

Water Cycle and Pollution

Big Idea/ Topic

Changing landscape as related to the hydrologic cycle and the impact of conservation practices

Standard Alignment

S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.

a. Ask questions to determine where water is located on Earth's surface (oceans, rivers, lakes, swamps, groundwater, aquifers, and ice) and communicate the relative proportion of water at each location.

b. Plan and carry out an investigation to illustrate the role of the sun's energy in atmospheric conditions that lead to the cycling of water.

(Clarification statement: The water cycle should include evaporation, condensation, precipitation, transpiration, infiltration, groundwater, and runoff.)

S6E6. Obtain, evaluate, and communicate information about the uses and conservation of various natural resources and how they impact the Earth.

b. Design and evaluate solutions for sustaining the quality and supply of natural resources such as water, soil, and air.

Connection to other content areas:

ELAGSE6RI7: Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.

ELAGSE6W7: Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

ELAGSE6W8: Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

Engage:

Phenomenon: Water gathers on a cold container as it sits outside or at room temperature. Where does the water come from? How did it get there? Why does the water not gather on all objects in the same way?

Students plan and carry out an investigation to explain why the water condenses on objects in certain conditions. Students plan investigation procedures, with guidance, using materials in the classroom or at home. The intent is for students to begin to build the understanding of how water is cycled.

Students are investigating what leads to the condensation. They may want to determine ways that would increase or decrease the amount of condensation, such as using containers with lids, placing items in the freezer, sealing items in plastic bags, etc.

Suggested materials: glass jars (with and without lids), plastic bottles (with and without lids), plastic bags that can be sealed, water, ice, etc.

Next have students examine the water cycle. The interactive graphic at the USGS can be used or printed for students use: <https://water.usgs.gov/edu/watercycle-kids-adv.html>

Students should make observations about how water moves in the water cycle while looking at the graphic. Students should, also, begin to hypothesize about what makes water move throughout the water cycle.

After students have had the opportunity to observe the image of the water cycle and plan/carry out their investigation then teachers should lead a class discussion to see what students have noticed, what they think and what they wonder. Some questions to assist in the discussion are listed below:

1. What happened to the water in your investigation? Why?
2. Is precipitation only rain?
3. What else is known as precipitation?
4. Where is water located on the earth?
5. Do you think the hydrologic cycle only involves precipitation, condensation, and evaporation? Why or why not?
6. What parts of the water cycle can you name?
7. Is water a renewable resource? Why or why not?
8. Is all water used in the same way? Why or why not?
9. How easily is water polluted? Why?
10. What leads to water pollution? Give examples.
11. Do you think industry is the only entity to cause water pollution? Why or why not?
12. Are plants impacted by water pollution? Why or why not?
13. Are animals impacted by water pollution? Why or why not?

Have students draft an explanation of why the water cycle is important to life on Earth. In the explanation include information about where you have seen the water cycle in action in your lives.

Unplugged: Give students a diagram of the water cycle and the questions to answer.

Explore:

Show students an image of Earth from space such as the one below:



[This Photo](#) by
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Teachers note: Another option for a visual that can be shared with students is available at [A drop in your hand: Water stewardship | National Oceanic and Atmospheric Administration \(noaa.gov\)](#). This may be done as a demonstration to show students the water cycle and amount of water in each location.

Ask students to hypothesize how much of Earth is water and how much of the water on Earth is fresh water.

Then have students generate other questions that they might have about water on Earth. Student questions may include, but are not limited to:

1. Why is there more water in the oceans than everywhere else?
2. Why can we not use salt water for most things?
3. What happens if you drink salt water?
4. Does salt water and fresh water become polluted in the same ways?
5. How do glaciers fit into the water cycle?

Have students obtain information about how much water on earth is in each location (oceans, rivers, lakes, swamps, groundwater, aquifers, and ice). Students may work to answer the questions that they have generated as well. Some resources that students can use to obtain information can be found at the following websites:

https://www.usgs.gov/special-topic/water-science-school/science/where-earths-water?qt-science_center_objects=0#qt-science_center_objects

https://www.usgs.gov/special-topic/water-science-school/science/how-much-water-there-earth?qt-science_center_objects=0#qt-science_center_objects

Georgia Department of Education

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Then have students explain why their hypothesis from earlier in the explore section is correct or not. Have students explain why they were or were not correct.

Then the teacher should lead a class discussion about how much of the Earth is water and how much of that water is contained in which places. The teacher may want to create a data chart or graph to allow students to visualize the percentage of water in each location. The teacher should, also, ask students why fresh water is important and why salt water is important.

Teachers note: Fresh water is essential for organism that live on land and salt water is essential for organisms that live in the ocean.

Unplugged: Provide students with an image of Earth and a place to record their hypothesis. Then provide students with the articles printed to use to obtain information.

Explain:

Have students plan an investigation on how the sun impacts the water cycle. The teacher should provide students with various materials. Materials could include:

- Cup
- Water
- Paper towels
- Access to sunlight
- Ice
- Marker

Teachers note: Students can plan all sorts of different investigations with the materials above. The main point is for students to plan an investigation that would allow them to see how the sun impacts water in the water cycle. This may mean that students plan an investigation that shows evaporation, runoff, or condensation.

The teacher should lead a discussion about what students noticed in the investigation that they planned.

Then have students complete the following to create their own model of the water cycle:

- Using your knowledge of the water cycle, draw the water cycle.
- Make sure you identify the following parts of the hydrologic cycle: precipitation, evaporation, condensation, infiltration, transpiration, runoff, and groundwater.
- Using a different color pen, pencil, or marker, make small circles to show where the sun impacts the water cycle.

Unplugged: Provide students with a list of materials that they can use for their activity. Then have students complete the planning and conducting of the investigation. Students can then draw the water cycle. The teacher may want to consider sending articles about the water cycle to assist students in planning their investigation.

Elaborate:

Ask students to brainstorm ways that pollution impacts water on Earth and where it can enter the water cycle.

Students may come up with but are not limited to the following:

- Trash runs into a river
- Pesticides run into bodies of water
- Plastic in the ocean
- Chemicals in rivers
- Oil spills in the ocean

Now have students focus on the following pollution and how it impacts the water cycle. Continue to explore the hydrologic cycle and the many ways farmers strive for water conservation and the issues of reducing pollution on the farm, take a look at this video: [Kentucky Farmer talks Farm Solutions to Water Pollution](#).

Discuss the video by asking the following questions:

1. What measures did the farmer take to reduce pollution on his farm?
2. How does this video relate to our use of water on earth?
3. Think about the use of this water by this farmer. He stated he started the process of cleaning up pollution (from his dairy farm) over 20 years ago. Do you think the stream would be more polluted or less polluted if he had not started this process those years ago? (More polluted because he has barriers in place for his dairy now – a holding pond for the water; solid waste going into a different location)
4. The water in the holding pond is used for irrigation. Is this water a part of the water cycle? Why or why not?

Now have students use the diagram, [What a Cycle](#), to label the parts of the water cycle (precipitation, evaporation, condensation, infiltration, transpiration, runoff and groundwater).

On the diagram add additional circles that indicate where pollution from the farm might occur within the water cycle. Then have a class discussion about pollution in water that has students answering the following questions:

- What is water pollution?
- How does water pollution impact the water cycle?
- Think about the farmer's solutions to reduce pollution on the farm. How did this help reduce water pollution?

Unplugged: The teacher should send an article and an image about water pollution from farms and solutions that can be used to reduce the amount of water pollution that comes from farms. The teacher should print and send how the diagram listed above.

Evaluate:

Have students think about a landfill. Ask students the following questions:

- Have you ever seen a landfill?
- What is a landfill?
- How does water interact with a landfill?

Students that have no experience with landfills may benefit from an image or video about landfills, but this can be determined based on the discussion.

Now give students the following scenario:

You are a part of a team that has been hired to plan a new landfill that a small town in the area has decided to build. The town is concerned that it could cause some problems with the ground water in the area. You are tasked with ensuring that the landfill will be built in the best area and has some solutions to assist in keeping the pollution from the ground water.

Students should make a plan to present to the town at the next town meeting.

Teachers note: A map of the town may assist students with their planning process. Also, students may need some suggestions of things that could help keep pollution in such as a liner, silk fencing and a water collection/cleaning system.

Students should share their designs with the class and discuss how it contains solutions to the town's concern that pollution will end up in the ground water supply.

Unplugged: The teacher should send information about landfills and how they contribute to water pollution. The teacher should also send the scenario and a rubric for students to complete the activity.

Lesson Checklist:

Standards:

S6E3. Obtain, evaluate, and communicate information to recognize the significant role of water in Earth processes.

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S6E6. Obtain, evaluate, and communicate information about the uses and conservation of various natural resources and how they impact the Earth.

- Design and evaluate solutions for sustaining the quality and supply of natural resources such as water, soil, and air.

Checklist:

- Ask questions about water on Earth.
- Communicate the relative amount of water in oceans, rivers, lakes, swamps. ground water, aquifers, and ice.

- Plan an investigation to obtain information about how the sun impacts the water cycle.
- Communicate how the sun impacts the cycling of water.
- Identify sources of water pollution.
- Design solutions to lessen water pollution.

Evidence of Student Success

Student mastery is assessed throughout this unit using formative and summative components. Student discussion, explanations and products should reflect the understanding indicated in the Evaluate section above. Each activity in the segment functions as an assessment opportunity as well to plan targeted supports or provide extension items. Formative options using the self-evaluation checklist and the activities at various points during the segment.

Distance Learning Supports

The goal for science education in the state of Georgia is as follows: All Students, over multiple years of school, actively engage in science and engineering practices and apply crosscutting concepts to deepen their understanding of the core ideas in these fields.

The learning experiences provided for students should engage them with fundamental questions about the world and with how scientists have investigated and found answers to those questions. This lesson includes the disciplinary core ideas, science and engineering practices and crosscutting concepts to actively engage students in exploring science concepts with real world topics. As part of the vision we must support the inclusion of all students in science learning.

Some **general** ideas to assist in supporting students that struggle are as follows:

- Be sure that students can access the information that you they are learning. Make sure that you can answer the following questions:
 - Do students have what they need to get the information? This is about them having the book or internet access to get to the information.
 - Once students obtain the information, are students able to determine what information is important? This is about the students having materials on the appropriate grade level and that is in a format that students can understand.
 - Is the material presented in multiple ways that allows all students to interact with information in a way that works for them? Such as video, audio, and articles.
 - Consider read aloud as a potential option for students that have reading deficits as an option to assist students in accessing the material. This could be done using video or via phone.
- Students may need ideas about where to find information. Providing students with information about what a reliable source is and even where to find reliable sources may be beneficial for students.
- Some students may find it difficult to complete the entire lesson workload. Some students may benefit from a reduced workload (note: this should be used only when absolutely



necessary). Be sure that the information that is removed will not negatively impact the student's understanding of the disciplinary core idea.

- Consider how students show their knowledge. Students need multiple ways and opportunities to show their knowledge. Things to consider:
 - Recording video or audio
 - Drawing
 - Writing
 - Typed
 - Verbal
- Provide students with a way to ask questions in a forum that does not cause anxiety. Frequently students do not want to ask questions in front of their peers because they are afraid of what their peers may think of them. So, be sure to provide students a way to ask questions that is private or anonymous.
- Consider materials that students need to complete the assignments.
 - Do students have needed materials?
 - What are some alternative materials that students may have available to them?
- Have a clear and consistent set of guidelines for providing consistent feedback to all students.
- Utilize graphic organizers such as those from the Wonderofscience.com
- Use high leverage and evidence-based practices to reach all students.

Some things to consider, **specific to this lesson**, when designing supports for students are as follows:

- The teacher should consider giving students a copy of the water cycle to write on. This should help students make observations about the water cycle.
- The teacher should consider providing students with questions in advance of the discussion.
- The teacher should give students the opportunity to construct and share their explanations in multiple formats. These formats could include written, verbally explaining, or recording audio/video.
- The teacher should consider giving students question stems to assist students in constructing questions.
- The teacher may need to consider modeling how to write questions that can be answered with more than yes or no.
- The teacher should consider providing students with sources to find information about the water cycle.
- The teacher should consider read aloud for all articles that are given in class.
- The teacher should consider providing information in multiple formats such as images, videos, and articles.
- The teacher should have clear and consistent discussions guidelines. This should assist students in feeling more comfortable contributing to the discussion.
- The teacher should consider providing students with a graphic organizer to help students plan their investigation.
- The teacher should consider having students work together to plan their investigation.
- The teacher should consider providing students the questions in advance of showing the video.
- The teacher may need to consider showing the video more than once.
- The teacher should use closed captions for all videos that are shown in class.



- The teacher may want to consider a rubric for the project in the evaluate section.
- The teacher should ensure that students have time to get feedback on their ideas for the landfill.
- The teacher should, also, ensure that students have the time and opportunity to revise their landfill plan as needed.

Engaging Families

Additional resources to support this segment can be found at GPB: [Georgia Home Classroom](#).