



FACILITATOR GUIDE

Measure Up!

Learning objectives

- Measuring, using tools, and counting are important skills for doing science.
- Very young children can use measuring tools to investigate foundational scientific concepts like distance, mass, and volume.
- Scientists develop and use measuring tools to gather information about the physical world, including faraway objects in space.

Materials

- Large plastic bin
- Large baking tray
- Small tarp/drop cloth
- Play sand
- 10-foot tape measure
- Blocks
- ½ cup measuring cups (2, of different styles)
- 2 cup (1 pint) liquid measuring cup
- Plastic balance scale
- Take-home caregiver bookmarks
- Activity and facilitator guides
- Information sheets
- *Tips for Interacting with Young Learners*

Alternatives to play sand: You may replace sand with pony beads, water, water beads, slime, modeling clay, dry rice, dry beans, or other similar sensory substrates if desired. Note that food-based substitutions may be allergens and you may have an institutional-based policy to avoid wasting food in activities and demonstrations.

Optional tools and materials: stopwatch, sand timer, thermometer (see “Optional extensions” section below).

The Explore Science toolkit comes complete with all necessary materials for this activity.

Materials are also readily available online or at local retail stores to create or restock activity kits. Graphic files can be downloaded from www.nisenet.org.

Safety

Monitor young children to prevent them from getting play sand in their eyes, ears, or mouth. If you substitute or refill with a different type of play sand, make sure that it adheres to Consumer Product Safety standards and contains no free silica, quartz, or tremolite asbestos.

Check measuring tools and materials periodically to ensure that small pieces don't break off and become choking hazards. If you introduce any additional items into the activity, be sure that they are not choking hazards.

Cleaning the Sand: Depending on the number of visitors, your own institutional policies, or other factors, you may need to clean the sand following the manufacturer's recommended protocol, available at <https://www.sandtastik.com/how-to-clean-sandtastik-sand>. As an added precaution, you may bake sand in a thin layer on an oven-safe tray at 350°F for 15–30 minutes. Allow sand to cool completely before pouring it into the plastic bin.

Advance preparation

Before you begin:

- Place the protective tarp on the floor or a low table, with the large plastic bin on top. Pour the sand (or alternate material) into the bin. If possible, you may choose to facilitate this activity at an existing sandbox or sand table.
- Spread out the blocks, measuring cups, and liquid measure on top of the sand in the bin. Place the plastic balance scale on the baking tray next to the bin. Hold on to the tape measure and any additional, optional measuring tools (stopwatch, thermometer) to introduce as appropriate.

Notes to the presenter

This activity provides caregivers with very young children a facilitated opportunity to engage in scientific ways of thinking by getting a feel for measuring tools. This exploration is developmentally appropriate for early learners. But rather than emphasizing content, this activity highlights science process skills: in other words, what doing science can look like at a young age. The goal is to help caregivers recognize their very young children as scientific learners and create the foundation on which kids ages 0–4 will build their science identities.

To cue the intended audience, try facilitating this activity on a low table, on the floor, and/or in a space designated for early learners.

ENGAGING ADULT CAREGIVERS

To get caregivers involved in the activity, hand them a bookmark to use throughout the exploration and point out the prompts listed on one side. Use concise language to explain the purpose of the activity. For instance: "This activity helps early learners get familiar with different types of measurement and gain confidence with STEM subjects. Together, you can continue this exploration in your daily life."

Actively assign tasks to adults throughout the activity. For example:

- Ask them to help count blocks or scoops of sand out loud;
- Hand them a measuring tool to use, following their child’s cues (they may assist with filling up a larger container with $\frac{1}{2}$ cup scoops, or help to add blocks to one side of the scale);
- Make them part of a challenge, like comparing the lengths of adult vs. child shoes or experimenting with how much sand adult vs. child hands can hold (see prompts in the section below).

ENGAGING EARLY LEARNERS

As a facilitator, you should model best practices for caregivers to use when engaging early learners in scientific thinking. For specific suggestions see the “Tips for Interacting with Young Learners” sheet included with this activity. Allow children to self-direct their exploration while narrating their actions in a way that highlights their use of tools, introduces vocabulary around measurement, and poses new challenges. For example: “You’re filling the liquid measure with scoops of sand to see how much it can hold. That’s an interesting investigation. Do you think all of that sand can fit on one side of the scale?”

Note that you *do not need* to cover all of these different areas of measurement over the course of the exploration. Instead, facilitators and caregivers should follow the child’s lead, providing support and building on the early learner’s natural inquiries throughout the activity. If things get repetitive, you can try redirecting toward a different type of measurement, but don’t worry if that doesn’t catch the participant’s interest. Repetition helps to cement understandings of cause and effect, and lays the foundation for replicability, another important science process skill.

Volume – when the child is moving sand into, out of, and among containers:

- Which holds more sand? The liquid measure or the cup?
- How many [$\frac{1}{2}$ cup] scoops does it take to fill the liquid measure?
- Do you think you can hold all the sand from the $\frac{1}{2}$ cup scoop in your hands? Make your hands into a cup, and have your adult pour the sand in. What happens to the sand that doesn’t fit?
- Can you find two containers or scoops that look different but hold the same amount (volume) of sand?

Mass – when the child is putting objects into the balance scale:

- Put a handful of sand into one side of the scale. What happens? How many blocks does it take to balance out?
- Which feels harder (heavier) to lift up: a $\frac{1}{2}$ cup of sand or the liquid measure full of sand?

- Fill the liquid measure with sand and dump it into one side of the scale. What happens? Now, fill the liquid measure with blocks and dump those into the other side of the scale. Which side is heavier?
- Fill both ½ cup measures with sand, and empty one onto each side of the scale. What happens?

Distance/Length – introduce this new form of measurement, using the same materials, as time allows:

- Draw a line in the sand. How many blocks can you line up next to it from end to end?
- How many blocks long is your shoe? How about your grown-up’s shoe?
- What other distance can you measure? How far away is _____ in blocks, inches, footlengths, etc.?
- Have your adult help to measure your height with the tape measure, and lock the tape measure at that length. Now: Can you find something else in the room that is the same length as you?

OPTIONAL EXTENSIONS

You may add optional materials and prompts to this activity in order to introduce other, more abstract types of measurement, especially if you are working with slightly older children (ages 4–6) and their caregivers. We recommend holding these materials (timer, thermometer) aside at the beginning of the activity, and introducing them as additional measuring tools if/when the flow of exploration allows.

Time

- With a sand timer: How tall a block tower can you build in thirty seconds?
- With a stopwatch: How long does it take to fill the liquid measure with scoops of sand?

Temperature

- With a digital kitchen thermometer: Insert the thermometer into a mound of sand to take its temperature. Next, hold the thermometer to find the temperature of your hand. Which is warmer?
- How can you make the sand warmer?

Difficult concepts

Scientific inquiry looks different at different developmental stages, but the basic skills needed to engage with the scientific process don’t change. Regardless of their own education or experience, all caregivers can encourage their children’s use of *science process skills*.

By using the balance scale, children are experimenting with the comparable weight of different objects. If you used the balance scale on the moon it would work just the same as

the one here on Earth, but a kitchen or doctor office scale would show a different number because the Moon's surface gravity is weaker. Note that the mass of an object is the amount of matter it contains, and the weight of an object is a measure of the force exerted on the object by gravity.

Whether or not children master measurement concepts (units, standardization, definitions, etc.) over the course of this activity, it is important to introduce them to the vocabularies and uses of measurement early on in their development. By hosting this activity, you can inspire caregivers to incorporate science process skillbuilding and open-ended questioning into everyday play and routines.

Staff training resources

Refer to the *Tips for Interacting with Young Learners* sheet in your activity materials.

Activity Training Video: <https://vimeo.com/441410224>

Edu-Cathalon Facilitation Training Video: <https://vimeo.com/304241578>

The NISE Network has a curated list of programs, media, and professional development resources that directly relate to the toolkit. These resources can be viewed and downloaded from: www.nisenet.org/earthspacekitextensions

Credits and rights

This activity was adapted from the Measuring series of activities, developed by the Collaborative for Early Science Learning. Retrieved from: www.sciencenter.org/resources-for-educators

Retroreflector array and Apollo module images courtesy NASA.

Earth Moon scale animation by Nickshanks licensed under Creative Commons BY 2.5, from Wikipedia, retrieved from [https://en.wikipedia.org/wiki/Lunar_distance_\(astronomy\)#/media/File:Earth-Moon.png](https://en.wikipedia.org/wiki/Lunar_distance_(astronomy)#/media/File:Earth-Moon.png)

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