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Leap into science

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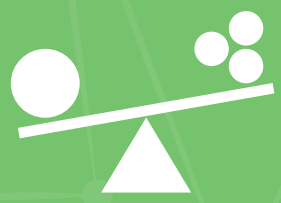
Balance



ACKNOWLEDGEMENTS

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PILOT PARTNERS: Thank you to our many pilot partners and families who tested, evaluated, and improved Leap into Science workshop activities. Leap into Science is stronger because of your ongoing commitment and invaluable contributions, for which we are extremely grateful.

FUNDERS: This material is based upon work supported, in part, by the National Science Foundation under grants DRL #0714685, #1223730, and #1712878. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation. This project is also made possible by a grant from the U.S. Institute of Museum and Library Services.

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What is Leap into Science?

OVERVIEW

Developed by The Franklin Institute Science Museum in Philadelphia, PA, Leap into Science is a program designed to build interest and skills in science and literacy for children ages 3–10 and their families, in community settings like libraries, museums, and out-of-school time programs. The program originated in 2007 through a partnership with the Free Library of Philadelphia, with the goal of engaging underserved children and families across Philadelphia in science and literacy learning. In partnership with the National Girls Collaborative, Leap into Science is now being disseminated through state partnerships between museums, libraries, out-of-school time organizations and others, to reach a broader and more diverse audience of children and families nationwide. For more information, visit leap.fi.edu.

KEY ELEMENTS OF WORKSHOPS

- Integrate **open-ended science activities with children's books** to highlight critical thinking skills that are important in both science and literacy.
- Provide opportunities to **think like a scientist** by making observations and predictions, testing ideas, and learning from something that may not have worked as planned.

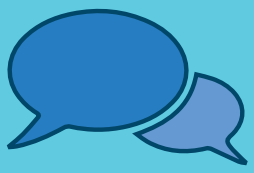
PROGRAM GOALS

- For **children and families** to have fun exploring science and books together, think scientifically, and build positive attitudes toward science learning in informal community settings.
- For **educators** to build knowledge, skills, and confidence in leading engaging science and literacy learning experiences for children and families.
- To build partnerships between **informal organizations** like libraries, museums, and out-of-school time organizations, and build their capacity for engaging underserved communities in science and literacy learning.

Leap into science core four

Ask Questions

Encourage Scientific Thinking



Cultivate Rich Dialogue

Make Connections

Leap into Science Core Four

Strategies for Building Science and Literacy Skills

1. Ask Questions

Ask questions when reading stories and exploring science concepts to deepen children's thinking and engagement.

Why:

- Questions bring out people's natural curiosity, motivating them to explore and learn.
- Questions allow children to express their ideas through language.

How:

- Ask *open-ended* questions—questions with multiple possible responses—to help children explain their thinking. Examples: *What do you notice? Why do you think that?*
- Ask *closed-ended* questions—questions with one or a few possible responses—to guide children toward a particular area of focus. Examples: *Where do you think the balancing point is? Where did the ball go when it fell?* Often follow up with an open-ended question: *Why do you think that? How can you tell?*

2. Encourage Scientific Thinking

Encourage children and their caregivers to think scientifically by observing, asking questions, making predictions, testing their ideas, and learning from repeated attempts.

Why:

- These practices strengthen critical thinking skills that are essential in both science and literacy learning.
- Focusing on the *process* of science rather than a specific *product* or outcome frees children and their caregivers to explore and take risks.

How:

- When reading a storybook, invite children to make observations about the book's cover, predict what they think will happen next, ask questions about the illustrations, and draw conclusions about the story.
- During science explorations, point out occasions when people notice things, guess what will happen, test a new idea, or learn from something that didn't work.
- Model scientific thinking yourself. If you don't know the answer to a participant's question, respond with: *I don't know! Let's find out together!*

3. Cultivate Rich Dialogue

Provide opportunities for children and their caregivers to learn new vocabulary words, use them in different contexts, and have meaningful conversations while learning together.

Why:

- Literacy skills develop when children use language in relevant contexts, such as everyday science concepts. Similarly, science learning requires language through describing, questioning, and communicating ideas.
- Rich dialogue during learning allows people to explore new concepts together, and strengthen their ability to express their ideas.

How:

- Define and use key vocabulary during the explorations.
- Encourage children and families to connect their ideas and discoveries back to words and concepts from the book(s).
- Encourage children and their caregivers to explain their ideas to each other during their explorations.

4. Make Connections

Connect learning experiences to people's everyday lives and interests to make the learning more meaningful and memorable.

Why:

- People understand new information better, and are more motivated to learn, when the topic is connected to their own experiences.
- Highlighting how children behave like scientists during their explorations can help them see themselves as scientists, and potentially increase their future interest in science careers.

How:

- Draw connections between children's everyday experiences and the books, activities, and science concepts by asking children about their interests relating to the topic; for example: *What do you like to do outdoors? What is it like to do that on a windy day?*
- Encourage children and their caregivers to reflect on the ways they were scientists during the workshop. Ask questions like *How did you feel like a scientist today?* or use a book, such as *What is a Scientist?* by Barbara Lehn, to guide the discussion.
- Introduce children and their caregivers to science role models who reflect their race, ethnicity, gender, and/or cultural background, either in person or through books, photos, articles, or credible websites.

About Balance

We balance all the time, even without realizing it. We bend over to pick up something we dropped, walk along curbs, run up and down hills or steps, and carry heavy bags on one shoulder—all without falling over. The Leap into Science balance workshops invite children and families to learn more about the science of balance by exploring and manipulating the placement of weight in toys, structures, and in their own bodies.

SCIENCE IDEAS

- **The weight of an object is equally distributed around its center of gravity.** Depending on how the weight and parts of an object are positioned, the center of gravity may be in the center of the object, or it may be somewhere else. For example, the weight of a ruler is distributed evenly on both sides, so its center of gravity is located at the midpoint of the ruler. However, a pencil's eraser makes it heavier on that side, so the pencil's center of gravity is located closer to the eraser, rather than at the midpoint.
- **An object will balance if its center of gravity is directly over (or under) its base of support.** However, if an object's center of gravity is not aligned with its base of support, it will fall over. For example, your body's center of balance is in the center of your torso, which stands directly over the base of your feet. Leaning too far over from your feet will make you fall over—unless you change the position of your feet or legs to compensate.
- **Changing an object's distribution of weight affects its ability to balance**. For example, adding more weight to one side of a balanced teeter-totter makes that side go lower to the ground while the other side goes up. To balance it again, you must either add an equal amount of weight to the other side in approximately the same location, or move the weight closer to the center of the teeter-totter.

Balance and Young Learners

For preschoolers, the goal of these explorations is not for them to fully understand or define balance. Very few young children can explain why tests of balance work, but they intuitively understand the idea based on their experiences with their bodies and toys. By comparing and contrasting things that are balanced and unbalanced, children learn new ideas in the context of what they already know and understand.

Encourage preschoolers to identify balance by describing what they see. They may say words like "straight," "flat," or "same" to express that something is balanced, and words like "tipping over" or "falling down" to indicate when something is out of balance.

Balance Preschool Workshop

AUDIENCE

Children ages 3–5 and their caregivers

TIME FRAME

40–60 minutes

SUMMARY

Children explore the concept of balance by listening to a story (*Balancing Act* by Ellen Stoll Walsh), balancing with their bodies, and creating balanced structures on simple teeter-totters.

GUIDING QUESTIONS

- What does balance look like on a teeter-totter?
- How does adding heavy or light objects change the way a teeter-totter balances?

KEY WORDS

Use these key vocabulary terms throughout the workshop to build understanding about balance:

balance

balanced

unbalanced

tipping over

straight

same

different

PREPARE

1. Review the Balance Preschool Workshop Question Guide on p. 17 and think about when and how you will incorporate questions into your facilitation. You may also wish to make copies of the Question Guide for caregivers to use during the workshop and/or take home.

2. If possible, research scientists whose work involves balance (such as architects or engineers) and who match the demographics of your audience and/or are local to your area. Gather photos, books, or articles about them to share with the group.

3. Assemble the teeter-totters:

   Large teeter-totter: Rest the flat side of the foam block on a table. Attach the center of the foam board to the rounded side of the block using a loop of duct tape, (see image page 14). Test that it balances correctly by placing one of each of the same object on either side of the teeter-totter. Adjust the board's position as needed.

   Paint-stick teeter-totters (1 per 2 children): Tape the cardboard tube down to the table at each end of the tube. Use a loop of tape to attach the center of a paint stick to the top of the cardboard tube, perpendicular to the tube (see image below). Secure the tubes to the tabletop with masking tape.

   Egg-carton teeter totters (1 per 2 children): Place a clothespin on the narrow end of a funnel to create a base. Rest the middle of an egg carton on top of the clothespin (see image below). Secure the funnels to the tabletop with masking tape.

4. Set up the space:

   - Tape a line of colored duct tape approximately five feet long on the floor for children to walk along.
   - *Optional: Create a book corner with recommended books and/or materials for drawing.*

MATERIALS

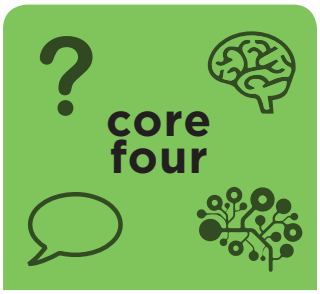
- *Balancing Act* by Ellen Stoll Walsh
- *What Is a Scientist?* by Barbara Lehn
- Colored duct tape, approx. 5-ft. length
- Roll of masking tape
- Foam board
- Half-round foam block
- Stuffed animal toys (several of different weights)
- Cardboard tubes (1 per 2 children)
- Wooden paint sticks (1 per 2 children)
- Small toys, wooden spools, large erasers, and/or similar objects for weights (several per child)
- **Balance** word card, printed on cardstock
- Egg cartons, lids removed (1 per 2 children)
- Funnels (1 per 2 children)
- Peg-style clothespins (1 per 2 children)

Optional Additional Materials

- Additional books about balance (see Recommended Book List)
- Books or hats for balancing on children's heads
- Pan balance
- Paper
- Crayons or markers
- Photo, book, or article about a scientist who uses balance in his or her job

WELCOME (5 minutes)

- Welcome children and caregivers to the workshop. Introduce yourself to the participants.
- Explain that today's workshop was created by The Franklin Institute Science Museum in Philadelphia. The goals of the workshop are to have fun exploring balance together and to think like scientists.
- Set expectations for children's and caregivers' respective roles; for example: *Kids, you are the scientists today. Grown-ups, your job is to help your scientists—ask them questions, and let your children take the lead!*



Words in bold highlight Core Four strategies
(see pp. 5-7 for details)

ENGAGE: Body Balancing (10 minutes)

- **Make connections** to children's everyday lives by asking about their experiences with balance. For example:
  - *Have you ever balanced something?*
  - *What does it feel like to lose your balance?*
- Stand on one foot and invite the group to join you. **Encourage scientific thinking** by asking them to make observations like:
  - *What does your body look like when you are balancing?*
  - *What is different when you are not balanced?*
- Encourage participants to try other ways to balance their bodies.
- Demonstrate how to walk along the tape line on the floor like a circus tightrope walker, holding your hands at your sides. Invite children one at a time to try it. **Ask questions** like:
  - *Are you able to balance?*
  - *What are you doing with your body to stay balanced?*
- Then invite them to try again, this time letting their hands move wherever they want.
  - *What do you notice about your hands?*
  - *How did this change the way you balanced?*

READ: Storytime (10 minutes)

- **Make connections** between the previous explorations and the key vocabulary word by reminding children that when they stood on one foot or walked along the tape line, they were balancing their bodies. Hold up the **balance** word card and sound out the word together by clapping the syllables— *bal-ance*.
- Show children the book *Balancing Act*. **Encourage scientific thinking** by inviting children to make observations about the cover of the book and predictions about the story:
  - *What do you notice on the cover of this book?*
  - *What do you think this story might be about? What makes you think that?*
- Read the story, pausing as new balancing situations occur. Invite children to say "ta-da!" each time the teeter-totter is balanced. **Encourage scientific thinking** by inviting children to make more observations and predictions. **Ask questions** like:
  - *What does the teeter-totter look like now?*
  - *Is it balanced? What makes you think that?*
  - *What do you think will happen when the salamanders get on the teeter-totter?*
- **Make connections** between the balanced teeter-totter in the book and the previous exploration:
  - *How is the teeter-totter like you when you were walking on the line?*

EXPLORE: Big Teeter-Totter (10 minutes)

- Encourage the group to explore balance using a teeter-totter like the animals in the story. Place a stuffed animal on one side of the large teeter-totter. **Ask questions** like:
  - *What do you notice about the teeter-totter?*
  - *Is it balanced? What makes you think that?*
  - *What can we put on the other side to make it balanced?*
- Invite children to experiment by taking turns placing animals on the teeter-totter. **Cultivate rich dialogue** by asking them to describe how it moves and what it looks like, and to share ideas about what to try next:
  - *What do you see here? What does the teeter-totter look like?*
  - *Where will you put your animal? What do you think will happen if you put it there?*
- **Make connections** between the book and the exploration by saying "ta-da!" (as in the story) when the teeter-totter is balanced. Once it is balanced, **ask questions** that challenge children to explore further:
  - *What will happen if I add another animal to this side?*
  - *How can we make it balanced now?*
  - *What does the teeter-totter look like on this page of the book? How can we make our teeter-totter look like this?*

EXPLORE: Individual Teeter-Totters (10–20 minutes)

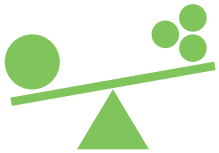
- Invite children to try balancing with teeter-totters of their own. Divide the group between the two types of teeter-totters. Offer a variety of small toys and other objects for children to add to their teeter-totters.
- Observe children as they explore the teeter-totters and encourage scientific thinking by inviting them to describe what they see, explain their thinking, and try new things:
  - *What do you notice about your teeter-totter?*
  - *Do you think it is balanced? What makes you think that?*
  - *What do you think will happen if we take away something on this side?*
  - *Do you think your teeter-totter will balance if you stack a few things on top of each other?*
  - *How can you make your teeter-totter balance a different way?*
- **Cultivate rich dialogue** by encouraging conversation between adults and children about their explorations. Suggest questions (like the ones on the Question Guide) for adults to ask their children about how the teeter-totter is balancing.
- If possible, allow children opportunities to experiment with balance using different tools—by switching from the paint-stick teeter-totter to the egg-carton version, or by returning to the large teeter-totter and animals.
- *Optional*: Invite children who finish earlier than others to read books and write or draw about their experiences in the reading area.

REFLECT: Discussion (5 minutes)

- Gather the group and **ask questions** to help children reflect on their explorations:
  - *How did we make things balance today?*
  - *Did anything happen that surprised you? What was it?*
- **Make connections** between children's actions and scientific practices by referencing pages from the book What is a Scientist? and asking children to share their own examples. **Ask questions** like:
  - *How did you feel like a scientist today?*
  - *When did you make a guess about something and test it?*
  - *Was there a time when you tried something over and over?*
  - *Did you have fun?*
- If possible, share a photo, book, or article about a scientist who uses balance in his or her job.
- End by thanking the group for doing great work as scientists. **Make connections** to children's lives by encouraging them to notice how objects balance outside and at home.

EXTEND: Additional Activity Ideas

- Read *Caps for Sale* by Esphyr Slobodkina or *Ten Apples Up on Top* by Theo LeSieg. Encourage children to act out balancing a stack of hats or books on their heads. **Ask questions** like:
  - *How many objects can you balance on your head at once?*
- Visit a local playground that has a teeter-totter. Invite children to explore balancing on a teeter-totter like the animals in *Balancing Act*.
- Read poems together about balance, such as "I Sat Down on a Seesaw" by Kenn Nesbit. Encourage children to make their own poems or songs about balance.
- Invite children to build tall towers with blocks or other materials. **Ask questions** like:
  - *How high can you build your tower before it falls over?*
- Introduce a pan balance—a tool that scientists use to compare the weights of objects. Present some heavy and light objects to the children and **encourage scientific thinking** by asking them to make predictions about which one they think is heavier. Invite them to test their ideas by placing objects in the pans of the balance.



Balance Preschool Workshop Question Guide

Here are some key questions you can ask to guide children's explorations during the workshop.

WORKSHOP SECTION	ASK
ENGAGE: Balance on one foot Walk on a line	*Have you ever balanced something? How did you do it?* *What does your body look like when you are balancing?* *What are you doing with your body to stay balanced?*
READ: Read *Balancing Act*	*What do you notice about the cover of the book?* *Is the teeter-totter balanced? What makes you think that?* *What do you think will happen when…?*
EXPLORE: Big teeter-totter Individual teeter-totters	*What do you notice about your teeter-totter?* *What can we put on the other side to make it balanced?* *What do you think will happen if we take away something from this side?*
REFLECT: Group discussion Read *What Is a Scientist?* Introduce a scientist	*How did we make things balance today?* *Did anything happen that surprised you? What was it?* *How did you feel like a scientist today?*

To find out more about The Franklin Institute and Leap into Science, visit leap.fi.edu

Balance Elementary Workshop

AUDIENCE:

Children ages 6–10

TIME FRAME:

60 minutes

SUMMARY:

Children explore the concept of balance by listening to a story (*Mirette on the High Wire* by Emily Arnold McCully), balancing with their bodies, and creating balanced kinetic sculptures with a variety of materials.

GUIDING QUESTIONS

- How does the distribution of weight affect how something balances?

KEY WORDS

Use these key vocabulary terms throughout the workshop to build understanding about balance:

balance

balanced

unbalanced

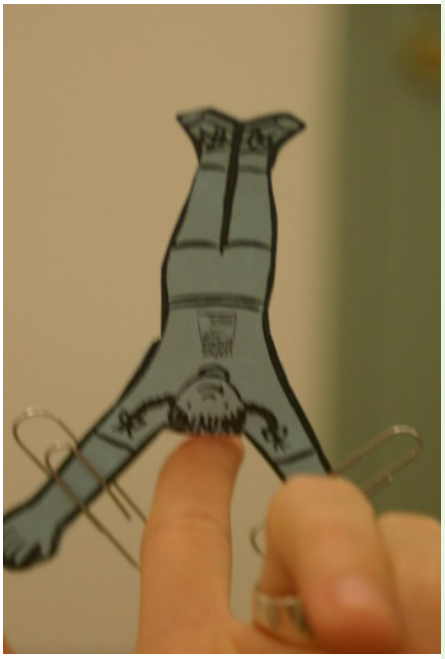
balancing point

weight

kinetic sculpture

PREPARE

1. Review the Balance Elementary Workshop Question Guide on p. 25 and think about when and how you will incorporate questions into your facilitation. You may also wish to make copies of the Question Guide for caregivers to use during the workshop and/or take home.
2. Create an example kinetic sculpture using the doll-head pin, chenille stems, and weights to share with children during the *Kinetic Sculpture* activity (see picture below).
3. If possible, research scientists whose work involves balance (such as architects or engineers) and who match the demographics of your audience and/or are local to your area. Gather photos, books, or articles about them to share with the group.
4. *Optional: Set up a reading and reflection area with books about balance and drawing or writing materials.*



MATERIALS

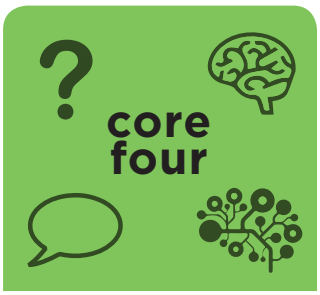
- *Mirette on the High Wire* by Emily Arnold McCully
- *What Is a Scientist?* by Barbara Lehn
- Copies of balancing girl template, printed on cardstock and cut out (1 per child)
- Jumbo paperclips (at least 2 per child)
- Standard paperclips (at least 4 per child)
- Rulers (1 per 2 children)
- Unsharpened pencils (1 per 2 children)
- Peg-style clothespins (at least 1 per child)
- Building materials for clothespin sculptures, such as chenille stems, washers, buttons, spring-loaded clothespins, rubber bands, masking tape
- Balance word card, printed on cardstock

Optional Additional Materials

- Additional books about balance (see Recommended Book List)
- Shoebox with lid
- Heavy object to fit in shoebox, such as a book or brick
- Blank paper
- Crayons or markers
- Photo, book, or article about a scientist who uses balance in his or her job

WELCOME (5 minutes)

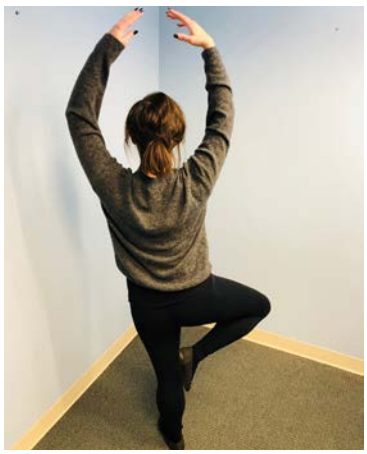
- Welcome children and caregivers to the workshop. Introduce yourself to the participants.
- Explain that today's workshop was created by The Franklin Institute Science Museum in Philadelphia. The goals of the workshop are to have fun exploring balance together and to think like scientists.
- Set expectations for their respective roles; for example: *Kids, you are the scientists today. Grown-ups, your job is to help your scientists —ask them questions, and let your children take the lead!*



Words in bold highlight Core Four strategies
(see pp. 5-7 for details)

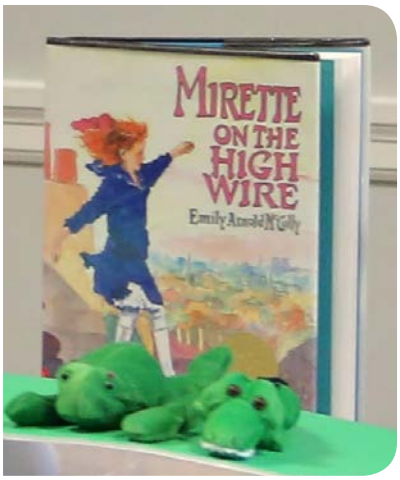
ENGAGE: Body Balancing (5 minutes)

- Introduce the theme of the workshop by showing the balance word card. **Make connections** to children's everyday lives by asking about their experiences with balance:
  - *Have you ever balanced something?*
  - *What does it feel like to lose your balance?*
- Ask the group to stand up and try balancing on one foot. **Encourage scientific thinking** by inviting them to make observations:
  - *What does your body feel like when you are balancing on one foot?*
  - *What do you do to stay balanced?*
- Invite children to try balancing in different positions, such as tree pose, or with their hands clasped behind their backs. **Ask questions** to help them notice how they reposition their bodies to stay balanced:
  - *Was it harder to balance in some positions than others? Why do you think that happened?*
  - *What did you do with your body to stay balanced?*


READ: Storytime (10 minutes)

- Show children the book *Mirette on the High Wire*. **Encourage scientific thinking** by inviting children to make observations about the cover of the book and predictions about the story:
  - *What do you notice on the cover of this book?*
  - *What do you think this story might be about? What makes you think that?*
  - *The name of the book is* Mirette on the High Wire*. What could that tell us about what happens in the story?*
- Read the story, pausing as new balancing situations occur. Encourage children to make more observations and predictions. **Ask questions** like:
  - *Where do you see balancing in this picture?*
  - *Do you think Mirette will stay balanced on the wire in that position? Why do you think that?*
  - *What is she doing with her body to stay balanced?*
- **Make connections** between the wire-walking in the book and children's experiences:
  - *How is Mirette's wire-walking like when we balanced on one foot? How is it different?*
  - *Have you ever balanced on something small or narrow? How is it different from balancing on flat ground?*



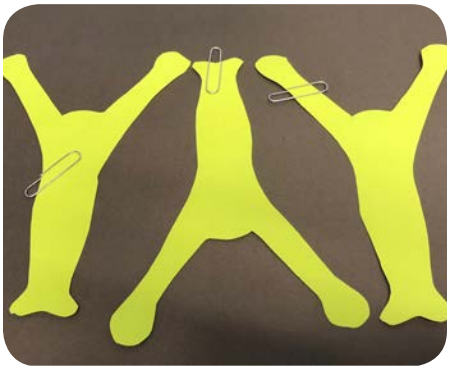
Note: Depending on the age of your group, you may wish to read only part of the story. For a shorter version, summarize the setting and characters from the first few pages (Mirette, Madame Gateau, and the boardinghouse) and begin reading on the third page of text: *"One evening, a tall, sad-faced stranger arrived."* Read the next nine pages, ending with Mirette's words, *"I will never ever fall again!"*

EXPLORE: Find the Balancing Point (10 minutes)

- Distribute an even mixture of rulers and pencils to the group so each child has one object. Invite them to try balancing their object on one finger. **Encourage scientific thinking** by asking them to predict where they should place their finger to make it balance. Allow a few minutes for children to test their predictions and experiment.
- Ask children with rulers to find a partner who has a pencil. **Cultivate rich dialogue** by inviting the pairs to share their observations with one another.
- Bring the group together and discuss their discoveries:
  - *Where is the balancing point on each object?*
  - *Why might the balancing point be in a different place on a pencil than on a ruler?*
- **Make connections** between the children's explorations with the objects and with balancing their bodies:
  - *How is the weight arranged in each object we were just balancing?*
  - *When you moved your arms to stay balanced, how did that change how your weight was arranged?*

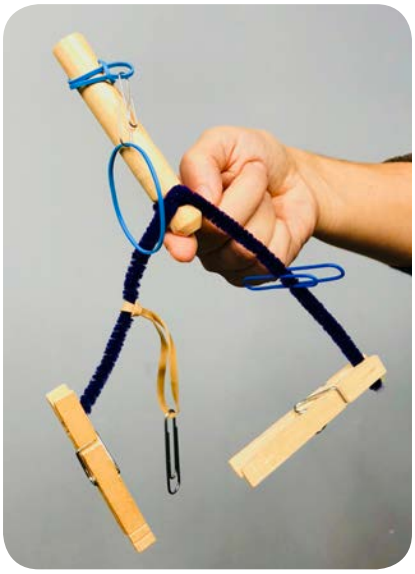
EXPLORE: Balancing Girl (10 minutes)

- Provide a balancing girl for each child and challenge them to balance her on her head on the tip of their finger. As they explore, **ask questions** to help them think about why she might be difficult to balance in this way:
  - *What do you notice?*
  - *What do you think would help her to balance better?*
- Distribute paper clips and encourage the group to add weight to their balancing girls somewhere that will help them balance. **Encourage scientific thinking** by inviting children to observe, predict, and test their ideas:
  - *Where can you put the paper clips to help her balance better?*
  - *What do you think will happen?*
  - *What did you notice about how she balanced that time?*
  - *How can you change the number or size of the paper clips to help her balance better?*
- **Cultivate rich dialogue** between children as they are exploring:
  - I notice you each tried something interesting with your balancing girl. Tell each other what you tried and how it is working.



EXPLORE: Kinetic Sculptures (15 minutes)

- Show the group your sample kinetic sculpture. Explain that a *kinetic sculpture* is a piece of art with parts that move. *Kinetic* means "moving," and a *sculpture* is a piece of art that is three-dimensional, not flat like a painting. Ask:
  - *Where do you see balancing in this sculpture?*
  - *How do you think this sculpture moves?*
- Set out the clothespins, chenille stems, and other building materials. Challenge children to create their own kinetic sculpture that balances in an interesting or unusual way, like the balancing girl did. If children need guidance, show the example sculpture you created as a model for how to get started.
- **Encourage scientific thinking** by inviting children to notice details and solve problems with their designs:
  - *What do you notice about how your sculpture is balancing?*
  - *What happens if you blow on it while it is balancing?*
  - *How can you add or remove objects to change the way your sculpture balances?*
  - *How did adding that piece change the way your sculpture balances?*
  - *Where else can you put that piece to arrange the weight differently?*



- **Make connections** between children's structures and their experiences with the balancing girl, the ruler and pencil, and the book:
  - *How is your sculpture like the balancing girl? What did you do to help the balancing girl balance?*
  - *The pencil wasn't the same on both sides, but it balanced when you moved your finger closer to the heavier side. How can you make your sculpture balance like the pencil?*
  - *How did Mirette position her body to balance on the wire in the book? How is that like the shape of your sculpture?*
- **Cultivate rich dialogue** by encouraging children to explain their ideas to one another or ask someone else about their approach:
  - *It looks like this person found a different way to solve the same problem. Tell each other what you tried to make your structures balance.*
- *Optional: Invite children who finish earlier than others to read books and write or draw about their experiences in the reading area.*

REFLECT: Discussion (10 minutes)

- Gather the group and invite children to share their kinetic sculptures with each other. Encourage them to reflect on their explorations by **asking questions** like:
  - *What did you do to make your sculpture or the balancing girl balance?*
  - *Did anything happen that surprised you? What was it?*
- **Make connections** between children's actions and scientific practices. Reference pages from the book *What is a Scientist?* and ask children to share their own examples. **Ask questions** like:
  - *How did you feel like a scientist today?*
  - *Did you ask any questions about how something balanced? How did you try to find answers?*
  - *When did you make a prediction about something and test it?*
  - *Was there a time when you tried something over and over?*
  - *Did you have fun?*
- If possible, share a photo, book, or article about a scientist who uses balance in his or her job.
- End by thanking the group for doing great work as scientists. **Make connections** to children's lives by encouraging them to notice how objects balance outside and at home.

EXTEND: Additional Activity Ideas

- Place a heavy object, such as a book or a brick, inside a shoebox with a lid, making sure the object is all the way against one end of the box. Place the covered box on a table, without revealing that there is something inside. **Ask questions** like:
  - *What do you think will happen if I push this shoebox closer and closer to the edge?*
  - *How far can I push it before it falls?* Move it slowly to the edge and test children's predictions. *Were the results surprising? Why?*
- Take the object out of the box and repeat the experiment. **Encourage scientific thinking** by inviting children to compare the results of the two experiments.
  - *How are the results different?*
  - *What happens if the object is in the center of the box? What if it is on the side closest to the table edge?*

- Read *Balancing Act* by Ellen Stoll Walsh. This book is particularly useful with early elementary-age children. While reading, **encourage scientific thinking** by inviting children to count the number of animals on each side, as well as the number of each type of animal, to get them thinking about equal weights on both sides. After reading, **ask questions** like:
  - *What was the problem the animals were trying to solve? What did they do to balance the teeter-totter?*

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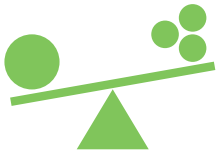

Balance Elementary Workshop Question Guide

Here are some key questions you can ask to guide children's explorations during the workshop.

WORKSHOP SECTION	ASK
ENGAGE: Balance on one foot Balance in different positions	*Have you ever balanced something? What did it look like?* *What are you doing with your body to stay balanced?* *Was it easier to balance in some positions than others? Why do you think that happened?*
READ: Read *Mirette on the High Wire*	*What do you notice on the cover of this book?* *Where do you see balancing in this picture?* *How is Mirette's wire walking like when we balanced on one foot?*
EXPLORE: Find the balancing point Balancing girls Kinetic sculptures	*What do you notice about how it is balancing?* *What do you think will happen if you…?* *How can you add something to change the way it balances?*
REFLECT: Group discussion Read *What Is a Scientist?* Introduce a scientist	*What did you do to make your sculpture or the balancing girl balance?* *Did anything happen that surprised you?* *How did you feel like a scientist today?*

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Balance Family Workshop

AUDIENCE:

Families with children ages 3–10

TIME FRAME:

40–60 minutes

SUMMARY:

In a series of activity stations, families investigate the concept of balance together by balancing with their bodies, exploring balancing games and toys, and creating balanced structures.

GUIDING QUESTIONS

- How does the distribution of weight affect how something balances?
- How does the base of support affect how something balances?

KEY WORDS

Use these key vocabulary terms throughout the workshop to build understanding about balance:

balance

balanced

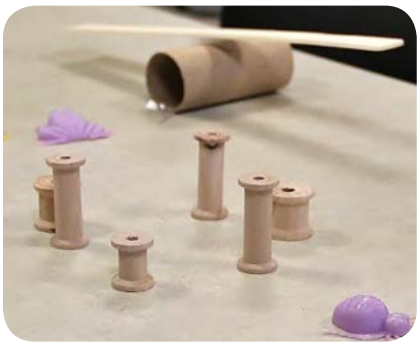
unbalanced

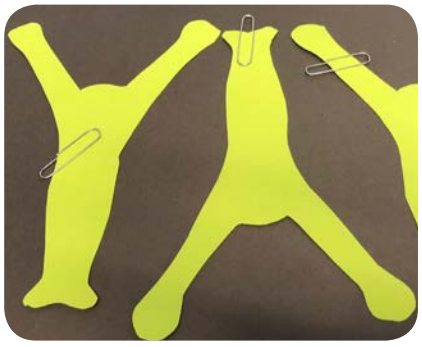
balancing point

weight

base

support





MATERIALS

- *Balancing Act* by Ellen Stoll Walsh
- *What Is a Scientist?* by Barbara Lehn
- 3–5 beanbags
- Roll of masking tape
- 3–5 rulers
- 3–5 pencils, unsharpened
- Several balancing games and toys
- 10–20 Styrofoam discs
- Approx. 50 toothpicks
- Approx. 50 jumbo paper clips
- Approx. 50 standard paper clips
- 3–5 copies of balancing girl template, printed on cardstock and cut out*
- 6–10 peg-style clothespins*
- Building materials for clothespin sculptures*, such as pipe cleaners, washers, buttons, spring-loaded clothespins, rubber bands
- 3–5 cardboard tubes
- 3–5 wooden paint sticks
- 3–5 egg cartons, lids removed
- 3–5 funnels
- Small toys, wooden spools, large erasers, and/or similar objects for weights (several of each)
- 3–5 additional books from the Recommended Book List, such as:

  Caps for Sale by Esphyr Slobodkina

  The Man Who Walked Between the Towers by Mordicai Gerstein

  Who Sank the Boat? By Pamela Allen
- Tent cards for each station, printed on cardstock and folded
- Balance vocabulary card, printed on cardstock

* *If participants will take their balancing girls and sculptures home, plan for 1 per person plus 3–5 extra.*

Optional Additional Materials

- Additional books about balance (see Recommended Book List)
- Blank paper
- Crayons or markers
- Photo, article, or book about a scientist who uses balance in his or her job

PREPARE

1. Review the Balance Family Workshop Question Guide on p. 33 and think about when and how you will incorporate questions into your facilitation. You may also wish to make copies of the Question Guide for caregivers to use during the workshop and/or take home.

2. If possible, research scientists whose work involves balance (such as architects or engineers) and who match the demographics of your audience and/or are local to your area. Gather photos, books, or articles about them to share with the group.

3. Set up the activity stations on different tables around the room. Allow space for 4–6 people to work at each station. Each station listed below has multiple activities and associated tent cards within it.

   Station 1. Balancing Bodies: Choose an area with open floor and wall space. Place the **Partner Balance** and **Beanbag Challenge** activity tent cards on or near a wall. Make 3–5 X's out of masking tape on the floor, with some of them 3 ft. from the wall (for children) and some 4 ft. from the wall (for adults). Place a beanbag on each X. Test that the X's are at an appropriate distance (so that you can't pick up the beanbag without falling over).

   Station 2. Balancing Objects: Set out the **Balancing Point** activity tent card, rulers, and pencils together. Set out the **Balancing Girl** tent card, balancing girl cut-outs, and paper clips together. Prepare 2–3 example balancing girls by adding one or two paper clips somewhere on the body or arms. Vary the placement of the paper clips so each example is different.

   Station 3. Balancing Games: Arrange the balancing games around a large table or floor area with the **Balancing Games** tent card in the middle, leaving enough space between them for 2–3 people to gather around each game. Place the balancing toys on a nearby surface with the **Balancing Toys** activity tent card.

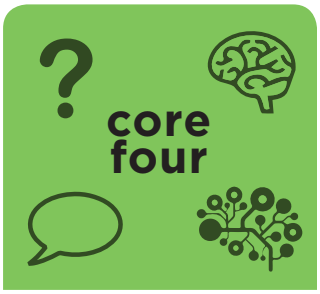
Station 4. Balancing Structures: Set out the **Leaning Tower** activity tent card, Styrofoam discs, and toothpicks together. Place the **Balancing Sculpture** activity tent card, clothespins, and other sculpture materials together.

Station 5. Young Scientist: Set out the **Teeter-Totter Test** activity tent card, *Balancing Act* by Ellen Stoll Walsh, teeter-totter materials, and weights together. Assemble two paint-stick teeter-totters by attaching a loop of tape between the center of a paint stick and the top of a cardboard tube, perpendicular to the tube (see image). Tape the middle of the tube to the table on both ends for stability. Assemble two egg-carton teeter-totters by placing a clothespin on the narrow end of a funnel to create a base and resting the middle of an egg carton on top of the clothespin. Tape the base of the funnels to the tabletop for stability (see image). Set out several spools, erasers, and/or toys for balancing on each teeter-totter.

Station 6. Read and Reflect: Set out the **Read about Balance** activity tent card and a selection of recommended books near a seating area for family reading. *Optional: include the Draw and Write about Balance activity tent card along with paper and crayons or markers.*

WELCOME (5 minutes)

- Welcome families to the workshop. Introduce yourself to the participants.
- Explain that today's workshop was created by The Franklin Institute Science Museum in Philadelphia. The goals of the workshop are to have fun exploring balance together and to think like scientists.
- Set expectations for their respective roles; for example: *Kids, you are the scientists today. Grown-ups, your job is to help your scientists —ask them questions, and let your children take the lead!*



Words in bold highlight Core Four strategies
(see pp. 5-7 for details)

ENGAGE: Body Balancing (5 minutes)

- Introduce the theme of the workshop by showing the balance word card. **Make connections** to families' everyday lives by asking about their experiences with balance:
  - *Have you ever balanced something?*
  - *What does it feel like to lose your balance?*
- Stand on one foot and invite the group to join you. **Encourage scientific thinking** by asking them to make observations:
  - *What does your body look like when you are balancing?*
  - *What is different when you are not balanced?*

READ: Storytime (10 minutes)

- Show the group the book *Balancing Act*. **Encourage scientific thinking** by inviting families to make observations about the cover of the book and predictions about the story:
  - *What do you notice on the cover of this book?*
  - *What do you think this story might be about? What makes you think that?*
  - *The name of the book is* Balancing Act. *What could that tell us about what happens in the story?*
- Read the story, pausing as new balancing situations occur. Encourage families to make more observations and predictions. **Ask questions** like:
  - *Is the teeter-totter balanced or unbalanced? How can you tell?*
  - *What can the animals do to balance the teeter-totter?*
  - *What happened to the branch at the end? Why do you think that happened?*
- **Make connections** between the balanced teeter-totter in the book and families' experiences:
  - *Have you ever been on a teeter-totter like this one? Did you make it balance?*
  - *What else have you seen that balances like a teeter-totter? What did it look like?*

EXPLORE: Activity Stations (30–40 minutes)

- Invite families to explore the activities at the stations. Encourage them to work as adult-child pairs or groups. As families explore together, walk around and visit the stations.
- **Encourage scientific thinking** by inviting families to describe what they see, explain their thinking, or test a new idea:
  - *What do you notice about how this is balancing?*
  - *What do you think will happen if you add a piece here? Why do you think that?*
  - *How can you make it balance in a different way?*
- **Cultivate rich dialogue** by encouraging conversation between adults and children as they explore the activities. Invite adults to ask their children questions from the tent cards or Question Guide. Ask children to describe to their adults what they are noticing, and what they plan to try next.
- **Make connections** by asking families to compare their observations to elements from the story or to their previous experiences:
  - *What games or sports do you like to play where you have to balance your body?*
  - *How is your structure like the teeter-totter in the story?*
  - *How is this balancing game different from what you did at the other station?*
- **Ask questions** like the ones below to more deeply engage families in the activities. Offer additional challenges, suggest new questions to investigate, or encourage them to find an alternate way to achieve their goal.

Partner Balance Challenges
Families take turns standing in different positions, while a partner pushes on their shoulder.

- *What do you notice about how it is balancing?*
- *What do you think will happen if you add a piece here? What makes you think so?*
- *How could you make it balance in a different way?*

Beanbag Body Challenge
Families stand with their heels against a wall and try to pick up a beanbag without moving their feet.

- *What happens if the beanbag is closer to the wall? What if it is farther away?*
- *Without the wall, how far away from the beanbag can you stand and still pick it up? What did you do to balance your body?*

Find the Balancing Point
Families explore balancing rulers and pencils with just one finger.

- *What might happen if you added a paper clip to one end of the ruler?*
- *Can you balance them on their short ends instead of their long ends?*
- *What other parts of your body could you use to balance the ruler?*

Balancing Girl Experiment
Families investigate weight distribution by adding paper clips to a cardstock figure in order to make it balance on a person's fingertip.

- *Can you make the girl balance with three paper clips? What about seven paper clips?*
- *What arrangement of paper clips makes her hardest to knock over?*
- *Can you make her balance on her feet instead of her head? What about her side?*

Reading Station:

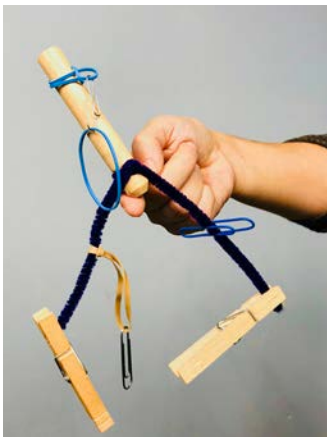
Families are invited to read additional books about balance and draw or write about their experiences with balance.

Balancing Games
Families play a variety of balance-based games and explore several balancing toys.

- *How could you make it balance with different things on each side?*
- *What is the most number of objects you can add and still have it balanced?*
- *How could you change or add to the toy so that it doesn't balance?*

Make a Leaning Tower
Families use toothpicks and foam discs to build leaning structures inspired by the Tower of Pisa.

- *How much "lean" can you build into your tower before it falls over?*
- *Does the height of the tower affect how much it can lean without falling?*
- *What other shape could you build that looks like it could fall over, but is actually balanced?*



Make a Balancing Sculpture
Families design a balancing kinetic sculpture by adding components to a peg-style clothespin to create a balanced structure.

- *How could you make it balance with different things on each side?*
- *Could you make your sculpture balance on the "feet" of the clothespin instead of the head?*

REFLECT: Discussion (5 minutes)

- Gather the group and ask adults and children to reflect on their explorations. **Ask questions** like:
  - *How did you make things balance today?*
  - *Did anything happen that surprised you? What was it?*
- **Make connections** between families' actions and scientific practices. Reference pages from the book *What is a Scientist?* and ask participants to share their own examples. **Ask questions** like:
  - *How did you feel like a scientist today?*
  - *Did you ask any questions about how something balanced? How did you try to find answers?*
  - *When did you make a guess about something and test it?*
  - *Was there a time when you tried something over and over?*
  - *Did you have fun?*
- If possible, share a photo, book, or article about a scientist who uses balance in his or her job.
- End by thanking the group for doing great work as scientists. **Make connections** to families' lives by encouraging them to notice how objects balance outside and at home.

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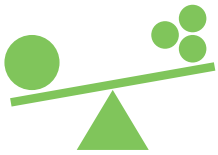

Balance Family Workshop Question Guide

Here are some key questions you can ask to guide children's explorations during the workshop.

WORKSHOP SECTION	ASK
ENGAGE: Balance on one foot	*Have you ever balanced something? What did it look like?* *What did you do with your body to stay balanced?*
READ: Read *Balancing Act*	*What do you notice about the cover of the book?* *Is the teeter-totter balanced? What makes you think that?* *What do you think will happen when…?*
EXPLORE: Balance station activities	*What do you notice about how it is balancing?* *What do you think will happen if you add a piece here? What makes you think that?* *How could you make it balance in a different way?*
REFLECT: Group discussion Read *What Is a Scientist?* Introduce a scientist	*How did you make things balance today?* *Did anything happen that surprised you? What was it?* *How did you feel like a scientist today?*

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Recommended Book List

*Allen, Pamela (1996). *Who Sank the Boat?* Putnam. ISBN-13:978-0698113732.

Borth, Teddy (2015). *Gymnastics: Great Moments, Records, and Facts*. Abdo Kids. ISBN-13: 978-1629706900

Gerstein, Mordicai (2007). *The Man Who Walked Between the Towers*. Square Fish. ISNB-13:978-0312368784.

Gray, Karlin (2016). *Nadia: The Girl Who Couldn't Sit Still*. HMH Books for Young Readers. ISBN-13: 978-0544319608.

Kroll, Virginia (2005). *Equal Schmequal*. Charlesbridge Publishing. ISBN-13: 978-1570918926.

*Lehn, Barbara (1999). *What Is a Scientist?* Millbrook Press. ISBN-13: 978-0761312987.

*LeSieg, Theo (1961). *Ten Apples Up on Top*. Random House. ISBN-13: 978-0394800196.

*MacLean, Kerry Lee (2014). *Peaceful Piggy Yoga*. Albert Whitman & Company. ISBN-13: 978-0807563830.

McCully, Emily Arnold (1997). *Mirette on the High Wire*. Putnam. ISBN-13: 978-0698114432.

Schlegel, Elfi (2012). *The Gymnastics Book: The Young Performer's Guide to Gymnastics*. Firefly Books. ISBN-13: 978-1770851337.

*Slobodkina, Esphyr (1968). *Caps for Sale: A Tale of a Peddler, Some Monkeys and Their Monkey Business*. Harper Collins. ISBN-13: 978-0064431439.

Tavares, Matt (2016). *Crossing Niagara: The Death-Defying Tightrope Adventures of the Great Blondin*. Candlewick. ISBN-13: 978-0763668235.

*Tompert, Ann (1996). *Just a Little Bit*. HMH Books for Young Readers. ISBN-13: 978-0395778760.

*Yoo, Tae-Eun (2012). *You Are a Lion! And Other Fun Yoga Poses*. Nancy Paulsen Books. ISBN-13: 978-0399256028.

*Walsh, Ellen Stoll (2010). *Balancing Act*. Beach Lane Books. ISBN-13:978-1442407572.

**Appropriate for early learners*

Materials List

Right-hand columns indicate which workshops require the materials: Preschool (P), Elementary (E), Family (F). In cases where specific materials are not available, materials with a comparable purpose (such as other balancing games, or objects for weights) may be substituted.

NON-CONSUMABLES	P	E	F
Balancing Act by Ellen Stoll Walsh (1)	X		X
Mirette on the High Wire by Emily Arnold McCully (1)		X	
What is a Scientist? by Barbara Lehn (1)	X	X	X
Foam core board or similar, 10″ x 30″ (1)	X		
Half-round foam roller, 6″ x 12″ (1)	X		
Small plush animal toys, such as Beanie Babies, preferably different sizes/weights (8–12 total)	X		
Cardboard tubes, such as toilet paper rolls (1 per 2 children)	X		X
Wooden paint stir sticks, 12″ (1 per 2 children)	X		X
Empty dozen-size egg cartons (1 per 2 children)	X		X
Peg-style clothespins (1 per 2 children)	X		X
Plastic funnels, 2–3″ diameter (1 per 2 children)	X		X
Wooden spools, 3/4″ diameter (2–3 per child)	X		X
1–2″ plastic animals (2–3 per child)	X		X
Jumbo paperclips (50)		X	X
Standard paperclips (50)		X	X
Rulers, 12″ (1 per 2 children)		X	X
Unsharpened pencils (1 per 2 children)		X	X
Beanbags, 3–5″ (3)			X
Styrofoam discs, 4” x 1” (10)			X
Round wooden toothpicks (50)			X
Magic Balancing Bird toy (4)			X
Chickyboom balancing game (1)			X
Jenga balancing game (1)			X
Balance word card, printed on heavy cardstock+	X	X	X
Activity station tent cards, printed on heavy cardstock+			X

(continued on next page)

+See Printable Resources section

CONSUMABLES	P	E	F
Masking tape (1 roll)	X	X	X
Colored duct tape (1 roll)	X		
Chenille stems, 12″ (at least 1 per child)		X	X
Peg-style clothespins (1 per child)*		X	X
Metal washers, 0.5–0.75″ (6–8 per child)*		X	X
Buttons, assorted sizes (6–8 per child)*		X	X
Mini spring-style clothespins, 1″ (2–4 per child)*		X	X
Copies of balancing girl template, printed on cardstock (1 per child)* +		X	X

OPTIONAL ADDITIONAL MATERIALS	P	E	F
Who Sank the Boat? by Barbara Allen (1)			X
The Man Who Walked Between the Towers by Mordicai Gerstein (1)			X
Caps for Sale by Esphyr Slobodkina (1)			X
Recommended balance books (see book list)	X	X	X
Photos, articles, or books about scientists who use balance	X	X	X
Blank paper for drawing	X	X	X
Crayons, markers, and/or pencils	X	X	X
Assorted caps/hats for balancing on heads (8–10)	X		
Pan balance (1)	X		
Large shoebox with lid (1)		X	
Brick, large rock, or similar heavy object (1)		X	

**Consumable if children take them home; otherwise reusable*

+See Printable Resources section

Standards Alignment

NEXT GENERATION SCIENCE STANDARDS

Science and Engineering Practices:

- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Analyzing and Interpreting Data
- Constructing Explanations and Designing Solutions
- Engaging in an Argument from Evidence

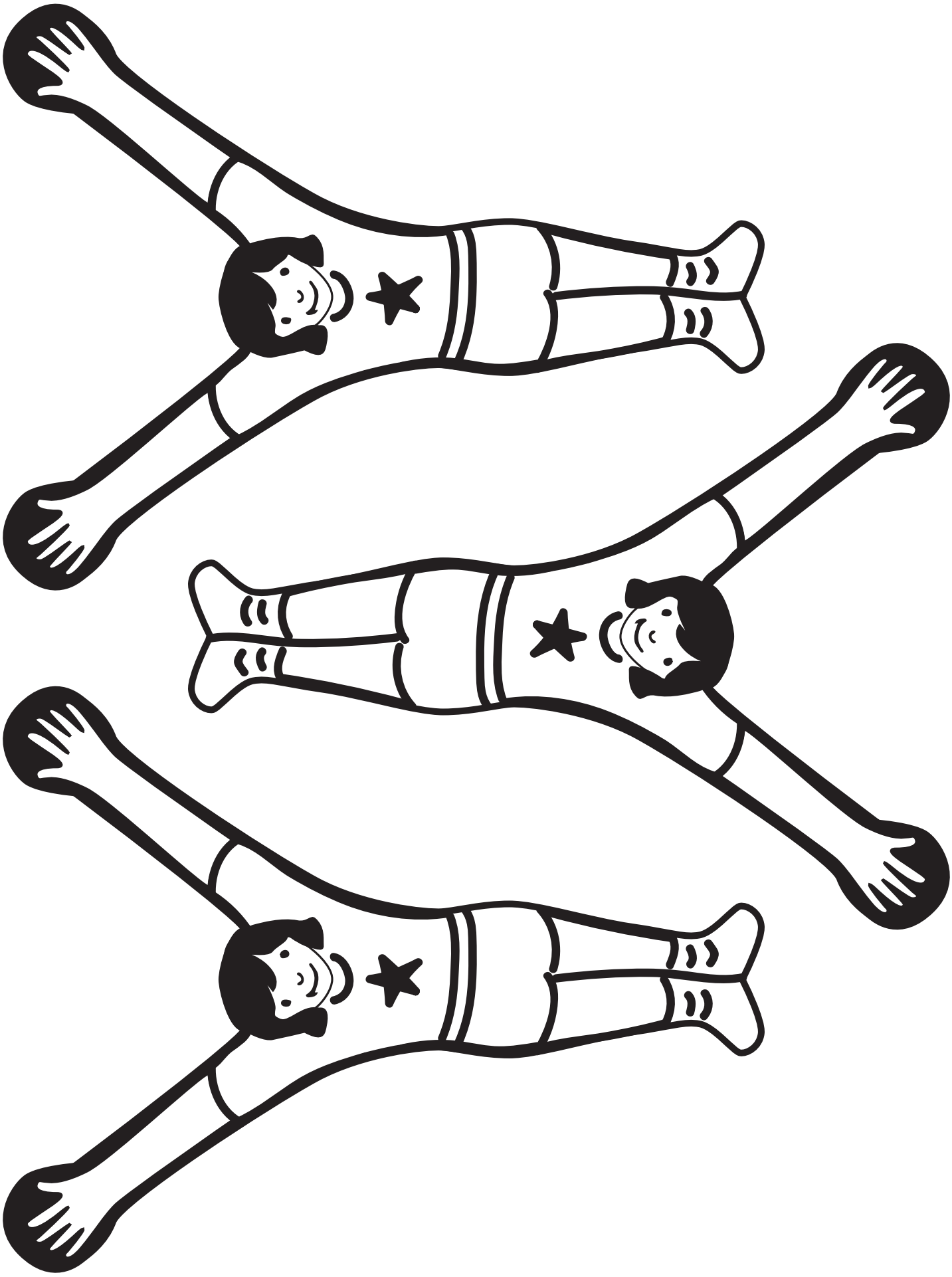
Crosscutting Concepts:

- Patterns: *Patterns can be observed and used to make predictions.*
- Cause and Effect: *Tests can gather evidence about cause-and-effect relationships.*
- Structure and Function: *The shape and stability of structures are related to their functions.*
- Stability and Change: *Systems may be stable under some sets of conditions and change under others.*

COMMON CORE STATE STANDARDS

English Language Arts Standards:

- CCSS.ELA-Literacy.SL.K-5.1: *Engage in collaborative conversations with diverse partners about age-appropriate topics.*
- CCSS.ELA-Literacy.L.K-5.5: *With guidance and support from adults, explore word relationships and nuances in word meanings.*
- CCSS.ELA-Literacy.L.K-5.6: *Use words and phrases acquired through conversations, reading and being read to, and responding to texts.*



el equilibrio

Fold Here

balance

Estación 1: **¡Equilibrio con tu Cuerpo!**

Fold Here

Station 1: **Balancing Bodies**

Desafíos de Equilibrio con Tu Compañero

Túrnate para permanecer en las posiciones que se indican abajo, mientras tu compañero suavemente empuja tu hombro.

- Párate sobre un pie.
- Párate de puntillas.
- Colócate en cuclillas con las rodillas flexionadas.
- Prueba la postura de yoga „Guerrero" (ver fotografía).

¿Cómo se distribuye tu peso en cada posición?

¿En qué posición es más fácil o más difícil mantener el equilibrio? ¿Por qué?

Fold Here

Partner Balance Challenges

Take turns standing in the positions below, while your partner gently pushes on your shoulder:

- Stand on one foot.
- Stand on your tiptoes.
- Stand in a squat with your knees bent.
- Try the yoga position Warrior One (see photo).

How is your weight distributed in each position?

Which ones are harder or easier to balance? Why?

Desafío de Relleno de Bolitas

Párate con los talones contra la pared.

Intenta recoger relleno de bolitas sin mover los pies.

¿Qué observas?

¿Cómo puedes cambiar tu cuerpo para alcanzar al relleno de bolitas?

Fold Here

Beanbag Body Challenge

Stand with your heels against the wall.

Try to pick up the beanbag without moving your feet.

What do you notice?

How can you change your body's position to get the beanbag?

Estación 2:

Objetos Equilibristas

Fold Here

Station 2:

Balancing Objects

Encuentra el Punto de Equilibrio

Intenta mantener el equilibrio de la regla en un dedo. Observa dónde está el dedo.

Intenta mantener el equilibrio del lápiz en un dedo.

¿Los puntos de equilibrio en cada objeto son iguales o diferentes?

¿Por qué crees que sea eso?

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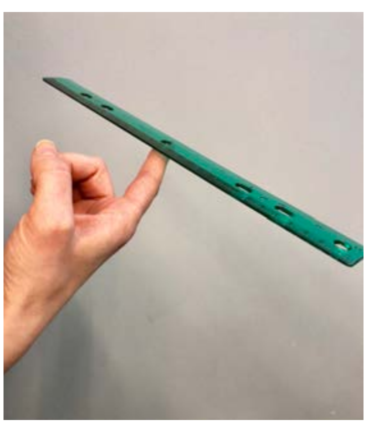
Find the Balancing Point

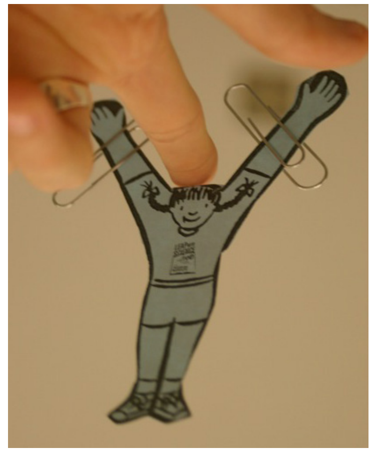


Try to balance the ruler on one finger. Notice where your finger is.

Try to balance the pencil on one finger.

Are the balancing points on each object the same or different?

What makes you think that?



Experimento de la Niña Equilibrista

Intenta mantener el equilibrio de la niña sobre la cabeza.

Compara las diferentes niñas equilibristas.

¿Qué notaste del modo en que las niñas hacen equilibrio?

¿Dónde puedes poner los sujetapapeles en tu propia niña para ayudarla a hacer equilibrio?

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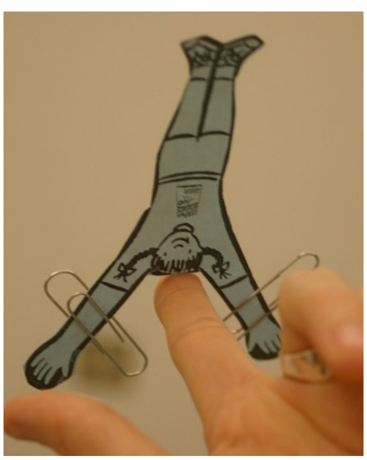
Balancing Girl Experiment



Try to balance the girl on her head using the tip of your finger.

Compare the different balancing girls.

What do you notice about how the girls balance?

Where can you put the paper clips on your own girl to help her balance?

Estación 3:
¡Hacer Equilibrio con Juegos y Muñecos!

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Station 3:
Balancing Games and Toys

Juegos de Equilibrio

Experimenta con el equilibrio jugando estos juegos de equilibrio con un compañero.

¿Cómo puedes equilibrar los objetos?

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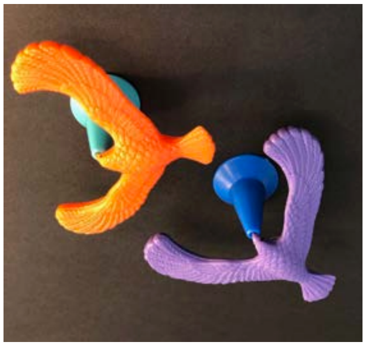
Balancing Games

Experiment with balance by playing these balancing games with a partner.

How can you make objects balance?

Muñecos de Equilibrio



Estos muñecos de equilibrio tienen pesas adicionales en su interior para hacer que los muñecos hagan equilibrio de maneras interesantes.

¿Dónde están las pesas adicionales ocultas en cada muñeco para hacerlos hacer equilibrio?

¿Por qué crees eso?

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Balancing Toys

These balancing toys have extra weights inside to make the toys balance in interesting ways.

Where are extra weights hidden in each toy to make them balance?

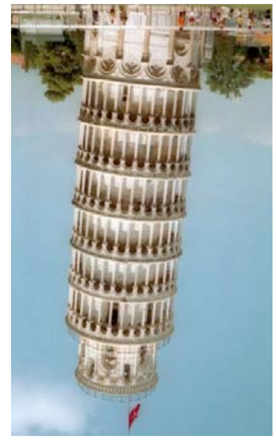
What makes you think that?

Estación 4: ¡Estructuras para Hacer Equilibrio!

Fold Here

Station 4: **Balancing Structures**

Hacer una Torre Inclinada



La Torre de Pisa en Italia parece que se derrumbará, pero en realidad está equilibrada.

¿Cómo puedes construir una torre inclinada que esté equilibrada?

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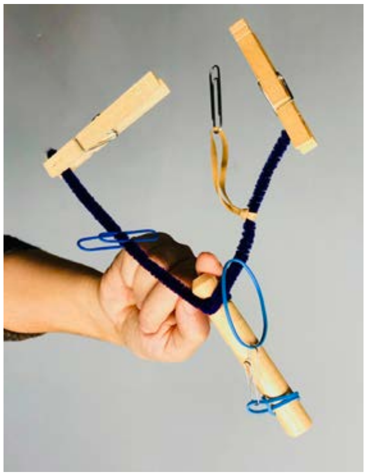
Make a Leaning Tower

The Tower of Pisa in Italy looks like it will fall over, but it is actually balanced.

How can you build a leaning tower that balances?

Hacer una Escultura Equilibrista



Algunos artistas crean esculturas con partes que se mueven y se equilibran.

¿Cómo se puede usar una pinza para hacer una escultura que se equilibre de manera interesante?

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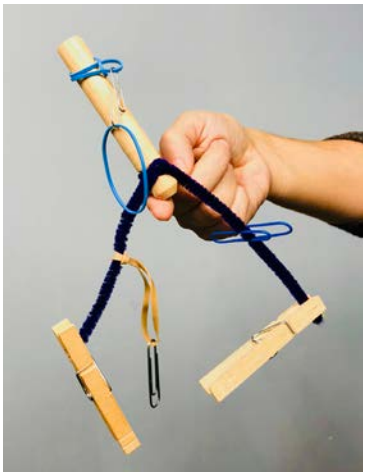
Make a Balancing Sculpture



Some artists create sculptures with parts that move and balance.

How can you use a clothespin to make a sculpture that balances in an interesting way?

Estación 5:
Joven Científico

(Adecuado para niños de entre 3 y 5 años)

Fold Here

Station 5:
Young Scientist

(Designed for children ages 3–5)

Prueba del Subibaja

Usa los objetos para equilibrar el subibaja.

Mira cómo tu subibaja se parece a las imágenes que aparecen en el libro *Balancing Act*.

¿Está el subibaja equilibrado?

¿Cómo lo sabes?

Fold Here

Teeter-Totter Test

Use the objects to balance the teeter-totter.

Notice how your teeter-totter looks like the pictures in the book *Balancing Act*.

Is the teeter-totter balanced?

What makes you think that?

Estación 6:
Lee y Refleja

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Station 6:
Read and Reflect

Dibuja y Escribe sobre el Equilibrio

Dibuja una imagen o escribe una historia, una canción o un poema sobre el equilibrio.

¿Qué hiciste hoy para explorar el equilibrio?

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Draw and Write about Balance

Draw a picture or write a story, song, or poem about balance.

What did you do today to explore balance?

Lee sobre el Equilibrio

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¡Lee estos libros para obtener más información sobre el equilibrio!

¿Dónde ves que el equilibrio está ocurriendo en los libros?

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Read about Balance

Read these books together to learn more about balance.

Where do you see balance happening in the books?