Educator Guide

# Science Activity 2: The Blue Planet: Water on Earth

## Educator Preview

### Activity Snapshot

Learners explore the different reservoirs of water on Earth.

### Timing | 45 minutes

| | |
|---|---|
| Get Ready & Team Up | 10 min. |
| Investigating Water on Earth | 25 min. |
| Reflect | 10 min. |
| **Total** | **45 min.** |

**Level Up Activities** 5–45 min. each

### Prep Snapshot*

**Prep Time 10 min.**

- Space Need: Sink
- Prepare cups of water.

**See Materials & Preparation for full info.*

### 21st Century Skills

**Connection**

- Critical Thinking

**Science Practices**

- Asking Questions and Defining Problems

### Guiding Question

*Where is there water on Earth?*

## Learners Will Do

Explore the different reservoirs of water on Earth.

## Learners Will Know

Water is a limited natural resource that can be found in different forms.

### Connecting Across Activities

| Activity 1: Sharing Experiences | Activity 2: Water on Earth | Activity 3: Water Habitability |
|---|---|---|
| **Last time**, learners shared experiences with, and stories about, water. | **Today**, learners explore the different reservoirs of water on Earth. | **Next time**, learners will explore how different living things need liquid water to survive. |

## Activity Resources

Access videos and digital resources using the link or QR code below. More information for teaching this curriculum is available in the Educator Guide Introduction, pgs. iii–xxv. Access more PLANETS units, research, and pathways at https://planets-stem.org/.

weblink: https://hov.to/9a619e3b

# Materials and Preparation

## Materials

### For the whole group

- *Our Ideas* poster (on paper or a shared digital document) Examples & Templates
- 1 tablespoon

### For each learner

- 1 pencil
- 2 index cards

### For each group of 4

- 1 measure with milliliters (such as a medicine cup), at least 5 mL
- 1 tablespoon sand
- 1 permanent or wet-erase marker that will work on a plastic cup
- 2–3 tablespoons table salt
- 5 clear plastic cups, 8 oz

## Activity 2 Materials Preparation (10 min.)

### Ahead of Time

1. Review the "In-Use Example" in the online Prep & Setup Guide (PDF) to help you think about what to add to the *Our Ideas* poster during the discussions in this activity.
2. Print one of the following handouts for each group of four learners:
   - Science Activity 2 Water Where We Are From Handout, pg. 32
   - Science Activity 2 Where Is the Water? Handout, pgs. 33-34
3. Try accessing and navigating NASA's Eyes on the Solar System app to determine if this tool will be a good fit for your learners. As needed, consider ways of demonstrating the scale of the Solar System in other modalities, such as the tactile NISE's Exploring the Solar System: Pocket Solar System and auditory Solar System in Sound.

## In Your Space

4. Place the *Our Ideas* poster in a visible place in your learning setting or prepare to share it digitally.
5. For each group, fill a cup with about 140 mL (about 5 fl oz) of water. (Leave the other four cups per group empty.)
6. Optional: Set up a device with a projector and internet access, then test video links and view:
   - Are There Oceans on Other Worlds? We Asked a NASA Expert (0:00 to 1:00)
   - Why Does NASA Want to Explore Jupiter's Ocean Moon? (0:00 to 1:07)

### Teaching Tip

Lead this activity in a room with a sink for easy setup.

### Support Learner Differences

To ensure all learners can use the cups, even if they cannot see them, get measuring cups with raised lines or tape fill lines at different levels on the cups.

### Level Up!

You can explore lab equipment application for blind and low-vision learners in this article about Independence Science Educational Laboratory Kits.

## Activity Guide

### Get Ready & Team Up (10 min.)

1. Ask: **If you did the last activity, what did you do and why?** *(We told stories about why water is important, which helped us understand why it's important to answer questions about water.)* Draw learners' attention to their work on the *Our Ideas* poster about how water is important for humans and other living things.

2. Show the first 1:00 of the video Are There Oceans on Other Worlds? We Asked a NASA Expert and the first 1:07 of the video Why Does NASA Want to Explore Jupiter's Ocean Moon? Ask: **Why might NASA want to look for water beyond the Earth?** *Where there is water, there is often life. NASA wants to figure out if the ocean on Europa could support life.*

3. Say: **NASA does not have limitless time and resources, so it cannot send spacecraft to explore everywhere. NASA needs to make decisions about which places are most likely to have what it is looking for. Once it has made those decisions, it spends the money and time to visit a few of those places. As scientists, we are going to try to answer the same big question as NASA: Where in the solar system should NASA search for life?** Write the question in a prominent place at the top of the *Our Ideas* poster.

### Support Learner Differences

If new learners are joining you, lead an inclusion activity (pgs. xx-xxi) and use other engagement strategies as necessary (pgs. viii–xviii).

### Teaching Tips

- If you cannot show the videos, tell learners that NASA is sending a spacecraft to Europa, one of the moons of Jupiter. Europa is a bit smaller than Earth's Moon, but its surface is covered in ice instead of rock. Scientists think there is a giant ocean underneath the ice. There may be vents that warm up parts of this ocean and create the conditions for life. NASA wants to figure out if places like Europa could support life. Find out more here: Meet Europa Clipper.
- Display NASA's Eyes on the Solar System app. Show and describe the parts of the solar system to get learners thinking about it. As needed, use NISE's Exploring the Solar System: Pocket Solar System or Solar System in Sound instead.

4. Ask: **What smaller questions will we need to answer in order to answer this question?** Allow learners to think of questions in pairs, then share them with the whole group. Record their questions on the *Our Ideas* poster in related categories. Possible categories of questions include:
   - Location of water: Where is there water? What kinds of places have water? (answered in Activity 2)
   - Habitability of water: What things live in water? Can we find water that doesn't have things living in it? What kind of water do different living things need? How can we figure out what living things are in water? (answered in Activity 3)
   - Planetary Bodies: What planets are in the solar system? What moons are in the solar system? What other types of planetary bodies (asteroids, dwarf planets, etc.) are in the solar system? (answered in Activity 4)
   - Water on Planetary Bodies: Which planetary bodies have water? How much water do they have? Is it liquid water? Which planetary bodies have water with the right conditions for life? (answered in Activity 5)

### Teaching Tip

Each activity in this pathway has a suggested Guiding Question. As much as possible, replace these questions with similar ones from the list of questions learners have thought of. Using learners' questions will increase their engagement. There will likely be questions you do not answer in the pathway. When you can, mention these questions and have learners think about ways to answer them in the future.

5. Say: **Today, we're going to start by investigating our questions about what kinds of places have water. We're going to start with what we know about places with water here on Earth.** Share the Guiding Question or a similar question from the *Our Ideas* poster with learners aloud and in writing (using multiple languages as needed): **Where is there water on Earth?**
6. Organize learners into groups of four.

## Investigating Water on Earth (25 min.)

7. Give each group a copy of Science Activity 2 Water Where We Are From Handout, pg. 32 and give each learner two index cards. Say: **This page gives instructions to help you think about different places with water. As a group, you have about 5 minutes to follow the instructions.**

8. After about five minutes, ask: **What kinds of places did you think of?** Have groups pair up and sort their index cards into categories that make sense together. *(Rivers, streams, ponds, and some lakes are places with fresh liquid water on land. Bays, gulfs, seas, and oceans are all salty water bodies. Clouds, mist, and fog are all examples of water in the air. Snow, glaciers, ice sheets, and icebergs are all frozen water. Some water is underground.)* **What do these places have in common?** *(All of these places store water. They are all reservoirs.)* Circulate and listen to groups' discussions.

9. Say: **Scientists use the word *reservoir* to mean a place where water is stored. All the places you have thought of are reservoirs. They can be on the surface of a planetary body, in the part of the planetary body under the surface (the subsurface), or in the air around the planetary body (the atmosphere).** Write the words *reservoir*, *surface*, *subsurface*, and *atmosphere* on the *Our Ideas* poster. You can have learners add translations, drawings, or related images to the poster as well.

### Support Thinking

- Following the instructions on Science Activity 2 Water Where We Are From Handout, pg. 32, learners will be identifying places with water. Provide examples as needed to prompt learner thinking. For example, water can be found in the ocean, rivers, lakes, ice sheets, clouds, living things, and the ground.
- Encourage learners to think about places with water that they shared in their stories during the previous activity.
- To help learners understand what they will be doing during this activity, play the translatable video Water Where We Are From Instructional Read Aloud.

### Support Learner Differences

As needed, allow learners to choose other methods of sharing their ideas, such as audio recordings or Braille. Post index cards with filenames on them so the record can be referenced later.

### Support Thinking

Support learners' understanding of reservoirs by mentioning human-made reservoirs near where you are and describing how they store water.

10. Say: **You've identified many of the key reservoirs of water on Earth. They include (1) in ice sheets, (2) underground, (3) in the ocean, (4) in lakes and streams, (5) in the air, and (6) inside life forms. Now, we're going to think about how much water is in each reservoir.** You can add names of these reservoirs, such as *ice sheets*, to the *Our Ideas* poster next to the terms *surface*, *subsurface*, and *atmosphere*. You can have learners add translations, drawings, or related images to the poster as well.

11. Give each group a copy of Science Activity 2 Where Is the Water? Handout, pgs. 33-34. Say: **This page gives instructions to help you think about how much water is in each reservoir on Earth. As a group, you have about 10 minutes to follow the instructions.**

12. Give each group 1 full cup, 4 empty cups, a marker, and a measure with milliliters (such as a medicine cup).

13. Give groups 10 minutes to follow the instructions. As needed, offer clarifications and explain that learners are estimating how much of Earth's water is in each of the reservoirs. Make sure they record their estimated amounts of water on *Science Activity 2 Where Is the Water? Handout,* pgs. 33-34.

14. Have each learner find the two index cards they wrote, that name places with water. Say: **Every place you thought of in your community is part of a reservoir. Take five minutes to put each index card in front of the reservoir it is a part of.**

### Support Learner Differences

- Give learners time to examine the materials before they follow the instructions.
- If you have learners who speak multiple languages, have them discuss words for "ice sheet" and related words in their preferred languages and notice similarities between languages. If you can, provide an example from a language you know. Take time to learn learners' words and use them throughout the activities.

### Level Up!

Have each group estimate how many cups of water like the one they received they would need to have in order to have all the water on Earth. Say: **The total amount of water on Earth is 10^22 (ten to the twenty-second) times larger than the amount of water in one of those cups.** Help learners understand just how big this number is by writing it out or otherwise expressing it in a way they can grasp. (Written out, it looks like 10,000,000,000,000,000,000,000; the USGS estimates there are 1,386,000,000 cubic kilometers of water on Earth in its FAQ "How much natural water is there?") (5 min.)

### Support Thinking

- To help learners understand what they will be doing during this activity, play the translatable video Where Is the Water Instructional Read Aloud.
- It may help learners if you remind them how numbers can be expressed as percentages or as fractions. For example, a cup with 25% of the water has 1/4 of the water. The values of all the cups together need to add up to 100%, which is equal to 1.

15. After about 5 minutes, ask: **Which reservoirs are your places a part of?** Have groups pair up to discuss or record their ideas on the *Our Ideas* poster. You can have learners add translations, drawings, or related images to the poster as well. Groups can also attach their index cards to the poster.

16. Say: **Now we will learn the actual amount of Earth's water in each reservoir. You will record these amounts and adjust the water in your cups to match.**
    - **96.5% of the water on Earth, represented by 134 milliliters of your water, is in the oceans on the surface.**
    - **About 1.5% of the water on Earth, represented by 2 milliliters of your water, is in ice sheets.**
    - **Another 1.5% of the water on Earth, represented by another 2 milliliters of your water, is underground.**
    - **The last 0.5% of the water on Earth, represented by 1 milliliter of your water, is in lakes, rivers, the atmosphere, soil, and living things.**

17. To help groups remember what is in each cup, do the following:
    - Give salt to each group and have learners add it to their ocean cups.
    - Give sand to each group and have learners add it to their underground cups.
    - Have each group draw snowflakes on the outside of their ice sheet cups.

### Support Thinking

Share these PLANETS Water in Extreme Environments resources: Science Activity 2 Optional Reference Visuals (PDF) and the videos Earth's Water Availability, Accessibility, and Usability and Water Phases and Reservoirs to help learners understand the amount and type of water in each reservoir.

### Level Up!

Take pictures of learners' cup and index card setups, print them out, and attach them to the *Our Ideas* poster. (20 min.)

## Reflect (10 min.)

18. Have learners revisit the Guiding Question in their small groups: **Where is there water on Earth?**

    *(Almost all water on Earth is salt water in the oceans, but it is also present in the atmosphere, in ice sheets, in living things and underground.)* Ask: **How does the amount of water in these reservoirs help us think about where there might be life?** *If most of the water in the solar system is salt water, like it is on Earth, then life is probably in salt water.* As needed, remind learners of the terms *reservoir*, *surface*, *subsurface*, and *atmosphere* on the *Our Ideas* poster.

19. Say: **Next time, we will keep answering our questions about the kinds of living things that we can find in water.**

### Level Up!

- Ask this story prompt question: **Can you tell a story about a time you needed to find or get to water?** *(Possible responses include while traveling or digging a well.)* Have learners share with a partner (note that the sharing can take forms other than speaking aloud). Consider returning to learners' ideas at the start of the next activity. (20 min.)
- Tell learners, if anyone asks them what they did today, they can tell them "We explored how much water there is on Earth and where it is." (5 min.)
- To observe the effects of salt on living things, give each group two potato slices and a cup of fresh water. Have them put one slice in their salty ocean cup and one in the cup of fresh water. Save the cups and have learners observe them next time, considering the effects of the different kinds of water on the two potato slices. (You can also run variations of this activity with halved grapes or gummy bears, and you can compare additional solutions such as water with sugar, vinegar, or baking soda.) (5+ min.)

## After the Activity

1. Clean up:
   - Save the *Our Ideas* poster for Activity 3.
   - Dispose of the salt water and sand.
   - Collect and save the markers, measures, and cups.
2. Plan for Science Activity 3. See Science Activity 3 Preparation on pgs. 36-37.
3. Take time to reflect on the following educator prompt. **What kinds of reservoirs did learners think of? Why do you think they thought of those kinds of reservoirs?**

### Water in Extreme Environments Additional Resources

Resources include All Downloads, All Videos, Family Connections, and more.

weblink: https://hov.to/7cb5c428

# Water Where We Are From

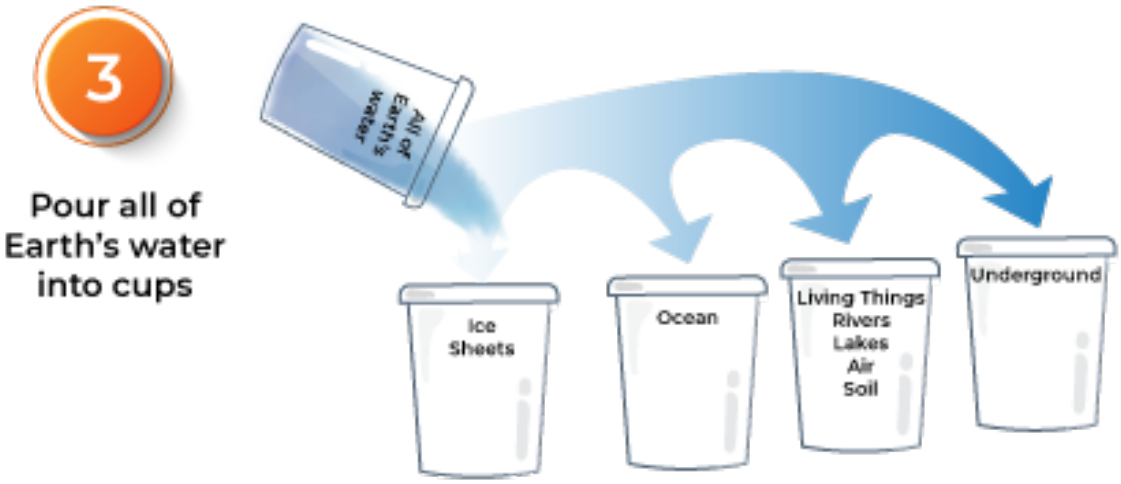
1. Think about a community you belong to. What are the different forms of water there? What are the places where you can find water?
2. Write one place where you can find water on each of your index cards. You can also draw a picture or describe it some other way.

# Where Is the Water?

1. Label the empty cups with the places on the list below:
   - Ice Sheets
   - Ocean
   - Rivers, Lakes, Air, Soil, Living Things
   - Underground
2. Imagine the water you have is all the water on Earth. Pour it into the cups to show how much of Earth's water you think is in each place. (For example, if you put 25% of your water in a cup, you think 25% of Earth's water is in that place.) Record your group's estimates in the chart.

| Reservoir | Estimated Amount | Actual Amount |
|---|---|---|
| Ice | % | % |
| Ocean | % | % |
| Rivers, Lakes, Air, Soil, Living Things | % | % |
| Underground | % | % |






Pour the amount you think is in each place compared to the others.