

# Lesson 3

# The Water Cycle

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## Prepare

In this lesson, students explore the water cycle as they investigate the Phenomenon Question **What causes rain clouds to form?** First, students observe a physical model of an ocean system and use that model to illustrate the processes involved in forming rain clouds. Then students investigate how the Sun and the ocean interact in the water cycle and determine that the water cycle requires energy from the Sun.

## Student Learning

### Knowledge Statement

The Sun and the ocean interact to form rain clouds as part of the water cycle.

### Objective

- Lesson 3: Explain how the Sun and the ocean interact to form rain clouds as part of the water cycle.

### Weather and Climate

#### Phenomenon Question

What causes rain clouds to form?

## Standards Addressed

		Lesson 3
<b>Texas Essential Knowledge and Skills: Content</b>		
3.5C	Predict, observe, and record changes in the state of matter caused by heating or cooling such as ice becoming liquid water, condensation forming on the outside of a glass of ice water, or liquid water being heated to the point of becoming water vapor. (Mastered)	●
4.8B	Describe and illustrate the continuous movement of water above and on the surface of Earth through the water cycle and explain the role of the Sun as a major source of energy in this process. (Mastered)	●
5.8B	Explain how the Sun and the ocean interact in the water cycle. (Mastered)	●
<b>Texas Essential Knowledge and Skills: Investigation and Reasoning</b>		
5.2D	Analyze and interpret information to construct reasonable explanations from direct (observable) and indirect (inferred) evidence.	●
5.3B	Draw or develop a model that represents how something that cannot be seen such as the Sun, Earth, and Moon system and formation of sedimentary rock works or looks.	●
<b>English Language Proficiency Standards</b>		
4A	Learn relationships between sounds and letters of the English language and decode (sound out) words using a combination of skills such as recognizing sound-letter relationships and identifying cognates, affixes, roots, and base words.	●

## Materials

		Lesson 5
<b>Student</b>	Science Logbook (Lesson 3 Activity Guide)	●
<b>Teacher</b>	Statue of Liberty Photographs (Lesson 3 Resource B)	●
	Ocean model: 1 L measuring cup (1), 6 qt clear plastic bin, small resealable plastic bag (1), heat lamp (1), ice cubes (6), plastic wrap, salt (35 g), digital scale (1), masking tape (1 roll), water as hot as the faucet allows (1 L)	●
	Evaporation Investigation Photographs (Lesson 3 Resource C)	●
<b>Preparation</b>	Prepare ocean model. (See Lesson 3 Resource A.)	●



# Lesson 3

**Objective:** Explain how the Sun and the ocean interact to form rain clouds as part of the water cycle.

## Launch 5 minutes

Display the Statue of Liberty photographs (Lesson 3 Resource B). Ask students to share the ways in which these images are similar to or different from each other.



*Sample student responses:*

- *They are taken in the same place. I think that's the Statue of Liberty.*
- *There is water in both photos. I think it's the ocean.*
- *One photo looks sunny and clear. The other one is cloudy and rainy.*

Highlight student responses that compare the weather in the two photographs. Point out that the first photo shows sunny weather with a clear sky, whereas the other picture shows a cloudy, rainy day.

## Agenda

Launch (5 minutes)

Learn (35 minutes)

- Observe Ocean Model (15 minutes)
- Draw Water Movement (10 minutes)
- Investigate Evaporation (10 minutes)

Land (5 minutes)


► Why do you think the weather is different in the two pictures?

- *Maybe they were taken in different seasons.*
- *They were probably taken on different days.*

If students suggest that the photographs were taken at different times of the year, remind students that although there are seasonal weather patterns, cloudy skies and precipitation can occur at any time of the year. Acknowledge that the photographs were taken on different days, and wonder aloud about where the rain clouds came from in the second photograph. Tell students that in this lesson they will explore the Phenomenon Question **What causes rain clouds to form?**

## Learn 35 minutes

### Observe Ocean Model 15 minutes

Display the prepared ocean model for students (Lesson 3 Resource A).  Tell students they will use the model to help them explain what causes rain clouds to form over the ocean. Describe the materials that make up the model. Inform students that the bottom of the bin contains hot salt water.

Invite students to share what they observe in the model.

*Sample student responses:*

- *There is water on the plastic wrap inside the bin.*
- *There is some water dripping back down into the bottom of the bin.*
- *The lamp is on. I think it is heating up the model.*

Remind students that the model represents an ocean system. Ask students to Think–Pair–Share in response to the following question.



#### Teacher Note

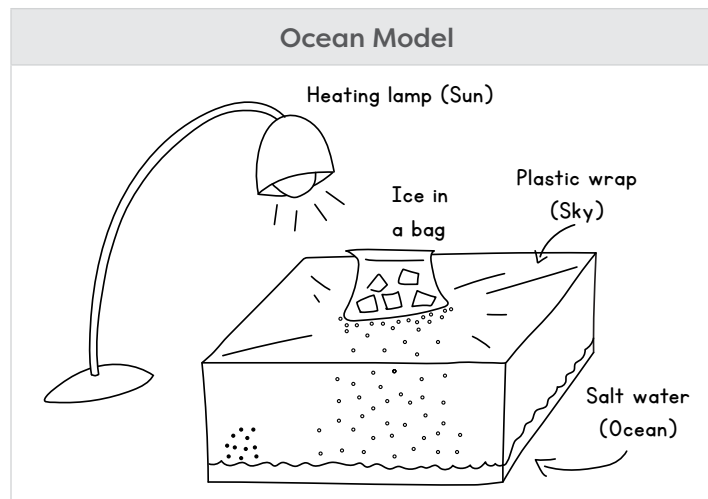
Turn on the heat lamp 15 minutes before the lesson begins. If students are present during model construction, ask them to make initial observations. If students are not present, consider taking a photograph of the model before turning on the heat lamp. Show this photograph to students during the lesson.

► What does each part of the model system represent in a natural ocean system?

- I think the lamp represents the Sun.
- The water in the bottom of the bin represents the ocean.
- I think the plastic wrap represents the sky.

As students share, use their responses to create a simple drawing of the model on a sheet of chart paper. Label each component of the model and what it represents in a natural ocean system.

Sample drawing:



Draw students' attention to the water collecting on the underside of the plastic wrap. Tell students that when the model was first set up, there was no water on the underside of the plastic wrap. Ask students to use their observations and knowledge about changes in the states of matter to explain why liquid water appeared on the plastic wrap. 🧊

Sample student responses:

- I think liquid water appeared because of something happening with water vapor.
- I think the ice cubes cooled water vapor in the bin, turning the gas into a liquid.




### Spotlight on Knowledge and Skills

Consider reviewing with students that changes in states of matter can occur because of heating or cooling (3.5C).

Highlight student responses that mention water vapor. Remind students that water vapor is water in the form of a gas. Tell students that the cooler temperature of the ice allowed condensation of water vapor to occur. Remind students that condensation is the process by which a gas becomes a liquid. Under most conditions, this process involves cooling a gas to a certain temperature. Acknowledge that for condensation to occur water vapor must be present in the ocean model.

► **Where do you think the water vapor in the bin came from?**

- *I think air contains some water vapor.*
- *You said the salt water in the bottom of the bin was hot. Even though it wasn't boiling, I think some of that water turned into water vapor.*

Remind students that water vapor is clear and colorless and cannot be seen, and confirm that some water vapor was already in the bin when the model was built. Explain that the rest of the water vapor was produced through evaporation. Remind students that evaporation is the process by which water on the surface of a sample becomes a gas. Explain that evaporation of water occurs in small amounts at any temperature where water is liquid, but it can be increased by heating the water. 

► **When water falls from the plastic wrap into the salt water, what process in the natural world is demonstrated?**

- *The water drops falling from the plastic wrap are like rain.*
- *Water falling to the ground is called precipitation.*

Confirm that water falling back into the bin represents rain and that rain is a type of precipitation.



### English Language Development

The terms *condensation*, *evaporation*, and *precipitation* are used repeatedly in this lesson. Sharing the Spanish cognates for *condensation* (*condensación*), *evaporation* (*evaporación*), and *precipitation* (*precipitación*) may be helpful (4A).

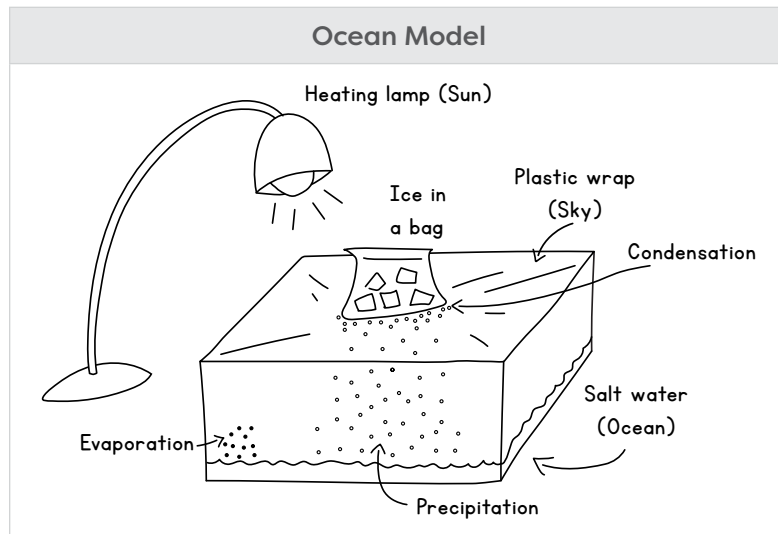
Add labels to the drawing of the ocean model to show where evaporation, condensation, and precipitation are happening.



### Teacher Note

If students are curious about the difference between evaporation and boiling, explain that, like boiling, evaporation involves a liquid turning into a gas. Unlike boiling, evaporation involves particles only on the surface of a liquid. When a liquid is heated to a specific temperature, it boils throughout the entire liquid but continues to evaporate at the surface.

Sample drawing:



► Which part of the model represents rain clouds in a natural system?

- *I think the water that collects on the plastic wrap is like clouds because precipitation falls from clouds.*
- *I think that when the water condenses on the plastic wrap, this represents what happens when clouds form.*

Confirm that the water collecting on the underside of the plastic wrap represents clouds. Tell students that clouds form when water vapor in the atmosphere cools and condenses into tiny water droplets. Explain that these water droplets combine to form bigger drops. When these drops are too heavy to float, they fall back to Earth as precipitation.

## Draw Water Movement 10 minutes

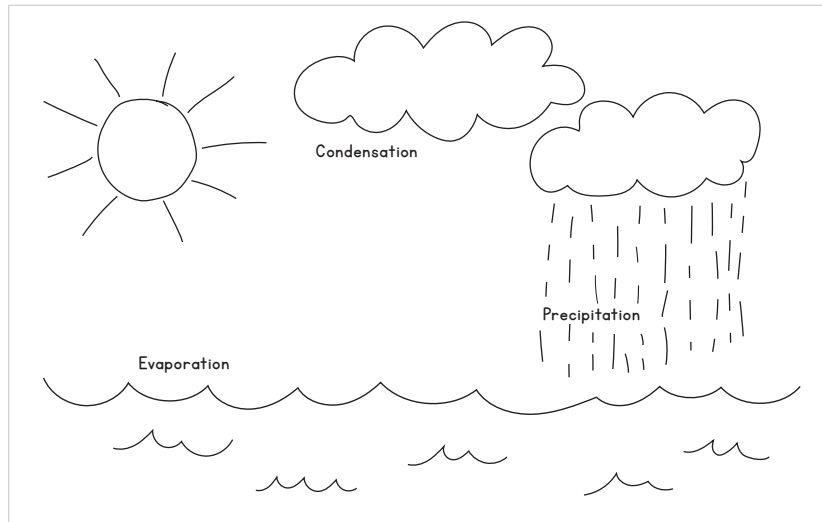
Display the cloudy, rainy day photograph (Lesson 3 Resource B) from the beginning of the lesson.

► How can we use the ocean model to help us explain what causes the rain clouds to form?

- *I think the same processes in the model happen in nature.*
- *I think the model shows how water vapor from the ocean can make clouds and rain.*

Agree that students can transfer their understanding of the ocean model to the natural system. Tell students to draw a model in their Science Logbooks (Lesson 3 Activity Guide) to show the way that rain clouds form over the ocean. Prompt students to use the labels *evaporation*, *condensation*, and *precipitation* in their models.

*Sample student model:*



► Which parts of the natural system did you include in your model?

- *I included the Sun, ocean, clouds, and rain. I drew the rain falling from the clouds into the ocean.*
- *I included the Sun, clouds, and the ocean. I also drew water vapor in the air.*

► How does your model show the way that rain clouds form?

- *In the model, I used dots to show water vapor evaporating from the ocean. I drew clouds, which form from condensation. I used lines to show precipitation.*
- *In the model, I drew arrows to show evaporation and precipitation. I drew clouds to show that when the water vapor in the atmosphere condenses, clouds form.*

Highlight student responses that suggest drawing arrows as an effective way to show where water is moving in each part of the model. Invite students to Think–Pair–Share to respond to the implications of adding arrows.

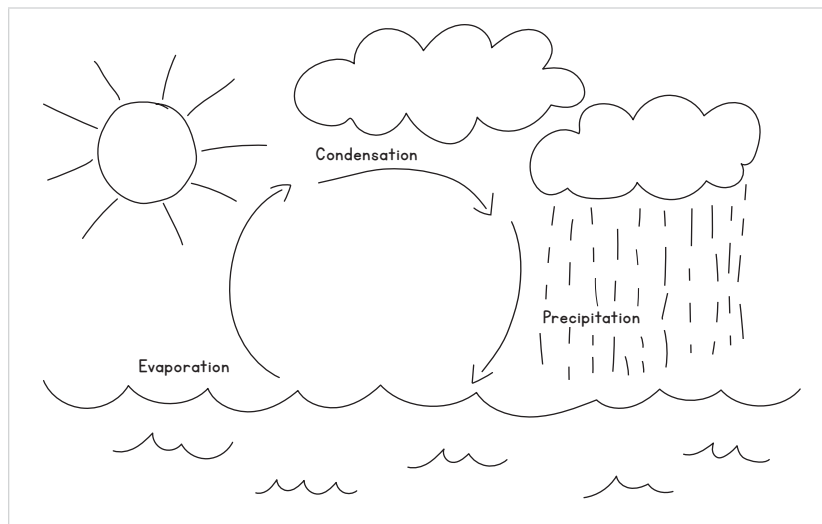


► How does adding arrows to your model help explain how rain clouds form?

- The arrows show me that water moves from the ocean to the sky and then that water vapor becomes the clouds. Then water falls back to the ocean when it rains.
- The arrows show where the water that makes clouds comes from. Then the model shows where the water in the clouds goes when it rains.

Agree that the arrows show the movement of water between the ocean and the sky, where clouds form. Summarize that water evaporates from the oceans to form water vapor in the atmosphere, which then condenses to form clouds. When tiny water droplets in a cloud combine and become large enough, the water falls back to the ocean as precipitation. Tell students to update their models in their Science Logbooks by adding arrows to show the movement of water between the different parts (Lesson 3 Activity Guide).

*Sample student response:*



Reveal to students that their models describe the **water cycle**, which is a series of processes by which water moves between Earth's oceans, air, and land. The water cycle involves the evaporation of water from the oceans, the condensation of water vapor to form clouds, and the return of water to the oceans by precipitation. Clarify that the processes occur continuously and simultaneously as water moves around Earth.



### English Language Development

Introduce the term *water cycle* explicitly. Consider having students describe the water cycle to a partner in their own words to clarify new knowledge.

## Investigate Evaporation 10 minutes

Direct students' attention back to the physical model of the ocean system. Switch off the heat lamp, and ask students to predict the ways the model will change without the lamp.

*Sample student responses:*

- *I think that less water will evaporate, so there will be less condensation and precipitation inside the model.*
- *The lamp was heating up the water and causing it to evaporate, so without the lamp the whole water cycle will stop.*

Highlight student responses that suggest there will be less evaporation, condensation, and precipitation without the heat of the lamp. Remind students that the lamp in the ocean model represents the Sun. Tell students to refer to their models in their Science Logbooks (Lesson 3 Activity Guide).

#### ► Can rain clouds form without the Sun?

- *I don't think so. Rain clouds form when water evaporates and condenses. I don't know if water would evaporate without the Sun.*
- *No. The Sun heats up the water and causes evaporation. Then the water vapor condenses. Without the Sun, the water cycle would stop.*

#### ► What can we do to investigate this question?

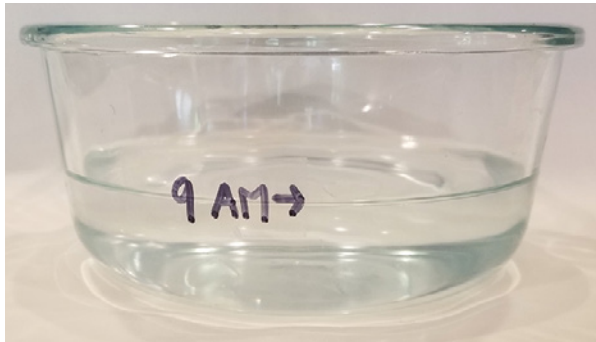
- *We can put our model out in the hot sun for a while and then move it to a place without sun. We can see if evaporation happens with and without the Sun.*
- *We can keep the lamp off and observe the model to see what happens.*

Highlight student responses that mention keeping the lamp off or putting their model in a place without sunlight. Tell students that they will observe photographs of an investigation that will provide them with evidence to help answer the question of whether rain clouds can form without the Sun. Explain that the investigation was conducted by placing a bowl of water outside during the day (in sunlight) and leaving it undisturbed for 8 hours. Another bowl of water was outside overnight (in darkness) for 8 hours. The amount of water in both bowls was the same when they were placed outside. 🌧️

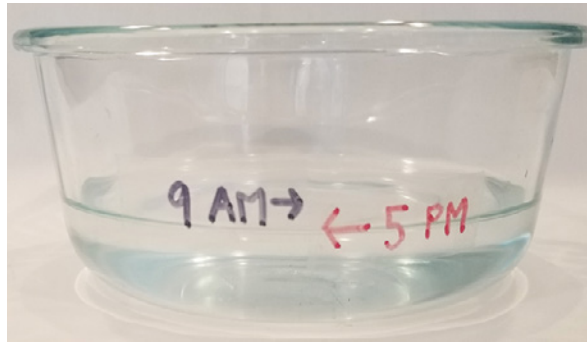
► **What do you think will happen to the amount of water in each bowl? Why do you think that?**

- *I think the bowl that was put outside during the day will have a lot less water. I think this because the Sun will cause the water to evaporate.*
- *I think the bowl that was put outside at night will look the same before and after it was put outside. I think this because it is colder at night and the water won't evaporate without the heat from the Sun.*

Display the daytime evaporation photographs (Lesson 3 Resource C).



9:00 a.m.



5:00 p.m.

► **How did the water level change in the bowl that was left outside during the day?**

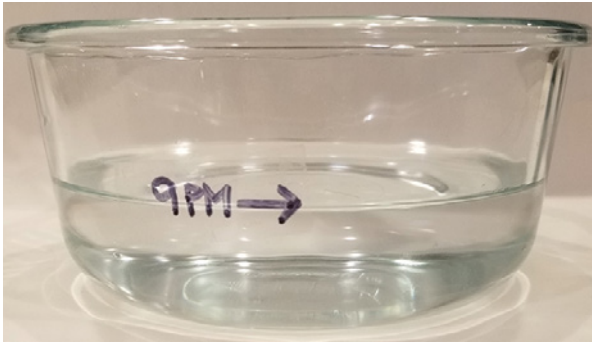
- *The water level decreased.*
- *About half the water evaporated.*



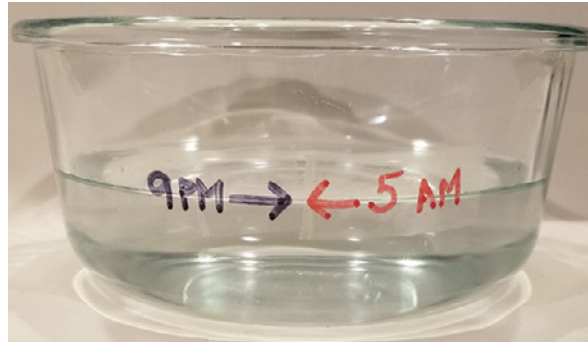
### Extension

Consider conducting this investigation with students in the classroom. Use student input to design and conduct the experiment. Encourage students to develop their own methods for comparing the amount of evaporation during the day and night. This extension would require an additional class period to collect and analyze the results of the investigation.

Display the nighttime evaporation photographs (Lesson 3 Resource C).



9:00 p.m.



5:00 a.m.

- ▶ How did the water level change in the bowl that was left outside overnight?
  - *The water level did not change.*
- ▶ What do these observations tell us about the water cycle?
  - *Without the Sun, the water cycle would stop.*
  - *The Sun causes water to evaporate. Without evaporation, there wouldn't be a water cycle.*

Agree that the Sun causes water to evaporate. Tell students that evaporation occurs in small amounts at any temperature but more evaporation occurs when water is heated. Explain that, like heating, the Sun provides the energy for water to evaporate and form water vapor. With decreased evaporation, less condensation of water vapor and precipitation occur. Summarize that the energy from the Sun makes the processes in the water cycle happen. 📄📖 Instruct students to write a caption in their Science Logbooks (Lesson 3 Activity Guide) to explain how the Sun and ocean interact in the water cycle to form rain clouds.

*Sample student responses:*

- *Energy from the Sun causes water from the ocean to evaporate. Water vapor in the atmosphere condenses to form clouds. When large enough water droplets form in a cloud, the water falls back to the ocean as precipitation. This cycle repeats. Without the Sun, the water cycle would not happen.*



### Spotlight on Knowledge and Skills

In Level 4, students define energy and differentiate among forms of energy, including thermal energy (4.6A).

If necessary, remind students that energy is needed to make something happen. Point out that the processes in the water cycle need energy to make them happen. Explain that this comes in the form of thermal energy from the Sun.



### Teacher Note

Because this experiment shows no visible change in the water level overnight, students may think that evaporation occurs only in sunlight. Tell students that evaporation can occur in the shade and at night. After it rains, the water evaporates in both sunny and shady areas. Remind students that evaporation can occur at any temperature from a liquid. Acknowledge that temperatures are cooler overnight without the Sun. Explain that evaporation happens at night because the Earth retains some heat overnight. Consider comparing the cooling of Earth with the cooling of a hot pan. Point out that after a stove burner is turned off, the pan slowly cools down. Explain that this is similar to what happens with Earth's surface. The surface heats up during the day and slowly cools down overnight.

- *Heat from the Sun warms up the water in the ocean. The water evaporates, and then it condenses to form clouds. The water in the clouds falls back to Earth as precipitation. The water cycle needs energy from the Sun and water from the ocean to make clouds and precipitation.*



**Check for Understanding**

Students explain how the Sun and the ocean interact in the water cycle.

TEKS Assessed	
3.8B Explain how the Sun and the ocean interact in the water cycle.	
Evidence	Next Steps
Look for evidence that all students <ul style="list-style-type: none"> <li>▪ explain that energy from the Sun causes water to evaporate from the ocean and</li> <li>▪ understand that other parts of the water cycle would not occur without the interaction between the Sun and the ocean.</li> </ul>	If students do not address the interaction of the Sun and the ocean in the water cycle, ask students to identify where the water for precipitation comes from. Then ask students to describe what causes water to move from the oceans into the air and clouds. Encourage students to revise their drawings to show the interaction between the Sun and the ocean. Prompt students to revise their explanations.

# Land 5 minutes

Revisit the Phenomenon Question. Invite students to use what they learned about the interaction between the Sun and the ocean to answer the Phenomenon Question.

► **What causes rain clouds to form?**

- *Rain clouds form during the water cycle. The Sun causes water in the ocean to evaporate. Then water vapor in the atmosphere condenses to form clouds. Water from clouds falls back to the ocean as precipitation.*

- *The Sun provides the energy for the water cycle, which causes water to evaporate from the ocean, clouds to form through condensation, and water to fall back to the ocean as precipitation.*

Acknowledge student responses. Summarize them to state that rain clouds form as part of the processes in the water cycle, which are driven by interactions between the Sun and the ocean.

## Optional Homework

Students make a list of everyday phenomena they observe that occur because of processes in the water cycle. Examples include dew forming on grass, rain puddles drying up, and fog forming over a body of water. Invite students to share their observations with the class.