

**Red Edition**  
Grade 3–4  
reading level

**Purple Edition**  
Grade 4–5  
reading level

## Objectives

- Understand what causes weather.
- Explore weather factors related to air.
- Explore weather factors related to the water cycle.
- Discuss three types of severe weather.
- Describe methods of predicting weather.
- Discuss weather instruments.
- Understand air masses and fronts.
- Interpret information displayed on weather maps.
- Explain how climate and weather are different.
- Discuss factors that affect climate.

## Reading Comprehension Skills

Preview the Book ♦ How to Read Diagrams

Main Idea and Details

**Skillbuilders are available for this title.**

## Supporting English Learners

**Activate Prior Knowledge** Enhance English Learners' ability to organize what they already know about weather and climate. Tie new information to students' own experiences, such as with thermometers and other weather instruments, and then relate it to the science concepts in each section. As you start each section, make explicit connections to new learning and concepts covered in previous sections.

## Summary

The Delta Science Content Reader *Weather and Climate* begins by introducing students to the atmospheric conditions that make up weather. The book then explores the connection between weather and the water cycle. Students learn about the causes and characteristics of several types of severe storms. They also discover the methods and instruments meteorologists use to collect and share weather data and make weather forecasts. The book concludes by discussing weather and climate patterns.

## Science Background

Weather is the state of the atmosphere at a given place and time. All weather is caused by energy from the Sun. The Sun heats Earth, causing water to evaporate and warm air to rise. When warm, moist air rises, cooler air rushes in to take its place. The uneven heating and cooling of Earth causes the air in the atmosphere to circulate. This continuous circulation of warm and cool air brings changes to the weather.

Meteorologists describe weather with respect to six main factors: air temperature, the amount of moisture in the air (humidity), air pressure, wind speed and direction, type and amount of clouds, and precipitation. The last two factors are components of the water cycle, the movement of water from Earth's surface to the atmosphere and back again.

Meteorologists use a variety of instruments to continually gather data on weather factors. They utilize this information and their knowledge of weather patterns to develop forecasts, or predictions, about coming weather. The data they collect help them track air masses, huge bodies of air in which the temperature and humidity are essentially the same throughout. Weather changes usually occur along the boundaries where different air masses collide. These boundaries are called fronts.

Climate is different from weather. Climate is the average weather pattern in an area over a long period of time. The two main characteristics of a region's climate are its average temperature and average precipitation.



# What Is Weather?

(pages 2–13)

## Before Reading

### Discuss the Cover

**Cover Image** Discuss the photograph on the cover of *Weather and Climate*. Use the information on the inside front cover to support the discussion.

**Science Statement** Discuss the science statement. Ask: *What kinds of weather happen where we live?* (Possible answers: rain, snow)

### Build Reading Skills (page 2)

**Preview the Book** Use Build Reading Skills on page 2 to review how to preview the book. Discuss the steps. Then model previewing the words in bold type.

**Think Aloud** *Why are some words set in bold type? I know that important vocabulary sometimes is set in bold type. Maybe that's what is happening here. Let me check. When I read the Vocabulary box on page 3, I see the words weather and atmosphere are both listed. Do these words appear in bold type later in the book? Yes, I see them both on page 4. I was right: the words in bold type are Vocabulary words.*

Guide students as they finish previewing *Weather and Climate*. Focus on nonfiction text features.

- Prompt them to look at the headings, photographs, captions, and diagrams. Ask questions such as *Why do you think that feature is there? How will it help you understand what you read?*
- Prompt them to look at other bold Vocabulary words. Guide the class in looking up a Vocabulary word in the Glossary.

Students can apply the skill in the Reflect on Reading activity on page 13.

**K-W-L Chart** Have students begin a K-W-L chart. They should add to it after each section.

What I Know	What I Want to Learn	What I Learned
Some clouds bring rain.	What makes clouds?	

### Make a Connection (page 3)

**Make a Connection** Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about weather. (Possible answer: Fog feels kind of wet. Also, I know that some clouds bring rain. Maybe fog forms from water.)

**Find Out About** Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

**Vocabulary** Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a T-chart on the board with the headings *Weather and Air* and *Weather and the Water Cycle*. Have students add words and information to the chart as they read.

## During Reading

### About Weather (page 4)

- Ask: *Describe where most weather happens.* (in the layer of the atmosphere closest to Earth, known as the troposphere)
  - Emphasize that differences in temperature are the result of uneven heating by the Sun. The amount of heating depends mostly on the angle at which the Sun's rays hit an area. The higher in the sky the Sun is, the more directly its rays strike Earth's surface and the warmer it gets. The Sun is high in the sky at the equator and low in the sky at the poles. This is why the Sun warms Earth more at the equator than it does at the poles.
  - Point out to students that they already know quite a bit about weather, because they make their own observations of it every day. Suggest that as they read, they compare their experiences with the information in the book.
  - The National Oceanic and Atmospheric Administration (NOAA) Web site includes weather resources for teachers and students.
  - Ask: *What is the weather like today?* (Possible answer: It is warm, cloudy, and windy.) *What weather factors did you just use to tell about the weather?* (Possible answer: air temperature, clouds, wind)
- ✓ **Checkpoint** (page 4) (Weather is what is happening in the air around Earth at a certain place and time. Weather is caused by energy from the Sun.)

## Weather and Air (page 5)

- Ask: *What happens to the particles in air when they take in energy from the Sun?* (They move faster and spread farther apart.)
- Point out that air temperature affects weather more than any other factor. This is because temperature affects the other factors. Ask: *How does temperature affect humidity?* (The warmer the temperature, the higher the humidity can be.)
- Ask: *Which usually has lower air pressure, cool air or warm air?* (warm air) *Why?* (The particles in warm air are farther apart than in cool air. So warm air is lighter than cool air. It rises and does not press down as hard on Earth's surface.)
- Ask: *How do differences in air pressure and temperature cause wind?* (Air moves from areas of higher air pressure to areas of lower air pressure. Air moves from cooler areas to warmer areas.)

✔ **Checkpoint** (page 7) (air temperature, humidity, air pressure, wind)

## Weather and the Water Cycle (page 8)

- Ask: *What causes evaporation in the water cycle?* (Energy from the Sun warms the water on Earth's surface. Some of the liquid water changes to the gas water vapor.)
- Emphasize that water vapor is part of the air, even though we cannot see it. Ask: *Where does the water in a puddle go when the puddle dries up?* (into the air)
- Students may point out that you can see water in the air, because clouds are made of water. Explain that we can see clouds because they are made of tiny liquid water drops. Water vapor in the air is invisible, though we can feel it as humidity.
- Air (and the water vapor in it) cools as it rises in the atmosphere for two main reasons. (1) As elevation increases, air pressure decreases. This causes the gas particles in air to spread farther apart and move more slowly, thus lowering the temperature. (2) Because air is warmed by Earth's surface, not directly by the Sun's rays, the farther air is from Earth's surface, the cooler it becomes.
- Ask: *What kinds of clouds look flat and layered?* (stratus) *If you saw these clouds in the sky, what weather would you expect?* (light rain or snow) *What affects the kind of precipitation that falls?* (how cold the air is)

✔ **Checkpoint** (page 10) (Water vapor cools as it rises in the atmosphere. The gas changes to tiny drops of liquid water. Water vapor condenses on dust in the air. Groups of tiny water drops form clouds. These water drops can join together and get larger and heavier. Then they may fall to Earth as precipitation.)

## Severe Weather (page 11)

- Explain that the electric charges that build up inside storm clouds are called static charges. Static charge often happens when objects rub together, such as when you walk across a carpet in your socks. Then, if you touch a doorknob or other metal object, you may get a shock. Inside storm clouds, the same thing happens on a much larger scale. Millions of tiny pieces of ice bump against one another and static charges build up, often resulting in lightning.
  - Ask: *What is the eye of a hurricane?* (the calm area in the center)
  - Emphasize that while tornadoes and hurricanes are both types of severe weather with spinning winds, they are very different. For example, there is often little warning that a tornado is forming, and most touch down on the ground for only a few minutes. On the other hand, there is often a week or more of warning that a hurricane is forming. These storms can last for days and usually take a few hours to pass over one spot.
- ✔ **Checkpoint** (page 13) (Possible answer: During a thunderstorm, strong winds blow and dark clouds bring heavy rain, lightning, thunder, and sometimes hail. A tornado is a quickly spinning funnel of air that can cause a lot of damage. A hurricane is a huge, powerful storm that brings strong winds and heavy rain to very large areas.)

## After Reading

**Reflect on Reading** (page 13) Have students review the headings, bold words, pictures, captions and other book features on pages 2–13 before answering. (Possible answer: On page 8, the red words in the picture of the water cycle match some of the bold words in the text. This helped me follow the steps in the water cycle.)

**Apply Science Concepts** (page 13) This activity applies a concept from Find Out About on page 3. To help students complete the activity, you may wish to allow five minutes each day for them to observe clouds. (Possible answer: I saw cumulus clouds. They were white and puffy and moved slowly across the sky. They brought fair weather.)

## How Is Weather Measured and Predicted?

(pages 14–19)

### Before Reading

#### Build Reading Skills (page 14)

**How to Read Diagrams** Use Build Reading Skills on page 14 to review how to read diagrams. Discuss the tips. Discuss with students that arrows, numbers, keys, legends, symbols, and color coding can be important features of diagrams. Then model how to read the warm front diagram on page 18.

**Think Aloud** *First, I read the title, “Warm Front.” Then, I read the labels. One arrow is labeled “warm air” and the other arrow is labeled “cold air.” Maybe the arrows show how air is moving when there is a warm front. I’ll read the caption to find out. I was right: a warm front forms when a warm air mass moves over a cold air mass.*

Guide students as they read the cold front diagram on page 18. Students can apply the skill in the Reflect on Reading activity on page 19.

#### Make a Connection (page 15)

**Make a Connection** Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about how weather is measured and predicted. (Possible answer: I know that a thermometer is a weather tool that shows the temperature.)

**Find Out About** Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

**Vocabulary** Read the Vocabulary words aloud. Explain to students that they will see these words in bold in this section. Start a word web on the board

with *Predicting Weather* in the center. Have students add words and information to the web as they read.

### During Reading

#### Predicting Weather (page 16)

- Ask: *What tools do meteorologists use to collect information higher in the air?* (weather balloons, weather radar, weather satellites)
- ✓ **Checkpoint** (page 16) (A weather forecast is a prediction about future weather. Meteorologists collect information about air temperature, wind, and other things. Then they use this information to make forecasts.)

#### Weather Instruments (page 17)

- Ask: *How does a rain gauge work?* (Rain collects in a clear container. Markings on the side show the rainfall amount.)
- ✓ **Checkpoint** (page 17) (Thermometer: air temperature; Anemometer: how fast the wind blows; Barometer: air pressure)

#### Air Masses and Fronts (page 18)

- Discuss the diagram of the warm front. Ask: *What kind of clouds do you think these are? Explain.* (Possible answer: I think they are stratus clouds. They look flat and layered and rain is falling from them. A warm front often brings light rain, and light rain often comes from stratus clouds.)
- The different shapes of the fronts in the diagrams on page 18 have to do with the weight of air. Warmer air is lighter than colder air, so it tends to rise. At a cold front, the cold air mass forms a curve where it pushes against and under the rising warm air mass. At a warm front, the warm air mass moves up over the cold air mass, pushing the trailing edge of the cold air mass into a gentle slope.

- ✓ **Checkpoint** (page 18) (weather changes)

#### Weather Maps (page 19)

- Discuss the weather maps. Ask: *What do the letters on the maps show?* (H: areas with high pressure; L: areas with low pressure) *What do the lines and symbols represent?* (fronts)
- ✓ **Checkpoint** (page 19) (to share weather information)

## After Reading

**Reflect on Reading** (page 19) (Possible answers: The red arrows show warm air, and the blue arrows show cold air. I think different colors are used to help you understand and remember what the arrows show.)

**Apply Science Concepts** (page 19) This activity applies a concept from Find Out About on page 15. Have students bring in copies of the weather maps they used to complete the activity, as symbols may vary. Students may see two other kinds of fronts on their weather maps. A stationary front, which occurs where air masses meet and stop moving, is often depicted by red half circles pointing in one direction with blue triangles pointing in the other. An occluded front, which results when a cold front, closely following a warm front, finally overtakes the warm front, is often depicted by alternating half circles and triangles pointing in the same direction.

## What Is Climate?

(pages 20–23)

### Before Reading

**Build Reading Skills** (page 20)

**Main Idea and Details** Use Build Reading Skills on page 20 to review main idea and details. Discuss the tips. Then model identifying the main idea and details in the first paragraph on page 22.

**Think Aloud** *The red heading tells me that this section is about weather patterns and climate. To find the main idea in the first paragraph, I ask myself, What is this paragraph mostly about? I think the main idea is that some weather changes follow patterns.*

Guide students to identify details in the paragraph that support the main idea. Students can apply the skill in the Reflect on Reading activity on page 23.

**Make a Connection** (page 21)

**Make a Connection** Discuss the Make a Connection question. Use this discussion to build background and activate prior knowledge about climate. (Possible answer: Maybe climate is the weather a place usually has.)

**Find Out About** Read each statement to help students set a reading purpose. Explain that these are the important topics that they will learn about in this section.

**Vocabulary** Read the Vocabulary word aloud. Explain to students that they will see this word in bold in this section. Start a Venn diagram on the board. Label one circle *Weather* and the other *Climate*. Label the space where the circles overlap *Both*. Have students add information about weather and climate to the diagram as they read.

### During Reading

**Weather Patterns and Climate** (page 22)

- **Ask:** *What is one way weather changes in a pattern?* (Possible answer: Summers are usually warmer than winters.)
- Note that the effect of latitude on climate is related to the uneven heating of Earth's surface. Places near the equator are usually warmer because the Sun is high in the sky and sunlight hits Earth directly.
- ✓ **Checkpoint** (page 23) (Climate is the average weather pattern in an area over many years. Possible answers: latitude, elevation, the shape of the land, nearness to water, ocean currents, prevailing winds, some gases in the atmosphere)

### After Reading

**Reflect on Reading** (page 23) (Possible answers: Main idea: Climate is the average weather pattern in an area over many years. Details: An area's climate has to do with its average temperature and precipitation. The higher a place is above sea level, the cooler its climate is. Places near the ocean usually have warmer winters and cooler summers.)

**Apply Science Concepts** (page 23) This activity applies a concept from Find Out About on page 21. Assist students in finding their location on the map as needed. After they have completed the activity, challenge them to think about factors in their area that might affect the climate.

 **Continued on last page**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

# Test: Weather and Climate

## Part A: Vocabulary

atmosphere	climate	condensation	evaporation
front	precipitation	temperature	weather

Choose the correct vocabulary word for each sentence. Write the word on the line.

1. We call what is happening in the air around Earth at a certain place and time \_\_\_\_\_.
2. The layer of the \_\_\_\_\_ closest to Earth is called the troposphere.
3. The warmer the air, the higher the air \_\_\_\_\_.
4. It is called \_\_\_\_\_ when liquid water changes to the gas water vapor.
5. Clouds form when water vapor changes to tiny drops of liquid water. This change is called \_\_\_\_\_.
6. Rain, sleet, hail, and snow are examples of \_\_\_\_\_.
7. The \_\_\_\_\_ where two air masses meet is shown with lines and symbols on a weather map.
8. When we say an area is hot all year and gets very little rain, we are talking about its \_\_\_\_\_.

## Part B: Science Concepts

Mark the best answer to each question.

9. Which pair of weather features is part of the water cycle?  
Ⓐ wind and temperature                      Ⓒ temperature and humidity  
Ⓑ air pressure and precipitation              Ⓓ clouds and precipitation
10. Which kind of cloud is white and puffy and often means fair weather?  
Ⓐ cirrus cloud                                      Ⓒ fog  
Ⓑ cumulus cloud                                   Ⓓ stratus cloud

## Test: Weather and Climate (continued)

**11.** A huge storm forms when winds begin to spin over warm ocean water. The storm brings strong winds and heavy rain. What is this kind of storm called?

- (A) hurricane
- (B) tornado
- (C) thunderstorm
- (D) air mass

**12.** Which weather instrument could be used to measure how fast a land breeze or a sea breeze is blowing?

- (A) anemometer
- (B) barometer
- (C) thermometer
- (D) wind vane

**Write the answer.**

**13.** Label the two kinds of fronts shown. Tell what usually happens at a front.

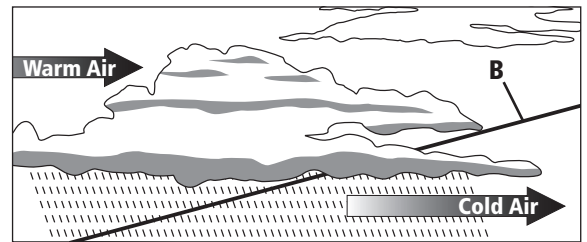
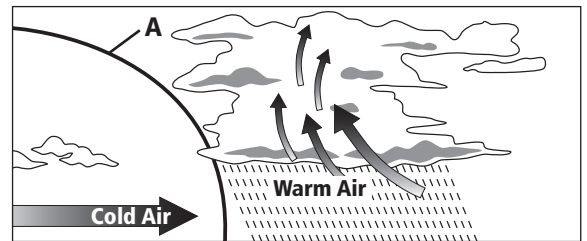
A \_\_\_\_\_

B \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



**14.** Explain how meteorologists predict weather. How do they share weather information with people?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**15.** Think about a place that is far north of the equator and has many mountains. What kind of climate might this place have? Explain.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Let's Review

## (inside back cover)

Have students complete their K-W-L charts before answering these questions. Possible answers are shown.

- 1. Cover Connection** (Weather is what is happening in the atmosphere at a certain place and time. Some places are warmer than others because the Sun does not heat Earth evenly. These differences cause air to move. As a result, weather is always changing. An area's climate has to do with its average temperature and precipitation.)
- 2.** (Air temperature: how hot or cold air is; Humidity: amount of moisture in air; Air pressure: weight of air pressing down on Earth; Wind: moving air; Clouds: groups of tiny water drops in air; Precipitation: water that falls to Earth)
- 3.** (Air mass: a large body of air with about the same temperature and humidity throughout; Front: the border between two air masses with different temperatures; Weather scientists track air masses and fronts because they bring weather changes.)
- 4.** (Weather is what is happening in the atmosphere at a certain place and time. Climate is the average weather pattern in an area over many years.)
- 5. How to Read Diagrams** (Evaporation happens when energy from the Sun warms the water in oceans, rivers, and lakes and from soil and plants. Water vapor moves up into the atmosphere and cools as it rises. Condensation happens when the gas changes to tiny drops of liquid water. Groups of tiny water drops form clouds. The water drops can join together and get larger and heavier.

Then they may fall to Earth as precipitation. Some precipitation goes into the soil. Some flows across the land into lakes, rivers, and oceans.)

- 6. Write** (Letters will vary but should include vivid details about the storm. Details may come both from the book and from personal experience. Remind students to use the proper format for a friendly letter.)

**Try It!** Students should observe water droplets forming and falling from the underside of the ice-cooled plastic wrap. Water droplets forming on the cooled surface demonstrate condensation. Droplets falling from the plastic wrap demonstrate precipitation.

**Science at Home** Have students do this activity at home with a family member. Remind them to explain the symbols and weather words in the forecast.

## Answers to Test

### (Teacher's Guide pages 6–7)

1. weather 2. atmosphere 3. temperature 4. evaporation  
5. condensation 6. precipitation 7. front 8. climate 9. D 10. B 11. A  
12. A 13. A: cold front; B: warm front; Weather changes usually happen at a front. 14. Meteorologists collect information about air temperature, wind, and other things. They use this information to make predictions called forecasts. They share information by making weather maps. 15. I think this place might have a cold climate. Latitude affects climate. Places farther from the equator are usually cooler. Elevation also affects climate. The higher a place is above sea level, the cooler its climate is.

**ADDITIONAL ASSESSMENT OPPORTUNITIES** Use the Checkpoints, Reflect on Reading, and Apply Science Concepts features and Let's Review questions as additional assessment opportunities.

*Delta Science Content Readers* are 24-page nonfiction student books with informative, engaging text and full-color photos and illustrations. The readers present key science content and vocabulary found on state tests, present key reading skills and strategies useful for reading informational text, support and extend the experiences and content of hands-on activities, promote scientific inquiry, and serve as a home-school link. They are available in two editions: Red Edition for Grades 3–4 and Purple Edition for Grades 4–5.

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