



with Ruff
Ruffman™



FACILITATOR GUIDE

A multi-generation engagement program designed to activate creative and collaborative learning using PBS KIDS media and resources



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THIS GUIDE BELONGS TO:



Welcome!



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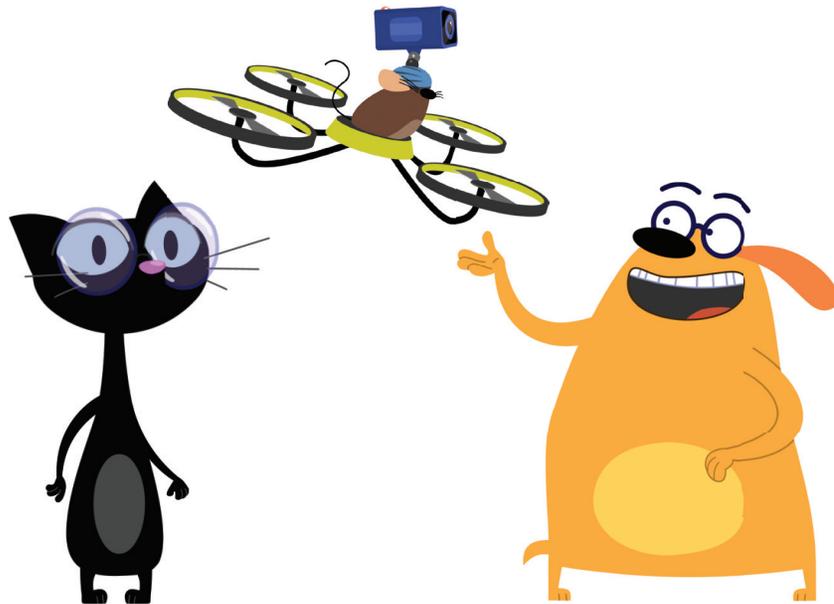


About Family and Community Learning

PBS KIDS Family and Community Learning is a series of workshops that engage families in hands-on collaborative and playful learning. Designed for families with children ages 5-8 (and younger/older siblings), the series uses both digital and tangible tools to support the development of science inquiry and engineering design practices as families observe, question, predict, investigate, build, share, and reflect with one another. The series aims to support and foster positive attitudes and perceptions about what science is and the ability for families to engage in and support one another's learning.

About *The Ruff Ruffman Show*

The Ruff Ruffman Show is a series designed to help kids ages four to eight learn about core science concepts and practices through videos, game-play, and hands-on activities. The series stars canine host extraordinaire Ruff Ruffman, who, along with his assistants, Blossom and Chet, answers questions from real kids, takes on challenges, and learns the value of failure—all while modeling science inquiry skills.



Take the time to explore all the media content before your sessions begin! Not only does this help familiarize you with the content, it also gets you comfortable with accessing the different media and game mechanics.

Science Inquiry and Engineering Design

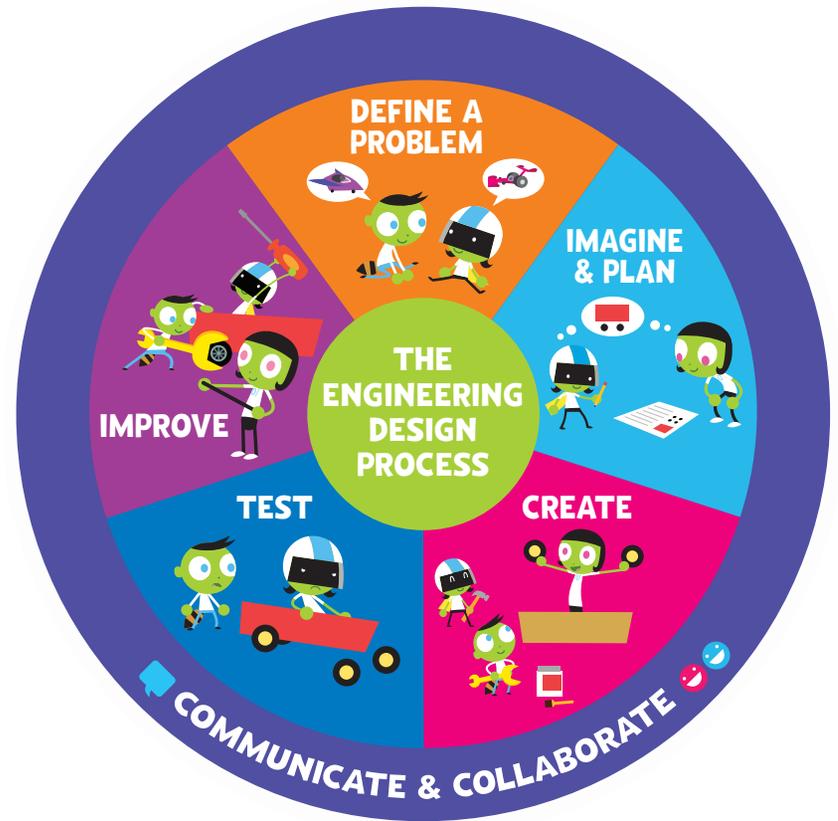
Instead of focusing on the what of science and engineering, science inquiry and engineering design are focused on the how. How do scientists do science? How do engineers approach engineering challenges? What practices and processes do they use to learn about and design for the natural world?

- They make observations using all five senses
- They ask LOTS of questions and/or identify challenges and problems
- They come up with plans for how to answer those questions and/or solve those problems
- They make predictions
- They investigate and collect data and information to help answer their questions
- They create and test solutions to problems
- They iterate on those solutions based on the results of their tests
- They draw conclusions about the questions they're trying to answer and share that information with others

These sessions are designed to support families engaging in the processes of science inquiry and engineering design.

Both processes are depicted in the graphics below. The individual components of both will be explored further within the contexts of the sessions.

It is also important to note the relationship between inquiry in science and inquiry in other subject areas. Children use similar thinking and reasoning skills when engaged in other academic areas, including math and literacy. Developing the habits and ability to engage with these processes will support learning across subjects.



Access to the Digital Games

Throughout this guide and experience, we include suggestions for incorporating some of the Ruff Ruffman digital games that have been designed to support and extend learning and play. These games can be accessed and played on computers, tablets, and phones with a Wi-Fi connection by visiting the Ruff Ruffman website (pbskids.org/ruff).

Alternatively, the games can also be accessed on tablets and phones through the PBS KIDS Games app. This option can be especially useful in situations where Wi-Fi is spotty or absent. By tapping on the image of the game in the games menu, the game will automatically be downloaded and stored on the device so that Wi-Fi isn't needed to play the game after the download is complete. Take the time before each session to make sure devices are set up and ready to go.



Curiosity Journals

The Curiosity Journals are interactive workbooks that families can keep by their side throughout their workshops. The journals are color coded, so as you go through the sessions and see calls for the families to use their journals, you can easily point them to the section they will use:

Pink = Mixtures

Blue = Materials

Purple = Friction

Green = Structures

While the journals have specific prompts that map to the sessions, there are also higher-level prompts to encourage the families to think more broadly about science and connect ideas from the workshops with their interests and everyday activities.

Encourage your families to use the pages at the end of the journals to jot down questions and curiosities that arise throughout their time at the camp.

When the families take their Curiosity Journals home on the last day, encourage them to keep using their journals to document and reflect on ideas they want to continue to explore once the FCL workshops are over.



Preparing for the Sessions

These workshops take time to prepare for, and require planning with regards to material allocation and set-up. Take the time to read through all four sessions well in advance of implementing the series so that you have a clear understanding of all of the moving pieces.

Be sure to order or shop for supplies well in advance of your workshops. Due to the amount of supplies, you will want to organize each session's supplies in advance.

Coordinate with your partners on storage of materials to make day of setup as easy as possible.

Materials for Entry Table

- Name badge materials:
 - Lanyards
 - Plastic name tag holders (3"x4")
 - Copies of the name badge template
- Warm-up game sheets to pass the time while waiting for families to gather
- Media release form



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Prepping for Each Session

The guides below lay out the specific materials needed for each session, but you will want to have the following prepared for every session:

- A meal to share
- Name badges
- Curiosity Journals
- Table conversation prompts
- Family game sheets (for families to play as they wait for the workshop to begin)
- Pencils, pens, markers, scissors, glue, scotch tape, duct tape
- Projector and computer to share media resources with the whole group
- Slides for each session to visually support key ideas
- Tablets or laptops (if available) with access to the Ruff Ruffman website (pbskids.org/ruff)
- Coloring sheets (for younger children who need an activity)
- Take home materials including books provided for each session



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Supply List

In addition to the above list which you will use throughout parts of every session, you will need the following for each individual session:

MIXTURES SESSION SUPPLIES

- "Ruff Mixes It Up" video pbskids.org/ruff/kitchen/videos
- Ruff's Cookie Creator digital game pbskids.org/ruff/kitchen/game
- Several premade play doughs (needs to be made just before or during the session as it dries out quickly)
- [1 set per family] Play dough supplies:
 - corn starch
 - food coloring (optional)
 - conditioner
 - glitter (optional)
- [Minimum 1 per family] Mixing bowl
- [Minimum 1 per family] Mixing spoon
- [Minimum 1 per family] Measuring cup
- Rubber gloves (latex free, in case of allergies)
- Newspaper or parchment paper for workspaces
- Trail mix ingredients such as: pretzels, cheese crackers, cereal, chocolate chips, dried fruit
- [Several per family] Quart-sized plastic baggies (for holding dough and trail mix)
- [1 per family] *Mix It Up!* books

MATERIALS SESSION SUPPLIES

- "A Dry Pet is a Happy Pet" video pbskids.org/ruff/materials/videos
- Photo Stuff with Ruff app pbskids.org/apps/photo-stuff-with-ruff.html
- Dress That Rhino digital game pbskids.org/ruff/materials/game (optional)
- Grab it and Run offline game pbskids.org/ruff/materials/activities (optional)
- A variety of materials such as:
 - duct tape
 - cardboard
 - pillowcase
 - binder clips
 - fan
 - feathers
 - foil
 - felt
 - fur
 - glue
 - plastic bags
 - shower curtain
 - sponges
 - spray water bottle
 - flashlight
 - light breathable fabric
 - foam darts
 - ping pong balls
- [1 per family] *Home* books

FRICITION SESSION SUPPLIES

- "Pulling for the Plushie" video pbskids.org/ruff/sports/videos
- Fish Force* game pbskids.org/ruff/sports/game
- [1 per family] Toy car - try to find ones heavy enough (such as Matchbox cars) that they go straight.
- [1 per family] Two-by- four-foot hardwood, plywood board, or thick cardboard
- A variety of materials such as:
 - sandpaper
 - plastic bag
 - play dough
 - bubble wrap
 - grippy rubber (such as pieces of an exercise mat or shelf liner)
 - Any others you have on hand that offer a variety of textures
 - tinfoil
 - paper bag
- [1 per family] Tape (strong enough to tape materials to the board)
- [1 per family] Binder clips (optional)
- [Per family] Books or other props (about six inches high) to lift board up to make a ramp
- [1 per family] Painters tape or washi tape (for marking distance lines)
- [1 per family] Rulers
- [1 set per family] Small stickers (for marking distance)
- [1 per family] *Ada Twist, Scientist* books

STRUCTURES SESSION SUPPLIES

- "Eye of the Hamster" video pbskids.org/ruff/structures/videos
- Hamster Run* game pbskids.org/ruff/structures/game
- A variety of materials such as:
 - cardboard pieces of various sizes
 - construction paper
 - cardboard tubes of various sizes (poster tube, paper towel tube, toilet paper tube)
 - wooden blocks
 - rope
 - plastic cups
- [1 per family] Duct tape
- [1 per family] Glue
- [1 per family] Ruff Ruffman Action Plushie
- [1 per family] *What Floats in a Moat* books
- All take home materials, including Curiosity Journals, vocabulary cards, and plushies, to send home with the families

Our Schedule

Here are our key dates for PBS KIDS Family & Community Learning:

EVENT	DATE
Recruitment Begins	
Facilitator Training	
Pre-Session 1 Reminder	
Session 1	
Pre-Session 2 Reminder	
Session 2	
Pre-Session 3 Reminder	
Session 3	
Pre-Session 4 Reminder	
Session 4	
Follow-up	

The Sessions

A RUNDOWN OF EACH SESSION



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Session 1

Mix It Up!

Playing With Mixtures

Eat Family and facilitator introductions

Explore Ruff Ruffman video, games, and discussion

Make Creating mixtures

Share Sharing, comparing, and discussing mixtures

Mixtures: Session Overview

Eat (25 minutes)

- Welcome families, and have them create name badges and design covers of Curiosity Journals.
- After everyone has arrived, begin meal. Encourage conversation between families using table conversation prompts. While families eat, move through:
 - Introductions
 - Preview the FCL structure and what families can expect each meeting: **Eat, Explore, Make, Share**
 - Introduce *The Ruff Ruffman Show*
 - Preview the day's session

Explore (40 minutes)

- Decide whether to keep families together, or divide into grown-up and kid groups.
- (10 minutes) Lead discussions
 - Grown-ups:
 - Preview FCL model
 - Introduce science inquiry
 - Discuss how and why we introduce this process to young children



- Discuss **mixtures**, including what a **mixture** is, and examples of **mixtures**
If there is time, discuss ways to support science learning in the kitchen or grocery store:
 - How can you engage your five senses (sight, touch, smell, taste, feel) when you're in the kitchen and/or grocery store?
 - How is using your senses helpful for young learners?
 - What kinds of math might be involved in cooking? How about reading or writing?
- Children (*use this pathway if keeping families together*):
 - Co-create community and collaboration guidelines
 - Discuss **mixtures**, starting with an exploration about what they already know about **mixtures**, and then a discussion about what a **mixture** is, and examples of **mixtures**
 - If there is time, read *Mix It Up*
- Bring grown-ups and children back together
- (3 minutes) Share community and collaboration guidelines
- (7 minutes) Watch video "*Ruff Mixes It Up*" (pbskids.org/ruff/kitchen/videos); consider pausing on occasion to reflect on vocabulary or big ideas explored in the video
- (10 minutes) Lead discussion on the video with questions like:
 - What is a **mixture**?
 - What happened when Ruff mixed his ingredients in the blender?
 - What happened when Ruff tried to unmix his smoothie in the blender?
 - What does Ruff mean by "unmix"?
 - Why couldn't Ruff unmix his smoothie?
 - Why could Scruff unmix his snack?

- (10 minutes) Play digital game *Ruff's Cookie Creator* (pbskids.org/ruff/kitchen/game)

- Support and engage families with questions as they play the game

- Wrap up this Explore section with questions to make connections between the video, game and to set-up the Make section

Make

(45 minutes)



- (5 minutes) Review materials for two **mixtures**: dough and trail mix. Encourage use of senses to observe and describe the materials

- (5 minutes) As a group, make **predictions** about what will happen when the ingredients for each mix are mixed together

- Record group **predictions** for the room to see

- (15 minutes) *Make Trail Mix*

- Support and engage families with questions as they make

- Have families record their recipes in their Curiosity Journals

- Write names on trail mix bags

- Discuss:

- What does your mix smell like? Feel like? Look like? Taste like?
- If you had to take out one ingredient, could you? Could you unmix all the ingredients?
- Do any of your original ingredients look different now that you've added them to your **mixture**? If so, how?
- If you wanted to change your **mixture**, could you? How?

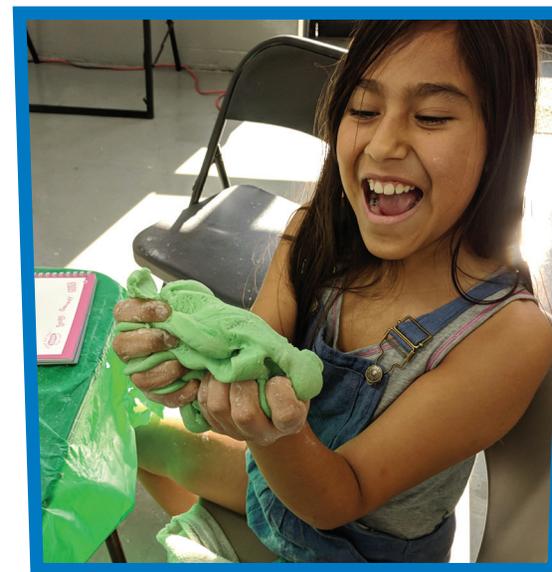
(20 minutes) Make Dough

- Review and discuss dough **properties**
- Support and engage families with questions as they make
- Discuss dough results and log results in Curiosity Journals; Ask questions like:
 - What happened to the corn starch in the **mixture**?
 - Can you get the corn starch back out?
 - Did anyone get a **mixture** that was too dry or too wet? How did you fix or change it?

Share

(10 minutes)

- Bring participants together either as a whole group or small groups with **mixtures** and Curiosity Journals
- Discuss sharing and feedback norms and expectations
- Have families share their **mixtures**; Encourage them to discuss what went well or didn't in their make, and what they observed about the **properties** of the **mixtures** they created
- Discuss any remaining questions, and encourage families to use the "Things We're Curious About" page in the Curiosity Journal to jot down ideas they want to continue to think about
- Collect Curiosity Journals for the next session
- Wrap up the session by giving families their take home materials



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Mixtures Supply List

View these activities as modules. It's recommended you follow them in sequence, but feel free to add, mix up, or drop sections as needed to accommodate your specific session.

Video, games and activities for this session can be found at: pbskids.org/ruff/kitchen

Activity	Materials
<p>Eat</p> <p>Have materials organized and ready for families to easily pick up on their way in.</p> <p>Have table prompts out on tables before families sit down to eat.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Meal <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Name badges <input type="checkbox"/> Game sheets (optional) <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Table conversation prompts
<p>Explore</p> <p>Have computer and projector set up for showing the video to the group. Alternatively, have families watch the clip on tablets or computers.</p> <p>Make sure devices are connected to the internet if they're used to access the digital games.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Computer, projector, slides <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Poster paper <input type="checkbox"/> Coloring sheets (optional) <input type="checkbox"/> Tablets/computers (optional, but preferred) <input type="checkbox"/> "Ruff Mixes It Up" video pbskids.org/ruff/kitchen/videos <input type="checkbox"/> Ruff's Cookie Creator digital game pbskids.org/ruff/kitchen/game

Make

Prepare workstations for making.

If you are concerned with dough getting on your workspace, consider taping newspaper or parchment paper down to make cleanup easier.

- Several premade play doughs (needs to be made just before or during the session as it dries out quickly)
- [1 set per family] Play dough supplies:
 - corn starch
 - conditioner
 - food coloring (optional)
 - glitter (optional)
- [1 per family] Mixing bowl
- [1 per family] Mixing spoon
- [1 per family] Measuring cup
- Rubber gloves (latex free, in case of allergies)
- Newspaper or parchment paper for workspaces
- Trail mix ingredients such as:
 - pretzels,
 - cheese crackers
 - cereal
 - chocolate chips
 - dried fruit
- [Several per family] Quart-sized plastic baggies (for holding dough and trail mix)
- Curiosity Journals
- Pencils
- Markers

Share

Have take-home materials organized and ready for pickup.

- Play dough creations
- Trail mix creations
- Curiosity Journals
- Pencils
- Markers
- Take-home sheets and *Mix It Up!* books to send home

Mixtures

Session Rundown

In this session, families will explore the **properties** of various types of **mixtures** and see how some can be unmixed, and some can't. They will watch and play with media and will work together on hands-on activities that engage the science inquiry process as they observe, question, **predict**, investigate, and share.

Session Goals

Families will:

- Explore how sometimes when materials are mixed together they keep their individual **properties**, and sometimes they don't.
- Describe specific **properties** of various materials.
- Encounter the following vocabulary: **mixture**, **properties**, and **predict**.
- Make **predictions** about how different materials may or may not change in different situations.
- Compare and contrast **properties** of different **mixtures**.
- Use different senses to observe the **properties** of materials and descriptive vocabulary to communicate these observations to others.
- Engage in discussions about **mixtures** and their **properties** to connect previous knowledge with new concepts explored through media and hands-on investigations.
- Think and act like scientists!
- Develop and strengthen positive attitudes for engaging with scientific content and participants' own abilities to collaborate and support one another's learning and play.

Eat

(30 minutes)

Welcome

- Use a welcome table for introductions, sign-ins, and name badge creations.
 - As families enter, greet them with casual conversation.
 - Have them create their name badges and work on them until all the families have arrived.



Encourage families to really personalize and make their name badges unique! Maybe each family wants to create a theme for their badges, or share something about their individual personalities through the design of their badges.



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Eat

- When all the families have arrived, invite them to get their food and eat.
- Encourage families to notice the conversation prompts on their table.
 - These are optional conversation pieces that are designed to get families talking to each other and nearby families, while priming the day's topic and activities.



Some prompts will be topical, and others will be focused on self-affirmation. Self-affirmation activities are a great way to build confidence and support the strengthening of positive self-perceptions among participants.

Introductions and Preview

While families eat, work through introductions and previewing the sessions.

- Starting with you, go around the room and have everyone introduce themselves.
 - Encourage participants to speak loudly and clearly, and ask them to share one interesting thing about themselves and/or one reason why they are attending the Family and Community Learning sessions.
- Introduce PBS KIDS Family and Community Learning, a series of interactive sessions that invite families to explore, make, and play together using PBS KIDS media and hands-on activities.
- Describe the structure of each session and it's four parts, **Eat, Explore, Make** and **Share**:
 - **Eat:** Families will share a meal and have time to get to know one another.
 - **Explore:** Grown-ups and kids will use media to explore the goals of the experience.
 - **Make:** Families will work together on hands-on projects.
 - **Share:** Families will share their projects with one another.



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Introduce *The Ruff Ruffman Show*.

- Ask the families if they know who Ruff Ruffman is. Let them know that Ruff is a hilarious, fast-talking, orange dog who loves to explore, play, learn, and hang out with his friends.
 - In this series of workshops, families will use Ruff Ruffman videos, games, and hands-on activities to play, build, explore, and learn about science together!
- Preview today's session, **mixtures**, where families will have an opportunity to explore the science of mixing and combining different materials.
 - Together families will:
 - **Explore:** Families will get familiar with **mixtures** through a Ruff Ruffman video, games, and discussion.
 - **Make:** Families will do some hands-on investigating as they make two different **mixtures** with two different sets of **materials** with different **properties**. As part of their investigation, they will make **predictions**, test different solutions, and revise as they go.
 - **Share:** Families will share their observations from their hands-on investigation, comparing and contrasting the two **mixtures** and their experiences making them.



Explore

(40 minutes)

The Explore section of each session is designed to provide participants with materials, media, and the time and space to dig into the concepts and themes of each session.

- Split up and check in with grown-ups and kids separately, or you can choose to keep the whole family together.



TIP

If you choose to keep the whole family together for the Explore section, use the “Children” pathway for the whole family.



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Grown-Ups

- Get the grown-ups together in a comfortable place for a group discussion.
 - This will be a time to preview the day’s activity and the Family and Community Learning model as a whole, as well as discuss ways to make connections to the concepts beyond the session.
 - Let them know that they are going to have lots of opportunities over the course of the sessions to explore different age-appropriate approaches to science and engineering, and encourage them to use the workshops as a time to have fun learning and playing alongside their kids.
 - Let them know that each session will also include this “Explore” time with just the grown-ups to check in and connect the dots between the sessions and how they relate to the kids’ overall learning and development.

Science Inquiry

□ Discuss science inquiry with the grown-ups.

- Ask the grown-ups what they think about science and what their experiences learning about science were like when they were in school.
- Ask them about what their hopes are for their children's experiences with learning science.
- Building upon their answers, explain that these sessions utilize an approach to learning about science that is very hands-on, collaborative, and designed to be interesting and fun for the whole family.
 - Some of the best learning occurs when kids are engaged and working alongside a grown-up that they know and trust and who can support their experience.
- Point out that the goals of the sessions aren't about kids learning specific science facts or information. If they do, that's wonderful, but more importantly, the sessions are designed to help give kids opportunities to think like scientists, and to engage in **science inquiry**.
- Instead of focusing on the what of science, science inquiry is focused on the **how**. How do scientists **do** science? What approaches and processes do they use to learn about the natural world?
 - They make observations using all five senses
 - They ask LOTS of questions
 - They come up with plans for how to answer those questions
 - They make **predictions**
 - They investigate and collect data and information to help answer their questions
 - They draw conclusions about the questions they're trying to answer and share that information with others

- This process is completely appropriate for young kids to use, and one that will grow and develop with them as they get older.
 - The activities in this session are designed to support families engaging in this process of science inquiry, and one of the best ways that they, as grown-ups, can support their children's experience is by asking them lots of supporting questions.
 - Asking open-ended questions like Why...? How come...? What do you think will happen if...? Are all great ways to support children to think critically and engage with science inquiry.
 - Explain that as facilitators, you'll be supporting families by asking lots of these types of questions throughout the workshops, and that you'll be encouraging the grown-ups to also be asking those types of questions as they support their children's experiences.



Mixtures

Discuss **mixtures**.

- Let grown-ups know that today they are going to engage in inquiry by exploring **mixtures** with their kids. A **mixture** is when you make something new by combining two or more things together.
- The kitchen is a great place to explore the science involved in **mixtures** since cooking is all about putting together different ingredients. And often with the help of heating or cooling, a change occurs and something new is made through that process. It might not seem like it, but cooking is basic chemistry!
 - Use one of the foods that were a part of your shared meal as an example, and ask participants if any of the other items they ate were also **mixtures**. How do they know?

Ask grown-ups if they have any ideas about how learning (science or otherwise) can be supported in the kitchen and/or at the grocery store:

- How can you engage your five senses (sight, touch, smell, taste, feel) when you're in the kitchen and/or grocery store? How is using your senses helpful for young learners?
- What kinds of math might be involved in cooking? How about reading or writing?



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Children

- Get the kids together in a comfortable place for a group discussion.
 - This discussion will be a time to preview the day's activity, and to discuss the Family and Community Learning model as a whole.
 - Since this is your first time connecting with the kids, take a minute to have everyone re-introduce themselves and check in to see how they are feeling about the session so far.
 - Are they excited to be here with their family?
 - What do they think they're going to be doing in these fun Ruff Ruffman workshops?

Community and Collaboration Guidelines

- Co-create community and collaboration guidelines.
 - Let them know that Family and Community Learning is all about playing and learning together as a family.
 - Ask the group if they know what the word *collaboration* means. As a group, work together to create a definition and write it on a piece of poster paper.
 - Explain that when collaborating and learning together as a community, it is really important to have some guidelines to make sure everyone has a fun and positive experience together. Ask the group why they think that might be so.



- Tell the group that you want them to come up with those guidelines!
 - Starting with the idea of respect, ask the group what they would do if they were in the middle of using a tablet but their parent or sibling wanted to take a turn. How would they respect their parent or sibling wanting to take a turn? Capture the main idea on the poster paper.
- Move on and discuss other collaboration and community guidelines you want to set as a group.
 - Focus on the concrete activities you'll be engaging in, such as planning projects, expressing ideas, asking questions, and giving feedback.
 - Ask the kids how they would like to act in those situations and how they would like others to act as well.



Giving kids ownership of their guidelines is a powerful way to set a positive tone and to create an inclusive atmosphere for the experience.



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Mixtures

Find out what the kids already know about **mixtures**. Ask:

- Does anyone know what a **mixture** is?
- Were there any **mixtures** as part of our meal? How do you know?
- Have you ever mixed something together?

Let them know that today they are going to make two kinds of **mixtures** as a family.

Then encourage them to be on the lookout for these words today:

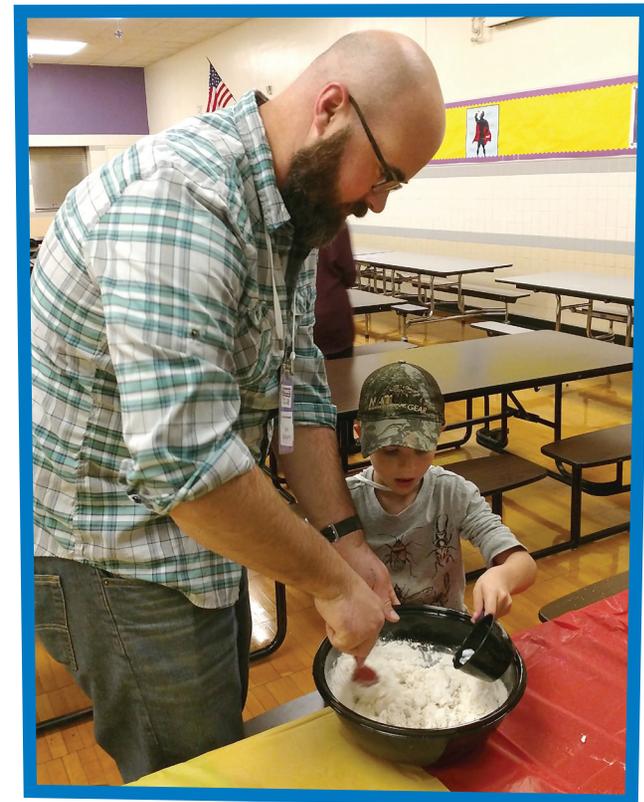
- **Mixture**, which is a new substance made by combining two or more substances.
- **Properties**, which are the characteristics of a substance.
- **Predict**, which is describing what you think will happen based on what you already know.

If they know what these words mean, encourage them to use them with their families during the session as they play together!



TIP

Don't spend too much time defining and discussing the words at this point. Vocabulary out of context is often meaningless to young children. Instead, introduce the words, tell them to be on the lookout for them, and then make a conscious effort to reference and incorporate them throughout the session.



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Reading Time

- If there's time, read the book *Mix It Up!* to the children. Pause often to ask questions, to help make connections to the activities everyone will engage in during the session.



If the grown-ups' discussion finishes before reading time is over, invite the grown-ups to join the children. This is a great opportunity to model highly interactive reading time with lots of room for questions and conversational supports built into the experience.

Together

- Bring the families back together.
- Have the kids share the community guidelines they created with the grown-ups.
- Before showing the Ruff Ruffman video "Ruff Mixes It Up," (pbskids.org/ruff/kitchen/videos) provide some info about Ruff and his videos to help orient the group to what they're about to watch.
 - You can say something like, "In this video, Ruff and his brother, Scruff, are in the middle of a cooking competition. Their challenge is dessert. I wonder how they will come up with a dessert that has different colors and keeps them all separated. Let's find out!" Then show the video.
- As the group watches, pause the video occasionally to reflect on new vocabulary and ideas being explored by Ruff and his friends. Here are some places you might pause:
 - After Ruff plans his smoothie using juice and two ice creams (but before he mixes it), ask the families if they think the smoothie will look the way he imagines it will (as a swirly picture). Why?
 - After Scruff says he is going to switch out the purple asparagus for gummy squids, ask the families if they think that will work. How?



Point out to grown-ups that asking questions during and after the video watching is a great way to co-view with their kids. Asking focus questions about what they're watching together can help support their thinking and learning.

- After the video, lead a group discussion about the topics in the video, using vocabulary and questions like:
 - What is a **mixture**?
 - What happened when Ruff mixed his ingredients in the blender?
 - What happened when Ruff tried to unmix his smoothie in the blender?
 - What does Ruff mean by "unmix"?
 - Why couldn't Ruff unmix his smoothie?
 - Why could Scruff unmix his snack?



Encourage families to discuss what happened to the **properties** of the ingredients when they were mixed. Did they change?



Switch gears and let the families know that they now have a chance to continue exploring **mixtures** and their **properties** by playing a digital game all about mixing ingredients in the kitchen.

- Have families play the digital game *Ruff's Cookie Creator* (pbskids.org/ruff/kitchen/game), in which they will practice **predicting**, testing, observing, reflecting, and revising in a simulated cooking game.
- Encourage family members to play the game collaboratively. It's important that everyone get a chance to interact with what's happening on-screen and to have input in what ingredients get mixed together to make the cookies.



TIP

Younger kids who need an alternate activity can work on coloring sheets of the Ruff characters. The art can be cut out and pasted into pages of the family's Curiosity Journal to help decorate as a way of encouraging younger siblings' participation.



TIP

Older kids can act as "tech mentors" and can help facilitators in getting families set up with their devices and games.



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- Walk around the room and support families as they play the game. Ask them:
 - How did you decide how much of each ingredient to add to the bowl? What kind of cookie do you **predict** those ingredients will make? Chewy? Gooeey? Crunchy?
 - Were you happy with the results of your cookies?
 - If not, how did you decide what parts of the recipe to revise to make better cookies?
 - How were your cookie **mixtures** like the **mixtures** from the video you watched?

□ Wrap up this Explore section by using some of the same questions above to make connections between the video and the game and to set up the hands-on exploration in the Make section.



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Make

(45 minutes)

Now that the families have explored **mixtures** through video, games, and discussions, they are going to make their own **mixtures**!

In this activity, families will create two types of **mixtures**, and will investigate which one can be unmixed and which one cannot.

Materials for both activities can be set out at the same time. Let families choose which activity they will do first.

- Before starting the investigation, encourage the families to use their senses to observe the materials for each **mixture**. Ask them:
 - What do you observe about the materials?
 - What do the materials look like? Feel like? Smell like? Taste like? Sound like?
 - What are the **properties** of the dough ingredients?
 - What are the **properties** of the trail mix ingredients?
 - How do the two sets of materials differ from each other? (For example, the dough ingredients include corn starch which is very fine; the trail mix ingredients are all dry and big pieces.)



TIP

If you want to let families touch the trail mix ingredients, have them put on rubber gloves first, as these ingredients will be consumed. Or encourage them to make observations by sight or smell, instead.

Explain to the families that, using their investigative skills, they're going to experiment to see which set of materials, when combined, can be unmixed again and which can't, and to try to understand why that is.

Before beginning a scientific investigation, it's helpful to make a **prediction** about what the results might be, using all the background knowledge they have. Making **predictions** can help scientists stay focused on the questions they're trying to answer.

- As a group, make **predictions** about what will happen when the ingredients for each mix are mixed together. Ask the following questions and capture their responses at the front of the room:
 - What do you **predict** will happen when the trail mix materials are mixed together? Will you be able to unmix the ingredients? Why or why not?
 - What do you **predict** will happen when the dough materials are mixed together? Will you be able to unmix the ingredients? Why or why not?



Asking *why* questions is a great way to encourage participants to communicate their thinking more deeply and to support their **predictions** and ideas with evidence based on background knowledge or observations that they've made. Both are valuable practices to develop in young learners.

It's time to make and investigate!



Activity One: Make Trail Mix (can be unmixed)

- Family members will choose from a variety of ingredients to make a custom trail mix. Every member can make their own.
 - Have everyone choose from various ingredients and add them to a plastic bag until they have a unique mix of goodies.



Some participants may want precise measurements for the trail mix recipe. If so, have them use the measuring cups from the dough activity.

- As families use the ingredients and make their mixes, engage them in conversation about their decisions. Ask them questions like:

- Why did you choose these ingredients?
 - Have you ever had a mix with these
- ingredients before?
- What do you **predict** your mix will taste like?

- When the mixes have been created, have the families write down their recipes in their Curiosity Journals and name their special creation.



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Watch for small ways you can help family members while making connections with them, such as by offering to hold their bag for them as they fill it up.

- Have them write their name on their bags.
- When they are done creating their trail mix, encourage family members to discuss the following questions with one another and to capture their answers in their Curiosity Journals:
 - What does your mix smell like? Feel like? Look like? Taste like?
 - If you had to take out one ingredient, could you? Could you unmix all the ingredients? (If you want to, try it!)
 - Do any of your original ingredients look different now that you've added them to your **mixture**? If so, how?
 - If you wanted to change your **mixture**, could you? How?



Activity Two: Make Play Dough (can't be unmixed)

Families will use simple ingredients to create their own play dough.

Play Dough Recipe

- 2 parts corn starch
- 1 part conditioner
- 1 mixing bowl
- Mixing spoon
- Measuring cup
- Food coloring (optional)
- Glitter (optional)
- Rubber gloves (optional, to avoid coloring hands)



Remind the kids that they don't want to eat this dough!



Put newspaper or parchment paper down on work surfaces to help make cleanup easier.

- Before the families get to work, show them a finished play dough **mixture**. Make this dough during or just before the session so it doesn't dry out.
- Pass a few doughs around so the families can touch and feel the consistency. Have them describe its texture. Is it sticky? Wet? Grainy? Soft? Squishy? Stretchy?
- Set up workstations so that each family has access to a container of corn starch, a bottle of conditioner, a mixing bowl, a mixing spoon, and a measuring cup. Also provide food coloring and glitter (optional). Keep the sample doughs on hand as well, as a comparison.



Give younger children extra doughs and cookie cutters to create and play with.

- Tell the families they will want to create a dough using 2 parts corn starch to 1 part conditioner. For example, they might want to start with 1 cup of corn starch, and ½ cup of conditioner.
- Have the families mix the ingredients until they are well incorporated.
 - Once it is mixed, they may need to knead the dough to get it to a nice texture. They may want to put some corn starch down on the surface before they begin to knead the dough, to help with sticking.
- Encourage families to discuss what they want their dough consistency to be.
 - They will likely have to test and improve their dough as they go to get the right texture. Scientists rarely get the 'right answer' on the first try, and engaging in this iterative process is a great way to support persistence.
 - If the dough is dry and falls apart, have them think about what they might need more of to make it a nice, soft dough of consistent texture.
 - If they add too much conditioner and it's too runny, encourage them to add more corn starch to see if they can create a texture they like.
 - As families make their dough, encourage them to use descriptive words to discuss its **properties**. Words might be: grainy, lumpy, sticky, watery, messy, or dusty.



Encourage families to create a few different doughs, so everyone can help with different parts of the making. Some kids will be able to do the whole process on their own, or can get an older sibling to help. Younger kids can help stir while water is being added, and can also help pick out and add colors to the dough.



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- When families have the consistency they like, they can try kneading in food coloring or glitter to make the dough uniquely theirs (optional)!

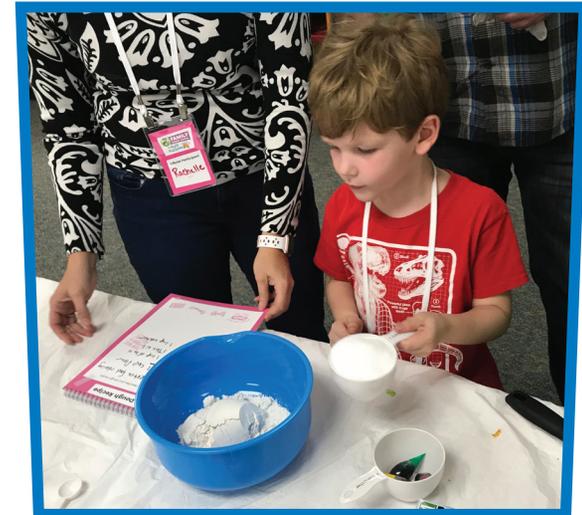


The food coloring may color their hands. If you have rubber gloves handy, encourage them to wear them if there is concern about getting messy.



Encourage families to make a few different colors of dough. Ask them: What do you observe when you mix the colors together? Can the colors be unmixed?

- Encourage families to discuss the following questions about their dough **mixtures** once they've finished making them and to capture their answers on the 'Our Dough Recipe' page in their Curiosity Journals:
 - What happened to the corn starch in the **mixture**?
 - Can you get the corn starch back out?
 - Did anyone get a **mixture** that was too dry or too wet? How did you fix or change it?
 - What words would you use to describe the final consistency of your dough?



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When they are done with their dough, they can store it in a plastic baggie to take home, but caution families that this dough doesn't last too long before it gets dry and crumbly.



Have a few premade doughs on hand (or have facilitators make some while the families are making) so that dough can be provided to anyone having trouble getting the right consistency with their dough. Participants can then color and glitter it if desired.

Share

(10 minutes)

Have the families come back together to share.

- Have the families bring their **mixtures** (dough and trail mix) as well as their Curiosity Journals to the group discussion.
- Discuss sharing norms.
 - Explain that sharing is an important part of the learning process. When sharing with others, we can be inspired by their ideas and work, and can get help with difficult and confusing problems.
 - It's also a great opportunity to build confidence as we explore our own ideas and work.
 - Remind families to be respectful, enthusiastic, and attentive to their fellow participants.
 - Model and encourage giving and receiving thoughtful feedback.
- Sharing can be done by table (if more than one family occupies a table) or other small group configurations.
- Ask the families to share one success, one challenge, and one thing they learned or would do differently next time.
- Revisit the **predictions** made by the whole group earlier in the session.



□ Ask if they have answers to the question regarding which set of ingredients created something new that could be unmixed.

- Which set of ingredients created a **mixture** that could not be unmixed? Why do they think that is?
- Do their results/conclusions line-up with their original **predictions**?
- Let them know that if they still don't know the answers to their questions, that's okay!

□ As the families share and time allows, offer a few more questions to reflect on, such as:

- What observations can you make about the **properties** of the two mixes you made?
- How was your experience making the trail mix and the play dough similar or different to Ruff and Scruff's experiences in the video?
- You just spent time thinking and acting like scientists together. You made observations, asked questions, made **predictions**, investigated, and drew conclusions together as families and a whole group. What was it like to do all of this science?
- Think about members of the community whose work involves **mixtures**, such as bakers, chefs, pharmacists and chemists. How might these workers use science in their jobs?



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- Ask the group what questions and curiosities still remain about the **mixtures** they made and about **mixtures** in general.
 - If you have the knowledge and resources on hand to answer the questions, great! If not, tell them that is a great question and encourage them to write or draw it on the 'Things We're Curious About' page of their Curiosity Journals.
 - Encourage all families to think of one action they can write down on this page as a way to investigate further at home in the coming weeks.

Wrap-up and Take-home

- Review the family's take-home materials.
 - Go over the resources they will be taking home, and demonstrate how to access the *Ruff Ruffman Show* media and activities related to the materials.
- Collect everyone's Curiosity Journals and let them know you are holding on to them until the next session.
- Have everyone help clean up.
- Give each family their take-home handouts, remind them of the details for the next session, and congratulate them on their great work!



Session 2

Material World

Investigating Material Science

Eat Review and preview

Explore Ruff Ruffman video, games, and discussion

Make Using materials to solve problems

Share Sharing, comparing, and discussing materials

Materials: Session Overview

Eat (25 minutes)

- Welcome families, and have them gather materials, name badges, and Curiosity Journals
- After everyone has arrived, begin meal
- Encourage conversation between families using table conversation prompts
- Lead a quick warm-up activity
- Preview the day's session

Explore (40 minutes)

- Decide whether to keep families together, or divide into grown-up and kid groups
- (15 minutes) Lead discussions
 - Grown-ups:
 - Introduce the engineering design process
 - Use senses to describe **properties** of **materials**; discuss how senses aid in science and **engineering**
 - Preview *Photo Stuff with Ruff* app (pbskids.org/apps/photo-stuff-with-ruff.html)
 - Children (use this pathway if keeping families together):



- Discuss **materials**, starting with an exploration about what they already know about **materials**
- Use senses to describe **properties** of **materials**
- If there is time, read *Home*

- Bring grown-ups and children back together

- (10 minutes) Watch video "A Dry Pet Is a Happy Pet" (pbskids.org/ruff/materials/videos) pausing on occasion to discuss big ideas explored in the video

- (5 minutes) Lead discussion on the video with questions like:
 - What was the problem Ruff needed to solve?
 - What were the different **materials** the kids **tested**?
 - What were the **properties** of the three **materials**? How would you describe them?
 - What did you observe when they applied water to the different **materials**?How did they **test** again to find the most waterproof material? Why did they do this?

- (10 minutes) Play *Photo Stuff with Ruff* app (pbskids.org/apps/photo-stuff-with-ruff.html)
 - Support and engage families with questions as they play the game

- Wrap up this Explore section with questions to make connections between the video, game and to set-up the Make section



Make

(40 minutes)

- Discuss the engineering design process with families
- Bring out **materials**
- Describe design challenges
- Each family chooses one challenge
- Use the 'Materials Challenge' pages of the Curiosity Journals to work through challenges using the engineering design process
- Test** the designs
- Revise the designs and **test** again (as time allows)



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Share

(15 minutes)

- Bring participants together either as a whole group or small groups with designs and Curiosity Journals
- Engage in sharing through Show and Tell or a Gallery Walk
- Final discussion of **materials** and review **engineering** design process
- Collect Curiosity Journals for the next session
- Wrap up the session by giving families their take home **materials**

Materials Supply List

View these activities as modules. It's recommended you follow them in sequence, but feel free to add, mix up, or drop sections as needed to accommodate your specific session.

Video, games and activities for this session can be found at: pbskids.org/ruff/materials

Activity	Materials
<p>Eat</p> <p>Have materials organized and ready for families to easily pick up on their way in.</p> <p>Have table prompts out on tables before families sit down to eat.</p>	<ul style="list-style-type: none"><input type="checkbox"/> Meal<input type="checkbox"/> Curiosity Journals<input type="checkbox"/> Name badges<input type="checkbox"/> Game sheets (optional)<input type="checkbox"/> Pencils<input type="checkbox"/> Markers<input type="checkbox"/> Table conversation prompts
<p>Explore</p> <p>Have the computer and projector set up and ready for showing the video to the group. Alternatively, have families watch the clip on tablets or computers.</p>	<ul style="list-style-type: none"><input type="checkbox"/> Computer, projector, slides<input type="checkbox"/> Curiosity Journals<input type="checkbox"/> Pencils<input type="checkbox"/> Markers<input type="checkbox"/> Tablets/computers (optional, but preferred)<input type="checkbox"/> Coloring sheets (optional)

Explore (continued)

If tablets are available, have them prepared with the *Photo Stuff with Ruff* app.

Make sure devices are connected to the internet if they're used to access the digital games.

"A Dry Pet Is a Happy Pet" video
pbskids.org/ruff/materials/videos

Photo Stuff with Ruff app
pbskids.org/apps/photo-stuff-with-ruff.html

Dress That Rhino game
pbskids.org/ruff/materials/game (optional)

Grab It and Run offline game
pbskids.org/ruff/materials/activities
(optional)

Make

Have materials in a place where families can observe them.

A variety of materials such as:

- foil
- felt
- fur
- glue
- plastic bags
- shower curtain
- duct tape
- cardboard
- pillowcase
- binder clips
- fan
- feathers
- sponges
- spray water bottle
- flashlight
- light breathable fabric
- foam darts
- ping pong balls

Curiosity Journals

Markers

Pencils

Share

Have take-home materials organized and ready for pickup.

Designs from Make session

Markers

Curiosity Journals

Take-home materials sheets and *Home* books to send home

Pencils

Materials

Session Rundown

In this session, families will explore **materials** and different **properties** of **materials**. They will watch and play with media and will work together through the **engineering** design process as they define a problem and plan, create, **test**, and improve upon their solutions.

Session Goals

Families will:

- Explore how some **materials** are better for certain uses than others, and that which are better (or worse) will depend on the problem they are trying to solve.
- Use different senses to observe and describe the **properties** of different **materials**.
- Compare and contrast **materials** by describing similarities and differences.
- Encounter the following vocabulary: **materials**, **properties**, **test** and **engineering**.
- Communicate observations of the **properties** of **materials** to others.
- Engage in discussions about **materials** and their **properties** to connect previous knowledge with new concepts explored through media and hands-on investigations.
- Think and act like **engineers**!
- Develop and strengthen positive attitudes for engaging with scientific content and participants' own abilities to collaborate and support one another's learning and play.



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Eat

(25 minutes)

Welcome

- Welcome families, and have them gather materials, name badges, and Curiosity Journals.
- When all the families have arrived, invite them to get their food and eat.
- Encourage families to notice the conversation prompts on their table.
 - These are optional conversation pieces that are designed to get families talking to each other and nearby families, while priming the day's topic and activities.

- Lead a quick warm-up activity to bring everyone together and start the session with a playful tone.

- Preview today's session, **materials**, where families will have an opportunity to explore the **properties** of **materials** and design solutions around those **properties**. Together families will:

- Explore: Through discussion and engagement with Ruff Ruffman media, families will get familiar with **materials** and their **properties**.
- Make: Families will use the **engineering** design process to solve a problem using different **materials**, just like Ruff. They will create, **test**, improve, and create some more!
- Share: Families will share their final designs and experiences engaging in the **engineering** design process with others, as well as share ideas and connections to their everyday lives.



Some prompts will be topical, and others will be focused on self-affirmation. Self-affirmation activities are a great way to build confidence and support the strengthening of positive self-perceptions among participants.

Explore

(40 minutes)

The Explore section of each session is designed to provide participants with materials, media, and the time and space to dig into the concepts and themes of each session.

- Split up and check in with grown-ups and kids separately, or you can choose to keep the whole family together.

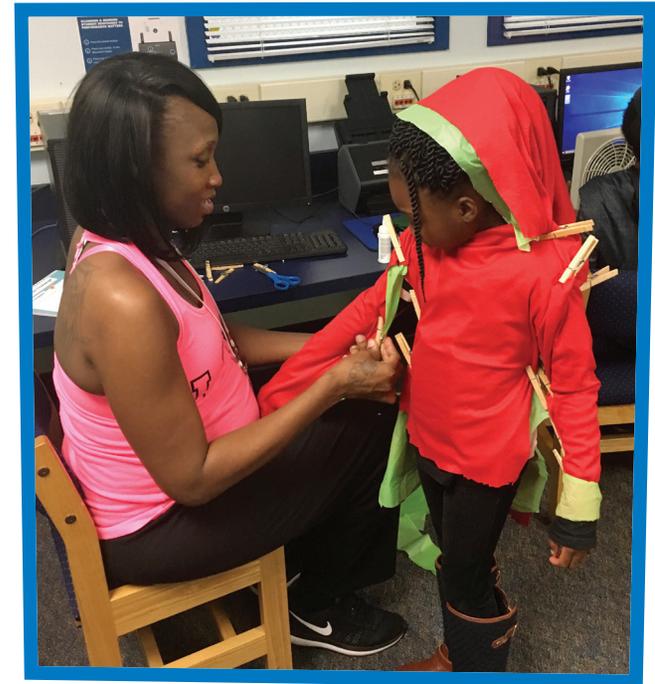


If you choose to keep the whole family together for the Explore section, use the “Children” pathway for the whole family.

Grown-Ups

- Get the grown-ups together in a comfortable place for a group discussion.
 - This will be a time to preview the day’s activity, as well as discuss ways to make connections to the concepts beyond the session.
 - Check in with everyone and see how they are feeling about the session and FCL overall.

- What stuck with them from the last session?
- Did they make any connections at home to the mixture activities and media?



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Engineering Design Process

- Discuss the **engineering** design process with the grown-ups.
 - Tell the grown-ups that during today's session the families will continue to think like scientists and to engage in science inquiry, but they'll also be thinking and acting like **engineers**.
 - Ask the grown-ups how they would define **engineering** and together work towards a definition that closely resembles:

Engineers use creativity, problem-solving skills, and knowledge of technology, math, and science to design, build, and improve products, machines, and structures for a better world. They curiously explore why and how things work, and try to figure out how to make things work even better.

- Where the process of science inquiry is driven by asking questions, investigating, and finding answers to those questions, **engineering** involves a process of identifying problems/challenges and then building and developing solutions to problems/challenges.
 - While a lot of the jobs that professional **engineers** do requires knowledge and skills too advanced for young children, the **engineering** design process that use to approach their work is a process that can be introduced and applied to nearly all project-based work, even projects designed for young children!
- This process is completely appropriate for young kids to use, and one that will grow and develop with them as they get older.
 - The activities in this session are designed to support families engaging in the **engineering** design process, and similar to last session, one of the best ways can support their children's experience is by asking them lots of supporting questions.
 - Asking open-ended questions like Why...? How come...? What do you think will happen if...? Are all great ways to support children to think critically and engage as they work to design and create solutions.

- Explain that as facilitators, you'll be supporting families by asking lots of these types of questions throughout the workshops, and that you'll be encouraging the grown-ups to also be asking those types of questions as they support their children's experiences.
- Show grown-ups the **engineering** design process image and take the time to introduce the different steps of the process.



Play Preview

□ Preview the *Photo Stuff with Ruff* app.

- If there are tablets, hand them out and show the app *Photo Stuff with Ruff* (pbskids.org/apps/photo-stuff-with-ruff.html). (If there are no tablets, use the game *Dress That Rhino* (pbskids.org/ruff/materials/game) instead.)

- Demonstrate how to open the app and play it, and then give them a chance to play it themselves. In addition to explaining the mechanics of the game, give the grown-ups a few questions or prompts they can use with their children later, such as:

- When the app asks you to find a new type of material, ask your child to tell you what the word means (particularly for words such as flimsy, wiggly, sparkly, wobbly, and stretchy). Kids might be able to act these out, even if they can't describe them using words. Or maybe they can do both!

- For some prompts (particularly ones that might be interesting or silly), ask your child why they chose the material they did for that picture.

- Encourage grown-ups to find ways to play along with their kids later in the session and to be involved in the game play. Families can decide what works for them; maybe everyone takes turns on different parts of the scene in a photo, or they all create the whole scene together.



Showing grown-ups the app in advance and providing them with a chance to try it on their own will help develop their confidence with using the technology alongside their children.

Children

- Get the kids together in a comfortable place for a group discussion.
 - This discussion will be a time to preview the day's activity, and learn more about **materials** and their **properties**.

Materials

- Find out what the kids already know about **materials**. Using the room as reference, ask questions such as:
 - What **material** is the floor made out of?
 - What **material** are the chairs made out of?
 - Why is that **material** good for making a chair?

Give the children an opportunity to familiarize themselves with different **materials** they might work with later as a family.

- Have a small selection of **materials** laid out (items such as felt, feathers, fabrics, shower curtain, etc), and pass them out to the kids.
- Discuss what they are and the **properties** of each one.
 - Encourage the children to use their senses to describe the **materials**: How does it feel: soft, crinkly, rubbery, sticky? What does it look like? How would it feel to wear it? Cover as many as time allows.



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□ Encourage the children to be on the lookout for these words today:

- **Materials**, which is what something is made of.
- **Properties**, which are the characteristics of an object or substance.
- **Test**, which is to try something out to see if your prediction is right.
- **Engineering**, which is a process of identifying and developing solutions to problems.

If they know what these words mean, encourage them to use them with their families during the session as they play together!



Don't spend too much time defining and discussing the words at this point. Vocabulary out of context is often meaningless to young children. Instead, introduce the words, tell them to be on the lookout for them, and then make a conscious effort to reference and incorporate them throughout the session.

Reading Time

If there's time, read the book *Home* to the children. Pause often to ask questions, to help make connections to the activities everyone will engage in during the session.



If the grown-ups' discussion finishes before reading time is over, invite the grown-ups to join the children. This is a great opportunity to model highly interactive reading time with lots of room for questions and conversational supports built into the experience.



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Together (15 minutes)

- Bring the families back together.
- Before showing the Ruff Ruffman video “A Dry Pet Is a Happy Pet,” (pbskids.org/ruff/materials/videos) provide some info about Ruff and the video to help orient the group to what they’re about to watch.
 - You can say something like, “In this video, you’ll see our favorite orange dog, Ruff, and his friends **testing** out different **materials** to see if they are waterproof. I wonder how they will **test** their **materials**. Let’s find out!” Then show the video.
- As the group watches, pause the video occasionally to reflect on new vocabulary and ideas being explored by Ruff and his friends. Here are some places you might pause:
 - After Ruff and Fluff head back inside because it’s raining, ask the families to describe some of the **properties** of Fluff’s mop costume.
 - Before Ruff calls his friends to investigate, ask the families what ideas they have for covering Fluff to keep him dry on his walk.



TIP

Point out to grown-ups that asking questions during and after the video watching is a great way to co-view with their kids, and is something they can practice at home.



□ After the video, lead a group discussion about the topics in the video, using questions like:

- What was the problem Ruff needed to solve?
- What were the different **materials** the kids **tested**?
- What were the **properties** of the three **materials**?
- What did they observe when they applied water to the different **materials**?
- How did they **test** again to find the most waterproof **material**? Why did they do this?
- What were the results of the **test**?
- Based on the results, what solution did Ruff **engineer**?



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Switch gears and let the families know that they now have a chance to continue exploring **materials** and their **properties** by playing a digital game.

□ Pass tablets out to families to play the *Photo Stuff with Ruff* app (pbskids.org/apps/photo-stuff-with-ruff.html)

- The app is a fun way to encourage observation and investigation of the **properties** of the world around them, as they are challenged to photograph specific **materials** based on different characters, settings, and scenarios.
- Encourage families to play the games collaboratively. It's important that everyone gets a chance to interact with what's happening on-screen and to have input in what material choices are being made.

- ❑ If you don't have access to mobile devices, have families play the digital game *Dress That Rhino* (pbskids.org/ruff/materials/game), in which they will help Ruff dress up a rhino by choosing **materials** with different **properties**.
- ❑ If no technology is available, or if the offline version is preferred, have families play the offline game *Grab It and Run* (pbskids.org/ruff/materials/activities). In this game, players run in pairs while holding different **materials**, from tinfoil to toilet paper, while trying not to break them. If you choose this option, make sure you have the necessary materials on hand during the session.



Younger children who need an alternate activity can work on coloring sheets of the Ruff characters. The art can be cut out and pasted into pages of the family's Curiosity Journal to help decorate as a way of encouraging younger siblings' participation.



Older children can act as "tech mentors" and can help facilitators in getting families set up with their devices and games.

- ❑ Regroup and discuss the games they just played.
 - Ask them:
 - Did the game help you notice any new **materials** around you? What were they?
 - Did the game help you think of new ways to describe the **properties** of **materials**?
 - What were some of the silliest **materials** you found or used?
 - In the video, Ruff needed to find something to keep Fluff dry. Did you come across any **materials** while playing the game that would have worked for Fluff?



Make

(40 minutes)

Now families will participate in their own **engineering** design challenges to further explore **materials** and their **properties**.

- Introduce the **engineering** design process graphic to the families.
 - Point out that **engineers** identify problems and then create solutions to those problems, which is exactly what Ruff did in the episode that everyone watched together.
 - Just like Ruff, they are going to work through this process to: **Define a Problem, Imagine and Plan** a solution, **Create** that solution, **Test** it out, and **Improve** upon it based on the results of their **tests**.
 - They will use their Curiosity Journals throughout the Make section to help them as they engage in this process.



As they work, be sure to point out the parts of the process you see being engaged in real time.



- Have the project **materials** visible so the families can familiarize themselves with them. Some of these may be **materials** they observed earlier.
- Introduce the four different design challenges and have the families each choose one that they want to create a solution for, or they can design their own problem scenario.
 - To solve their challenge, each family will design something that one (or more) family member can wear that will represent a solution to the challenge.

Challenge 1: Design something you could wear to keep you dry from water.

- Where/when/why might you wear something like this?
- What are some things that keep you dry? What **properties** do those items have?

Challenge 2: Design something that can give you some shade or sun protection on a hot, sunny day.

- Where/when/why might you wear something like this?
- What are some things that provide shade? What **properties** do those items have?

Challenge 3: Design something warm and cozy that you could wear in cold weather.

- Where/when/why might you wear something like this?
- What are some things that keep you warm? What **properties** do those items have?

Challenge 4: Design something tough and protective that could deflect small objects.

- Where/when/why might you wear something like this?
- What are some things that you wear to protect you? What **properties** do those items have?

Challenge 5: Design your own scenario!



Feel free to collect group ideas at this time for additional scenarios that the families might design for. Encourage wild and silly ideas!



Engage younger children in their own version of this activity with a sensory table to explore **materials**. Give them their own set of **materials** and objects to touch and play with and apply different **materials** to.

- Have the families find the 'Materials Challenge' page in the Curiosity Journals, and write down which problem they are solving for in the **Define a Problem** box.
- Next, encourage families to **Imagine and Plan**. Have them record which **materials** they plan to use to solve the problem. They might also want to do a quick sketch of what their creation might look like.



Families can think of something decorative they can add to their design and engage younger children in the activity by having them decorate it.



- Now it's time to Create! Have families collect the **materials** they need and find a space to work.
 - Some **materials** will need to be shared, so help with material distribution. Things like tape and glue can be given to small groups to share.



For families looking for an additional challenge, encourage them to add more **materials** after their first **test** to see if they can add a secondary solution. For example, if they make a shield for Challenge 4, can they think of a way to make their shield waterproof?



- As each family works on their designs, they'll also need to find a way **Test** it to see if they're successfully solving the challenge they've set for themselves!
- Help each family find the best way to **test** their creation and log the results of the **test**, as well as ideas for improvement, in the 'Materials Challenge' section of their Curiosity Journals. Some **testing** suggestions:

- **Challenge 1 Test:** Design something you could wear to keep you dry from water.
 - Have one family member wear the creation, and have another gently spray them with water from a spray bottle. Remove the item and see if they are dry underneath.
 - Ask them: Did it work? How can it be improved? Even if it protected the family member from getting wet, could it be even more waterproof?



If it's a rainy day, go outside to **test** instead!

- **Challenge 2 Test:** Design something that can give you some shade or sun protection on a hot, sunny day.
 - In a space where there is direct light (using the sun or a strong flashlight), have one family member wear their creation and see if it shades them from the light. Have them remove the item and see if the shade goes away.
 - Ask them: Did it work? How can it be improved? If the item provided some shade, could it provide more with some changes?



Depending on the direction of the light (sun), they may need to try a few spots to get some shade!



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- **Challenge 3 Test:** Design something warm and cozy that you could wear in cold weather.
 - Have one family member wear their creation, and then have another blow a fan on them. Have them remove the item and get blown by the fan again.
 - Ask them: When they were wearing their item, did they feel warmer when the cool air blew on them? How can it be improved? Could they have blocked the cool air even more, or covered more of their body?

- **Challenge 4 Test:** Design something tough and protective that could deflect small objects.
 - Have one family member wear their creation, and then have another throw a small, harmless object, such as a foam dart or Ping-Pong ball, at the creation.
 - Ask them: Did the item deflect the object? If so, how could it be made even stronger, or cover more parts of the body? Or could it be changed to fit a different part of the body?

- If any families designed their own scenario, work with them to find a way to test it.

When the families have finished their **tests**, have them work to **improve** their designs based on the results.

- You can also encourage them to add features even if their **tests** worked well. The **test** and revision process can be repeated as often as time allows.



Encourage each family to find one improvement they could take on to make their design even better. If it didn't work as they'd planned, remind them that **engineering** a solution often takes many tries to refine and get it just right.



Share

(15 minutes)

Bring the families back together to share.

- Have the families bring their designs as well as their Curiosity Journals to the group discussion.
- Optional Share Activity: Show and Tell
 - If time allows and your families are interested, have them demonstrate their creations for the whole group!
 - Have them share the challenge they designed for, their creation, what happened during their **test**, and how they improved their solution.
- Optional Share Activity: Gallery Walk
 - If demonstrating the designs is not ideal for your group, have them do a gallery walk of the designs.
 - Place all the designs around the room, and put a piece of paper out with each one. Have the families go around and visit the designs, and encourage them to leave a positive comment or drawing, or an idea for taking it to the next level on the piece of paper.
 - After the families have all had time to visit a few of the designs, have the families collect their feedback.



TIP

Encourage the families to spread out so everyone gets some feedback on their design.



Inevitably, multiple families will attempt the same challenge. More likely than not, their designs will be different from one another. Be sure to celebrate these differences. When solving problems and engaging in **engineering** activities, rarely is there only one right answer. There are often lots of different possibilities!

□ Regroup for a final discussion on **materials** and the **engineering** design process.

- Sharing can be done by table (if more than one family occupies a table) or other small group configurations.



If the Share portion is done in small groups, have a facilitator work with each small group to help guide the reflection and discussion.

- Across the video, games, and activity, families discussed and explored a variety of **materials** and their **properties**. Ask them to think back to the videos they watched and their own design challenge:
 - Did anyone use any of the **materials** from the video or games (cardboard, shower curtain, dish towel) when designing their solutions? If so, how was your use of the **material** the same as or different from how they used the **material** in the video or games?
 - Think about the way Ruff's friends **tested** their **materials** in the video. How were your **tests** similar or different?
- Think about members of the community whose work involves working with different materials, such as firefighters, construction workers, and interior designers. How might these workers use materials in their jobs?

- Ask the families about their investigations and their use of the **engineering** design process in the activity.
 - What was it like using the **engineering** design process as a way of approaching their challenge as a family?
 - How could they imagine using this process again on a future project? Do you ever do anything like this in school?
 - What was the most challenging part of **engineering** their own projects? What was the most fun?

Wrap-Up and Take-Home

- Review the family's take-home materials.
 - Go over the resources they will be taking home, and demonstrate how to access the *Ruff Ruffman Show* media and activities related to the materials.



If time allows, you can also read the book they will be taking home.

- Collect everyone's Curiosity Journals and let them know you are holding on to them until the next session.
- Have everyone help clean up.
- Give each family their take-home handouts, remind them of the details for the next session, and congratulate them on their great work!



Session 3

Stick or Slide

Exploring Friction

Eat Review and preview

Explore Ruff Ruffman video, games, and discussion

Make Build ramps to investigate friction

Share Sharing, comparing, and discussing friction

Friction: Session Overview

Eat

(20 minutes)

- Welcome families, and have them gather materials, name badges, and Curiosity Journals
- After everyone has arrived, begin meal
- Encourage conversation between families using table conversation prompts
- Lead a quick warm-up activity
- Preview the day's session

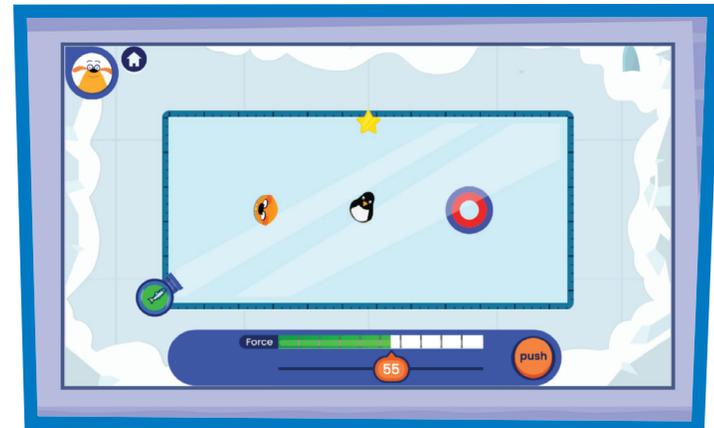
Explore

(40 minutes)

- Decide whether to keep families together, or divide into grown-up and kid groups
- (15 minutes) Lead discussions
 - Grown-ups:
 - Check in with grown-ups regarding any questions they have, and engage in a brief review of the previous session
 - Review science inquiry
 - Discuss **friction**, including examples of **friction**
 - Preview *Fish Force* game (pbskids.org/ruff/sports/game)



- Children (use this pathway if keeping families together):
 - Discuss **friction**, starting with an exploration about what they already know about **friction**
 - Review science inquiry
 - If there is time, read *Ada Twist, Scientist*
- Bring grown-ups and children back together
- (10 minutes) Watch video "Pulling for the Plushie" (pbskids.org/ruff/sports/videos) pausing on occasion to discuss big ideas explored in the video
- (5 minutes) Lead discussion on the video with questions like:
 - In the video, what was different about the three **surfaces** (sand, grass, concrete)?
 - How did the different **surfaces** affect the sled's movement?
 - Why did the concrete allow the sled to go fastest? What properties did it have that made it different from the other **surfaces**?
- (10 minutes) Play digital game *Fish Force* (pbskids.org/ruff/sports/game)
 - Support and engage families with questions as they play the game
- Wrap up this Explore section with questions to make connections between the video, game and to set-up the Make section



Make

(40 minutes)

- Discuss **friction** with families
- Give materials to families
- As a group, engage in science inquiry as each family **investigates** the impact of **friction**:
 - Observe materials
 - Plan & predict
 - Investigate** & collect data
 - Reflect & draw conclusions

Share

(20 minutes)

- Bring participants together either as a whole group or small groups with Curiosity Journals
- Discuss engagement in science inquiry and the results of the investigation
- Wrap up the session by giving families their take home materials



Friction Supply List

View these activities as modules. It's recommended you follow them in sequence, but feel free to add, mix up, or drop sections as needed to accommodate your specific session.

Video, games and activities for this session can be found at: pbskids.org/ruff/sports

Activity	Materials	
<p>Eat</p> <p>Have materials organized and ready for families to easily pick up on their way in.</p> <p>Have conversation prompts out on tables before families sit down to eat.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Meal <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Name badges <input type="checkbox"/> Game sheets (optional) 	<ul style="list-style-type: none"> <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Table conversation prompts
<p>Explore</p> <p>Have the computer and projector set up for showing the video to the group. Alternatively, have individuals or pairs watch the video on tablets or computers.</p> <p>Make sure devices are connected to the internet if they're used to access the digital games.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Computer, projector, slides <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Tablets/computers (optional, but preferred) 	<ul style="list-style-type: none"> <input type="checkbox"/> Coloring sheets (optional) <input type="checkbox"/> "Pulling for the Plushie" video pbskids.org/ruff/sports/videos <input type="checkbox"/> <i>Fish Force</i> game pbskids.org/ruff/sports/game <input type="checkbox"/> <i>Bottle Cap Hockey</i> (optional) pbskids.org/ruff/sports/activities

Make

Have materials in a place where families can observe them.

- A variety of materials such as:
 - sandpaper
 - plastic bag
 - play dough, or others you have on hand as long as they offer a variety of textures
 - bubble wrap
 - grippy rubber (such as pieces of an exercise mat or shelf liner)
 - tinfoil
 - paper bag
- [1 per family] Toy car - try to find ones heavy enough (such as Matchbox cars) that they go straight.
- [1 per family] Painters tape or washi tape (for marking distance lines)
- [1 per family] Two-by-four-foot hardwood, plywood board, or thick cardboard
- [1 per family] Rulers
- [1 per family] Tape (strong enough to tape materials to the board)
- [1 set per family] Small stickers (for marking distance)
- [1 per family] Binder clips
- Curiosity Journals
- [per family] Books or other props (about six inches high) to lift board up to make a ramp
- Pencils
- Markers

Share

Have take-home materials organized and ready for pickup.

- Materials from investigation
- Markers
- Curiosity Journals
- Take-home sheets and *Ada Twist, Scientist* books to send home
- Pencils

Friction

Session Rundown

In this session, families will explore **friction**. They will watch and play with media and will work together on a hands-on activity to engage in the science inquiry process as they observe, question, predict, **investigate**, collect data, and share and draw conclusions.

Session Goals

Families will:

- Explore how **friction** affects how objects move.
- Explore how different materials cause different amounts of **friction**.
- Encounter the following vocabulary: **friction**, **surface**, and **investigate**.
- Make and test predictions about how different **surfaces** impact the amount of **friction** on an object, and how an object moves across those **surfaces**.
- Engage in discussions on **friction** to connect previous knowledge with new concepts explored through media and hands-on investigations.
- Think and act like scientists!
- Develop and strengthen positive attitudes for engaging with scientific content and participants' own abilities to collaborate and support one another's learning and play.



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Welcome

- Welcome families, and have them gather materials, name badges, and Curiosity Journals.
- When all the families have arrived, invite them to get their food and eat.
- Encourage families to notice the conversation prompts on their table.
 - These are optional conversation pieces that are designed to get families talking to each other and nearby families, while priming the day's topic and activities.
- Lead a quick warm-up activity to bring everyone together and start the session with a playful tone.
- Preview today's session, **friction**, where families will have an opportunity to explore **friction** and how different materials cause different amounts of **friction**. Together families will:
 - Explore: Through discussion and engagement with Ruff Ruffman media, families will get familiar with **friction** and how different **surfaces** change the amount of **friction** on an object.
 - Make: Families will engage in an investigation by using ramps and various materials to test the effect of different **surfaces** on a toy car's movement.
 - Share: Families will share the results of their investigations and experiences with one another, and connect their making and exploration to their everyday lives.



TIP

Some prompts will be topical, and others will be focused on self-affirmation. Self-affirmation activities are a great way to build confidence and support the strengthening of positive self-perceptions among participants.

Explore

(40 minutes)

The Explore section of each session is designed to provide participants with materials, media, and the time and space to dig into the concepts and themes of each session.

- Split up and check in with grown-ups and kids separately, or you can choose to keep the whole family together.



If you choose to keep the whole family together for the Explore section, use the “Children” pathway for the whole family.

Grown-Ups

- Get the grown-ups together in a comfortable place for a group discussion.
 - This will be a time to review ideas from the previous session, as well as preview the day’s activity.
 - Engage in a brief discussion about the last session:
 - What stuck with them from the materials session activities and media?
 - Did they make any connections at home to the materials session activities?
- Review science inquiry.
 - Let the grown-ups know that today they will continue to engage in science inquiry as they think and act like scientists while doing some fun hands-on investigations.
 - Discuss how the grown-ups saw the kids engaging in science inquiry in the previous sessions. Point out instances where:

- They made observations using all five senses
 - They asked questions
 - They came up with plans for how to answer those questions
 - They made predictions
 - They **investigated** and collected data and information to help answer their questions.
 - They drew conclusions about the questions they were trying to answer and shared that information with others
- Refer to the science inquiry graphic to support this discussion.



Discuss **friction**.

- Let grown-ups know that today they are going to engage in inquiry by exploring **friction** with their kids. **Friction** is a force that slows the motion of object.
- **Friction** is created when two objects rub together and push and pull against each other.
- Discuss examples of **friction**, including a lot of **friction** (rubber shoes on the floor) and a little **friction** (hard-soled shoes on ice).



Friction can be complicated to describe. Encourage using examples with body movement or pictures if a participant seems to know the concept but is having trouble verbalizing it.

Play Preview

Preview the *Fish Force* digital game (pbskids.org/ruff/sports/game).

- Give the grown-ups tablets or laptops and show them the game *Fish Force*. Demonstrate how to open and play the game, then give them a chance to play.
 - Explain that in this game they will explore force, as well as **friction**. Force is a push or pull on something.
- Encourage grown-ups to find ways to play along with their kids later in the session and to be involved in the game play.



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Children

- Get the kids together in a comfortable place for a group discussion.
 - This discussion will be a time to preview the day's activity, and learn more about **friction**.
 - Find out what the children already know about **friction**. **Friction** is a force that slows the motion of object. **Friction** is created when two objects rub together and push and pull against each other.
 - Ask some questions about **friction** to help guide a fun introductory discussion:
 - Who has slid across a wood or concrete floor in their socks?
 - Who has tried to do the same thing on a carpeted floor or outside in the grass?
 - Who has some ideas on why it might be easier or harder to slide on some of these **surfaces**?
 - Using objects around you as a reference, ask "what would happen if..." to discuss **friction** on an object.
 - An example might be "What would happen if I tried to slide across the rug in my shoes?"



TIP

Friction can be complicated to describe. Encourage using examples with body movement or pictures if a child seems to know the concept but is having trouble verbalizing it.



☐ Encourage the children to be on the lookout for these words today:

- **Friction**, a force that slows how an object moves, when two objects rub together and push or pull against each other.
- **Surface**, which is the outside layer of something.
- **Investigate**, which is when you explore things and find stuff out.

If they know what these words mean, encourage them to use them with their families during the session as they play together!



Don't spend too much time defining and discussing the words at this point. Vocabulary out of context is often meaningless to young children. Instead, introduce the words, tell them to be on the lookout for them, and then make a conscious effort to reference and incorporate them throughout the session.

Reading Time

☐ If there's time, read the book *Ada Twist, Scientist* to the children, pausing often to ask questions and connect back to the activities everyone is engaged in during the session.



If the grown-ups' discussion finishes before reading time is over, invite the grown-ups to join the children. This is a great opportunity to model highly interactive reading time with lots of room for questions and conversational supports built into the experience.



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Together (15 minutes)

- Bring the families back together.
- Before showing the Ruff Ruffman video “Pulling for the Plushie,” (pbskids.org/ruff/sports/videos) provide some info about Ruff and the video to help orient the group to what they’re about to watch.
 - You can say something like, “Now you are going to watch a video where Ruff and his friends **investigate friction**. I wonder how their investigation will be different from yours. Let’s find out!” Then show the video.
 - As the group watches, pause the video to reflect on new vocabulary and ideas being explored by Ruff and his friends. Here are some places you might pause:
 - After Blossom shows Ruff the three **surfaces** Steve pulled him across, ask them why some **surfaces** might have made him go faster than others.
 - After the kids in the video make their predictions about which **surface** will allow the fastest movement, ask the families what their predictions are. Why?
- When the video is over, lead a discussion with the following questions:
 - In the video, what was different about the three **surfaces** (sand, grass, concrete)?
 - How did the different **surfaces** affect the sled’s movement?
 - Why did the concrete allow the sled to go fastest? What properties did it have that made it different from the other **surfaces**?
 - If the concrete allowed the sled to go the fastest, does that mean it created more **friction** for the sled, or less?

Switch gears and let the families know that they now have a chance to continue exploring **friction** by playing a digital game.

- Have families play *Fish Force* (pbskids.org/ruff/sports/game). In this game, families will use force and **friction** to help Ruff rescue his plushie toy!
 - Encourage families to play the games collaboratively. It's important that everyone gets a chance to interact with what's happening on-screen and to have input in what material choices are being made.



This game has visual cues to help the players. If they need help, there is a hint button that can provide visual support on how to use the slider to get the right amount of force.



Older children can act as "tech mentors" and can help facilitators in getting families set up with their devices and games.

- If no technology is available, or if the offline version is preferred, have families play the offline game *Bottle Cap Hockey* (pbskids.org/ruff/sports/activities). In this game, players slide a bottle cap across different **surfaces**, trying to get closest to the target. If you choose this option, make sure you have the necessary materials on hand during the session.
- As families play, encourage facilitators to walk around the room and to support their play by asking the following questions:
 - How does the amount of force used relate to the distance the object moves?
 - How do changes to the **surface** (the patch of sand) affect how the object moves?
 - If it were all sand instead of ice, would you need to use more force or less force to move the fish?
 - What is your favorite part of this game? What is the most challenging?

Make

(40 minutes)

Now families will participate in their own investigations to explore **friction** by using and testing different **surfaces** to see how they affect the distance an object travels.

□ Provide each family with the following materials for the activity:

- two-by-four-foot board
- tape
- three materials for different **surfaces** (such as sandpaper, bubble wrap, play dough, grippy rubber, or plastic bags).
- Make sure each family has a variety of **surfaces** so they can see some differences in their tests.



These are suggested materials but can be swapped out for any others that are available. The goal is to provide a variety of textures that will affect how the cars move.



Families can think of something decorative they can add to their ramp and engage younger children in the activity by having them decorate it.

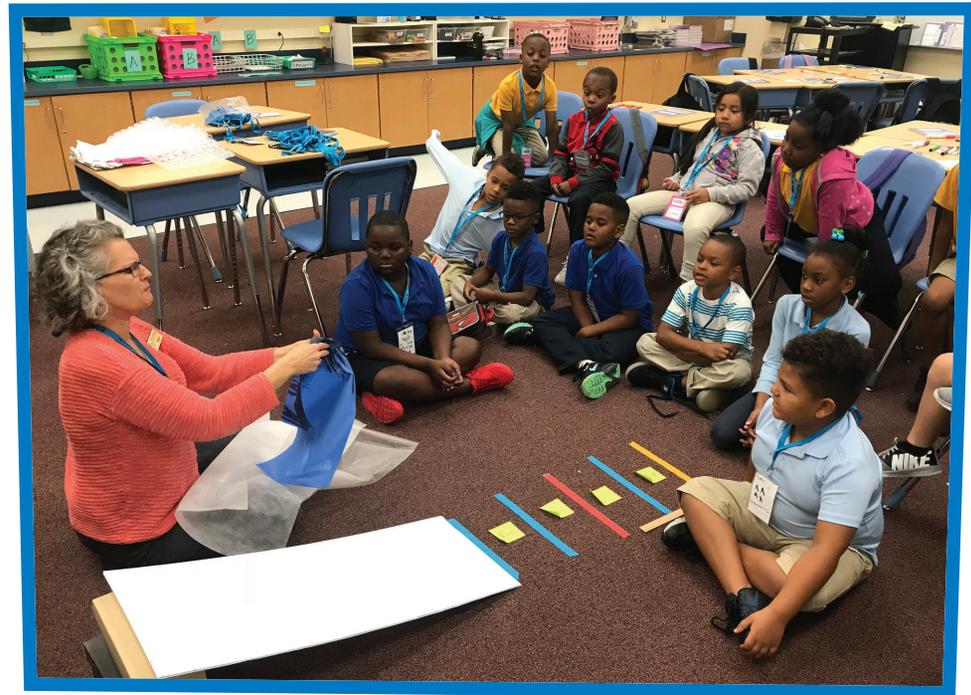


Engage older children by activating them as documenters who take photos or draw pictures of their family learning together. This is a great way to get older siblings involved, and documentation can serve as a powerful tool for both reflection and motivation.

The families will now work through various parts of the science inquiry process as they work through the **Friction** Frenzy investigation.

Making Observations: Ask the families to notice the differences and similarities in their materials.

- Encourage them to touch the material to feel the textures. Ask them to think about these ideas:
 - What are words to describe the textures of these different materials? Smooth? Bumpy? Squishy? Sticky? Rough? Slick?
 - Do you think an object such as a small toy car would have any trouble rolling on any of these **surfaces**? Why?
- Have the families log these observations on the 'Friction Frenzy Surface' pages of their Curiosity Journal.



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□ Plan & Predict: It's time for families to set up their investigations!

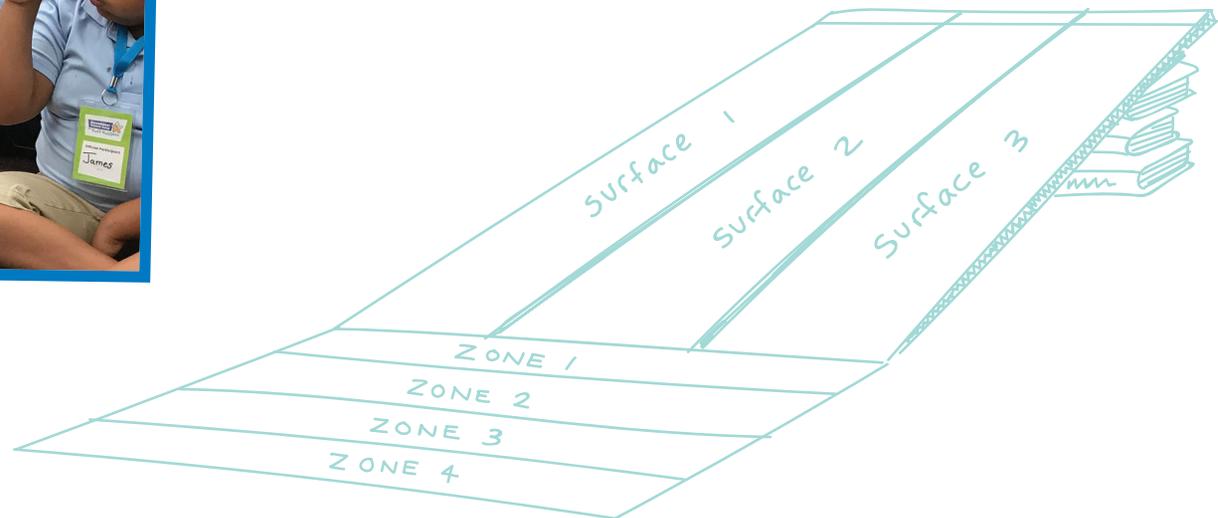
- Each family will prop their board up about six inches high using books or other props (so that the ramp is long, not tall).
- Have them set up three lanes on the board with their three materials.
- Lanes will likely be six inches to a foot wide and should have space between them.



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Most materials should be able to be taped down along the edges, leaving the middle clear (except for play dough, which can just be pressed onto the board). Encourage participants to get the materials as flat as possible so the cars don't fly off.



- Starting at the foot of the ramp and extending away from the ramp, have the families tape lines six inches apart to serve as distance lines to help them measure how far the cars travel after leaving the ramp.
- Have them mark the space between the lines as “zones”—between the bottom of the ramp and the first line is “Zone 1”; between the first line and second line is “Zone 2”; and so on.



Help families get their ramps set up so that each family’s setup is as close to the same as possible. Also help families measure out their distance lines to make sure that each group is approaching it similarly. This will help in sharing results with the whole group later.



Encourage families to divide up the work. Roles might be:

- **Builder:** This person creates the ramp, making sure it is at a good angle and secure.
- **Measurer:** This person marks where each lane will go, making room for each material, and also helps measure the distance lines at the end of the ramp.
- **Designer:** This person chooses which material goes in each lane.
- **Taper:** This person helps the designer tape down the materials and can also help tape the distance lines at the end of the ramp.

- Now based on their observations of the materials, which ones do they think will make the car stop, go really far, or go somewhere in the middle?
- Have them log these predictions in their journals.



When making predictions, encourage families to think hard about what they already know and what they've already observed. Using critical thinking skills when making predictions can support deeper learning, especially when learners are able to compare the actual results with their predictions, creating an opportunity to analyze and interpret why the prediction was right or wrong.

Investigate and Collect Data: When their predictions are made, it's time to run their investigation!

- Families will do several tests by rolling cars down the ramp.
- Family members will need to play different roles during the **investigation**. Encourage families to rotate through these roles so that everyone gets a chance to try each. The roles include:
 - One pencil holder, who holds the car back
 - One car holder, who holds the car steady
 - One observer, who records in the Curiosity Journal how far the car traveled
 - One counter, who counts down when the car should be released ("Three, two, one, go!")

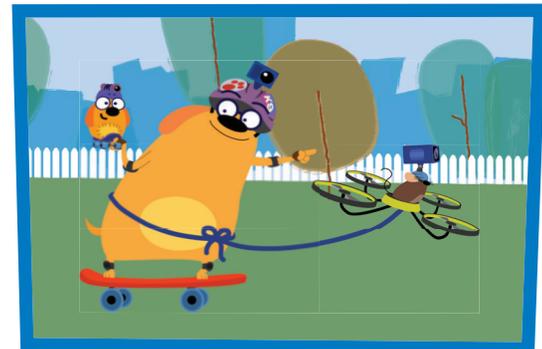


Younger children can "run tests" by sending the car down the ramp right after the official tests. This way they still get to play along but don't have to follow a specific role.



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- When the team is ready to send the car down the ramp, have the person holding the car let it go, and have the person holding the pencil raise it so the car can travel down the ramp.
 - The person holding the car should not push the car—they are only holding it steady until it's time to release it.
 - Have the observer document the results of each test in the Curiosity Journal 'Friction Frenzy Results' page.
 - Encourage each family to do three test runs on each **surface**, documenting and comparing the results to see if each test gives the same results.
 - Have them move down the lanes on their board, repeating the actions of running three tests, and compare the results.
 - While the families conduct their investigations, visit them and ask: Do they get the same results on each test for each **surface**? If not, why do they think that is?
- Reflect and Draw Conclusions: When they've tested all three materials, ask them to reflect on and analyze all the results they documented in their Curiosity Journals:
- Are any of the results for the different materials the same (a tie)?
 - If so, is this surprising? What are the differences in the **surfaces** tested?
 - What is the biggest difference in the results (the shortest distance traveled by the car versus the longest distance traveled by the car)?
 - Which material(s) let the car travel the farthest?
 - Which material(s) seemed to keep the car from moving very far?



Ask Questions: Ask the group if any new questions have emerged based on their investigation.

- Encourage families to document these new questions in their Curiosity Journals.
- Explain that the work of scientists rarely ends after a single investigation, and that answering one question often creates a whole set of questions to continue to explore and **investigate!**

Share

(20 minutes)

Bring the families back together to share.

- As a group, discuss ways that families acted and thought like scientists as they engaged in science inquiry during the session. Some possible talking points include:
- Observing and Noticing:
 - In what ways did you and your kids use your senses to make observations?
 - Did these observations help in making predictions about how the car might travel on the **surfaces**?
 - Asking Questions:
 - What are examples of questions you asked and explored?
 - Predicting and Planning:
 - Was it helpful to spend time making predictions that your family could compare your results against?
 - How close were your predictions to the actual results?

- Investigating:
 - What were some of the challenges your family faced during your investigation?
 - What are some important skills for being a good investigator?
 - Did Ruff model any of those skills?
- Collecting Data:
 - Was it important or useful to collect data in your Curiosity Journals? Why or why not?
- Reflecting and Drawing Conclusions
 - What conclusions did you come up with after you finished your investigation?
 - Was it easier to make your conclusions because of the time you spent engaging in the other parts of the process?
- Discuss the results of the investigation.
 - What **surfaces** created the most **friction**?
 - What **surfaces** created the least **friction**?
 - Were any of the results surprising or unexpected? Why?
- Think about members of your community, such as transportation workers and athletes. How does **friction** impact their work?



Wrap-Up and Take-Home

- Review the family's take-home materials.
- Go over the resources they will be taking home, and demonstrate how to access the *Ruff Ruffman Show* media and activities related to the materials.



If time allows, you can also read the book they will be taking home.

- Collect everyone's Curiosity Journals and let them know you are holding on to them until the next session.
- Have everyone help clean up.
- Give each family their take-home handouts, remind them of the details for the next session, and congratulate them on their great work!



Session 4

Build It Up

Learning about Structures

Eat Review and preview

Explore Ruff Ruffman video, games, and discussion

Make Design and build a playground for a Ruff plushie

Share Sharing, comparing, and discussing structures

Structures: Session Overview

Eat (20 minutes)

- Welcome families, and have them gather materials, name badges, and Curiosity Journals
- After everyone has arrived, begin meal
- Encourage conversation between families using table conversation prompts
- Lead a quick warm-up activity
- Preview the day's session

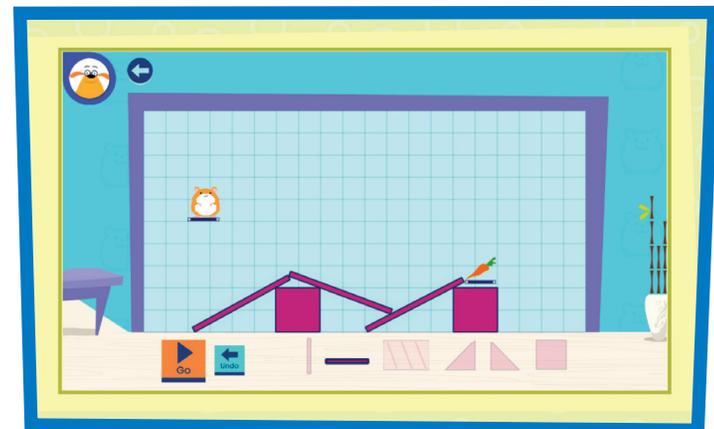
Explore (40 minutes)

- Decide whether to keep families together, or divide into grown-up and kid groups
- (15 minutes) Lead discussions
 - Grown-ups:
 - Check in with grown-ups regarding any questions they have, and engage in a brief review of the previous session
 - Review the engineering design process
 - Introduce **structures** and discuss features that make **structures stable**
 - Preview *Hamster Run* game (pbskids.org/ruff/structures/game)



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- Children (use this pathway if keeping families together):
 - Discuss **structures**, starting with an exploration about what they already know about **structures**
 - If there is time, read *What Floats in a Moat*
- Bring grown-ups and children back together
- (10 minutes) Watch video “Eye of the Hamster” (pbskids.org/ruff/structures/videos) pausing on occasion to discuss big ideas explored in the video
- (5 minutes) Lead discussion on the video with questions like:
 - Some objects stack more easily than others. What kinds of things are easy to stack, and why?
 - What kinds of things are hard to stack, and why?
 - What kinds of shapes are better for building a **stable structure**?
 - Ruff’s friends talk about the importance of support for their sky bridge. What did they mean?
- (10 minutes) Play digital game *Hamster Run*
 - Support and engage families with questions as they play the game
- Wrap up this Explore section with questions to make connections between the video, game and to set-up the Make section



Make

(40 minutes)

- Revisit the engineering design process with families
- Bring out materials; **observe** and describe them using senses
- Discuss how the materials could be used to build different types of **structures**
- Have families design and build a playground for the Ruff Ruffman Action Plushie using the
- 'Build a Playground' pages of the Curiosity Journals to work through the engineering design process
- Engage families with questions as they play with their **structures**

Share

(20 minutes)

- Ask for volunteers to show the playground they made and to share their experience working together
- Wrap up discussion and celebration
- Wrap up the session by giving families their take home materials, including Curiosity Journals, Vocabulary Cards, and plush



Materials Needed for the Day

View these activities as modules. It's recommended you follow them in sequence, but feel free to add, mix up, or drop sections as needed to accommodate your specific session.

Video, games and activities for this session can be found at: pbskids.org/ruff/structures

Activity	Materials
<p>Eat</p> <p>Have materials organized and ready for families to easily pick up on their way in.</p> <p>Have conversation prompts out on tables before families sit down to eat.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Meal <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Name badges <input type="checkbox"/> Game sheets (optional) <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Table conversation prompts
<p>Explore</p> <p>Have the computer and projector set up for showing the video to the group. Alternatively, have individuals or pairs watch the video on tablets or computers. Make sure devices are connected to the internet if they're used to access the digital games.</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Computer, projector, slides <input type="checkbox"/> Curiosity Journals <input type="checkbox"/> Pencils <input type="checkbox"/> Markers <input type="checkbox"/> Tablets/computers (optional, but preferred) <input type="checkbox"/> Coloring sheets (optional) <input type="checkbox"/> "Eye of the Hamster" video pbskids.org/ruff/structures/videos <input type="checkbox"/> <i>Hamster Run</i> game pbskids.org/ruff/structures/game

Make

Have materials in a place where families can observe them.

- A variety of materials such as:
 - cardboard pieces of various sizes
 - cardboard tubes of various sizes (poster tube, paper towel tube, toilet paper tube)
 - construction paper
 - wooden blocks
 - rope
 - plastic cups
- [1 per family] Duct tape
- [1 per family] Glue
- [1 per family] Ruff Ruffman Action Plushie
- Curiosity Journals
- Pencils
- Markers

Share

Have take-home materials organized and ready for pickup.

- Playground creations from Make session
- Curiosity Journals
- Pencils
- Markers
- Take-home sheets, Vocabulary Cards, Curiosity Journals and *What Floats in a Moat* books to send home

Structures

Session Rundown

In this session, families will explore **structures**. They will watch and play with media and will work together on a hands-on activity to engage in the engineering design process as they define a problem and plan, create, test, and improve upon their solution.

Session Goals

Families will:

- Explore how the **stability** of a **structure** can be affected by properties of the materials used to build it.
- **Observe** how the **stability** of different kinds of **structures** are affected by properties such as shape, size, and what they are made of.
- Encounter the following vocabulary: **structure**, **stability**, **sturdy**, and **observe**.
- Imagine and plan for how different materials and design choices could affect the strength and **sturdiness** of a **structure**.
- Discover problems that can be solved by design using different materials and by organizing materials in different ways to change their shape, size, and symmetry.
- Communicate **observations** of the properties of **structures** to others.
- Engage in discussions about **structures** and their properties to connect previous knowledge with new concepts explored through media and hands-on investigations.
- Think and act like engineers!
- Develop and strengthen positive attitudes for engaging with scientific content and participants' own abilities to collaborate and support one another's learning and play.

Eat

(25 minutes)

Welcome

- Welcome families, and have them gather materials, name badges, and Curiosity Journals.
- When all the families have arrived, invite them to get their food and eat.
- Encourage families to notice the conversation prompts on their table.

- These are optional conversation pieces that are designed to get families talking to each other and nearby families, while priming the day's topic and activities.

- Lead a quick warm-up activity to bring everyone together and start the session with a playful tone.
- Preview today's session, **structures**, where families will have an opportunity to explore **structures** and what makes a **structure stable** and **sturdy**. Together families will:

TIP

Some prompts will be topical, and others will be focused on self-affirmation. Self-affirmation activities are a great way to build confidence and support the strengthening of positive self-perceptions among participants.

- Explore: Through discussion and engagement with Ruff Ruffman media, families will get familiar with **structures** and what helps make **structures stable**.
- Make: Families will use the engineering design process to solve a problem using different materials to design a playground for a Ruff plushie. They will create, test, revise, and create some more!
- Share: Families will share their final designs and experiences engaging in the engineering design process with others, as well as share ideas and connections to their everyday lives.

Explore

(40 minutes)

The Explore section of each session is designed to provide participants with materials, media, and the time and space to dig into the concepts and themes of each session.

- Split up and check in with grown-ups and kids separately, or you can choose to keep the whole family together.



If you choose to keep the whole family together for the Explore section, use the “Children” pathway for the whole family.

Grown-Ups

- Get the grown-ups together in a comfortable place for a group discussion.
 - This will be a time to review ideas from the previous session, as well as preview the day’s activity.
 - Engage in a brief discussion about the last session:
 - What stuck with them from the friction activities and media?
 - Did they make any connections at home to the friction activities?
 - Did they find themselves engaging in any aspects of the science inquiry process in their everyday lives?



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□ Revisit the engineering design process with the grown-ups.

- Let the grown-ups know that today you are going to revisit the engineering design process, which was introduced in the Materials session.
- Refer to the engineering design process graphic, and ask if anyone can help recall and describe the different parts of the process.

□ If a review is needed/wanted, go over the different parts of the process:

- **Define a Problem:** All engineers start by coming up with a goal or a problem that they want to solve.
- **Imagine and Plan:** With lots of possible ways to go about creating or building a project, it's important to take some time to think about the possibilities and to create a plan to provide guidance for the team before everyone starts building.
- **Create:** Build, construct, or make a project.
- **Test and Improve:** Testing your project as you go is an efficient way to save time and to fix mistakes if you realize something isn't working.
- **Communicate:** Sharing your project with others for feedback throughout the process is a great way to get new ideas.



- Encourage grown-ups to continue to keep this process in mind today as they explore **structures** with their children.
 - One of the best ways they can continue to support their children’s learning as they design and build together is to ask open-ended questions that support critical thinking. Examples might include:
 - Why did you place that object on top of that object?
 - What do you think would happen if...?
 - Does our **structure** look **stable**? How could we make it more **stable**?

- Let the grown-ups know that today they will be exploring **structures**, and properties that make a **structure sturdy** or **stable**.
 - Engage the grown-ups in a brief discussion about what makes a **sturdy** and **stable structure**.
 - They will use the engineering design process with their children to create **structures**, and will play a game that further explores building **stable structures**.



Play Preview

- Preview the *Hamster Run* digital game (pbskids.org/ruff/structures/game).
- Give the grown-ups tablets or laptops and show them the game *Hamster Run* (pbskids.org/ruff/structures/game). Demonstrate how to open the game and play it, and then give them a chance to play it.
- In addition to explaining the mechanics of the game, give the grown-ups a few questions or prompts they can use with their children later, such as:
 - As your child plays, if they aren't sure about their decision, encourage them to "test" it! They can always use the "undo" button if they don't like where they've placed a block.
 - After your child is comfortable with the game, encourage them to get creative with their solutions. Can they solve the puzzle in a way that isn't obvious?
- Encourage grown-ups to find ways to play along with their kids later in the session and to be involved in the game play.



Children

- Get the kids together in a comfortable place for a group discussion.
 - This discussion will be a time to preview the day's activity, and learn more about **structures**.
 - Start the conversation by asking what the children already know about **structures**.
 - Think about a tower, which is a type of **structure**. What might this kind of **structure** need to be **sturdy** and strong, to keep it from falling over?
 - What kind of materials do you think you could use to build a tower that is **sturdy** and strong?
 - If a **structure** is **sturdy**, it is strong, and if it is **stable**, it doesn't move easily. What are some things a **structure** might need so it is **stable** and doesn't move easily?
- Now that they have heard these words, have them be on the lookout for them today:
 - **Structure**, or something that is built.
 - **Stable/stability**, which is when something doesn't move easily.
 - **Sturdy**, another word for strong.
 - **Observe**, or using your senses to gain information about something.



Don't spend too much time defining and discussing the words at this point. Vocabulary out of context is often meaningless to young children. Instead, introduce the words, tell them to be on the lookout for them, and then make a conscious effort to reference and incorporate them throughout the session.

If they know what these words mean, encourage them to use them with their families during the session as they play together!

Reading Time

- If there's time, read the book *What Floats in a Moat* to the children, pausing often to ask questions such as:
 - Why does Archie doodle and draw?
 - Why didn't the first two boats work?



TIP

If the grown-ups' discussion finishes before reading time is over, invite the grown-ups to join the children. This is a great opportunity to model highly interactive reading time with lots of room for questions and conversational supports built into the experience.



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Together (15 minutes)

- Bring the families back together.
- Before showing the Ruff Ruffman video "Eye of the Hamster," provide some info about Ruff and the video to help orient the group to what they're about to watch.
 - You can say something like, "In these videos, you'll see Ruff's friends build an obstacle course for a hamster! But how do they plan and test the pieces of the course? Let's find out!" Then show the video.
 - As the group watches, pause the video to reflect on new vocabulary and ideas being explored by Ruff and his friends. Here are some places you might pause:

- After Ruff's friends tell Ruff their problem (that their hamster is bored), ask families what they would do to solve the problem.
- After Ruff falls off the sky bridge (the platform with balls under it), ask families why they think it didn't work for him.

□ When the video is over, lead a discussion with the following questions:

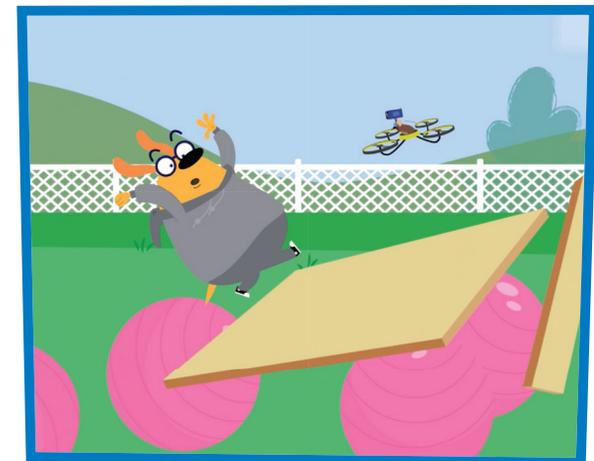
- Some objects stack more easily than others. What kinds of things are easy to stack, and why?
- What kinds of things are hard to stack, and why?
- What kinds of shapes are better for building a **stable structure**?
- Did anyone notice Ruff and his friend engaging in the engineering design process as they worked on the sky bridge and the obstacle course? What parts of the engineering design process did they engage in?
- Ruff's friends talk about the importance of support for their sky bridge. What did they mean?



Encourage them to think about properties such as flat sides versus spheres.



When the families discuss support, encourage them to think about what support is, and how the placement of supports helps make a **structure stable**.



Switch gears and let the families know that they now have a chance to continue exploring **structures** by playing a digital game.

- Have families play *Hamster Run* (pbskids.org/ruff/structures/game). In this game, the families will experiment with a variety of building pieces to construct **stable** and **sturdy structures** that help the hamster get to its carrot.
 - Encourage families to start with the leveled challenges, and then, if there is time, have them try to create their own levels.
- If no technology is available, move on to the Make.



Younger children who need an alternate activity can work on coloring sheets of the Ruff characters. The art can be cut out and pasted into pages of the family's Curiosity Journal to help decorate as a way of encouraging younger siblings' participation.



Older children can act as "tech mentors" and can help facilitators in getting families set up with their devices and games.

- As families play the game, have facilitators spread throughout the room to support families as they play. Engage in discussions with families around the following questions:
 - How was this game like the video you watched?
 - Did you always get the solution right on the first try in the game?



Creative work and problem-solving can be frustrating. Encourage anyone who expresses frustration with the process to appreciate their hard work. Persisting through tough challenges is often when the best learning occurs.



Let them know that there may be multiple ways to correctly solve the challenge.

- What kinds of things did you notice the **structures** needed to be **stable**?

Make

(40 minutes)



Now families will participate in their own investigations to further explore **structures**.



Engage older children by activating them as documenters who take photos or draw pictures of their family learning together. This is a great way to get older siblings involved, and documentation can serve as a powerful tool for both reflection and motivation.



Engage younger children by giving them their own set of wooden blocks to stack and build with.

- Before they begin and as they work, reorient the families to the engineering design process graphic.
 - They will use their Curiosity Journals to aid them as they work through the process to: **Define a Problem, Imagine and Plan, Create, Test, and Improve.**
- Lay out a variety of materials (such as cardboard, construction paper, rope, plastic cups) for the group to **observe**.
 - To encourage different ways materials might be considered for use in their creations, have the group use their senses to make some initial **observations** about the materials.



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- After the families have explored the materials, ask the group a few questions to help them apply the materials to different situations, such as:
 - How could you use these materials to make a base for a **structure** like a tower?
 - How could you use these materials to create ramps or platforms?
 - Not all **structures** are towers. What are some other **structures** you might create with these materials?

Inspired by the video and game they engaged with earlier, families can now work on building a model of a playground for their Ruff Ruffman Action Plushie to play on!

- Using the engineering design process, families will build a functional playground for their plushie.
 - Give each family a plushie, and have them find the 'Build a Playground' pages in their Curiosity Journals. Have them fill out these pages as they go.
 - Tell the families that they are going to create a playground made up of multiple parts.
 - Family members can each make their own piece or work together to create a few pieces, whatever works best for their family.



□ **Define a Problem:** Before they begin, they need to define a problem or challenge that they want to create a solution for. Some options include:

- Create a playground that is just the right size for their plushie.
- Create playground parts that can fit together.
- Create playground parts that do different things. (Examples are: slide, swing, tunnel, sky bridge, and climbing **structure**.)



Encourage them to try to create solutions that address multiple problems or challenges!

□ **Imagine and Plan:** Next, support families as they imagine and plan what they want to build for their plushie.

- Encourage them to sketch some plans for their creation in their Curiosity Journals and to think about the materials available to them. They can refer to their sketches while they build.



While the families define their problem, and imagine and sketch their plans, encourage them to also think about not only how their piece of equipment fits their plushie well, but also how it could connect to other pieces of equipment to make a whole playground.



As you check-in with families while they work on this part, ask them to revisit the problems a few times as they imagine and plan. They need to make sure their plans serve as a solution to the problem they defined. It's easy to go in a different direction once ideas start flowing!

□ **Create:** After the plans are made, it's time to create. Using the materials available to them, they should start building their playground equipment!

- Encourage the families to refer back to their plans. They should also keep their plushies nearby so they can test, measure, and change the materials they are using as needed.

TIP

Encourage families to create roles for each family member, much like they did in the Friction Frenzy activity. Depending on how they approach building different pieces, some roles for this project might be: tester, constructor (the one who manipulates the cardboard pieces), taper or gluer, connector (the one who makes sure the pieces fit together), decorator, project manager (the one who makes sure every part of the process is attended to).

TIP

Remind the families that during the build, they will probably have to try several solutions to get something that works. It's rare to get something right on the first try!

□ **Test:** When they have a completed piece of playground equipment, it's time to test it!

- Have the families put their plushie in (or on) the equipment and give it a try.
- Have them **observe** things that need to be adjusted. They may look for things such as:
 - Does the plushie fit perfectly, or is it too big or too tight?
 - Does the plushie move easily through the creation?
 - Is the creation **stable** and **sturdy** enough to support the plushie?
- Have them record these **observations** in their journals.



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Improve: Now that they have an idea of how their first try works, they are ready to improve their playgrounds.

- Have the families refer to the **observations** they made from the test, and record possible solutions to make their build even better.
- Then have them make the changes and test it once again.



The process of testing and improving can be done as often as time and ideas allow.

When the families are happy with the equipment they built, have them put the pieces together to make a whole playground!

- Have them move the plushie through the different parts and see how the whole thing works together.
- As they play, encourage them to think about other things they could create to make it even bigger.

While they play, visit the families and ask them:

- How are your creations similar to or different from the hamster obstacle course in the video?
- Why did you choose these materials to build with?
- Have you done anything to make your **structure** more **stable** or **sturdy**?
- What kinds of changes did you have to make to get the design just right?



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- How was your final design different from the sketch you drew?
- Think of this playground as a model of a real playground. Do you think what you built could be remade for kids to play on? What would need to be changed or added for kids to be able to use this playground? What materials would you use?

Share

(20 minutes)

Bring the families back together to share.

- Ask for volunteers to demonstrate their playground for the whole group.

- Encourage them to share how they came up with their idea, and how their plushie plays on their playground.
- Ask them to describe the most fun and most challenging parts of making it.
- Encourage the families to listen attentively as others share and to contribute to one another's work by offering supportive feedback or questions about their process.



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Encourage the families to write down ideas and inspiration they might have from the other designs in their Curiosity Journals. This is a great activity to try again with other toys at home!



Another option is to do a gallery walk here. Put paper out next to each playground, and have the families go around and visit the different creations. Encourage them to leave positive comments or ideas on the papers for the creators to read later. You may want to ask if every group is okay with other families trying out their playgrounds so they can touch and test them as well.

- When all the playground creations have been demonstrated, bring the group back together and ask them some questions, such as:
 - What are some properties **structures** need to be **stable**?
 - What kinds of things did you have to think about when you designed your playground?
 - What kinds of great ideas did you get from seeing the other families' designs?
 - Think about members of the community whose work involves structures, such as architects, builders and developers. How might these workers use engineering in their jobs?

Wrap-Up and Celebrate!

If this is your last FCL session, take some time to engage in a culminating discussion and celebration of your shared experience together.

- Use the following questions to help guide a reflective discussion with families:
 - What was the most exciting and fun part of the last four sessions together? What was the most challenging?
 - How might the two different processes that were explored during the sessions be used to support future science, engineering, and other fun learning experiences at home, at school, and elsewhere?
 - Was it fun to combine the videos, games, and hands-on activities all together? How did that affect the ways you were able to learn and play together?



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- Reiterate all the incredible work you've accomplished together tinkering, collaborating, making, problem-solving, investigating, learning, and engaging in science inquiry and engineering design.
- Hand out all take-home materials.
- Present families with their Certificate of Achievement.
- If you have plans to continue engaging with families in some capacity, share your plans with them. This could include pointing families to other local events and activities to take part in or pointing them to online and on-air resources they can use.
 - Make sure families know how to keep in touch with you and your partners (such as through social media, websites, phone or email, or calendar of events).
- Before everyone leaves, make sure to get a group picture!



If families have gotten close over the course of the experience and want to exchange contact information, help facilitate that sharing. With that said, also be sensitive about families who may not want to share their contact information.

