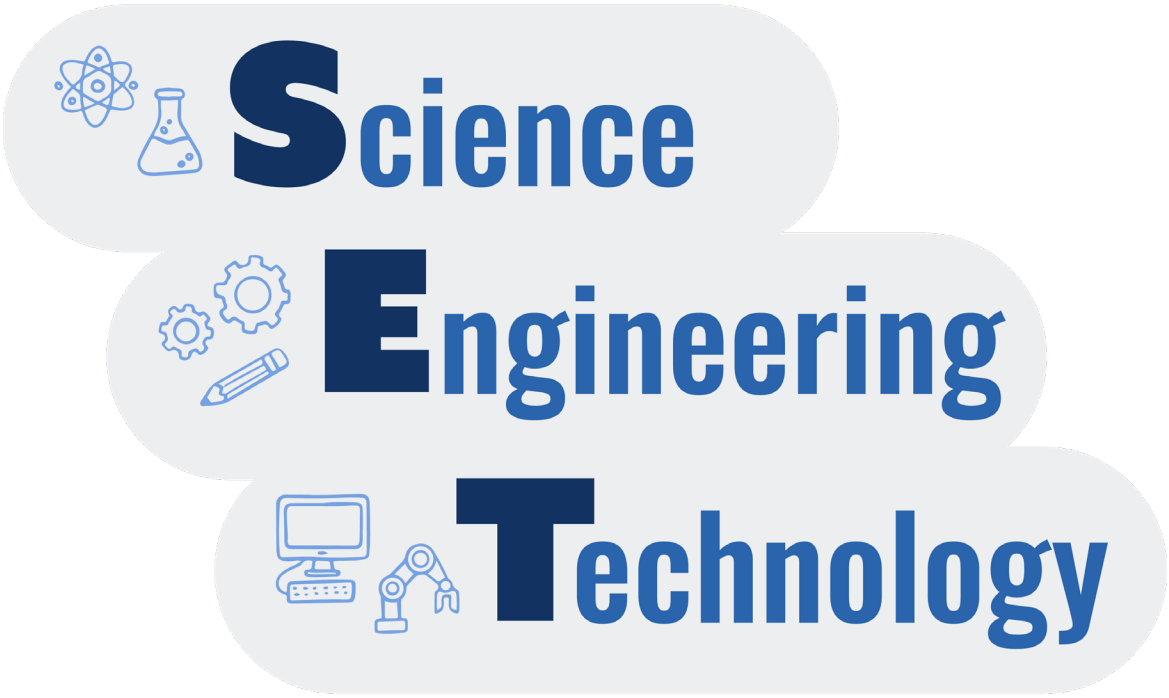
Ready, S.E.T. (Science, Engineering, Technology), Go!



Educator Preview

Activity Snapshot

Learners investigate water. As scientists, they figure out where water is located. As engineers, they design a technology to get the water.

Timing | 45 minutes

Get Ready & Team Up	10 min.
Plan & Create (S.E.T.)	25 min.
Reflect (Go!)	10 min.
Total	**45 min.**

Level Up Activities 5–30 min. each

Prep Snapshot*

Prep Time 90 min.

- Space Need: Sink
- Read unit.
- Print Notebooks.
- Prepare containers.
- Make *Our Ideas* poster.

**See Materials & Preparation for full info.*

21st Century Skills

Connection

- Critical Thinking

Habits of Mind

- Use a structured problem-solving process.

Science Practices

- Planning and Conducting Investigations

Guiding Question

How can we identify where there is water? How can we get it?

Learners Will Do
As scientists, identify which containers hold water. As engineers, design a way to get the water out.

Learners Will Know
Water is a limited natural resource, but scientists can figure out where water is, and work with engineers to get it and use it.

Connecting Across Activities

Ready, S.E.T., Go!	Activity 1: Sharing Experiences
Today, learners start exploring water. As scientists, they figure out where water is located. As engineers, they design a technology to get the water.	**Next time**, learners will share experiences with and stories about water.

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/9009148c

Materials and Preparation

Materials

For the educator

- *Our Ideas* poster (on paper or a shared digital document)
  Examples & Templates
  - index cards
  - markers
  - scissors
  - tape

For each learner

- Science Notebook (PDF)
- safety gloves and goggles (optional)

For the whole group

- 1 cup sand
- 1 permanent marker
- 6 to-go coffee cups (or other opaque containers) with lids
- 21 felt dots (or other raised adhesive objects for labeling containers, optional
- soda water (or water and non-medicated seltzer tablets)
- vinegar
- water
- additional substance such as water ice, dirt, or rocks
- Disinfecting wipes (to clean lids)

For each group of 4

- 1 cup, clear plastic
- 1 square foot of aluminum foil
- 1 square foot of plastic wrap
- 1 to-go coffee cup (or other opaque container) with lid
- 5 cotton balls
- 5 craft sticks
- 5 feet of string
- 5 index cards
- 5 paper clips
- 5 straws

Teaching Tip

If you think learners will benefit from having more space in the Notebook, print one-sided or add sheets of blank paper as you make the Notebooks.

Ready, S.E.T., Go! Materials Preparation (90 min.)

Ahead of Time

1. Read through the PLANETS Science Pathway Educator Guide Introduction, pgs. iii–xxv, to learn more about the science content in this unit.

Teaching Tip

This activity is the same in both the Science and Engineering Pathways. If your learners have already done this activity in one pathway, you do not need to repeat it.

This activity can stand alone as a brief single-session program.

2. Print and staple one Science Notebook (PDF) for each learner, in color if possible. As needed, prepare to share the Notebook digitally.
3. Print your own copy of the Notebook for your reference.
4. Download and prepare to share the *Ready, SET, Go* slides. If you cannot project them, print a copy for each group instead.
5. Prepare an *Our Ideas* poster by following the online Prep & Setup Guide (PDF). Add the Guiding Question "How can we identify where there is water? How can we get it?" so learners can refer to it throughout the activity.

Support Learner Differences

The Science Notebook can be printed in large font and you can share a digital version that will work with screen readers. The Notebook is written in English, but you can translate the instructions into other languages; see translation guidance in our Translatable Glossary (DOCX).

Teaching Tip

You can begin the *Our Ideas* poster with several standard 23" × 32" pieces of chart paper. You may fill them up before the end of the pathway, in which case you can add more pieces as needed.

The *Our Ideas* posters capture students' authentic language and ideas as they emerge in real-time discussions. The posters are not meant to simply display and front-load vocabulary. The posters develop over time as the educator listens for and adds the language that learners use in the moment, thus validating their ideas, providing feedback, and supporting sensemaking and language development.

Support Learner Differences

Different learners have different needs. Choose from the following tips to best support your learners:

- View the Translanguaging Video to support learners who speak multiple languages.
- For those with low vision: add tactile elements, such as three-dimensional representations and Braille. Prepare a shared digital document all learners can access, ensuring that it supports text-to-speech for your learners.
- Add learner questions to the *Our Ideas* poster to foster an interest-led approach.

6. Assemble one set of materials for each group (cup, plastic wrap, cotton balls, string, index cards, paperclips). You can store each group's materials in a bag for easy distribution.
7. Label six coffee cups with the numbers 1 to 6. Optional: Attach the listed number of felt dots to each cup (1 felt dot on cup 1, 2 felt dots on cup 2, etc.).

Support Learner Differences

Adding felt dots to the cups allows all learners to refer to them by number (for example, "Container 2"), even if they cannot see the written labels. Using stickers or squares of tape, or punching through the back of a sticky note with a pen-tip to make raised hole punches, can also work.

In Your Space

8. Place the *Our Ideas* poster in a location all learners can access. Make a plan to store it between activities.
9. Fill one unnumbered coffee cup with water for each group.

Teaching Tip

Lead this activity in a room with a sink for easy setup. Otherwise, bring a half-gallon of water.

10. Fill Cup 1 with water. Put on the lid.
11. Fill Cup 2 with sand. Measure or feel to ensure its weight is roughly the same as Cup 1. Put on the lid.
12. Fill Cup 3 with water and add roughly a teaspoon of vinegar. Measure or feel to ensure its weight is roughly Cup 1. Put on the lid.
13. Leave Cup 4 empty. Put on the lid.
14. Fill Cup 5 with soda water (or water and non-medicated seltzer tablets). Measure or feel to ensure its weight is roughly the same as Cup 1. Put on the lid.
15. Fill Cup 6 with the non-liquid-water choice most appropriate for your site. Measure or feel to ensure its weight is roughly the same as Cup 1. Put on the lid.
    - Filling a cup with water and freezing it overnight into solid ice can spark conversations around the differences of water in solid form and what it would take to convert it to liquid.
    - Filling the cup with another material–such as beads, rocks, dirt, or marbles–can result in a distinct sound or odor distinguishable from water.
16. Set out the six numbered cups at six different stations.

Teaching Tip

You will need to make clear that learners should **NOT** drink out of any of the cups. Consider marking the cups to indicate that they are not for drinking. You can also tape over the holes in the coffee cup lids, although this will make the contents more difficult to smell.

Activity Guide

Get Ready & Team Up (10 min.)

1. Organize learners into groups of four.
2. Say: **NASA is sending spacecraft to explore many planets, moons, and asteroids around the solar system. One of the things NASA is searching for is water. Water is fundamental for life. Human explorers will need clean water to survive, and we might find other living things in water around the solar system. Today, we're going to explore two problems that NASA is facing.** Share the Guiding Question with learners aloud and in writing (using multiple languages as needed): **How can we identify where there is water? How can we get it?**

Plan & Create (S.E.T.) (25 min.)

Science: Find the Water

3. Display *Ready, S.E.T., Go!* slide 1: *Searching for Water*. Have learners discuss in their groups: **What do you notice about these images?** *(They all show ways of finding water. Observing animals who hunt fish; cattails grow by water; smooth stones often show up in riverbeds and dry washes; people dig wells to find water; satellites can identify where there is water.)*
4. Say: **Many times, people can't see the water they are searching for, so they have to detect it in other ways, such as by using the things you just talked about.**
5. Say, **Today, we're going to use more methods to figure out where there is water.** Have learners discuss in their groups: **What are other ways that people are able to find water without seeing it?**
6. Give each learner a Science Notebook. Say: **This Notebook is a place to record your observations and ideas.**

Support Learner Differences

If learners are new to you or each other, have them share their names, name pronunciations, and other important parts of their identities. These introductions are important for all learners and can be especially relevant for Indigenous learners, multilingual learners, and learners with different physical abilities. You can also distribute index cards and have learners write anything they want you to know but do not want to share with the whole group, such as resources that will help them learn. If everyone knows each other's names, ask if anyone has a middle name or nickname you could learn to pronounce. Invite them to share about it.

For more strategies to engage learners, refer to Designing Instruction to Reach Diverse Learners, pgs. x–xv.

Check out the Intentional Grouping Strategies, pg. xxii.

Teaching Tip

Throughout this guide, information for you to say to students appears in **bold**. You can say the bold sentences exactly as they are written or paraphrase them.

7. Have learners turn to *Find the Water*, pg. 2 in their Science Notebook. Say: **This page gives instructions to help you identify where there is pure, liquid water. As a group, you will go to six different stations. You will have about two minutes at each station. You cannot open or look into the containers, but you can use hearing, smell, and the way each container feels to gather data about them. Do NOT drink or eat anything from the containers.** Demonstrate how to "waft" the scent from the container with your hand to your nose, and warn learners about smelling the containers too deeply or closely.

Teaching Tips

- Consider ways to help learners remember not to look in the containers, such as by having them close their eyes.
- If you have safety gloves and goggles, have learners put them on.
- Ensure there is a quiet space to listen for bubbles. You may need to refresh bubbles between groups.

8. Allow each group to go to a station and begin examining the container there. As needed, offer clarifications and explain that learners are trying to determine whether each container has water and/or something else inside without opening it.
9. Every 1–2 minutes, have each group switch to the next station.
10. After learners have finished their final stations, revisit the first part of the Guiding Question: **How can we figure out where there is water?** *(We can make observations by sound, smell, and feeling. We can use what we know about water and other substances.)* Have groups pair up to discuss or record their ideas on the *Our Ideas* poster. Say: **We will keep gathering ideas on this poster.**
11. Open the numbered containers and tell learners what was in each of them. Discuss the differences among the clean liquid water, water mixed with other substances (vinegar, bubbles), and (if you included it) ice.
12. Point to a container that most learners thought did not have water. Ask: **Why did you think there was not water in this container?** *(Because it was too heavy; because it didn't sound like water.)* Explain that learners used these observations to make hypotheses, hypotheses, which are ways people explain what they think will happen based on what they know.

Support Learner Differences

- Recording learners' ideas using words, diagrams, and pictures on the *Our Ideas* poster or shared digital document throughout the activities allows them to refer to the poster to remember words and build on past ideas. You can refer to an "In-Use Example" in the Prep & Setup Guide (PDF).
- If you have learners who speak multiple languages, encourage them to share in their preferred languages.

13. Display the *Searching for Water* slide again. Say: **Humans often need to find water that we can't see directly. Throughout history, people have done this in many ways, from studying local animals and plants, to digging holes and wells, to analyzing types of rocks, to measuring how light reflects from other planetary objects in space. Like these people, you have been using some practices of scientists. There are many other things scientists do that we did not have time to do today, such as choosing a question and analyzing our results.** Write the word *scientist* on the *Our Ideas* poster. Have learners come up with a description of scientists together and record it on the poster. (For example: Scientists ask questions, test things out, make observations and measurements, and gather evidence to answer the questions.) You can have learners add translations, drawings, or related images to the poster as well.

Engineering: Access the Water

14. Ask: **When people figure out how to find water they can't see, what kinds of things do they do next?** *Drill a well, get it out, use it.*

15. Say: **Now that you have identified where water is, you will design something to get it out of the container. You can use a variety of different materials: plastic wrap, cotton balls, string, index cards, and paper clips. You can't move the container because it represents a natural water source, like a lake, that can't be moved.**

16. Have learners turn to *Collect the Water*, pgs. 3-5 in their Science Notebook. Say: **This page gives you instructions to figure out how to collect the water. As a group, you will have about 10 minutes to follow the instructions.**

17. Give each group one coffee cup with water, one plastic cup, and the materials you listed.

18. Give groups 10 minutes to follow the instructions. As needed, offer clarifications and explain that learners are moving water from the container to the cup using the materials provided, without touching the cup directly. Say: **Try to move at least a few tablespoons of water.**

Level Up!

NASA has used satellite data to create a map of where water can likely be found near the surface of Mars. This map could be used by future astronauts to find drinking water on Mars! Read more here: https://www.nasa.gov/solar-system/nasas-treasure-map-for-water-ice-on-mars/ (5 min.)

Support Thinking

To help learners understand what they will be doing during this activity, play the translatable video Water in Extreme Environments Read Aloud.

Support Learner Differences

Give learners time to examine the materials before they begin the challenge.

Level Up!

For an additional challenge, learners can attempt to move the water using only index cards.

19. After about 10 minutes, revisit the second part of the Guiding Question: **How can we get water?** *(We can design devices that help us collect it.)* Have groups pair up to demonstrate their devices, discuss, or record their ideas on the *Our Ideas* poster.

20. Display *Ready, S.E.T., Go!* slide 2: *Water Technologies.* Say: **Humans often need to move water from one place to another. Throughout history, people have done this in many ways, from the shadoof in Egypt to stepwells in India, to water storage systems in the Southwest and water redirection systems in Central America. Like these people, you have been using the practices of engineers.** Write the word *engineer* on the *Our Ideas* poster. Have learners come up with a description of engineers together and record it on the poster. (For example: Engineers design things to solve problems.) You can have learners add translations, drawings, or related images to the poster as well.

21. Say: **Scientists often start with a question and work to answer it. Engineers start with a problem and work to solve it. The objects, systems, and processes engineers design to solve problems are *technology*; for example, your designs to move and collect water are technologies. Engineers often design technologies that help scientists answer their questions.** Write the word *technology* on the *Our Ideas* poster. You can have learners add translations, drawings, or related images to the poster as well.

22. Have learners refer to *Collect the Water*, pgs. 3-5 in their Science Notebook. Say: **Engineers record how the technologies they design work and find ways to improve them. As a group, you have about five minutes to record how your water collection technologies worked and think of ways you could improve them if you had other materials.**

Level Up!

- Learners may believe that *technology* refers only to devices powered by electricity. Explain that anything designed by people to solve a problem is technology. Have learners identify non-electrical technologies around them. (10 min.)
- Have learners think about how their technologies would function if they were larger and used in a different setting, such as a river next to a farm field. What would have to change to make sure the technologies kept working as intended? (5 min.)
- Have learners create portrayals–through drawing, acting, or some other method of their choice–of scientists and engineers working together to identify and get water. (30 min.)

Reflect (Go!) (10 min.)

23. Have learners discuss the following questions in their small groups: **Where on Earth do you think it is easier or harder to get water? Why? What about other places in the solar system?**

24. Say: **Next time, we will think about what we already know about water and why it is important.**

After the Activity

1. Clean up:
   - Keep the *Our Ideas* poster for Activity 1.
   - Collect all materials and containers. Where possible, save the materials and substances for reuse.
   - Keep the cups for Activity 2.
2. Have learners invite people from the community, including their families and friends to the Science Share-Out in Activity 7.
3. Plan ahead for Activity 1. See Activity 1 Preparation on pgs. 18-19.
4. Take time to reflect on the following educator prompt. **How did you create continuity between the science and engineering portions of the activity?**

Water in Extreme Environments Additional Resources

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

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