

# Problem Solvers Activity SE 15: Ramp and Roll

## CHILDREN ARE LEARNING...<sup>1</sup>

### Science Content:

- A ramp (inclined plane) is a surface with one end higher than the other.
- Objects behave differently on a ramp; they may roll, slide, or stay in place.
- The shape of an object affects how it moves on a ramp.
- Pushes can have different strengths and directions.
- Pushing an object can change the direction and speed of its motion.
- Pushing on an object can start its motion.
- A bigger push makes things move more quickly.
- The steeper the ramp, the more quickly an object moves down the ramp.

## CHILDREN ARE DOING...

### Science Practices:

- Explore cause and effect
- Make predictions
- Make observations
- Plan and carry out investigations

**Note on Preparation Time:** Acquiring materials and building ramps will require more-than-usual prep time. However, once constructed, ramps will be used in three Problem Solvers activities and may be used for free play as well.

## MATERIALS NEEDED:

One ramp for every 2 children—**See next page for ramp options.**

1 basket or tray per pair of children

### **For Ramp Testing:**

*Rolling Items:* 3 different balls for every 2 children (choose from: tennis balls, ping-pong balls, wiffle balls, rubber bouncy balls, pom-poms, foam balls, textured balls, etc.)

*Non-Rolling Items, choose two different options such as:*

Craft sticks—2 for every 2 children

Spoons—2 for every 2 children

<sup>1</sup> Adapted from the Next Generation Science Standards (kindergarten): <https://www.nextgenscience.org/>

Chopsticks—2 for every 2 children

Jingle Bells—2 for every 2 children

**Optional:** Other testing items to consider in place of/in addition to those above: Egg-shaped shakers, rulers, buttons, spools, jacks, plastic cups, etc.

### PREPARATION:

- **For the ENGAGE activity:**
  - Position a ramp and ball in the center of the opening circle.
- **For the EXPAND activity:**
  - Prepare the ramps (1 ramp per 2 children). Note that this activity (15) and the next 2 activities (16-17) all use ramps so, if possible, it's easiest to do these activities consecutively while you have the ramps in your classroom. If possible, designate an area in your classroom for ramp exploration.
  - Create two baskets (or trays) of ramp testing materials for children. Each basket should contain 2-4 different types of balls/optional materials, 1 craft stick, 1 chopstick, 1 jingle bell, and 1 spoon.

## How to Build Ramps: Implementing This Activity

Some programs have ramps as part of their classroom inventory and, if that is the case with your setting, feel free to use the ramps available to you.

If you need to build ramps for this activity, the following options are suggested:

### Option 1: Foam Pipe Insulation (alternative materials: Pool Noodle(s), Paper towel/toilet paper/wrapping paper tubes)

1. Foam pipe insulation is inexpensive and found at home/building supply stores. It is generally sold in 6-foot lengths, with a cut opening on one side. Carefully using scissors, a sharp serrated knife or utility knife, cut through the other side to form two halves.
2. Cut each half into 3-foot lengths. The foam ramp can be leaned against a stack of blocks, bookshelf, etc.
3. Note: Instructions are the same if using pool noodles or cardboard tubes—cut in half to form “half-pipes.” This style of ramp cannot easily be used for toy cars, but can be used for balls and other objects that fit into its curved opening.

### Option 2: Vinyl Gutter Ramp

1. Vinyl gutters are inexpensive and found in most home/building supply stores. (Stores may even be willing donate some to your program.) Often the store will cut the gutter into lengths for you at no charge. Typically, gutters are sold in 10 feet lengths. If you can, request the gutter be cut into 4 sections: 4-feet, 3-feet, 2-feet, and 1-foot lengths.
2. Cover the cut ends of the gutter with duct tape, so there are no sharp edges.
3. Gutter ramps can be leaned against a stack of cardboard boxes, a low bookshelf, stool, stack of blocks, etc.

### Option 3: Cove Molding Ramp

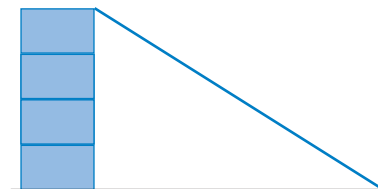
1. Like vinyl gutters, wooden cove molding is fairly inexpensive and found in most home/building supply stores. Select a molding that is at least  $1\frac{3}{4}$  inches wide. Molding is typically sold by the foot. If you can, request 10 feet, cut into 4 sections: 4-feet, 3-feet, 2-feet, and 1-foot lengths. (Additionally, cove molding may be cut into small pieces—4 inches, 8 inches, 12 inches—and paired with dry, clean sponges as supports to create a table-top ramp set.) Home/building supply stores may be willing to donate molding to your program and often will cut to size at no charge.
2. Sand the cut ends of the molding so there are no rough edges. Children can help with this part and often really enjoy it!
3. Molding is flat on the bottom—this will form your ramp. With the flat side facing up, lean the wooden molding against cardboard boxes, a low bookshelf, stool, stack of blocks, etc.

### Option 4: Foamboard

1. Foamboard can be found at office supply/craft stores. It is often sold in pieces that are about 30"x40". Each piece can form 2 ramps.
2. Cut the foamboard in half to form two, 15"x20" pieces.
3. Lean the foamboard against a low bookshelf, stool, stack of blocks, etc. to form a ramp. You can add a wad of masking tape under the foamboard to hold it in place on the bookshelf/stool.

### Option 5: Blocks & A Flattened Cardboard Box

1. Stack 3-5 unit blocks (wooden, cardboard or foam) to the desired height of your ramp—perhaps 8-10". You can also stack shoeboxes instead of blocks. If you are using blocks, it's often easier to tape the blocks together using masking/painter's tape so it's one stack.
2. Flatten a 12-18" wide cardboard box.
3. Lean the box on your stack of blocks. Make sure the ramp touches the floor. (See image to the right.) Place a wad of masking tape on the underside of the ramp, sticking it to the stack of blocks, so it stays in place.



## Activity Instructions

### ENGAGE

Gather a group of 4 children at a table or in a circle on the floor. (Note: Groups of 6 children work well if you are teaching 4-year-olds. Adjust materials as needed.)

**EXPLAIN:** Today we're going to be Problem Solvers and explore something called a *ramp*. Has anyone heard that word before?

*Place a ramp in the center of the circle. Place a ball near the ramp.*

**ASK:** Here's my ball. What can we do to get the ball to move? (*Children may suggest pushing it or blowing on it.*)

**EXPLAIN:** Yes, we have to do something to the ball to get the ball moving because it's on a flat surface—this means the floor is level. But let's look at my ramp. The ramp is on an incline—an incline is a surface that slopes, or has one end higher than the other. What can we do to make the ball move on the ramp? (*Take children's ideas and try them.*)

**ASK:** Have you ever seen a slide at the playground? A ramp is like a slide. A ramp and a slide both have an incline, with one end higher than the other.

*Encourage children to tell you about their experiences with a slide. You might ask guiding questions like:*

- Can you talk with me about how a slide works? What happens if you sit on a slide?
- Do you go down slowly or quickly on a slide? *(Sometimes it depends—on what the slide is made of, or what the child is wearing.)*
- Have you ever dropped a leaf, pinecone or piece of mulch down a slide? What happens?
- What would you like to try or do with our ramps today?

*Summarize children's knowledge of how a ramp works, and what they want to explore.*

## EXPAND

**PREPARE:** We are going to explore ramps today. *(Assign two children to each ramp.)* Let's look at our ramps. If it's a ramp, one end has to be higher than the other. Can you show me the *higher* end of your ramp? Can you show me the *lower* end of your ramp?

**EXPLAIN:** Look at how my ramp starts at the high end here, and it ends at the floor. *(Point as you observe.)*

- Remember that we call this surface—that is high at one end and low at the other—an *incline*. Can you say that word: *incline*? My ramp makes an incline.
- What do you think might happen if we let go of a ball at the top of my ramp? What if we let go of a popsicle stick at the top? *(Take children's ideas.)*

*Distribute a basket of ramp materials (balls, etc.) to each pair.*

**ASK:** Let's look at these materials. We're going to use these materials to be scientists and test these different items on our ramps today. *(Encourage children to share their ideas by asking questions like the following.)*

- What can we do with these materials?
- What would you like to put on the ramp first?
- What do you think will happen if we put the spoon on the ramp?

*Review safety rules if needed, or for older children, ask: What do you think are some rules that can keep us safe when we're playing with ramps?*

**EXPLAIN:** Now it's your turn to explore the ramps with the materials in your basket.

*Give children time to experiment with a range of materials, including those that roll and those that don't.*

**NOTE:** Children may prefer using the materials that "work" on the ramp (those that roll). Encourage children to explore what happens when they place a non-rolling item (like the spoon or popsicle stick) on the ramp. How can they make these items move down the ramp? For example, they can push/slide these items down the ramp.

**OBSERVE:** The teacher's role during this part of the activity is to observe the children at play. Share the following messages as you observe and interact with children:

- **A push will start the ball rolling.** Sometimes letting go of a ball at the top of the ramp will start it rolling, but **PUSHING on a ball will definitely start it moving.** Ask children how they can get the popsicle stick or spoon down the ramp. Notice together how they had to push it. Teachers might also start this discussion if they see a child pushing a ball *up* the ramp: What kind of push is needed if you want to push it up instead of down the ramp?

- **Pushing an object can change its direction.** Notice if a ball moves in an unexpected direction (like off the ramp or bouncing off another object on the floor). Ask children what they think happened. **Summarize their discovery:** *We discovered that you can push objects in different directions.*
- **Only objects with a curved surface can roll down the ramp, like our balls.** Observe children comparing how objects like a ball vs. a spoon or craft stick perform on the ramp. If they don't engage in this experimentation themselves (some will be too excited by the balls!), encourage them to "see what happens." Ask: *What do you think will happen when you put the craft stick at the top? I see it didn't roll. Why do you think it can't roll?* Children may point out that some balls (smooth vs. textured) roll faster down the ramp. **Summarize their discovery:** Only objects with a curved surface, like the ball, can roll down the ramp. Smooth, rounded objects roll the fastest.
- **Some objects can slide down the ramp.** Objects like the craft stick and the spoon will slide down the ramp (slowly) if they're pushed. Encourage children to place one of these objects at the top of the ramp and ask: *What can you do to get the spoon to move down the ramp?* **Summarize their discovery:** Pushing on an object can start its motion.

**SUMMARIZE:** We did a really interesting experiment today. We put objects like balls and spoons on the ramp to learn how a ramp works. *(Summarize the key points above that children explored in this activity.)*

## EXPLORE

**ASK:** Now, let's see if we can try some ramp challenges together! Are you ready, Problem Solvers?

### Testing Flat Surfaces:

**ASK:** First, let's take your ramp down and put it flat on the floor. Is this still a ramp? *(Take children's ideas. It is not still a ramp because one end is not higher than the other.)* Do you think our ball will still roll? *(Take children's ideas.)*

**OBSERVE:** Let's try it. Let's place our ball and let go. Let's see if it rolls. What happened? *Allow children to share their results.*

**SUMMARIZE:** What did we learn about ramps? We learned that a ramp must have an incline, or have one end that's higher than the other, in order to work. Let's put our ramp back up again. *Assist as needed.*

### Testing the Force Applied to Balls:

**OBSERVE:** When we move an object—push or pull it—it's called *force*. This time, let's try pushing the ball with a gentle force. Let's push the ball gently! *(Demonstrate. Notice what happens to the ball. Did it behave the way children predicted? If so, what happened? If not, what happened?)*

**ASK:** Now, let's change the way we push. This time, let's try a *firm* force. We'll push firmly. Can someone show me how to push their ball *firmly*? It's a little harder than a gentle push. What do you think—how far will the ball roll? *(Why do you think it will roll far?)*

**OBSERVE:** Let's try it! Let's push *firmly*! *(Demonstrate. Notice what happens to the ball. Did it behave the way children predicted? If so, what happened? If not, what happened?)*

### Testing the Angle of the Ramp's Incline:

**ASK:** Now, let's change the incline of our ramp. Let's bring our ramp down low, so there's not a very big incline. *(Depending on the kind of ramp you are using, there will be different ways to adjust the angle of the incline. Demonstrate how to reduce the angle of the incline for children. Assist if needed.)* What do you predict—will our ball roll quickly or slowly down the ramp now?

**OBSERVE:** Let's try it! *(Demonstrate, releasing a ball at the top. Notice what happens. Did it behave the way children predicted? If so, what happened? If not, what happened?)*

**ASK:** Now, let's make our ramp much higher at the top end. *(Depending on the kind of ramp you are using, there will be different ways to adjust the angle of the incline. Demonstrate how to increase the angle of the incline for children. Assist if needed.)* What do you predict—will our ball roll more quickly or more slowly than before? What makes you think that?

**OBSERVE:** Let's try it! *(Demonstrate. Notice what happens to the ball. Did it behave the way children predicted? If so, what happened? If not, what happened?)*

**SUMMARIZE:** What did we learn about ramps today? (Take children's ideas. Summarize.) Firm pushes make the ball roll farther. With gentle pushes, the ball doesn't roll very far. When our ramp is very low, balls don't roll very quickly. But when our ramp is very high, the ball rolls fast down the ramp!

**TRANSITION:** Now it's your turn to explore with the ramps!

- Give children time to experiment with different objects, different pushes (firm or gentle), and different angles on their ramp.
- Be prepared that firm pushes may result in balls rolling farther into the room. Be sure children are set up in a safe place for this activity. If needed, remind children that a firm push must also be a safe push—that balls should not be pushed so firmly they end up in the air.
- Move from group to group, observing and asking questions about what they are doing and learning.

**OBSERVE:** The teacher's role during this part of the activity is to observe the children at play. Focus on sharing the following messages as you observe and interact with children:

- **Pushes can have different strengths.** Ask children to try pushing *gently* or *softly*. What happens to the object on the ramp? What if they push **hard**? **Summarize their discovery:** *You discovered that you can push the ball in different ways—with a gentle or hard push.*
- **Pushing an object can change its speed. A bigger push makes things go faster down the ramp and roll farther off the ramp.** Notice together with children how balls react differently to soft or hard push. Ask children what they see: How far did the ball go each time? Does it look different on the ramp if it has a hard or soft push? **Summarize their discovery:** *Pushing a ball firmly makes it move down the ramp faster and roll farther along the floor. Pushing a ball gently means that it moves down the ramp more slowly and doesn't roll as far on the floor*

## REFLECT

To close the activity, bring the children back together. Use a reflective question/s - like those below - to prompt children's thinking about ramps.

- What did you learn about ramps today?
- Did you like using firm pushes or gentle pushes on the ramp? Why?
- When the ball goes down the ramp, what can you do to make it go faster?
- What can roll down a ramp? Is there anything that doesn't roll down a ramp?
- Tell me about how ramps work.

**SUMMARIZE:** Today we learned about ramps. We learned a ramp has an incline, with a surface with one end higher than the other. We learned that some objects, like balls, roll down the ramp. Other objects don't move down the ramp on their own—we have to push them. We learned that by pushing a ball firmly, it can roll faster down the ramp and farther along the floor. By pushing gently, balls roll more slowly and not as far.

## Individualizing the Activity

### Make it more challenging:

- Give children time to construct their own ramps, with your guidance, rather than building ramps for them.
- Give children non-standard measurement tools (like post-it notes or unit blocks) to measure the distance that a ball rolls off the ramp. Including measurement experiences includes early math learning in this activity as well.
- Children may ask to make their ramp's incline steeper or you can scaffold this thinking by asking: "Can you think of a way to change the incline of your ramp?" Let them figure out how to do so—for example, they might use additional blocks, stack books under the ramp, or even hold it up at a sharper angle. Prompt children to predict how changing the angle of the incline might affect the way things roll down the ramp—will they roll faster or slower?

### Make it less challenging:

- Provide limited materials for exploration—1 or 2 types of balls and 1 or 2 items that don't roll (spoon, popsicle stick). Focus on (1) how the ramp works and (2) how the strength of the push influences the speed of the object rolling down the ramp.
- In the **Explore** section of the activity, lead these activities for the group—giving children the chance to push the balls—rather than having them do the activities in pairs.

## MAKING CONNECTIONS ACROSS THE DAY:

- Add a ramp to the block area and encourage children to use cars, balls, and other objects on the ramp during free play. You can also model how a wedge-shaped block can be used as a ramp. Child-directed explorations with ramps may pick up now that they have the experience with this lesson.
- When you are on the playground, prompt children to watch peers on the slide. How is the slide like a ramp? Can they find the incline on the slide (which is the high side and which is the low side)?
- Experiment with the slide at a time when your class can be alone on the playground. Explore how different objects (toy cars, stuffed animals, sand shovels/buckets, mulch, leaves) roll or move down the slide.
- Notice inclines and ramps in the world around you. For example, parking garages often have ramps for vehicles to get from one level of the building to another. Buildings may have ramps to ensure people who use wheelchairs can enter and exit safely. Delivery trucks sometimes use a ramp to get boxes from inside the truck to the ground. Prompt children to look for the incline when they see a ramp in the community.

## Song: *Ramp and Roll!*

For this song, you'll need to have your ramp set-ups in place as children will be using the ramps to perform the actions in the song. Model these actions for children as noted below.

### CHORUS

Ramps are fun ways we can play.	(Free dance)
Let's explore some ramps today.	
Rolling, pushing, fast or slow.	(Pretend to push a ball)
See how far our ball can go!	(Hand to forehead, look out in the distance)

Push it fast, push it slow.	(Pretend to push a ball)
See how far that ball can go.	(Hand to forehead, look out in the distance)

Now let's go experiment	(Go to the ramps in the room)
Rolling balls right down our ramps!	

### SPOKEN WORD

All right!	
Now it's time to experiment!	
Take your ball to the top of the ramp,	(Set up ball on ramp)
And give it a very <i>gentle</i> push.	(Model pushing the ball gently)
How far did your ball roll?	(Model the answer: Not too far!)

Now take your ball to the top of the ramp again	(Set up ball on ramp)
And this time, give it a <i>strong</i> push.	(Model pushing the ball strongly)
Did it roll faster or slower than before?	(Model the answer: Faster!)
Did it roll farther or not as far?	(Model the answer: Farther!)

### CHORUS

Ramps are fun ways we can play.	(Free dance)
Let's explore some ramps today.	
Rolling, pushing, fast or slow	(Pretend to push a ball)
See how far our ball can go!	(Hand to forehead, look out in the distance)

Push it fast, push it slow.	(Pretend to push a ball)
See how far that ball can go.	(Hand to forehead, look out in the distance)

Ramp and roll is really great;	
'Til next time, I just can't wait!	(Smile and lift arms up in excitement!)

## Making Literacy Connections

Share the following book with children as an opportunity to deepen their understanding of ramps.

**Suggested Book:** *Inclined Planes* by Martha E. H. Rustad

A similar title is *Ramps and Wedges* by Sian Smith; the first 13 pages of this title focuses on ramps.

### AS YOU READ:

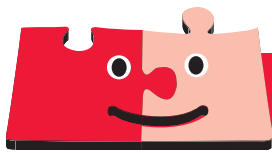
- On the first page, ask children to look at the photo of the hen. Can they find the ramp?
- On the next page, ask children to show you which end of the ramp is higher than the other. Do children know what this special vehicle is called? It's a *forklift*, and it helps people move a lot of boxes or objects at once.

- On the page with Ty and the box, ask children why they think Ty is putting his box in the truck. (Is he moving with his family? Have the children in your class ever moved? Did they put their boxes in a moving truck with ramp?)
- Point to the trolley on the next page. Explain that trolleys run on tracks, but they are powered from electricity they receive from an overhead wire (show children in the picture). This trolley track is a ramp, because one end is at the top of a hill. Can children show you where the lower end is?
- The next photo is of a ramp that moves suitcases into a plane. Ask children if they have ever been in a plane. Where did they go? Did their suitcases ride in the bottom of the plane like the ones in the picture?
- On the page with Ray, see if children can find the ramp. Ask why they think it's important to have ramps into buildings for people who use wheelchairs.
- Roller coasters have lots of ramps! Ask children if they have ever been on a roller coaster. How does it feel to be at the top of the ramp? How does it feel to roll down the ramp? How do they feel about roller coasters?
- The next photo shows how a slide is a ramp. Have children ever been on a playground slide or a water slide (like in the photo)? Do they prefer being at the top of the ramp or the bottom of the ramp? (*Prefer* means that you like one thing better than another.)
- The final page is a question: How do you use inclined planes? Ask children how they use ramps in their school, home or community? (You might point out that many toys—like a marble run or toy parking garage have ramps built in.)

## BUILD ON THE BOOK: RAMP TREASURE HUNT

**Materials:** None

1. To prepare: Take a few minutes to walk around your program and the neighborhood nearby. Look for ramps in/out of buildings, inclined curb cuts leading to a crosswalk, the slide on a playground, a railing along a set of stairs, or ramps in use at a construction site. Make a note of where you find ramps—look for 2-4 examples. Choose examples that are within a short walk of your program.
2. Tell children that the class will be going on a ramp treasure hunt – that you will be taking a walk to discover 3 ramps nearby. Ask children to tell you once again what a ramp is (a surface that is higher at one end and lower at the other).
3. Walk on your pre-determined route and play “I-Spy” to prompt children to spot the ramp if they don’t on their own: “I spy a ramp somewhere on this red brick building.” If it is safe to do so, let children walk up/down the ramp and explore how it slopes from high to low.
4. If possible, take a photo of each ramp with the children. Printing and posting these photos in the classroom is a great documentation of ramps in your community.

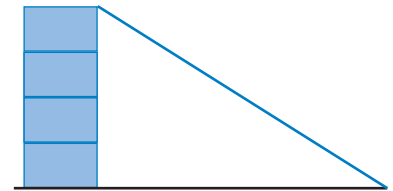


## What Are Ramps?

This week, build a ramp with your child and discover how it works!

Here's what you can try:

- Flatten an empty cereal box.
- Create a ramp by leaning the flat box on a stack of books, blocks, or another small box. (See picture.) You might need to stick a ball of tape on the bottom to hold the cardboard in place.
- Offer your child a small ball, toy car, or other child-safe item that rolls. Explore how the ramp works together. What happens when you push the ball *gently*? What happens when you push the ball *firmly*? Encourage your child to predict what might happen. Talk with them about what they see: How does the ramp work?
- Offer your child an item that doesn't roll—like a spoon, chopstick, book or envelope. Can the two of you figure out a way to move this item down the ramp? Together, you'll discover how things that roll can move down the ramp more quickly and easily, compared to things that only slide.
- You can also explore ramps in your community—like the slide at the playground! Can your child show you the top and bottom of the ramp (or slide)? What will happen when they get to the top and push off?





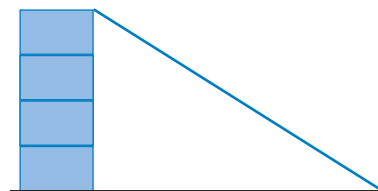
## Solo para familias

### ¿Qué son las rampas?

Esta semana, ¡construya una rampa con su hijo y descubra cómo funciona!

Esto es lo que puede hacer:

- Aplane una caja de cartón que tenga por lo menos de 15 a 30 cm de ancho.
- Haga una rampa apoyando la caja aplanada en una torre de libros, bloques o en otra caja pequeña. (Vea la imagen). Es posible que tenga que pegar una bola de cinta adhesiva en la parte inferior para mantener el cartón en su sitio.
- Dele a su hijo una pelota pequeña, un carrito de juguete u otro objeto que ruede y sea seguro para los niños. Observen juntos cómo funciona la rampa. ¿Qué ocurre cuando se empuja la pelota con *cuidado*? ¿Qué ocurre cuando se empuja la pelota con *firmeza*? Invite a su hijo a predecir lo que puede ocurrir. Hable con él sobre lo que está viendo: ¿Cómo funciona la rampa?
- Dele a su hijo un objeto que no ruede, como una cuchara, un palillo o un pedazo de papel. ¿Pueden encontrar entre los dos la manera de hacer bajar este objeto por la rampa? Juntos descubrirán que los objetos que ruedan pueden bajar por la rampa más rápida y fácilmente que los que sólo se deslizan.



También pueden explorar las rampas de su comunidad, como el tobogán del parque infantil. ¿Puede su hijo mostrarle la parte de arriba y la de abajo de la rampa (o tobogán)? ¿Qué pasará cuando llegue arriba y se impulse?

