ACTIVITY 3: Slip or Stick?

It's all about friction!

Friction is a force that occurs when two objects rub together, slowing or stopping motion.

TARGET AGE GROUP

Preschool-K

TIME

60-90 minutes

PREPARATION

Review the RTL Activities introduction for tips and suggestions before implementation.

WATCH

"Fact and Friction" (6:11-09:01)

The Cat in the Hat Knows A Lot About That!

Pause the video and reflect on Nick, Sally and Cat in the Hat. Here are some places you might pause: After Nick says, "We must be missing something?" **(~07:00)**, ask the kids:

- *Why do you think Nick and Cat in the Hat did not slide down as fast as Sally?*

After Thing Two slides down the slidey-slide and Cat in the Hat says, "Let's take a closer look," **(~08:31)**, ask the kids:

- *What is different about the surface of Thing Two's slide compared to Thing One's slide?*

Let's investigate how different surface materials affect how far an object moves.

EXPLORE

Kids will test different types of surfaces using a variety of materials that slide or roll.

Materials:

- ☐ Three or more cardboard pieces each measuring approximately two feet by four feet. Cover cardboard in various materials, such as:.
    - Sandpaper
    - Bubble wrap
    - Aluminum foil
    - Paper bags
    - Plastic bags
    - Grippy rubber
    - Playdough
    - Fabric
- ☐ Objects that will slide and/or roll, such as:
    - Crayons
    - Interlocking plastic bricks (ie. LEGOS ®)
    - Balls
    - Wooden blocks
    - Toy cars
    - Small foil/plastic containers
    - Washed recyclable soup cans with duct tape over the sharp edge
    - Tube-shaped chip container
    - Lids

EXPLORE

Materials (CONTINUED):

- ☐ Magnifying glasses
- ☐ Books, boxes, blocks or other sturdy materials to construct ramps

Instructions:

Explore the Materials:

- ☐ Using cardboard pieces and sturdy materials, construct at least three ramps each covered in different materials.
- ☐ Have kids feel and describe each surface. Ask:
  - *What words would you use to describe each surface?*
  - *Which surface would you describe as bumpy, rough, fluffy, smooth, slippery, etc.?*

Record kids' observations.

Friction Predictions:

Let kids know they are going to explore friction. Remind them that friction is a force that slows the motion of an object. Ask:

- *In the video, why did Thing Two slow down and stop when he tried to slide down the slide? What happened to his slidiness?*

Encourage children to predict which surface will cause the most friction.
Record predictions.

Investigate Friction:

Ask the kids to investigate which surface causes the most friction ask:

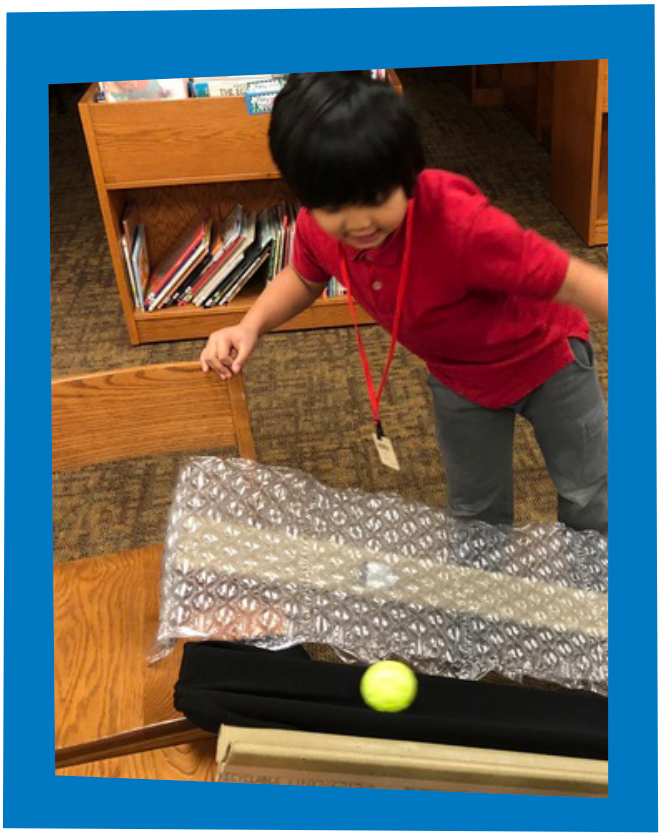
- *What do you observe as the objects roll/slide down the ramp?*
- *Which objects roll/slide fast? Why do you think it rolls/slides fast?*
- *Which objects roll/slide slow? Why do you think it rolls/slides slow?*
- *Do any of the surfaces cause the objects to stay put?*

After investigating the surfaces, ask kids:

- *Did anything surprise you?*
- *Did the object move down the ramp how you thought it would?*
- *Why do you think it did or didn't?*
- *What surface caused the most friction?*

More ways to play:

- ☐ Make predictions and measure how far objects roll or slide on each surface using standard or non-standard forms of measurement.
- ☐ Explore the impact that height makes on the distance that objects slide or roll by having kids raise or lower the ramps.
- ☐ Investigate which objects roll and which objects slide on each surface.
- ☐ During outdoor time, investigate and test a variety of materials the way Oscar does in the book that you read together—using sticks, leaves and grass.



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READ

Read *Oscar and the Cricket: A book about moving and rolling* by Geoff Waring. Use the following discussion prompts:

BEFORE READING:

☐ Have children look at the cover of the book and predict what they think will happen. Share that Oscar is a cat that finds a ball.

- *What do you think Oscar will do with the ball?*
- *What would you do if you found a ball?*

DURING THE READING:

☐ Have children predict what will happen to the ball throughout the book. Suggested questions include:

- *What causes the ball to move the way it does?*
- *What do you predict will happen when the ball rolls through the mud?*

AFTER THE READING:

- *What finally causes Oscar's ball to stop?*

OTHER BOOK SUGGESTIONS:

Move it!: Motion, Forces and You by Adrienne Mason
Newton and Me by Lynne Mayer
Ramps and Wedges by Ian Smith
Roll, Slope and Slide: A Book about Ramps by Michael Dahl

PLAY

Slidea-ma-zoo

This game can be accessed online within the *PBS KIDS Games* app and the *Cat in the Hat Builds That!* app, which can both be downloaded for free on your smartphone or tablet's app store.

Sally and Nick are in Frictionarium and are testing out some of the newest slides! Players can adjust the slide height and texture to achieve the intended goal. They can also observe the slide texture by using the Micro-ma-boodle (a Seussian magnifying glass).

As kids are playing the game, have them share their predictions about how the height and/or texture of the slide will affect the intended goal.

SHARE

Send the parent letter home with kids to encourage at-home conversations with families about this activity.

Hello Families:

Today your child investigated friction with a "Slip or Stick" activity. Through an exploration with Cat in the Hat from the PBS KIDS program *The Cat in the Hat Knows a Lot About That!*, we discovered that bumpy or rough surfaces cause more friction than smooth or slippery surfaces.

To find out more about what your kid learned, you can ask:

- *What words would you use to describe the surface on the ramps you played with today?*
- *Which surfaces were bumpy, rough, fluffy, smooth, slippery, etc.?*
- *Did any of the surfaces cause objects to stay put? If so, which objects?*

We also had the opportunity to read together *Oscar and the Cricket: A Book About Moving and Rolling* by Geoff Waring. Have your child retell the story to you.

Here are some related books to look for at the library:

Move it!: Motion, Forces and You by Adrienne Mason

Newton and Me by Lynne Mayer

Ramps and Wedges by Ian Smith

Roll, Slope and Slide: A Book about Ramps by Michael Dahl

Tune into your local PBS station and visit pbskids.org online for more opportunities to learn, watch and play together with your family. Watching videos and playing games with your kids encourages social interactions, bonding and learning.

You can also access PBS KIDS content free in PBS KIDS Video app and the PBS KIDS Games app.

Resources to Support Friction Activities

Get kids thinking and investigating like scientists using this collection of friction resources from Ready to Learn and PBS KIDS. Providing young kids the opportunity to participate in simple, PBS KIDS-inspired investigations is a great way to support developing science inquiry skills and practices. They can ask questions, make predictions, collect data, draw conclusions and experience science inquiry first-hand.

These resources can be used and adapted to meet the particular needs of your learning environment and participating kids. Whether you are a program director, classroom teacher, after-school and summer provider, PBS station staff or any other adult working with young kids, these resources are for you!

Resources are grouped by activities, videos and games (online and mobile), and include a list of books related to the topic of friction. Resources can be used as-is, adapted, grouped to make a complete lesson, integrated into preexisting lessons, or used as a jumping off point for your own lesson ideas.

For more resources, visit: pbslearningmedia.org/collection/rtl-educator

Videos

The Cat in the Hat Knows a Lot About That!
"Fact and Friction"
Grade Level: PreK-K

Sally loses her 'slidiness' and when they visit Frictionarium, they find out about a force called friction that can stop a person from sliding.

The Ruff Ruffman Show
Pulling for the Plushie!
Grade Level: K-2

Explore sports science as Ruff Ruffman races over different surfaces to rescue his plushie. Ruff's plushie is buried in a prize load of kibble! To get it back, Ruff will have to get Steve, a very unfriendly llama, to pull him and 200 pounds of kibble over one of three surfaces: sand, grass or pavement.

Sid the Science Kid
Backseat Driving with Grandma – Friction
Grade Level Pre-K-1

In this episode of Sid the Science Kid, Sid learns all about friction and how elements such as texture and material play into the resistance created between materials.

Activities

The Ruff Ruffman Show!
Friction Racing | Science Crafts for Kids
Grade Level: K-2
Ruff Ruffman loves to explore the world through science and engineering. You and your kids can explore the concept of friction by conducting an investigation using a toy car and ramp. See what you need to get racing!

The Ruff Ruffman Show
Bottle Cap Hockey
Grade Level: K-2
Kids explore forces, motion and friction through sports science in the Bottle Cap Hockey activity from the Ruff Ruffman Show. Kids try to see how many points they can score with bottle caps as they observe, investigate, predict, reflect and record their results.

The Ruff Ruffman Show
Ups and Down
Grade Level: K-2
This activity is a collaborative activity for two or more players to build a ramp that will roll a ball to a specific target. The kids will build their ramp using their science inquiry and engineering design skills.

The Cat in the Hat Knows a Lot About That!
Slidea-ma-zoo
Grade Level: PreK-2
Have fun exploring the impact of friction and inclines as you experiment with slides while racing Thing One and Thing Two.

The Ruff Ruffman Show
Fish Force
Grade Level: K-2
Help rescue Ruff's toy from the penguins' ice rink! Use science inquiry to predict and investigate force and motion in this sports science game.

Games

The Cat in the Hat Knows a Lot About That!
Slidea-ma-zoo
Grade Level: PreK-2
Have fun exploring the impact of friction and inclines as you experiment with slides while racing Thing One and Thing Two.

Ruff Ruffman Show
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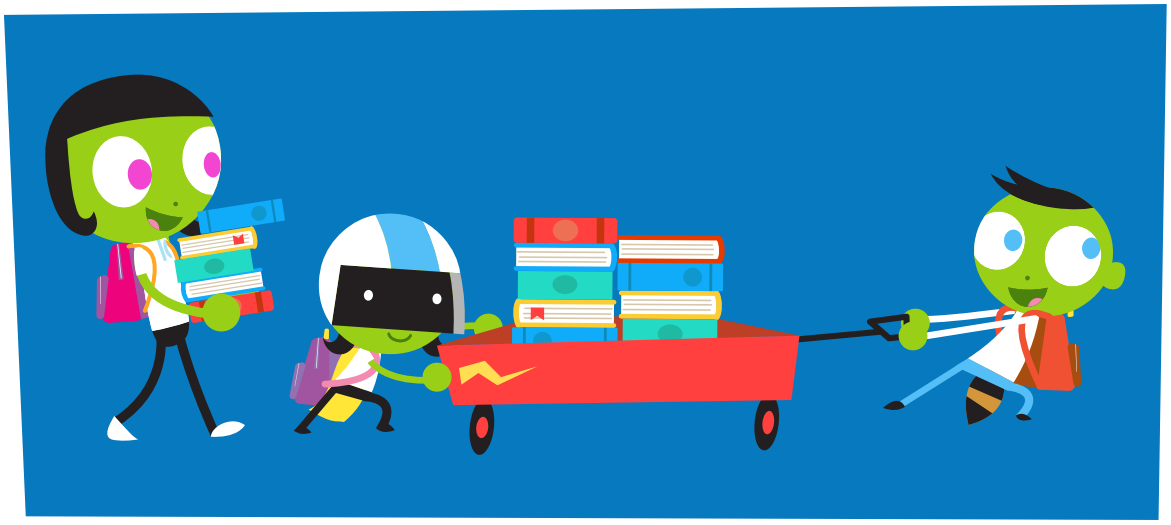
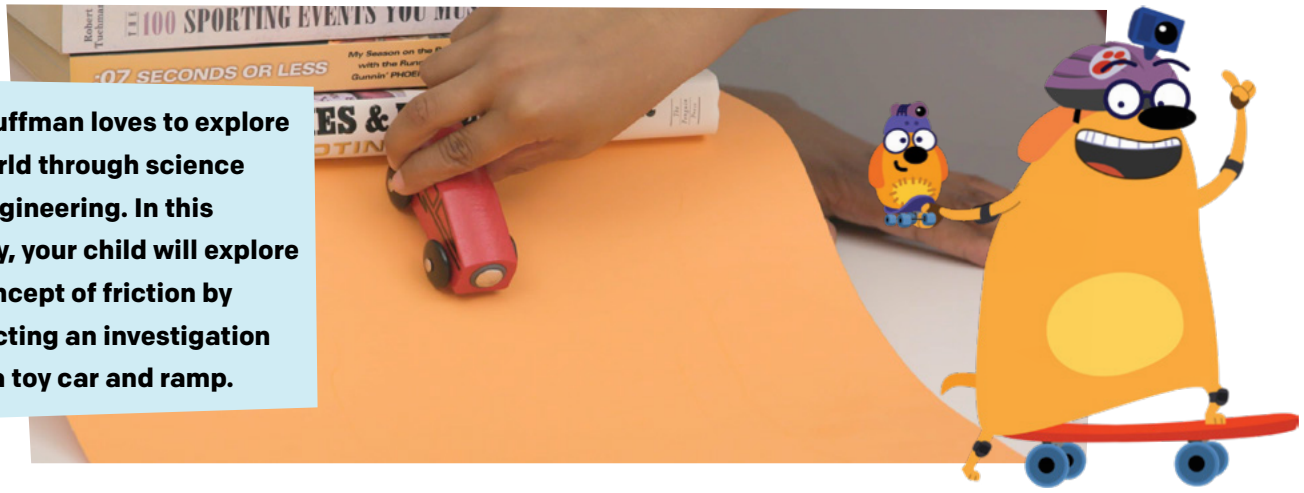
Grade Level: K-2
Help rescue Ruff's toy from the penguins' ice rink! Use science inquiry to predict and investigate force and motion in this sports science game.

Books

Oscar and the Cricket: A book about moving and rolling by Geoff Waring
Roll, Slope and Slide: A Book about Ramps by Michael Dahl
Newton and Me by Lynne Mayer
Move it!: Motion, Forces and You by Adrienne Mason
Ramps and Wedges by Ian Smith



Friction Racing



Ruff Ruffman loves to explore the world through science and engineering. In this activity, your child will explore the concept of friction by conducting an investigation using a toy car and ramp.

How to Experiment with Friction

Friction is a natural, unseen force that slows things down. However, not all surfaces will slow objects at the same rate. If you roll a ball across gravel or a rough sidewalk, it will slow down sooner than if you roll it across a smooth floor or ice. In this activity, your child will build a ramp and then use a toy car to test which of two surfaces has the least amount of resistance or friction.

The Science Behind the Fun

Physical Science:

Your child is learning about motion and forces and how different conditions such as surface material and friction can affect an object's movement

Scientific Inquiry:

Your child is using measurement tools to gather data and then using a chart to record and compare that data to determine the results of an experiment.

Vocabulary:

Friction pronounced [**frik**-shən]
The resistance that one surface or object encounters when moving over another

While You Play

Scientists conduct investigations and experiments to determine if a hypothesis or prediction is correct. In this experiment, your child will test whether a smoother surface has less friction than a rough surface.

As you complete this activity, ask your child to talk about each surface and predict how far the car will travel.

1. Make a prediction at the beginning of the project: Do you think a toy car will travel farther on a rough or smooth surface?
2. Feel each surface that you are testing. Is each surface rough or smooth?
3. Make a prediction for each surface prior to testing it.
4. Talk about the results. On which surface did the car travel farther? Why?

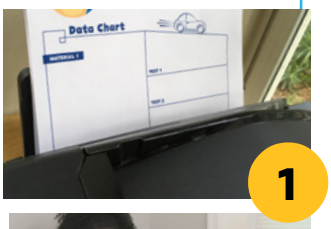
Friction Racing

What you'll need

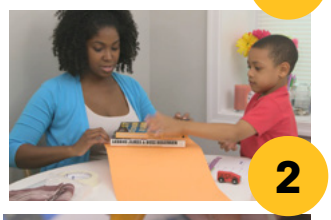
- Books
- Large piece of cardboard or poster board
- A material to cover the surface of the cardboard (Examples: dish towel, t-shirt, denim jeans, sandpaper, bubble wrap)
- A toy car or any kind of toy or object with wheels that can roll across a flat surface
- Ruler or nonstandard measuring device such a block or shoe
- Printable chart
- Pencil
- Masking tape

Directions

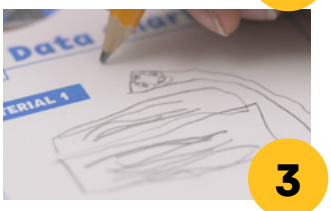
Step 1
Print out the Friction Racing Data Chart.



Step 2
Stack several books on top of each other. Place one end of a smooth piece of cardboard or poster board across the top of the book pile. Then stack more books on top of that so that the cardboard is held securely in place. Make a crease in the cardboard at the edge of the books so that the cardboard now forms an inclined plane that reaches to the floor.



Step 3
Draw a picture of your ramp in the materials column on your data chart.

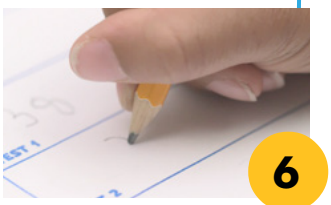


Step 4
Starting at the top of your ramp, release your toy car so that it travels down the ramp and potentially continues across the floor.

Step 5
Use the ruler or a nonstandard measuring device to measure how far the car traveled from the top of the ramp to where it stopped. Record your measurement in the second column of your data sheet.

Directions continued

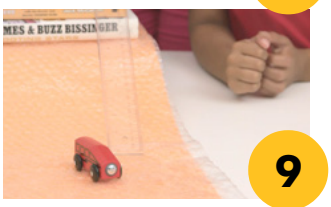
Step 6
Repeat the experiment twice more on the cardboard, releasing your car at the same point as the first time. Record your results on your chart.



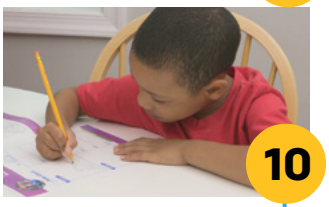
Step 7
Use the masking tape to attach another type of surface, such as the dish towel, to the surface of the cardboard. Be sure to cover any areas where the car will travel. Draw a picture of the ramp as it looks now in the second part of the materials column on your data chart.

Step 8
Perform the experiment three times on this new surface and record your results. You should now have raced the car down the ramp six times (three times on the plain cardboard and three times on your added material).

Step 9
Compare your results. Did the car always go farther on one surface? Did it go a lot farther or only a little? Did the car go about the same distance on both surfaces?



Step 10
Draw a conclusion. Since a car will likely go farther on a surface with less friction, based on your findings, which surface that you tested do you think has the least amount of friction?



More ways to play
Ruff Ruffman

- A Plushie for Grandma
  Visit: pbskids.org/video/ruff-ruffman-show/3004252839
- Pulling for the Plushie!
  Visit: pbskids.org/video/ruff-ruffman-show/3004268660
- Music Video: I Won't Give Up: Ruff Ruffman Action Plushie!
  Visit: pbskids.org/video/ruff-ruffman-show/3004270779

Bottle Cap Hockey

Time:
45-60 minutes

Explore:
forces and motion, friction, inquiry process (predict, investigate, reflect)

Materials:

- ☐ Gather up as many **bottle caps** as you can around the house (metal caps, plastic caps, jar lids). Try to find bottle caps that are about the same weight and size. If you don't have enough, you could try using pennies or other coins.
- ☐ A piece of cardboard
- ☐ A piece of fabric, like a sheet or blanket
- ☐ Strong tape, like duct tape
- ☐ A target (make an X with tape, or design your own to tape down)
- ☐ Use a long table as the play space, or you can use the floor

Kid Description: Grab a grown-up and some friends for Ruff's take on table hockey! How many points can you score?

This game is for two to six players, and should be played at a wide table or on the floor. You should have one grown-up for every two to three children who are participating. If you have kids with motor issues or who otherwise cannot participate, ask them to be a coach or score keeper.

The Ruff Ruffman Show

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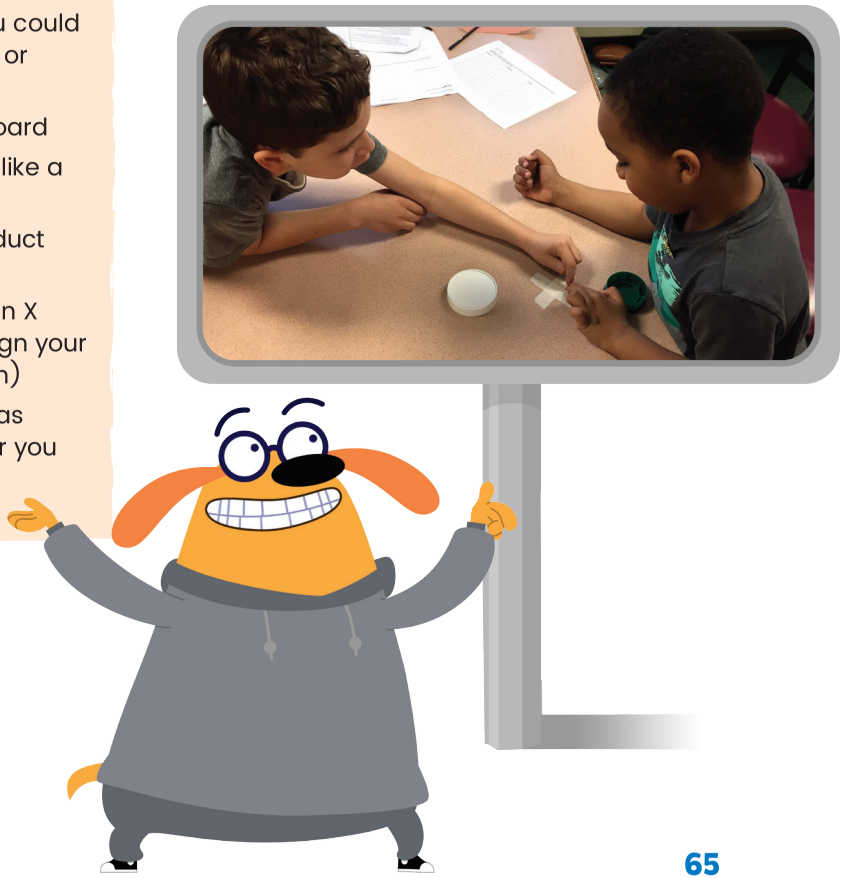

Ask

★ Sit in a circle and pass around one of the bottle caps. Ask kids to use their senses to investigate it.

- **Ask:** How does the bottle cap feel? Is it smooth or rough?
- **Ask:** How much does the bottle cap weigh? Is it light or heavy?

★ Then, pass around the fabric and cardboard, or ask the kids to walk to the different surfaces.

- **Ask:** How do each of these feel? Are they smooth or rough?
- **Ask:** Do you think it would be easy or hard to slide a bottle cap across these?

★ Explain the rules of the game:

- **Explain:** All players stand at one end of a table, and a target is at the other end. The players take turns sliding their bottle caps toward the target. Everyone will try once, and then get a second try. Players can strategically knock an opponent's

cap farther away from the target. The player whose bottle cap is closest to the target gets one point. Play twice at each surface for round one.

- For round two, the table will be covered with fabric.
- For round three, the table will be covered with cardboard.
- At the end of three rounds, the player with the most points wins.

Predict

★ Ask the kids which materials will allow the caps to move most easily: the tabletop or floor, the fabric, or the cardboard?

- **Ask:** Do you think it will be easiest to slide a bottle cap across the table, the fabric, or the cardboard?

★ On the printout, have the kids draw their predictions.

- **Ask:** Based on your investigation of the materials, do you predict it will be easy or hard for the bottle caps to slide on the three different surfaces? Draw your predictions on the chart.

Investigate

★ Line the players up at one end of a table, and place the target at the other end. With many players it might be easier to have them sit nearby, and only come to the end of the table when it's their turn.

★ Put all the caps in a bag or hat and ask the players to take turns reaching into the bag to pick out their caps for the round.

★ Play the first round on an uncovered table. Each player goes twice.

★ After round one, cover the table with fabric (using some tape), and play again. Each player goes twice.

★ After round two, cover the table with cardboard (using some tape), and play again. Each player goes twice.

★ At the end of the three rounds, the player who has the most points wins!

Reflect

★ After the game is over, clean off the table and sit together.

★ Ask kids to look at their predictions on the printout.

- **Ask:** Let's reflect on the game we just played. Which surface was easiest or hardest to slide on? Table, cloth, or cardboard? Why do you think so?
- **Ask:** What other materials could you use in this game?

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Chart

Bottle Cap Hockey

Draw how far you predict your bottle cap will go on each surface.

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Table (or floor)	Cardboard	Fabric
Target	Target	Target
You	You	You

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Time:
60 minutes

Explore:
forces and motion, engineering design process (define a problem, imagine and plan, create, test, and improve)

Materials:
In addition to a ball (ping-pong, tennis, golf, or bouncy ball), you'll need a bunch of household items that have different structural elements: wide bases, thin bases, tubes, surfaces, fasteners, heavy things, and light things. If this is a competition, you'll want to have one set of the same materials for each team.

Here are some suggested materials, but feel free to use your own!

- ☐ **Large Objects:** cardboard tubes, cereal boxes, plastic bottles, paper plates, card stock, paper/plastic cups
- ☐ **Fasteners:** pipe cleaners, rubber bands, paper clips, tape
- ☐ **Long Objects:** straws, popsicle sticks/tongue depressors, toothpicks
- ☐ **Wildcard Ideas:** tinfoil, plastic wrap, sandwich bags

Ups and Downs

Kid Description: Grab a grown-up and some friends for this building activity. Can you make a ramp that will roll a ball right to the target?

This activity is for two or more players to collaborate (or compete!) to build a ramp. It can be played indoors or outdoors.

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Wonder

★ Sit in a circle and pass around the materials. Ask kids to use their senses to explore them.

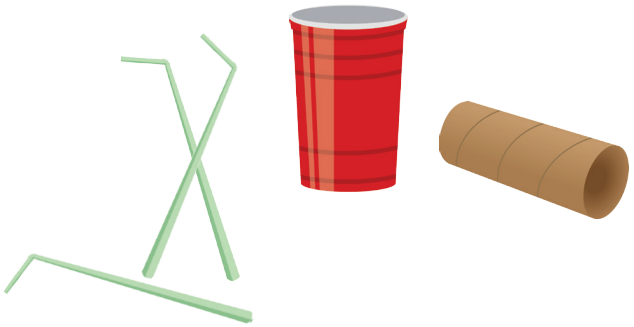
- **Ask:** What is this material?
- **Ask:** How does each material look?
- **Ask:** How does each material feel?
- **Ask:** How does each material sound?

Define a Problem

★ Explain the rules for the activity

- **Explain:** Each team will work together to build a ramp that will send the ball as close as possible to the target. You'll get 15 minutes to build, test, and improve, and then it's time to share your ramps!

  Note: If you'd like to create your own ramp challenge, or if kids want to define their own goals, go for it! You could try changing the time, distance, or other rules of the game.



Imagine and Plan

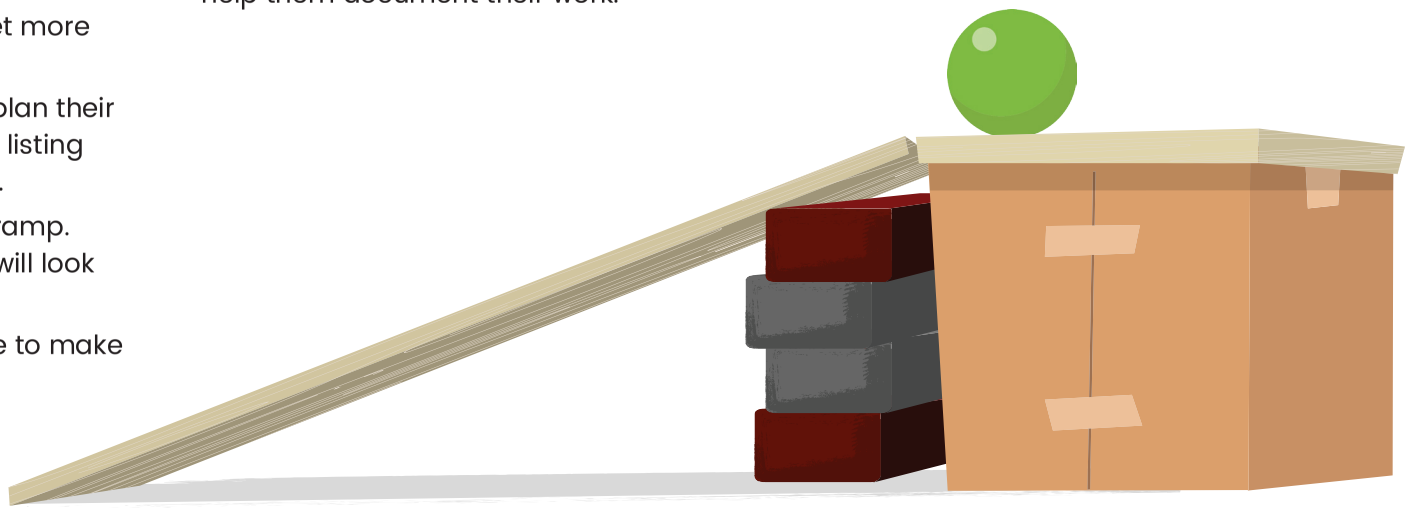
- Set out the target six feet from the starting line where the kids will build their ramps.
- Ask kids to choose the materials they think will be best for building their ramps.
  - **Show:** Here's the target; it's six feet away from where your ramps will be.
  - **Ask:** Based on your investigations, which materials do you predict would make the best ramp for the ball to reach this target? Pick out the materials you want to build with. You can always get more materials later!
- Have the kids use the printout to plan their ramp design, sketching it out and listing the materials they're going to use.
  - **Ask:** Let's make a plan for your ramp. Can you draw what your ramp will look like on the printout?
  - **Ask:** What materials will you use to make your ramp? List them out here.

Create

- Set up the kids with their building materials at the starting line.
- Set the timer for 15 minutes and tell the kids to start building!
- If kids get stuck, try giving them a hint about how to build. For example:
  - **Hint:** You'll need to make sure your ramp is tall enough so the ball can get speed from gravity!
  - **Hint:** You'll need a way to guide the ball in the right direction!
  - **Hint:** Try rolling the ball while you're building to see what happens. That's called a "test". Don't wait until the end to start testing your ramps.
  - **Hint:** Use your tests to improve your design. You can always redesign your ramp if it isn't working!
- While kids build, try taking a few pictures to help them document their work.

Test

- When time is up, ask players to roll the ball down their ramp towards the target.
- If you can, try taking a video to document the test.
  - **Ask:** It's time to test out what you've built! Roll your ball down the ramp, and see how close it lands to the target.
  - **Ask:** Whose ball is closest to the target? That's a well-designed ramp!



Reflect

★ Have everyone sit in a circle near the starting line.

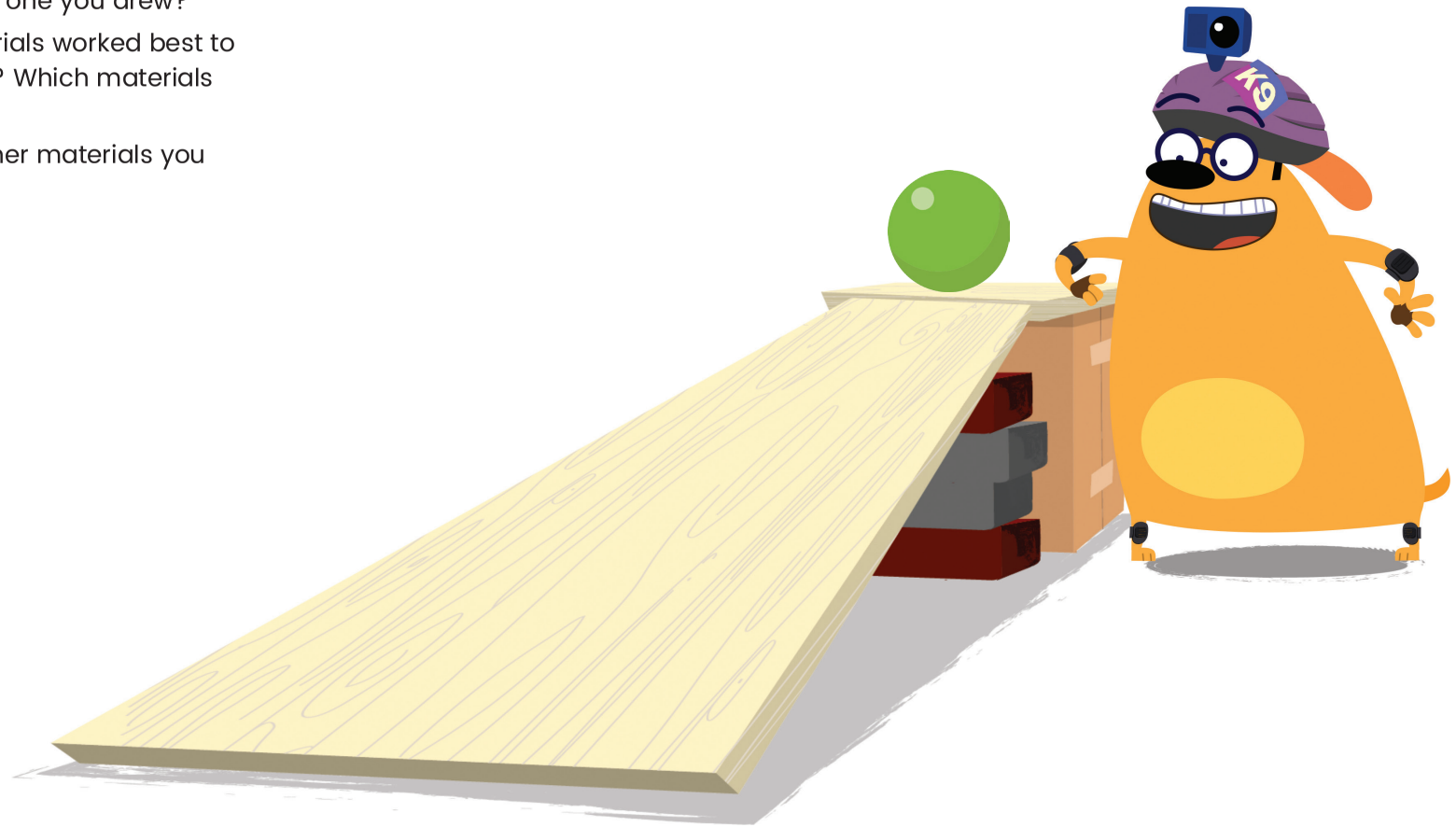
★ Ask kids to look at their drawing of their ramp, and compare it to the ramp they built.

- **Ask:** How was the ramp you built different from the one you drew?
- **Ask:** Which materials worked best to make your ramp? Which materials didn't work?
- **Ask:** Are there other materials you would like to try?

Improve

★ Ask kids to improve their ramp designs based on the results of their test.

- **Ask:** How would you improve, or make your ramp better, so the ball can go farther? Spend a few minutes changing your design, then run the test again and see if you get a different result!



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Activity

Ups and Downs

Draw your ramp in the space provided, and list which materials you're going to use. What do you predict will happen when you test your ramp?

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Materials:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

Prediction:

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