have a competition to see how your Fling Flyers perform!

Take a few minutes to decorate and practice flinging your Flyer.

If there's anything you'd like to change about your Flyer from last time, feel free to try it out!

Activity 2: Opening Ceremony: Forces that Affect Flight (10 minutes)

Materials

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

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Steps

Recite the Pledge of Allegiance and the Promise and Law.

Conduct any troop business.

Review the forces that affect the Fling Flyer's ability to fly with Brownies.

SAY:

What forces affect your Fling Flyer? (Answer: Thrust, drag, lift, gravity.)

What force pushes the Flyer forward through the air? (Answer: The thrust from the rubber band.)

Why does the Flyer slow down? (Answer: The drag pushes air molecules out of the way.)

What pulls the Flyer back down to the ground? (Answer: Gravity.)

Why doesn't it fall straight down if gravity is pulling on it? (Answer: Lift. Air is in the way—the wings deflect the air, which pushes back up on the wings.)

What happens when forces are unbalanced, like throwing a paper airplane on a windy day? (Answer: The object moves in the direction of the greater force.)

What happens when forces on an object are balanced? (Answer: Neither force moves the object.)

Introduce Brownies to today's activities.

SAY:

Today, we're going to test our Fling Flyers in a Troop Fling Flyer Competition!

First, we'll decide what we want to test our Fling Flyers for, or our goals.

After, you'll have a chance to test and improve your Fling Flyers in a Troop Fling Flyer Competition!

Engineers test and redesign their new creations many times to find one that works.

Activity 3: Test Your Fling Flyer (15 minutes)

Materials

- Fling Flyers created by girls in Activity 1: As Girls Arrive: Prepare for Testing
- Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.
- Masking tape

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- Cone, rock, or anything else to mark the furthest distance flown

Steps

Brownies test their Flying Flyers in a Troop Fling Flyer Competition for Step Three of the Fling Flyer Design Challenge.

Create goals for the Troop Fling Flyer Competition with Brownies.

SAY:

Engineers design and build things to meet goals or needs they see in the world.

For our competition, what should we test?

Girls may say: Which Fling Flyer goes farthest, which Flyer goes highest, which Flyer stays in the air longest, etc.

Today, let's test to see whose Flyer goes the farthest, whose stays in the air (or stays airborne) the longest, and who can do the most flips or tricks!

Have Brownies improve their Fling Flyers before the Troop Fling Flyer Competition. They can test fling their Flyers to see how different materials work.

SAY:

Now that we know we want our Fling Flyers to fly far, stay in the air, and try to do tricks, we have a better idea of how to build them to meet these goals.

Do you want to rebuild your Flyer? Here are some other types of paper and materials you could try for your Flyer. Feel free to add or take off anything from your last design!

Give the girls time to test and improve their designs.

Hold the Troop Fling Flyer Competition. Create a masking tape line for girls to stand on to fling their Flyers.

SAY:

Now it's time to see how well your Fling Flyers work!

Let's start by standing on the line to see which Flyer flings the farthest!

Brownies fling their Flyers, either by taking turns or all at once.

(Note to Volunteers: If taking turns, mark how far the Flyer flings with a cone, rock, or anything else to mark the distance flown. As girls take turn, move the object to the new Flyer's distance if it is farther than the last distance marked.)

Repeat, but have Brownies test for longest time airborne, measuring seconds by counting.

Repeat once more, with Brownies having their Flyers do flips or other tricks.

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Activity 4: Analyze and Share Your Results (10 minutes)

Materials

- None

Steps

Brownies review their results and come to conclusions for Step Four of the Fling Flyer Design Challenge.

SAY:

Okay, you've tested your Fling Flyers, and we have results from the Troop Fling Flyer Competition.

Let's look at what you've learned.

Our results from the Fling Flyer Competition are called data. For example, how far your flyer went, how fast it went, and how well it flew are all different types of information, or data.

Engineers look at all the data from a test to figure out what works best and what needs to be improved.

It's a little bit like solving a puzzle! Now you get a chance to do that, too.

Divide girls into small groups of 3-4 to brainstorm and analyze their results.

SAY:

Let's take a few minutes to think about our results and see what you can figure out from our data.

Figuring out what our data means is called analysis.

Engineers work together to brainstorm and analyze their data and results to form bigger ideas on how to improve their designs.

Here are some questions to get you started:

- *What did the farthest flying Fling Flyers have in common?*
- *What did the longest airborne Fling Flyers have in common?*
- *What did the most acrobatic (most tricks) Fling Flyers have in common?*

Give girls 5 minutes or so to brainstorm and discuss in groups.

SAY:

Okay, what did you figure out?

Give girls time to report on what they think their results showed.

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SAY:

Very interesting!

Now take another look and see if you can answer these questions:

- *How did your Fling Flyer move when gravity and lift were balanced?*
- *How did it move when gravity is stronger? When lift was stronger?*
- *Did weight matter?*

Give girls time to report on what they think their results showed.

After they're done, move right to the next step (Activity 5: Brainstorm Ways to Improve Your Design).

Activity 5: Brainstorm Ways to Improve Your Design (10 minutes)

Materials

- Fling Flyers from Activity 3: Test Your Fling Flyer
- Optional: Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.

Steps

Have Brownies form a Friendship Circle.

SAY:

You did a great job of gathering data and results and analyzing them. That's what engineers do, too! Then they used what they've learned to make their design even better.

As you tested your Fling Flyer, did you change the design to improve it? How?

If you were going to keep working on your Fling Flyer design, what would you change and why?

Let girls answer. Make sure every girl gets a chance to speak.

SAY:

Those are great ideas. Remember, no matter what you're building or what project you're working on, you can always keep making it better. That's what engineers do.

Optional: If there's extra time, Brownies can redesign their Flyers.

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Activity 5: Closing Ceremony: Awards (10 minutes)

Materials

- Fling Flyer Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Steps

Brownies earn the Fling Flyer Design Challenge badge.

SAY:

You've now earned the Fling Flyer Design Challenge badge, which means you have learned about the forces that affect flight as you designed, built, and tested a Fling Flyer.

You also learned how to come up with ways to test how well your flyers worked. Then you fine-tuned your design after testing it, just like engineers.

Please step forward when I say your name to accept your award.

Lead a round of applause for each Brownie as she steps forward.

SAY:

When you leave here, who do you want to tell about what you learned?

Girls may say: My parents, my brothers and sisters, my friends at school.

That's great! When you learn something, it's fun to pass it on to others. We can all learn from each other.

End the meeting with a Friendship Squeeze.

Now that I've earned this badge, I can give service by:

- Showing Daisies that engineering can be fun by demonstrating my Fling Flyer.
- Sharing what I learned about the forces that affect flight with my friends or family.
- Showing friends how to make a Fling Flyer and then having a contest to see how far they can fly.

Design Challenge Badges Glossary for Brownies

Brownies may not know some of the words used in these badges. Here are definitions you can share with them:

Balanced forces exist when forces are equal on an object. When the forces are balanced, the object does not move.

Data is information that engineers receive, collect, or observe during testing of their designs.

Drag is the force (air molecules) that acts against something in flight.

Engineers are people who like to know how things work. They design and build things people use every day, like computers, phones, roads, bridges and cars.

Features are parts of a product that are designed make them more useful.

Force is the strength or energy that creates movement. Push and pull are examples of force.

Friction is a force that slows moving objects.

Gravity is a force that pulls objects toward each other and towards the earth.

When potential energy is released, it becomes **kinetic energy** which bring bodies and object to move.

Lift is a force that pushes back up on the wings during flight.

Potential energy is the energy stored in your body and everything else in our world.

Thrust is the force that moves an object.

Unbalanced forces exist when forces are unequal on an object. When the forces are unbalanced, it moves in the direction of the greater force.

Brownie Design Challenge Badges (DIY Activity Version)

Brownie Design Challenge Badges: Materials List**Leap Bot Design Challenge 1****Activity 1: As Girls Arrive: Jump Up!**

- None

Activity 2: Opening Ceremony: What Do Engineers Think About?

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Learn About Springs

- **Sample Leap Bot** handout
- Optional: Leap Bot made by you to show girls

Activity 4: Build Your Leap Bot

For each Leap Bot, girls will need at least:

- 1 wooden dowel. Alternatively, you could use straws, BBQ skewers, unsharpened pencils, etc.) (**Note to Volunteers:** Make sure the dowels fit in the spools.)
- 1 spool (**Note to Volunteers:** While girls will only need one spool to build a Leap Bot, offering a variety of spools in different sizes will give girls the chance to engineer individual designs and test out different solutions.)
- 1 piece of heavy cardboard (6 inch x 6 inch square)
- 1 compression spring (**Note to Volunteers:** Make sure the spring fits over the dowel. You should be able to purchase one box of springs with enough springs in a variety of sizes to fit your entire troop.)
- Clay or poster putty
- Tape (masking or duct)
- 2 pipe cleaners
- Scissors
- Optional: wood glue for girls to connect multiple spools into one Bot

Activity 5: Closing Ceremony: Flash Chat

- None

Leap Bot Design Challenge 2**Activity 1: As Girls Arrive: Prepare for Testing**

- Leap Bots created by girls in Leap Bots Design Challenge 1 (**Note to Volunteers:** If you were unable to save the Bots between meetings, Brownies can rebuild them during this activity.)
- Leftover materials, like spools, dowels, pipe cleaners, etc.
- Supplies for girls to change the size of and decorate their Leap Bots, like construction paper, googly eyes, stickers, markers, tape, scissors, etc.
- Optional: wood glue for girls to connect multiple spools into one Bot

Brownie Design Challenge Badges (DIY Activity Version)**Leap Bot Design Challenge 2 (continued)****Activity 2: Opening Ceremony: Leap Bot Forces**

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Create a Way to Test How Well Your Leap Bot Performs

- Leap Bots created by girls in Activity 1: As Girls Arrive: Prepare for Testing
- Rulers, yardsticks, etc.
- Tape
- Paper

Activity 4: Record the Results of Your Test

- Leap Bots created by girls in Activity 1: As Girls Arrive: Prepare for Testing
- Leap Bot Testing Stations created by girls in Activity 3: Create a Way to Test How Well Your Leap Bot Performs
- Long and short compression springs (3 or more for testing team) (**Note to Volunteers:** Make sure the springs fit over the dowel. You should be able to purchase one box of springs with enough springs in a variety of sizes to fit your entire troop.)
- Paper
- Pencils

Activity 5: Share Your Results

- Papers with testing results created by girls in Activity 4: Record the Results of Your Test.

Activity 6: Closing Ceremony: Awards

- Leap Bot Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or the Girl Scouts' website.)

Fling Flyer Design Challenge 1**Activity 1: As Girls Arrive: Engineering Paper Airplanes**

- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Crayons, colored markers

Activity 2: Opening Ceremony: Taking Flight!

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Learn About Forces that Affect Flight

- Paper Airplanes from Activity 1: As Girls Arrive: Engineering Paper Airplanes

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Brownie Design Challenge Badges (DIY Activity Version)

Fling Flyer Design Challenge 1 (continued)

Activity 4: Design and Build a Fling Flyer

- **Sample Fling Flyer** handout
- Prior to the meeting, make a Fling Flyer to show girls.
- Paper
- Pencils

For each Fling Flyer, girls will need:

- 1 dowel
- 10 or more craft sticks
- 1 paper clip
- 1 large rubber band
- 1 piece of heavy cardboard (small square)
- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Tape (masking or duct) or glue
- Scissors

Activity 5: Closing Ceremony: Fling Flyer Forces

- None

Fling Flyer Design Challenge 2

Activity 1: As Girls Arrive: Prepare for Testing

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)
- Materials for girls to redesign or decorate their Flyers, like craft sticks, paper, markers, stickers, etc.

Activity 2: Opening Ceremony: Forces that Affect Flight

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Test Your Fling Flyer

- Fling Flyers created by girls in Activity 1: As Girls Arrive: Prepare for Testing
- Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Activity 4: Analyze and Share Your Results

- None

Brownie Design Challenge Badges (DIY Activity Version)

Fling Flyer Design Challenge 2 (continued)

Activity 5: Brainstorm Ways to Improve Your Design

- Fling Flyers from Activity 3: Test Your Fling Flyer
- Optional: Leftover materials for girls to redesign their Flyers, like craft sticks, paper, paper clips, tape, etc.

Activity 6: Closing Ceremony: Awards

- Fling Flyer Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or the Girl Scouts' website.)

Race Car Design Challenge 1

Activity 1: As Girls Arrive: Playing with Force and Friction

- Sports and game balls (one for each pair of girls). Bring different types of balls for girls to roll and observe friction. For example, you might bring a marble, tennis ball, basketball, ping pong ball, baseball, etc.
- Create two lines with masking tape on the floor. Each Brownie should sit on the line, facing their partner.

Activity 2: Opening Ceremony: Engineering Speed

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Learn How Design Can Affect Speed

- Toy car to demonstrate force and friction

Activity 4: Design and Build Your Race Car

- **Sample Race Car** handout
- Optional: Create a sample race car for girls to reverse engineer.

Suggested materials for each race car:

- 2 or 4 (depending on length and size of cabin) wooden dowels. Alternatively, you could use BBQ skewers, straws, or other materials to attach the wheels through the car cabin. **(Note to Volunteers:** Make sure the dowels or other wheel attachments fit in the wheels and allow wheel rotation.)
- 4 wooden wheels. Alternatively, you could bring round soda caps, CDs, or other round materials for girls to test.
- Clay or poster putty
- Small and medium boxes (assorted sizes.) A variety of boxes give girls the opportunity to try different materials for their car.
- Optional: Other materials for girls to use in their race car, such as paper towels, pieces of cardboard, cups, etc.

Brownie Design Challenge Badges (DIY Activity Version)

Race Car Design Challenge 1 (continued)

Activity 4: Design and Build Your Race Car (continued)

- **Note to Volunteers:** Depending on what you have available, Brownies can experiment using the different materials to create their race car.

Activity 5: Closing Ceremony: Share Your Design

- Race Cars built by Brownies in Activity 4: Design and Build Your Race Car

Race Car Design Challenge 2

Activity 1: As Girls Arrive: Build A Simple Ramp

- Race cars created by girls in Race Car Design Challenge 1. (**Note to Volunteers:** If you were unable to save the race cars between meetings, Brownies can rebuild their cars during this activity.)
- Folders, poster boards, cardboard, etc., to lean against something to create a ramp
- Books, boxes, tables, etc. to create the height and top of a ramp

Activity 2: Opening Ceremony: Reviewing Force and Friction

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Activity 3: Design Your Racetrack

- Poster boards, cardboard, etc., to lean against something to create ramps
- Table(s) or books to create the top of ramps
- Paper or newspaper
- Masking tape

Activity 4: Conduct a Fair Test and Record Results

- Yardstick
- Ramp created by girls in Activity 3: Design Your Racetrack
- Race cars created by girls in Race Car Design Challenge 1 or rebuilt in Activity 1: As Girls Arrive: Build a Simple Ramp
- Leftover or additional materials for girls to rebuild their race cars. You may want to bring dowels, wheels, boxes, cups, cardboard, paper tubes, clay or poster putty, tape, etc.
- Optional: Phone or camera to capture “photo finishes”

Activity 5: Share What You Learned

- Race cars redesigned by girls in Activity 4: Conduct a Fair Test and Record Results

Activity 6: Closing Ceremony: Awards

- Race Car Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or the Girl Scouts’ [website](#).)

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Brainstorming Tips: Think, Pair, Share

How to Run a Think, Pair, Share Activity:

Tell girls that they're going to brainstorm answers to your question using "Think, Pair, Share."

Lead girls through the basic steps by telling them they will:

1. Break into small groups.

2. Listen to the question or prompt.

3. Think about their answers.

- Girls may want to write their answers down.
- Twenty seconds should be enough time, since girls will need to sit quietly.

4. Pair with other girls.

- Girls talk with one to three other girls (depending on group size), making sure everyone has a chance to share their answers. If there's time, it's OK for girls to ask questions about each other's answers.
- For pairs, 20 seconds should be enough time. If your troop enjoys discussion, consider extending this to 1 to 2 minutes.

5. Share with the group.

- Girls share their answers with the larger group.
- This can be completed in 20 – 30 seconds, but will run longer based on group size and how the group sharing is done.

There are two ways to set up group sharing:

- **Strongly Recommended:** One girl shares the best/most interesting/summary answer for the group. This approach is great if you're running short on time. It also helps develop conflict resolution and compromise skills.
- **Optional:** Each girl shares her partner's answer. This helps girls develop active listening skills, but will run longer because all girls are sharing.

The Girl Scout Promise

On my honor, I will try:

**To serve God and my country,
To help people at all times,
And to live by the Girl Scout Law.**

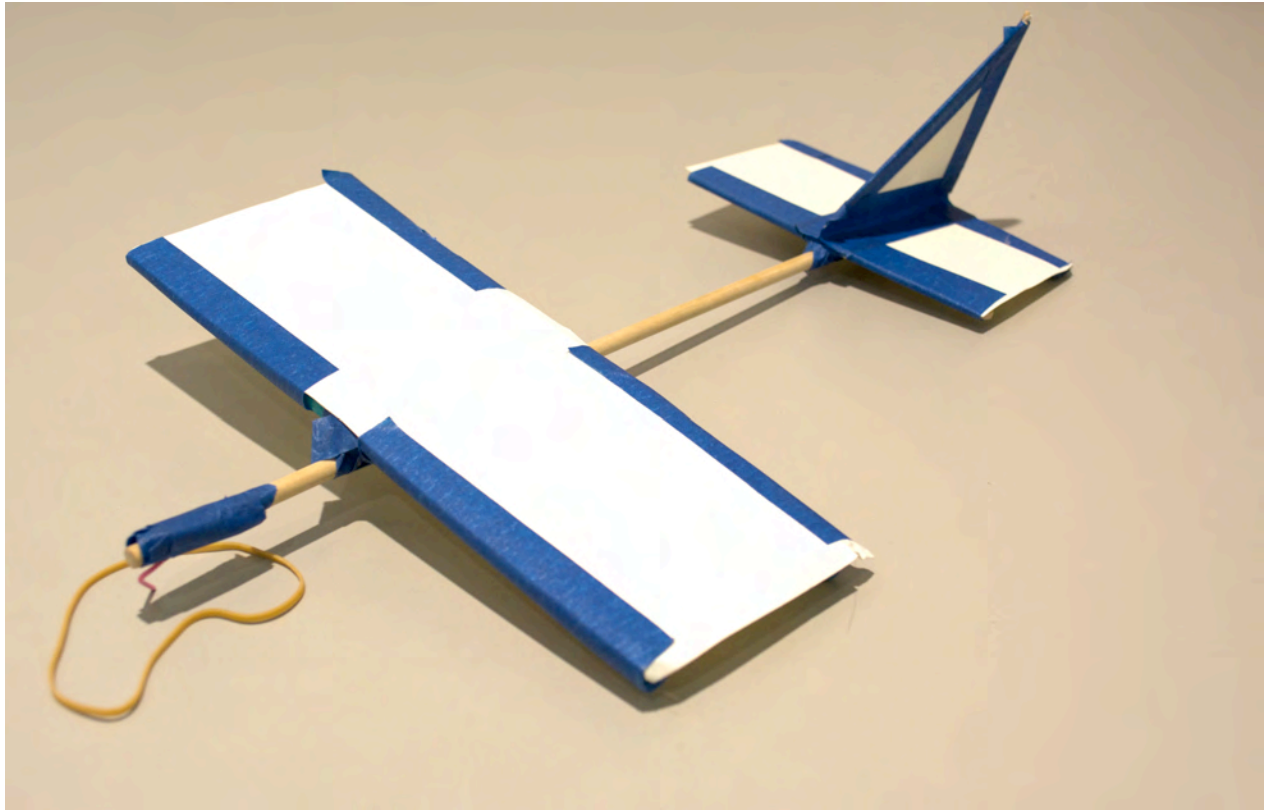
The Girl Scout Law

I will do my best to be

**honest and fair,
friendly and helpful,
considerate and caring,
courageous and strong, and
responsible for what I say and do,
and to
respect myself and others,
respect authority,
use resources wisely,
make the world a better place, and
be a sister to every Girl Scout.**

Fling Flyer Design Challenge

Sample Fling Flyer



This Fling Flyer is made from: 1 dowel, 8 craft sticks, 1 paperclip, 1 rubber band, paper, tape.

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

Note to Volunteers on the GoldieBlox Making Things Zoom kit:

This version of the badge uses the GoldieBlox Making Things Zoom kit. Each kit includes 6 sets of GoldieBlox parts for the badge, (i.e. you can create 6 of any Brownie Design Challenge badge from one kit). Inside the kit are six sets of GoldieBlox parts that allow girls to earn all 3 Brownie Design Challenge badges. Two to four girls can use each set. So, if you have 12 girls, you will need one kit for them to work in pairs.

The kit is no longer available to purchase, but you can find a full parts list at the end of this handout if you want to pull together the GoldieBlox for the badges. If you do not have the GoldieBlox, we recommend completing the badge using the DIY instructions now included as the Meeting Plan on VTK.

Materials List

As Girls Arrive: Prepare for Testing

- Fling Flyers created by girls in Fling Flyer Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint
- 2 T-joints
- 1 craftstrucion wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)
- 1 rubber band

Opening Ceremony: Forces that Affect Flight

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Test Your Fling Flyer

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Step Four: Analyze and Share Your Results

- None

Step Five: Brainstorm Ways to Improve your Design

- Fling Flyers from Step Three: Test Your Fling Flyer
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)

Closing Ceremony: Awards

- Fling Flyer Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Detailed Activity Plan

As Girls Arrive: Prepare for Testing (10 minutes)

Materials

- Fling Flyers created by girls in Fling Flyer Design Challenge 1. **(Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint
- 2 T-joints
- 1 craftstruction wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

- 1 rubber band

Steps

Welcome Brownies, and have them practice with their Fling Flyer before the Troop Fling Flyer Competition.

Optional: If you were unable to save the Fling Flyers between meetings, Brownies can rebuild them.

SAY:

Today, we're going to have a competition to see how your Fling Flyers perform!

Take a few minutes to practice flinging your Flyer to get ready.

If there's anything you'd like to change about your Flyer from last time, feel free to try it out!

Opening Ceremony: Forces that Affect Flight (10 minutes)

Materials

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Steps

Recite the Pledge of Allegiance and the Promise and Law.

Conduct any troop business.

Review the forces that affect the Fling Flyer's ability to fly with Brownies.

SAY:

What forces affect your Fling Flyer? (Answer: Thrust, drag, lift, gravity.)

What force pushes the Flyer forward through the air? (Answer: The thrust from the rubber band.)

Why does the Flyer slow down? (Answer: The drag pushes air molecules out of the way.)

What pulls the Flyer back down to the ground? (Answer: Gravity.)

Why doesn't it fall straight down if gravity is pulling on it? (Answer: Lift. Air is in the way—the wings deflect the air, which pushes back up on the wings.)

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

What happens when forces are unbalanced, like throwing a paper airplane on a windy day?
(Answer: The object moves in the direction of the greater force.)

What happens when forces on an object are balanced? **(Answer: Neither force moves the object.)**

Introduce Brownies to today's activities.

SAY:

Today, we're going to test our Fling Flyers in a Troop Fling Flyer Competition!

First, we'll decide what we want to test our Fling Flyers for, or our goals.

After, you'll have a chance to test and improve your Fling Flyers in a Troop Fling Flyer Competition! Engineers test and redesign their new creations multiple times to find a design that works well for their goals, whether it's solving a problem or creating a brand new product.

Now that we know we want our Fling Flyers to fly far, stay in the air, and try to do tricks, we have a better idea of how to build them to fit these goals.

Step Three: Test Your Fling Flyer (15 minutes)

Materials

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Steps

Brownies test their Flying Flyers in a Troop Fling Flyer Competition for Step Three of the Fling Flyer Design Challenge.

Create goals for the Troop Fling Flyer Competition with Brownies.

SAY:

Engineers design and build things to meet goals or needs they see in the world.

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

For our competition, what should we test?

Girls may say: Which Fling Flyer goes farthest, which Flyer goes highest, which Flyer stays in the air longest, etc.

Today, let's test to see whose Flyer goes the farthest, whose stays in the air (or stays airborne) the longest, and who can do the most flips or tricks!

Have Brownies improve their Fling Flyers before the Troop Fling Flyer Competition. They can test fling their Flyers to see how different materials work.

SAY:

Now that we know we want our Fling Flyers to fly far, stay in the air, and try to do tricks, we have a better idea of how to build them to fit these goals.

Do you want to rebuild your Flyer? Here are some other types of paper you could try for wings. Feel free to add or take off any GoldieBlox!

Give the girls time to test and improve their designs.

Hold the Troop Fling Flyer Competition. Create a masking tape line for girls to stand on to fling their Flyers.

SAY:

Now it's time to see how your Flyers fling!

Let's start by standing on the line to see which Flyer flings the farthest!

Brownies fling their Flyers, either by taking turns or all at once.

(Note to Volunteers: If taking turns, mark how far the Flyer flings with a cone, rock, or anything else to mark the distance flown. As girls take turn, move the object to the new Flyer's distance if it is farther than the last distance marked.)

Repeat, but have Brownies test for longest time airborne, measuring seconds by counting.

Repeat once more, with Brownies having their Flyers do flips or other tricks.

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

Step Four: Analyze and Share Your Results (10 minutes)

Materials

- None

Steps

Brownies review their results and come to conclusions about what it all means for Step Four of the Fling Flyer Design Challenge.

SAY:

Okay, you've tested your Fling Flyers and we have results from the Troop Fling Flyer Competition.

Let's look at what you've learned.

Our results from the Fling Flyer Competition are called data. Engineers look at all the data from a test to figure out what works best and what needs to be improved.

It's a little bit like solving a puzzle! Now you get a chance to do that, too.

Divide girls into small groups of 3-4 to brainstorm and analyze their results.

SAY:

Let's take a few minutes to think about our results and see what you can figure out from our data.

Figuring out what our data means is called analysis.

Engineers work together to brainstorm and analyze their data and results to form bigger ideas on how to improve their designs.

Here are some questions to get you started:

- *What did the farthest flying Fling Flyers have in common?*
- *What did the longest airborne Fling Flyers have in common?*
- *What did the most acrobatic (most tricks) Fling Flyers have in common?*

Give girls 5 minutes or so to brainstorm and discuss in groups.

SAY:

Okay, what did you figure out?

Give girls time to report on what they think their results showed.

Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

SAY:

Very interesting!

Now take another look and see if you can answer these questions:

- *How did your Fling Flyer move when gravity and lift were balanced?*
- *How did it move when gravity is stronger? When lift was stronger?*
- *Did weight matter?*

Give girls time to report on what they think their results showed.

After they're done, move right to the next step (Step Five: Brainstorm Ways to Improve Your Design).

Step Five: Brainstorm Ways to Improve Your Design (10 minutes)

Materials

- Fling Flyers from Activity 3: Test Your Fling Flyer
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)

Steps

Have Brownies form a Friendship Circle.

SAY:

You did a great job of gathering data and results and analyzing them.

That's what engineers do, too! Then they used what they've learned to make their design even better.

As you tested your Fling Flyers, did you change the design to improve them? How?

If you were going to keep working on your Fling Flyer design, what would you change and why?

Let girls answer. Make sure every girl gets a chance to speak.

SAY:

Those are great ideas. Remember, no matter what you're building or what project you're working on, you can always keep making it better. That's what engineers do.

If there's extra time, Brownies can redesign their Flyers.

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Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

Closing Ceremony: Awards (10 minutes)

Materials

- Fling Flyer Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Steps

Brownies earn the Fling Flyer Design Challenge badge.

SAY:

You've now earned the Fling Flyer Design Challenge badge.

Please step forward when I say your name to accept your award.

Lead a round of applause for each Brownie as she steps forward.

SAY:

You have earned your Fling Flyer Design Challenge award, which means you have learned about the forces that affect flight as you designed, built, and tested a Fling Flyer. You also learned how to design an investigation—and fine-tune your design after testing it, just like engineers.

When you leave here, who do you want to tell about what you learned?

Girls may say: My parents, my brothers and sisters, my friends at school.

That's great! When you learn something, it's fun to pass it on to others. We can all learn from each other.

End the meeting with a Friendship Squeeze.

Now that I've earned this badge, I can give service by:

- Showing Daisies that engineering can be fun by demonstrating my Fling Flyer.
- Sharing what I learned about the forces that affect flight with my friends or family.
- Showing friends how to make a fling flyer and then having a contest to see how far they can fly.

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Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

GoldieBlox Making Things Zoom kit – Parts Breakdown

GoldieBlox	# in set	# in kit (6 sets)
Quarter Pegboard	1	6
Small Wheel Hub	6	36
Small Wheel End	8	48
Big Wheel End	2	12
Blox (18 mm)	8	48
Coupler Joint	4	24
Elbow Joint	6	36
T-Joint	4	24
Corner Joint	4	24
Cross Joint	4	24
5-way Joint	8	48
Popcorn Joint	2	12
Peg	18	108
Mini Axle	16	96
Short Axle	12	72
Long Axle	8	48
Short Flexi Axle	6	36
Long Flexi Axle	2	12
Washer	8	48

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Fling Flyer Design Challenge 2 (Version for the Making Things Zoom Kit)

Spacer	12	72
Crank	1	6
Star Stopper	10	60
Suction Cup	2	12
Tire	4	24
Noodle Belt	1	6
Spring - medium	2	12
Spring - short	2	12
Rubber band	1	6
Pom Poms	10	60
Stickers	2	12
Punch Outs	2	12
Poster	1	6

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Fling Flyer

engineering concept:
AERODYNAMICS

build date:

I built it!



x1



x1



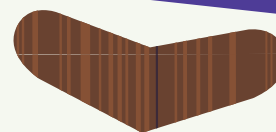
x2



x2



x1



x1



x1



Fling Flyer Design Challenge badge

Brownie Design Challenge Badges: Materials List

Leap Bot Design Challenge 1

Opening Ceremony: All About Solving Problems

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn About Springs

- Sample Leap Bot made from the GoldieBlox Making Things Zoom kit

Step Two: Build Your Leap Bot

- GoldieBlox Making Things Zoom kit (one set for each pair or small team)

For each Leap Bot, girls will need these GoldieBlox:

- 4 mini axles
- 1 long axle
- 2 angle joints
- 2 elbow joints
- 4 spacers
- 4 pegs
- 1 star coupler
- 3 wheel hubs
- 3 small wheel ends
- 2 big wheel ends
- 1 long spring

Leap Bot Design Challenge 2

As Girls Arrive: Prepare For Testing

- Leap Bots created by girls in Leap Bots Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Bots between meetings, Brownies can rebuild them during this activity.)
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team).

Opening Ceremony: Leap Bot Forces

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Create a Way to Test How Well Your Leap Bot Performs

- Leap Bots created by girls in Leap Bot Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Rulers, yardsticks, etc.
- Tape
- Paper

Brownie Design Challenge Badges: Materials List

Leap Bot Design Challenge 2 (continued)

Step Four: Record the Results of Your Test

- Leap Bots created by girls in Leap Bot Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Leap Bot Testing Stations created by girls in Step Three: Create a Way to Test How Well Your Leap Bot Performs
- **Leap Bot Recording Sheet**, one for each girl or team
- Long and Short springs from the GoldieBlox Making Things Zoom kit (3 or more from each set for each pair or small team)
- Leftover pieces from the GoldieBlox Making Things Zoom kit (for each pair or small team)

Step Five: Share Your Results

- **Leap Bot Recording Sheets**, filled out by girls in Step Four: Record the Results of Your Test

Closing Ceremony: Awards

- Leap Bot Design Challenge award, one for each girl

(Note to Volunteers: You can buy these awards from your council shop or on the Girl Scouts' website.)

Fling Flyer Design Challenge 1

As Girls Arrive: Engineering Paper Airplanes

- Paper (Construction, white, etc. A variety of papers gives girls the opportunity to try making planes with different paper weights.)
- Crayons, colored markers

Opening Ceremony: Taking Flight!

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn About the Forces that Affect Flight

- Paper Airplanes from As Girls Arrive: Engineering Paper Airplanes

Step Two: Design and Build a Fling Flyer

- GoldieBlox Making Things Zoom kit (one set for each girl, pair, or small team)
- Sample Fling Flyer
- Paper
- Pencils
- Optional: **Fling Flyer Investigation worksheets**

For each Fling Flyer, girls will need these GoldieBlox:

- 2 mini axles
- 1 long axle
- 2 star stoppers
- 1 angle joint
- 2 T-joints
- 1 craftstruction wing (Alternatively, you can prepare or have girls create their own wings using cardstock, construction, or copy paper and scissors/paper hole push.)
- 1 rubber band

Brownie Design Challenge Badges: Materials List

Fling Flyer Design Challenge 2

As Girls Arrive: Prepare for Testing

- Fling Flyers created by girls in Fling Flyer Design Challenge 1. (**Note to Volunteers:** If you were unable to save the Flyers between meetings, Brownies can rebuild them during this activity.)

Opening Ceremony: Forces that Affect Flight

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Test Your Fling Flyer

- Fling Flyers created by girls in Fling Flyer Design Challenge 1 or As Girls Arrive: Prepare for Testing
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)
- Masking tape
- Cone, rock, or anything else to mark the furthest distance flown

Step Five: Brainstorm Ways to Improve Your Design

- Fling Flyers from Step Three: Test Your Fling Flyer
- Cardstock, construction paper, or copy paper (the heavier the better)
- Scissors or hole punches
- Leftover pieces from the GoldieBlox Making Things Zoom kit (one set for each pair or small team)

Closing Ceremony: Awards

- Fling Flyer Design Challenge award, one for each girl

(**Note to Volunteers:** You can buy these awards from your council shop or on the Girl Scouts' website.)

Race Car Design Challenge 1

As Girls Arrive: Playing with Force and Friction

- Sports and game balls (one for each pair of girls). Bring different types of balls for girls to roll and observe friction. For example, you might bring a marble, tennis ball, basketball, ping pong ball, baseball, etc.
- Create two lines with masking tape on the floor. Each Brownie should sit on the line, facing their partner.

Opening Ceremony: Engineering Speed

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step One: Learn How Design Can Affect Speed

- Toy car to demonstrate force and friction

Brownie Design Challenge Badges: Materials List

Race Car Design Challenge 1 (continued)

Step Two: Design and Build Your Race Car

- GoldieBlox Making Things Zoom kit (one set for each pair or small team.) Feel free to add additional pieces from personal GoldieBlox kits that you or your Girl Scouts may own.

Closing Ceremony: Share Your Design

- Race Cars built by Brownies in Step Two: Design and Build Your Race Car

Race Car Design Challenge 2

As Girls Arrive: Build A Simple Ramp

- Race cars created by girls in Race Car Design Challenge 1. (**Note to Volunteers:** If you were unable to save the race cars between meetings, Brownies can rebuild their cars during this activity.)
- Folders, poster boards, cardboard, etc., to lean against something to create a ramp
- Books, boxes, tables, etc. to create the height and top of a ramp

Opening Ceremony: Reviewing Force and Friction

- Flag
- Optional: Poster Board with the Girl Scout Promise and Law

Step Three: Design Your Racetrack

- Poster boards, cardboard, etc., to lean against something to create ramps
- Table(s) or books to create the top of ramps
- Paper or newspaper
- Masking tape

Step Four: Conduct a Fair Test and Record Results

- Yardstick
- Ramp created by girls in Step Three: Design Your Racetrack
- Race cars created by girls in Race Car Design Challenge 1 or rebuilt in As Girls Arrive: Build a Simple Ramp
- Optional: Phone or camera to capture “photo finishes”

Step Five: Share What You Learned

- Race cars redesigned by girls in Step Four: Conduct a Fair Test and Record Results

Closing Ceremony: Awards

- Race Car Design Challenge award, one for each girl

(**Note to Volunteers:** You can buy these awards from your council shop or on the Girl Scouts’ website.)