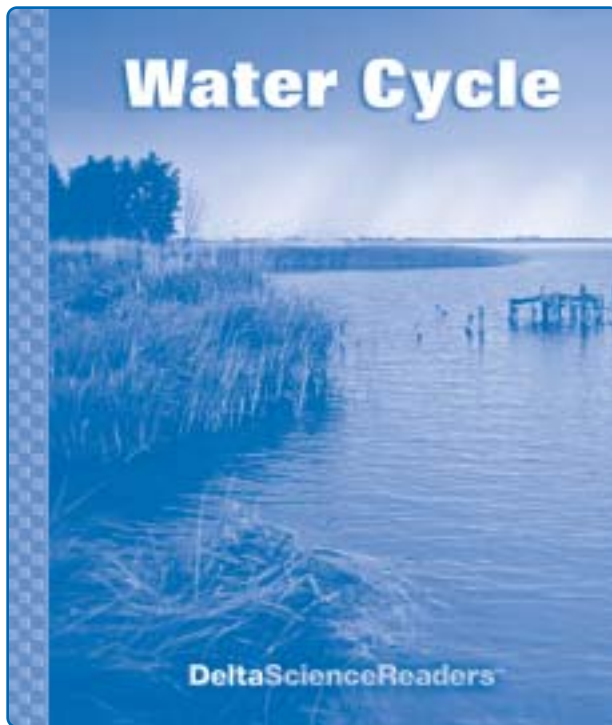


# Water Cycle



*Delta Science Readers* are nonfiction student books that provide science background and support the experiences of hands-on activities. Every **Delta Science Reader** has three main sections: *Think About . . .*, *People in Science*, and *Did You Know?*

Be sure to preview the reader Overview Chart on page 4, the reader itself, and the teaching suggestions on the following pages. This information will help you determine how to plan your schedule for reader selections and activity sessions.

Reading for information is a key literacy skill. Use the following ideas as appropriate for your teaching style and the needs of your students. The After Reading section includes an assessment and writing links.

## OVERVIEW

In the Delta Science Reader *Water Cycle*, students read about why Earth is called the water planet. They find out about salt water and fresh water and where each kind of water is found. They observe how water changes form by freezing, melting, evaporating, and condensing. They trace the water cycle and find out how heat energy from the sun is related to the water cycle. They learn how Earth's weather is affected by the water cycle. They also read about Luke Howard, the scientist who first classified clouds. Finally, students investigate water as a natural resource.

## Students will

- ▶ find out that almost three-fourths of Earth's surface is covered by water and that most of Earth's water is the salt water in oceans and seas
- ▶ discover that fresh water is found on Earth's surface, in the ground, in plants, and in the atmosphere
- ▶ understand the relationship between temperature and how water changes form through freezing, melting, evaporation, and condensation
- ▶ learn the stages of the water cycle and the role that it plays in the weather
- ▶ examine nonfiction text elements such as table of contents, headings, and glossary
- ▶ interpret photographs and diagrams to answer questions
- ▶ complete a KWL chart

## READING IN THE CONTENT AREA SKILLS

- Make and confirm predictions about sources of fresh water
- Identify cause-and-effect relationships related to water's changes of state
- Compare and contrast the states of matter in which water can be found
- Identify main ideas and supporting details in text sections
- Describe the sequence of events in the movement of water through plants
- Demonstrate critical thinking
- Interpret graphic devices
- Summarize

## NONFICTION TEXT ELEMENTS

*Water Cycle* includes a table of contents, headings, photographs, illustrations, captions, boldfaced terms, diagrams, maps, labels, a chart, and a glossary.

## CONTENT VOCABULARY

The following terms are introduced in context and defined in the glossary: *absorb, atmosphere, cloud, condensation, desalination, estuary, evaporation, freeze, glacier, groundwater, humidity, iceberg, ice cap, irrigation, lake, melt, ocean, photosynthesis, porous, precipitation, resource, river, runoff, surface water, transpiration, water conservation, water cycle, water table, water treatment plant, water vapor, weather.*

Optional vocabulary: *nonrenewable resource, renewable resource*

## BEFORE READING

### Build Background

Access students' prior knowledge of the water cycle by displaying and discussing the cover. Ask, *What do you see in this picture?* (water, a lake, a shoreline with plants, ocean) *What effects do you think bodies of water such as this have on our everyday lives?* (Accept reasonable responses.)

Read the title aloud, and invite students to share what they know about the topic from their personal experiences and hands-on explorations in science. To stimulate discussion, ask questions such as these: *What is rain? What do you think causes rain? Where does the water in rain come from? Where can we find water? What are some ways that water changes?*

Begin a group KWL chart by recording facts students know about the water cycle in the K column and questions students have about the water cycle in the W column. You may want students to copy the KWL chart so they can maintain their own charts as they read.

K What I Know	W What I Want to Know	L What I Learned	+ What I Want to Explore Further

### Preview the Book

Explain that when students preview nonfiction, they should look at the title, the table of contents, headings, boldfaced words, photographs, illustrations, charts, graphics, and captions.

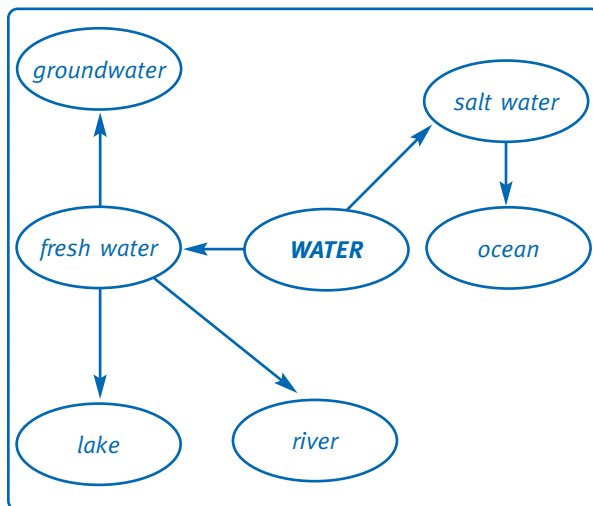
Then preview the book with students. Call attention to the various nonfiction text elements and explain how they can help students understand and organize what they

read. Ask questions such as these: *How do the headings help you predict what you will read about? What do you see in this picture? How do you think it will help you understand the text?* Explain that the words in boldface type are important words related to the water cycle. Point out that these words are defined in the glossary. Choose one word and have students find its definition in the glossary.

### Preview the Vocabulary

You may wish to preview some of the vocabulary words before reading, rather than waiting to introduce them in the context of the book. Possibilities include creating a word wall, vocabulary cards, sentence strips, or a concept web.

For example, some of the words can be categorized in multiple ways. With students, develop a word web such as the following.



▲ Beginning of concept web for **water**.

### Set a Purpose

Discuss with students what they might expect to find out from the book, based on their preview. Encourage them to use the questions on the KWL chart to set an overall purpose for reading.

## GUIDE THE READING

Preview the book yourself to determine the amount of guidance you will need to give for each section. Depending on your schedule and the needs of your class, you may wish to consider the following options:

- **Whole Group Reading** Read the book aloud with a group or the whole class. Encourage students to ask questions and make comments. Pause as necessary to clarify and assess understanding.
- **Shared Reading** Have students work in pairs or small groups to read the book together. Ask students to pause after each text section. Clarify as needed and discuss any questions that arise or have been answered.
- **Independent Reading** Some students may be ready to read independently. Have them rejoin the class for discussion of the book. Check understanding by asking students to explain in their own words what they have read.

### Tips for Reading

- If you spread out the reading over several days, begin each session by reviewing the previous day's reading and previewing what will be read in the upcoming session.
- Begin each text section by reading or having a volunteer read aloud the heading. Have students examine any illustrations or graphics and read accompanying captions and labels. Discuss what students expect to learn, based on the heading, illustrations, and captions.
- Help students locate context clues to the meanings of words in boldface type. Remind them that these words are defined in the glossary. Provide help with words that may be difficult to pronounce.
- As appropriate, model reading strategies students may find helpful for nonfiction: adjust reading rate, ask questions, paraphrase, reread, visualize.

## Think About . . . (pages 2–12)

### Pages 2, 3 *Why Is Earth Called the Water Planet? and Salt Water*

- Before students read, direct their attention to the photograph of Earth seen from space. Ask, *What is the main feature of Earth that you see?* (the oceans) Then have students read about the water planet.
- Elicit main ideas about Earth and its water. Ask, *What makes Earth the water planet?* (Almost three-fourths of its surface is covered by water.) *What is the most important idea—the main idea—you learned about the importance of water?* (Water makes life on our planet possible.) *What detail supports this main idea?* (All living things need water to stay alive and healthy.) *What are some of the ways in which we use water?* (drinking, cooking, bathing, transportation, electrical power, water sports)
- Have students read the body text on page 3 and look at the photographs and captions on pages 2 and 3. Ask, *What kind of water covers most of Earth?* (salty ocean water) *What are the names of Earth’s four main oceans?* (Pacific, Atlantic, Indian, Arctic) Direct attention to the map and guide students to recognize that the oceans are all connected.
- Ask, *What is the most interesting or surprising fact you learned about salt water?* (Responses will vary, but students may mention the existence of saltwater lakes as a surprising fact.)
- If necessary, provide help with the pronunciation of *estuary* (ES-chew-air-ee).

### Page 4 *Fresh Water on Earth’s Surface*

- Have students read page 4 to learn about Earth’s surface water. Ask, *Where is most of Earth’s fresh water?* (frozen in glaciers, ice caps, and ice sheets) You might want to tell students that scientists estimate that if all of the ice in the glaciers and ice caps melted, the sea level would rise by

about 80 meters (about 260 feet). Point out that water frozen in ice caps is not available to us, but people have been working on ways to harvest icebergs for their water.

- Have students study the diagram at the bottom of page 4 and read the caption. Ask, *Are you surprised to learn how little fresh water there is on Earth’s surface? Why or why not?* (Responses will vary.) Encourage students to predict where else fresh water might be found.
- If necessary, provide help with the pronunciation of *glacier* (GLAY-shur).

### Page 5 *Fresh Water in the Ground*

- Before reading page 5, ask students whether any of them predicted that fresh water could be found in the ground. Have them confirm their predictions by reading the text about groundwater and studying the diagram.
- Ask, *How does water get into the ground?* (Water from rain and melting snow and ice seeps into the soil and fills air spaces in soil and rock.) *What are soils and rocks that can absorb water called?* (porous) Point out that the word porous comes from *pore*, which means “opening.” Have students explain what the water table is. (Water spreads out in soil and rock and fills all the air spaces. The top level of that water is called the water table.)
- Encourage students to speculate about what happens to the water table in periods when there is very little rain or snow. (It gets lower.)
- If necessary, provide help with the pronunciation of *porous* (POR-us).

### Page 6 *Fresh Water in Plants*

- Before students read page 6, ask, *Did you predict that plants are a place where fresh water is stored?* Have students read to confirm their predictions. Remind them

to study the diagram to help them understand the text.

- After reading, ask, *How do plants use water?* (Water moves minerals and stored food to all parts of a plant. Plants mix water with carbon dioxide to make their own food.) *What happens when plants do not get enough water?* (They wilt and die.)
- To test understanding, ask students to describe the sequence of events in the movement of water through a plant. (Groundwater is absorbed into the roots. It travels up the trunk or stem and into the leaves. There, water is used in photosynthesis to make food for the plant. Water that is not used by the plant goes into the air through tiny holes in the leaves.) *What is this movement of water from a plant into the air called?* (transpiration) *How did the diagram help you understand the text?* (It shows in picture form what the text explains with words.)
- If necessary, provide help with the pronunciation of *chlorophyll* (K-LOR-uh-fil), *photosynthesis* (fo-to-SIN-thuh-sis), and *transpiration* (tran-spuh-RAY-shuhn).

### Page 7 *Fresh Water in the Atmosphere*

- Before having students read page 7, ask whether anyone predicted that some fresh water is found in the atmosphere, or air. Invite students to read page 7 to confirm their predictions.
- Check comprehension by asking, *What two forms does water in the atmosphere take?* (One form is as a gas called water vapor. The other form is as water droplets or ice crystals in clouds.) *Which of these forms can we see? Which are we unable to see?* (We can see clouds, but we cannot see water vapor.)
- Ask, *What is humidity?* (a measure of the amount of water vapor in the air) *How would you describe the humidity today? Would you say that it is high or low?*

(Responses will vary.) *What do you think causes the humidity to change?* (Accept all ideas.) Explain that the amount of water vapor in the air changes with the temperature. More water evaporates into the air when it is warm, and more water condenses out of the air when it is cool.

- If necessary, provide help with the pronunciation of *atmosphere* (AT-muh-sfeer), *humidity* (hew-MID-ih-tee), and *hygrometer* (hi-GROM-uh-ter).

### Pages 8, 9 *How Water Changes Form*

- Have students read the text about states of matter in the first column on page 8 and look at the accompanying photographs and labels. Check comprehension by having students summarize the information. (The three states of matter are solid, liquid, and gas. A solid has a shape of its own; a liquid and a gas do not. Ice is the solid form of water, water is the liquid form, and water vapor is the gas form.) Guide students to compare and contrast the three states of matter of water. Ask, *How are ice, water, and water vapor alike?* (They are all forms of water.) *How are they different?* (Ice has its own shape. Water and water vapor have no shape of their own. We can see water and ice, but we cannot see water vapor.)
- Then have students read through the end of page 9 to discover how water changes form. Ask, *What causes water to change form?* (adding or taking away heat energy) *What happens when enough heat energy is taken away from a liquid—water?* (It becomes a solid—ice.) *What causes a solid such as ice to turn back into a liquid?* (adding heat) *What is this process called?* (melting) *What is the effect of adding more heat to a liquid?* (The liquid changes into a gas. Water becomes water vapor.) *What is this process called?* (evaporation) *What causes water vapor to turn back into a liquid?* (taking heat away; cooling it) *What is this process called?* (condensation) Discuss the examples of each process shown in the photographs.

- You may wish to tell students about two other changes of state for water: frost formation occurs when water changes directly from a gas to a solid, and sublimation is the direct change from solid to gas.
- If necessary, provide help with the pronunciation of *evaporation* (ih-vap-uh-RAY-shuhn).

### Pages 10, 11 *What Is the Water Cycle?*

- Before students read pages 10 and 11, write the word *cycle* on the board. Explain: *The words cycle and circle are related. Just as you can run your finger around and around a circle, a cycle repeats itself in the same order.* Brainstorm some other terms or words that contain *cycle*. (Students may suggest *bicycle, tricycle, life cycle, cyclone*.) Then ask, *What do you think the water cycle might be?* Before they answer, tell students to think about what they learned about how water changes form and what causes these changes. (Accept reasonable responses.)
- Have students examine the diagram and read the caption and labels to confirm their ideas about the water cycle. Ask, *How does water from Earth's surface get into the air?* (It evaporates.) *What happens to water vapor in the air?* (It condenses and forms clouds.) *What do you see falling from the clouds?* (rain) *Where does the rain go?* (It falls back down to Earth's surface and into the ground.)
- Then have students read the text on page 10 to determine what causes this cycle to take place. Ask, *What is the water cycle?* (the movement of water between Earth and the atmosphere and back again) To check comprehension of the water cycle, elicit the cause-and-effect sequence. Ask, *What causes the water cycle to begin?* (Heat energy from the sun warms Earth's water and causes it to evaporate.) *What happens to warm air in the atmosphere?* (It cools and condenses back into water.) *What is the effect of*

*condensation?* (Clouds form.) *What causes the clouds to release their water?* (The water droplets get larger and heavier.) *What happens to the precipitation?* (It returns to Earth, becomes surface water and groundwater, and the cycle starts again.)

- Ask whether students were surprised to learn that the same water continually moves through the water cycle between Earth and the atmosphere. Invite students to explain why they were or were not surprised. Point out that the water we use today is the same water that has been on Earth since the oceans were formed on the planet several billion years ago. It all passes through the water cycle over and over again. Every day 1 trillion tons of water move through the water cycle.
- Students may be interested to know that the water cycle was first suggested some 2,500 years ago by a Greek scientist, Thales of Miletus (c. 625–550 B.C.E.)
- If necessary, provide help with the pronunciation of *precipitation* (prih-sip-ih-TAY-shuhn).

### Page 12 *Earth's Weather*

- Have students read page 12 to discover how the water cycle affects the weather. Check comprehension by having students explain what causes changes in the atmosphere. (the heating and cooling of the land, water, and air) Ask, *How do these changes affect the weather?* (They cause changes in the temperature and in the amount of water vapor in the air. They affect cloud formation and precipitation.)
- Have students look at the photographs and read the captions. Ask, *What causes rain to fall?* (Water droplets become too big and heavy to stay in the air.) *What causes snow to fall instead of rain?* (Cold temperatures keep the ice crystals that fall from clouds frozen all the way to the ground.) *What is fog?* (a cloud that is close to the ground)

- If appropriate, discuss the difference between weather and climate. Explain that *weather* refers to day-to-day conditions, such as rain, sunshine, wind, and snow. *Climate* refers to the average weather conditions in an area over a long period of time.

### People in Science (page 13)

#### Luke Howard

- Before they read, access students' prior knowledge of clouds. Invite volunteers to share what they know about the different types of clouds and their names. Have students study the cloud photographs and read the captions. You may wish to have students look out the window to determine the types of clouds—if any—that are in the sky and what kind of weather they are a clue to. Then have students read page 13 to learn about the man who first named and classified clouds.
- Students may be interested to know that before 1800, clouds were often described as only “essences” floating in the sky. Their nature and causes were not understood. Ask, *What conclusions can you draw from the fact that Howard's system is still in use today?* (Students may suggest that it is a useful system or that no better system has been suggested.)
- If necessary, provide help with the pronunciation of *cirrus* (SEER-us), *cumulus* (KEW-myuh-lus), and *stratus* (STRAT-us).

#### Further Facts

- Luke Howard is regarded as the father of meteorology, the science that deals with the atmosphere, especially the weather.
- Howard's interest in the skies was stimulated by the brilliant sunrises and sunsets and incredible skies of 1783, when he was eleven. Violent volcanic eruptions in Iceland and Japan had sent clouds of dust and ash into the air, causing unusual atmospheric effects in

the Northern Hemisphere that lasted from May through August.

- Howard kept a daily record of his meteorological observations for more than thirty years.
- “Notes on the Modifications of the Clouds,” in which Howard presented his cloud classification system, was illustrated with Howard's own watercolors when it was published in 1803. Many of Howard's sketches can be viewed online.
- Howard later added a fourth category of clouds—*nimbus* (the Latin word for “rain”)—to identify clouds from which rain was falling.

### Did You Know? (pages 14–15)

#### Water Is a Resource

- Before they read pages 14–15, invite students to guess how much water the average person in the United States uses each day. Record guesses on the board. Then have students read to find out about water as a resource.
- After they read, ask, *Other than household use, in what ways is water a natural resource?* (Dams change energy from moving water into electricity; water is used for irrigation on farms; most drinking water comes from groundwater; many foods we eat, such as fish and shellfish, live in water.)
- Ask, *How do people affect our water supply, according to the text?* (Water can be polluted by chemicals and fertilizers. Paved areas prevent water from entering the groundwater, which lowers the water table.) You may wish to discuss other ways water is affected by people's actions, such as these: Evaporation behind dams adds water vapor to the atmosphere. Irrigation canals divert water from one place to another, causing drought where the water once flowed naturally. Wells lower the water table.

- You may wish to introduce the concept of renewable and nonrenewable resources. Renewable resources are resources that are either available in unlimited supply or that are constantly being replaced or replenished. The sun and wind are limitless renewable resources; forests are a renewable resource that can be replaced. Nonrenewable resources cannot be replaced once they are used. Coal, oil, and natural gas are examples of such resources. They will eventually be used up. Ask students which kind of resource they think water is and why. (Water is a renewable resource; water keeps moving through the water cycle being used again and again.)
- Discuss the chart of water use with students. Encourage students to share their reactions to the amounts of water used for each activity and the estimated daily use presented on page 15. Stimulate discussion by asking questions such as these: *What is the most surprising fact you learned about water use? Will knowing this information change the way you use water? What changes can you make to use less water?*
- If necessary, provide help with the pronunciation of *desalination* (de-sal-ih-NAY-shuhn).

## AFTER READING

### Summarize

Complete the KWL chart you began with students before reading by asking them to share the answers to their questions. Call on volunteers to retell each text section. Then have students use the information in the KWL chart to write brief summary statements.

Discuss with students how using the KWL strategy helped them understand and appreciate the book. Encourage them to share any other reading strategies that helped them understand what they read.

Direct attention to the fourth column in the chart and ask, *What questions do you still*

*have about the water cycle? What would you like to explore further?* Record students' responses. Then ask, *Where do you think you might be able to find this information?* (Students might mention an encyclopedia, science books, and the Internet.) Encourage students to conduct further research.

### Review/Assess

Use the questions that follow as the basis for a discussion of the book or for a written or oral assessment.

1. What are the two kinds of water on Earth? (salt water, fresh water) Where is each type found? (Salt water is found in oceans and saltwater lakes. Fresh water is found in glaciers, ice caps, lakes, ponds, rivers, the ground, plants, and the atmosphere.)
2. What are the three states of matter of water? (ice, a solid; water, a liquid; and water vapor, a gas) How does water change state? (Water changes state when heat is added or removed. Heating solid ice causes it to melt and change to a liquid. Heating liquid water causes it to evaporate to a gas. Cooling water vapor makes it condense to a liquid. Cooling liquid water to the freezing point makes it freeze to solid ice.)
3. How does the water cycle affect the weather? (Changes in the water cycle cause changes in the atmosphere. This causes changes in the weather, such as the amount of clouds or precipitation.)

### Writing Links/Critical Thinking

Present the following as writing assignments.

1. Describe the stages in the water cycle, and tell why the water cycle is important. (Water on Earth is warmed by the sun and turns into water vapor. In the air, water vapor condenses and forms clouds. Water droplets in clouds fall to Earth as precipitation. Then the cycle starts again. Students' ideas about the importance of the water cycle will vary but should include that it allows us to use the same water over and over and that it affects Earth's weather.)

2. Luke Howard studied something other people had not thought worth studying—clouds. As a result, he made important discoveries about the relationship between clouds and weather. If you could spend time studying something other people have not paid much attention to, what would you choose? Why? (Responses will vary.)

**Science Journals:** You may wish to have students keep the writing activities related to the Delta Science Reader in their science journals.

### References and Resources

For trade book suggestions and Internet sites, see the References and Resources section of this teacher's guide.