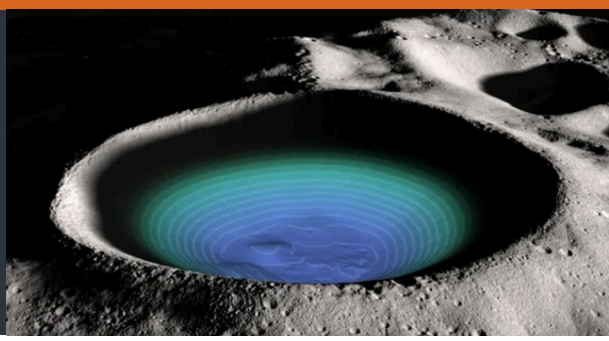
Investigating Water on Earth and The Moon



Summary

All living things are possible because of Earth's giant "life support system." For this MO, teams will focus on one aspect of Earth's systems: water. They will create a placed-based water cycle model and use the water cycle as inspiration to design and test prototype water purification systems for astronauts on the Moon.

Materials Needed

- Water!
- Supplies for building water purification devices which could include:
  - cups/beakers
  - plastic wrap
  - salt
  - food coloring
  - potting soil
  - filtration media like coffee filters
  - cotton balls
  - sand etc.

Resources from Companion Course Lesson 3:

- Engage Section: An activity to help teams learn where the water at school, at home, and in their community comes from.
- Explore Section: A game to help students understand the water cycle and experiments that demonstrate portions of the water cycle.
- Explain Section: Examples of place-based water cycle models.
- Elaborate Section: Guidance to support students in creating their water purification prototypes.

Additional Resources:

- Video: Water Experiment Video

Getting up to Speed

When NASA sends people to space, they have to replicate all of the "life support systems" that are present here on Earth, including food, water, air, and temperature control. Making sure that these systems work well all the time is truly a matter of life and death! For example, NASA must find ways for the Artemis astronauts to clean, conserve, and reuse any water collected on the Moon.

To learn more about life support systems on upcoming NASA Missions, check out the resources in the Getting up to Speed with Artemis document.

Mission Guidance

The Earth purifies water for humans every day, but we often don't think about it. In this MO, teams will learn about how the water cycle purifies their water on Earth and use what they learned as inspiration to design a water purification device for astronauts on the Moon.

To learn about the water cycle on Earth, teams will create a visual model of their local water cycle like an annotated map, flow chart, infographic, or any other labeled visual. (See the Explain section of the Companion Course lesson for examples.) Teams must focus on what purifies and recycles water in their area, rather than including every detail of the Earth's water cycle.

Teams should start by deciding the area their model will represent. They will need to find out where their school's or home's drinking water comes from. Next, teams should identify the "reservoirs" in this area that store water, such as lakes, rivers, or groundwater aquifers. They can even include clouds and oceans. Then, teams should learn about the processes in the area's water cycle, both visible and invisible, that move water from one reservoir to another like evaporation, runoff, and groundwater flow.

Finally, teams should consider possible sources of contamination in their area, such as pollution or waste. It's unlikely the water at school or home is unsafe to drink, so teams should also investigate the processes that purify water and remove these contaminants. The team's model should include both the sources of contamination and the purification processes, and where they happen. The model must also include symbols or colors to show where the water is safe to drink and where it might be contaminated.

When they have completed their water cycle model, teams should use what they've learned to design, build, and test a water purification device based on how the water cycle cleans water. Teams can choose the methods and materials to use for their device. They should also determine methods to test and evaluate how well their device works. See the Elaborate section in the associated Companion Course lesson additional support.

Teams should be exploring and learning from the water cycle in their community, including where their drinking water comes from. The Engage section in Companion Course Lesson 3 can help uncover what they know and investigate what they need to find out and the Explain section can help them develop their model.

Deliverables

As they work, teams should keep track of their results in their Science and Engineering Notebooks (SEN). At the end of the Challenge, teams will be asked to submit a Mission Development Log (MDL) to NESSP that shows how the students worked through the Mission Objective and summarizes their results. NESSP provides a Mission Development Log Template to help guide what teams should include in their MDL. Please see MO-1 for guidelines on the format and length of the MDL.

MO-3 What must be in your Mission Development Log (MDL)?

Every MDL must include:

- A picture or drawing of the team's local water cycle model. Including:
  - An explanation of the area shown and why it was chosen.
  - Represent and label all reservoirs (lakes, rivers, clouds, etc) and water cycle processes (evaporation, runoff, etc.).
  - Represent and label the sources of contamination and purification.
  - Represent and label the source of your drinking water at school or community organization.
  - Symbols or colors that indicate where the water is safe or is not safe to drink.
- A description of their prototype purifying water including:
  - At least 3 photos of the prototype being set-up or tested.
  - A description of the part or parts of the purification device that was inspired by the water cycle on Earth.
  - A description of how the prototype was tested, including what the team observed or measured, and the results. Teams should also estimate the rate that their device can clean water. (How much per minute, hour, or day?)
  - A conclusion statement that describes whether or not the prototype worked. Is the water safe to drink?

Middle and high school team's MDL must include:

- Qualitative data that was used to check how well the team's water purification device worked.