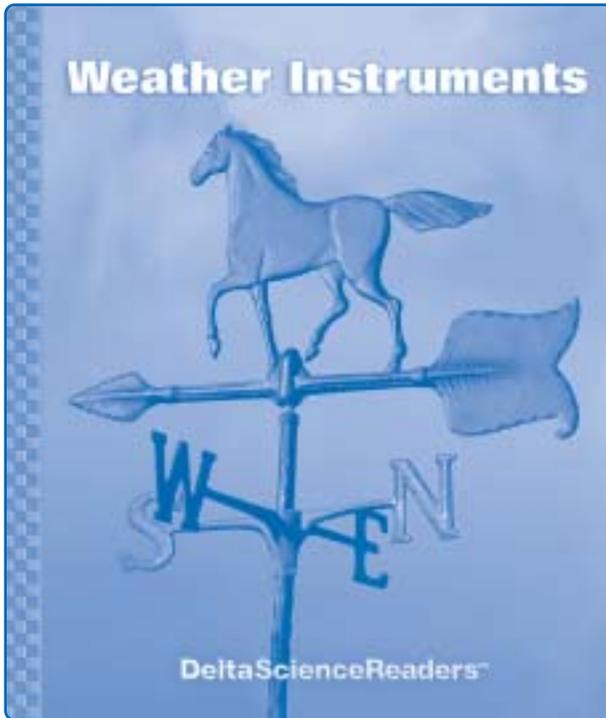


# Weather Instruments



*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 link.

## OVERVIEW

In the Delta Science Reader *Weather Instruments*, students explore what weather is and what factors cause changes in the weather. They explore various weather tools, such as the thermometer, barometer, wind vane, anemometer, hygrometer, and rain gauge. The book also presents biographical sketches of key scientists in this field—Gabriel Fahrenheit, Anders Celsius, and Sir Francis Beaufort—and describes the work of airport meteorologists. Students also discover how a thermometer works and read about wind chill.

### Students will

- ▶ explore weather-related concepts
- ▶ learn about and discuss a variety of weather instruments
- ▶ discuss the function of a table of contents, headings, and a glossary
- ▶ interpret photographs and graphics—diagrams, table, chart—to answer questions
- ▶ complete a KWL chart
- ▶ organize information in different ways

## READING IN THE CONTENT AREA SKILLS

- Categorize information about weather instruments
- Recognize cause-effect relationships in atmospheric conditions
- Compare and contrast weather instruments
- Demonstrate critical thinking
- Interpret graphic devices
- Summarize

## NONFICTION TEXT ELEMENTS

*Weather Instruments* includes a table of contents, headings, photographs and illustrations, captions, diagrams, charts, boldfaced terms, table, and a glossary.

## CONTENT VOCABULARY

The following terms are introduced in context and defined in the glossary: *air mass, air pressure, anemometer, atmosphere, barometer, Beaufort scale, Celsius, cirrus cloud, cloud, cold front, condensation, cumulus cloud, evaporation, Fahrenheit, front, humidity, hygrometer, meteorologist, precipitation, rain gauge, stationary front, stratus cloud, temperature, thermometer, troposphere, warm front, water cycle, water vapor, weather, weather map, wind, wind chill, wind vane.*

## BEFORE READING

### Build Background

Access students' prior knowledge of weather and weather instruments by displaying and discussing the cover. Point out the wind vane and ask: *What do you think this object is?* (a wind vane) *Where is it?* (on a roof) *Why?* (The wind can blow on it without being blocked by trees.) Then 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 do you know about weather? What kinds of weather instruments do you know about?*

Begin a class KWL chart by recording facts students know about weather and weather instruments in the K column. You may wish to copy the KWL chart and ask students to 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

Take a few minutes to have students look through the book. Explain the steps involved in previewing nonfiction: think about the title, read the table of contents, read the headings, read boldfaced words, and examine any photographs, illustrations, charts, and graphics.

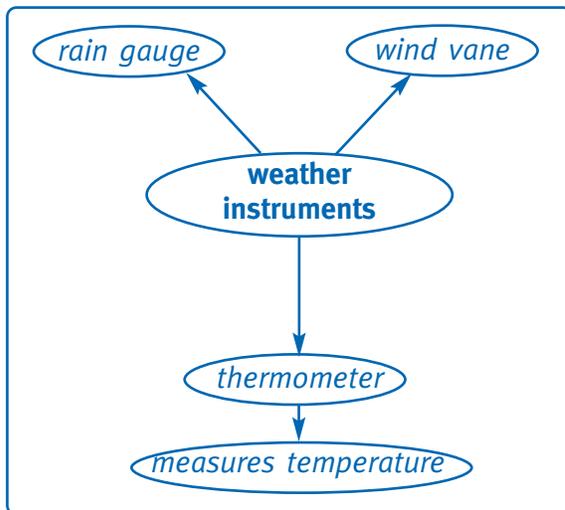
Call attention to the various nonfiction text elements and explain how each feature can help students understand what they read. Point out that the table of contents lists all the main headings in the book and their page numbers. Note that the headings on pages 2–8 are in the form of questions. Ask: *How do the headings help you know what you will learn about?* Point to some of the illustrations and ask questions such as: *What does this picture show you? How do you think it will help you understand the text?* Explain that the words in boldface type are important words related to weather and weather instruments that students will learn when they read the book. Point out that these words are defined in the glossary. Choose one word and have students find its definition in the glossary.

Following the preview, ask: *What questions do you have about weather and weather instruments that you would like this book to answer?* Record students' responses in the second column of the KWL chart. Explain that they will complete the chart after they finish reading.

### 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, develop with students a web such as the following, based on points made in the Build Background discussion and on the preview.



▲ A concept web for **weather instruments**.

### Set a Purpose

Discuss with students what they might expect to find out when they read the book, based on their preview. Encourage them to use their individual questions 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 form pairs or small groups and read the book together. Pause students after each text section to clarify as needed and to discuss any questions that arise or have been answered. New questions can be added to the KWL chart.
- **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 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. Discuss what students expect to learn, based on the heading. Have students examine any illustrations or graphics and read accompanying captions and labels.
- 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 2–9)

### Pages 2, 3 *What Causes Earth’s Weather?* and *How Do We Measure Air Temperature?*

- Have students study the diagram on page 2, and read the labels with them. Ask: *What does the diagram show?* (the layers of the atmosphere) *What is the bottom layer called?* (the troposphere)
- Before you read the body text, ask students to pay attention to causes and effects. When finished reading, ask: *What two things act together to cause weather?* (sun and air) *What effect does heat energy from the sun have on Earth?* (Heat energy from the sun warms Earth unevenly.) *What happens as a result?* (Warm and cold air masses form.)
- If necessary, provide help with the pronunciation of *troposphere* (TROH-puh-sfir).
- After students examine the photographs on page 3 and read the captions, discuss how knowing the temperature is useful in everyday life. Ask: *How can knowing the outdoor temperature help you plan what to wear?* (You would know whether to wear warm clothes or cool clothes.)
- After you read the body text, explain that students will read about Gabriel Fahrenheit, who developed the Fahrenheit scale, and Anders Celsius, who developed the Celsius scale, later in this book. Invite students to tell what they know about these two scales.
- Begin a two-column Weather Instruments chart with the headings *Measuring Instrument* and *What It Measures*. List *thermometer* in the first column and have students tell you what to write in the second column.
- If necessary, provide help with the pronunciation of *Fahrenheit* (FAR-uhn-hite) and *Celsius* (SEL-see-uhs).

### Pages 4, 5 *How Do We Measure Air Pressure?* and *How Do We Measure Wind?*

- Have students read the text on page 4 to learn about air pressure. Ask: *What is air pressure?* (the weight of the air pressing down on Earth’s surface) Read the caption for the photograph of the hikers and ask: *If you were on a mountain, would the weight of the air above you be greater or less than it is here?* (less) *Why?* (There is less air above pressing down.)
- Explain that the reason air pressure does not squash us is that we have air inside our bodies. The air inside us balances, or makes up for, the pressure of the outside air.
- If a barometer is available, use it to help students understand the description of how a barometer works. Add *barometer* to the Weather Instruments chart.
- If necessary, provide help with the pronunciation of difficult words, such as *barometer* (buh-ROM-uh-tur).
- Read page 5 to find out about wind. Ask: *What causes wind?* (air moving from a high-pressure area to a low-pressure area)
- Have students compare and contrast a wind vane and an anemometer. Ask: *How are a wind vane and an anemometer alike?* (They are both tools to measure wind.) *How are they different?* (A wind vane shows wind direction. An anemometer measures wind speed.) Add *wind vane* and *anemometer* to the Weather Instruments chart.
- If necessary, provide help with the pronunciation of *anemometer* (an-i-MOM-uh-tur).

### Pages 6, 7 *What Causes Clouds and Precipitation?* and *How Do We Measure Humidity?*

- Ask students whether they have ever noticed steam rising from a boiling pot of

water. Ask whether they have ever noticed drops of moisture on plants or other surfaces on a cool morning. Invite students to speculate about the causes. Explain that they will learn what causes these conditions when they read page 6.

- Have students examine the water cycle diagram. Read the title and the caption, and provide help as needed with the terms *evaporation*, *precipitation* and *condensation*. Ask students to describe what is happening in the diagram. Invite them to discuss any questions they have about it.
- If necessary, provide help with the pronunciation of *evaporation* (i-vap-uh-RAY-shuhn), *condensation* (kahn-duhn-SAY-shuhn), and *precipitation* (pri-sip-uh-TAY-shuhn).
- Read page 6 to find out about the water cycle. Explore causes and effects with students. Ask: *What causes water to turn into a gas?* (Heat energy from the sun warms the water.) *What is this called?* (evaporation) *What causes water vapor to change back into water droplets?* (It rises and cools down.) *What is this called?* (condensation)
- Help students extend the learning. Ask: *What was happening when you saw steam rise from boiling water?* (The water was evaporating and turning into a gas.) *What caused the dew you saw on a cool morning?* (The water vapor in the air condensed on the cool surfaces of grass and leaves.)
- Have students look again at the water cycle diagram. Ask: *How does the diagram help you understand what the text describes?* (It shows with pictures what the text says with words.)
- Before reading page 7, ask: *What do you think a desert feels like?* (hot and dry) *How do you think a jungle would feel?* (hot and damp) Have students read to find out what causes this difference.

- Check comprehension by asking questions such as these: *What is humidity?* (how much water vapor is in the air) *Would the air be more humid in winter or in summer? Why?* (summer, because more water evaporates when it is warm) *Why would close temperatures on a wet-dry bulb hygrometer mean that the air is humid?* (The temperature in the thermometer didn't change, which means that the water in the cloth didn't evaporate and cool it down.) Add *hygrometer* to the Weather Instruments chart.
- If necessary, provide help with the pronunciation of *hygrometer* (hye-GROM-uh-tur).

### **Pages 8, 9 How Do We Measure Precipitation? and Other Weather Instruments**

- Review with students that precipitation is water or ice falling from clouds. Encourage students to name as many different types of precipitation as they can think of. Record their answers. Read page 8 to learn about different types of precipitation and how precipitation is measured.
- Direct attention to the photograph of the rain gauge, and have students read the caption. Ask: *Which do you think would be the better place to put a rain gauge, under a tree or in an open space? Why?* (an open space, because a tree would block some rain)
- Point out that you can measure rain with a rain gauge and snow with a ruler. Ask: *How could you measure hail?* (Students may suggest measuring the size or depth of hailstones.) Add *rain gauge* and *ruler* to the Weather Instruments chart.
- Invite students to compare the types of precipitation mentioned with the list they created. Add to the list as needed.

- Have students look at the photographs on page 9 and read the captions. Ask whether they have ever watched a weather report on television. Encourage them to share their experiences. Ask: *In addition to satellites and weather balloons, how else do you think TV weather forecasters get information?* (Students may mention radar or airplanes, such as the ones that fly into hurricanes.)

## People in Science (pages 10–13)

### Pages 10, 11 *Gabriel Fahrenheit, Anders Celsius, Sir Francis Beaufort*

- Before reading page 10, remind students that they learned that thermometers use two scales, called the Fahrenheit scale and the Celsius scale. Read to find out about the scientists who developed these scales.
- Discuss the photograph of the thermometer, and guide students to compare and contrast the two scales. Ask: *What is the boiling point of water on the Fahrenheit scale?* (212 degrees) *On the Celsius scale?* (100 degrees) *What is the freezing point of water on these two scales?* (32 degrees on the Fahrenheit scale, 0 degrees on the Celsius scale) *Why do you think scientists use the Celsius scale instead of the Fahrenheit scale?* (Accept reasonable responses.) You may wish to point out that the Celsius scale is also called the centigrade scale. *Centigrade* means “100 degrees,” and there are exactly 100 degrees on the Celsius scale between the freezing and boiling points of water.
- Read the body text before having students examine the chart on page 11. After students study the chart, have them observe wind conditions outside and answer the question posed in the text.
- You may wish to explain that more scientific methods of determining wind speeds, such as anemometers, have replaced the Beaufort scale.

- If necessary, provide help with the pronunciation of *Fahrenheit*, *Celsius*, and *Beaufort* (BOH-fuhrht).

### Further Facts

#### *Gabriel Fahrenheit (1686–1736)*

- German physicist born in Danzig (Gdansk), Poland; died in The Hague, The Netherlands.
- Invented the alcohol thermometer in 1709 and the mercury thermometer in 1714.
- Invented a hygrometer to measure relative humidity.
- Discovered that different liquids have different boiling points and that they vary with atmospheric pressure.
- Discovered that water with impurities can remain liquid below the freezing point.

#### *Anders Celsius (1701–1744)*

- Swedish astronomer born and died in Uppsala, Sweden.
- Professor of astronomy at the University of Uppsala from 1730 to 1744; built the Uppsala Observatory in 1740.
- Published works on the aurora borealis (the northern lights) and helped determine that the shape of the earth is like a flattened sphere, as predicted by Sir Isaac Newton.

#### *Sir Francis Beaufort (1774–1857)*

- Born in County Meath, Ireland.
- Began his naval career at the age of 13 as a cabin boy; served in the British Navy until he was 81.
- Started keeping a weather journal after three years at sea; continued this practice until his death.

- Appointed hydrographer to the Admiralty in 1829 (hydrography is the study of the geographic features of bodies of water).
- The Beaufort Sea, a sea of the Arctic Ocean off Alaska's northern coast, was named after him.
- Promoted to Rear Admiral in 1846, and two years later knighted by Queen Victoria for service to England.

### Pages 12, 13 *Airport Meteorologists*

- Ask students where they think a meteorologist might work besides in a television station as a TV weather forecaster. *Where might it be important to know about weather conditions in other parts of the country or the world?* Explain that students will read about the job of an airport meteorologist.
- Ask students to examine the photographs and read the captions. Discuss the information presented.
- Review what students have learned about weather instruments by asking: *What kinds of tools do you think an airport meteorologist uses to gather data for a weather map?* (Students should name the weather instruments discussed in the text.)
- Also ask if students see any clouds outside today. Can they tell what kind of cloud?
- If necessary, provide help with the pronunciation of difficult words, such as *meteorologist* (mee-tee-ur-OL-oh-jist).

### Further Facts

#### *Kinds of Meteorologists*

There are many different kinds of meteorologists:

- Research meteorologists study special fields of meteorology, such as tropical weather systems.

- Regional forecasters specialize in the weather of one area.
- Consulting meteorologists provide information to businesses, industries, and governments on how weather affects areas of specific interest to them.
- Broadcast meteorologists inform the public about the weather through radio or television reports.
- Synoptic meteorologists study global weather observations, interpret computer output, and monitor large-scale weather systems.
- Physical meteorologists study the electrical and chemical properties of the atmosphere.
- Dynamic meteorologists create models of how the atmosphere circulates around the globe.

### Did You Know? (pages 14–15)

#### *How Thermometers Work and About Wind Chill*

- If possible, have several different types of thermometers available for students to examine. Invite them to share their ideas about how a thermometer works.
- Read page 14 about how a thermometer works. As needed, explain the terms *expand* and *contract*. Guide students to identify cause-effect relationships. Ask: *What makes the liquid in a thermometer rise when the temperature rises?* (It expands.) *Why do you think the metal inside the round thermometer gets longer when the temperature rises?* (The heat makes it expand.)
- Ask students: *Have you ever noticed that it feels much colder when the wind is blowing than when the air is calm? Why do you think this is so?* Have students read page 15 to learn about wind chill.

- Discuss the Wind Chill Chart and ask questions to have children use the chart, for example: *If the air temperature is 25 degrees F and the wind is blowing at 45 miles an hour, how cold does the wind chill make it feel?* (5°F)

## 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 and the Weather Instruments 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 weather and weather instruments? 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 causes weather? (Heat energy from the sun warms Earth's surface, which heats the air above it. Because the heating is uneven, hot and cold air masses form. Pressure differences make the air move and cause changes in weather.)

2. Name three weather measuring tools and tell what they measure. (Students may mention the following: thermometer—air temperature, barometer—air pressure, wind vane—wind direction, anemometer—wind speed, hygrometer—humidity, rain gauge—amount of rain.)
3. What is the water cycle? (Heat energy from the sun warms Earth's water, which causes it to evaporate and become water vapor. Water vapor rises and cools. When water vapor cools, it condenses into drops of water that fall back to Earth as rain or snow. This water flows into Earth's rivers, lakes, and oceans, and the cycle begins again.)

### Writing Link/Critical Thinking

Present the following as a writing assignment.

Think about where rain comes from. Why does Earth never run out of rain? (It never runs out of rain because the same water is being used again and again. Water from rivers, lakes, and oceans evaporates to form water vapor that returns to Earth as rain or snow.)

**Science Journals:** You may wish to have students keep the writing activities related to the 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.