FOCUS ON SCIENCE

Observing and Predicting Weather

On Level

Earth Science
Weather

FOCUScurriculum

Observing and Predicting Weather

Scientific Inquiry

The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process.

Represent, present, and defend their proposed explanations of everyday observations so that they can be understood and assessed by others.

Beyond the use of reasoning and consensus, scientific inquiry involves the testing of proposed explanations involving the use of conventional techniques and procedures and usually requiring considerable ingenuity.

Use conventional techniques and those of their own design to make further observations and refine their explanations, guided by a need for more information.

Conduct an experiment designed by others.

Earth Science

Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.

Weather describes the conditions of the atmosphere at a given location for a short period of time.

Climate is the characteristic weather that prevails from season to season and year to year.

The uneven heating of Earth's surface is the cause of weather.

Air masses form when air remains nearly stationary over a large section of Earth's surface and takes on the conditions of temperature and humidity from that location. Weather conditions at a location are determined primarily by temperature, humidity, and pressure of air masses over that location.

Most local weather condition changes are caused by movement of air masses.

The movement of air masses is determined by prevailing winds and upper air currents.

Fronts are boundaries between air masses. Precipitation is likely to occur at these boundaries.

High-pressure systems generally bring fair weather. Low-pressure systems usually bring cloudy, unstable conditions. The general movement of highs and lows is from west to east across the United States.

Hazardous weather conditions include thunderstorms, tornadoes, hurricanes, ice storms, and blizzards. Humans can prepare for and respond to these conditions if given sufficient warning.

Substances enter the atmosphere naturally and from human activity. Some of these substances include dust from volcanic eruptions and greenhouse gases such as carbon dioxide, methane, and water vapor. These substances can affect weather, climate, and living things.

Observing and Predicting Weather

English Language Arts

The following is a selective listing of the competencies and indicators addressed in this book.

Literacy Competencies
Word Recognition
- Integrate sources of information to decode unfamiliar words, self-monitor, and self-correct forword-reading accuracy

Background Knowledge and Vocabulary Development
- Acquire new vocabulary by engaging with a variety of texts written by a range of different authors

Comprehension Strategies
- Read grade-level texts and answer literal, inferential, analytic, and evaluative questions

Observing and Predicting Weather

How to Help Your Students Make the Best Use of This Book

Encourage students to develop nonfiction literacy skills by completing the Active Reader activities. Also encourage them to . . .

• Underline main ideas in paragraphs.

• Circle details that support the main ideas.

• Write down questions as they read.

• Circle key words as well as unfamiliar words.

Printing Instructions

Student Book: print pages 5–30

Assessments: print pages 31–34

Answer Key: print pages 35–38

FOCUS ON SCIENCE

Observing and Predicting Weather

How do matter and energy interact to produce weather patterns?

Off the coast of Florida, huge winds get stronger and faster. The swirling mass heads for land and people prepare for the worst. Residents nail boards over their windows to protect them from wind. Those who live on the beach move inland. The weather is about to become brutal—and being prepared can mean the difference between life and death.

Observing and Predicting Weather

Table of Contents

Starting Points

Build Background

Use Your Knowledge

Hurricanes. Tornadoes. Ice Storms. Tsunamis. Every region has extreme weather events. Write two or three sentences about extreme weather events where you live.

_____

_____

_____

_____

Hands On Science

Analyze Weather Forecasts Scientists use many tools to forecast weather. They use satellite pictures, balloons and aircrafts, radar, human observations, and more. How accurate are weather forecasts? In this activity you will investigate the accuracy of weather forecasting where you live.

1. **Choose the weather forecast you will use. It could be in a newspaper or on the Internet, TV, or radio. Use the same forecast every day.**

2. **Answer the questions under "Hypothesize" on the next page.**

3. **Each day for a week, record the details of the weather forecast for the following day in the chart on page 9.**

4. **The next day, observe the weather. Record the details in the "Actual Weather" column in the chart. Use your observations and a thermometer, if possible, to note what the actual weather is like.**

5. **At the end of one week, answer the questions under "Conclusions" on the next page.**

Hands On Science

Analyze Weather Forecasts Answer the "Hypothesize" questions. Then, use the chart on the next page to compare the weather forecasts with the weather that actually occurs. Return to this page to answer the "Conclusions" questions.

Hypothesize

What kinds of weather do you expect to see? Why? Write your hypothesis as an "if...then..." statement. For example, If there are dark clouds, then I expect it to rain.

_____

_____

What kinds of weather do you predict will occur most often? Again, write an "if...then..." statement.

_____

_____

Conclusions

How many days was the forecast accurate? _____

What kinds of weather occurred most often?

_____

_____

What can you conclude about the accuracy of weather forecasting?

_____

_____

_____

_____

Analyze Weather Forecasts

Include details such as these in your observations:

high temperature:	88°	**low temperature:**	62°
humidity:	80%	**wind:**	northerly wind 15–20 mph
cloud cover:	cloudy	**precipitation:**	chance of thunderstorms

Day	Weather Forecast	Actual Weather
1		
2		
3		
4		
5		
6		
7		

Observing and Predicting Weather OL
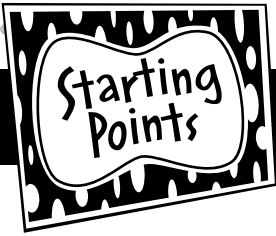
Key Vocabulary

Rate Your Knowledge

The words listed below have to do with weather and climate. Rate your understanding of each word by putting a checkmark or writing a few words in the appropriate column. After completing this book, come back to this page and write the definitions of words you did not know.

	I don't know it.	I've seen it, and I think it means . . .	I know it well. It means . . .
climate			
weather			
atmosphere			
precipitation			
saturate			
hurricane			
vortex			
mesocyclone			
thermometer			
barometer			
cumulus clouds			
station model			

Use Roots to Unlock Meaning

Many science words come from Greek or Latin. Knowing Greek and Latin roots can help you unlock the meanings of science terms.

1. The root *meter* means "to measure." Two words from the list above use this root. Write the words below. Then use a dictionary to explain how the root contributes to the meaning of each word.

   _____

   _____

2. The Greek word *meteoron* refers to events that occur in the sky. The suffix *–ology* comes from Greek and means "the study of." The suffix *–ist* means "a person who practices." Use this information to write a definition of **meteorologist**.
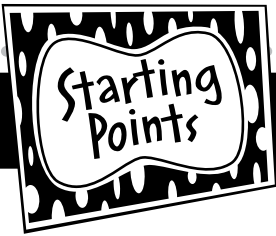
Key Concepts

What is the relationship between climate and weather? **Climate** and weather have some things in common. For example, when you talk about both, you discuss temperature. You talk about rain and snow. You use terms like *hot, cold, humid,* and *dry.* You think about the kinds of clothes you need to wear to be comfortable.

The main difference is weather is the outside conditions in a given location at a point in time. The weather right now might be sunny. Tomorrow's weather might be rainy. Weather is always changing.

Climate is the average pattern of weather year after year. It is the average temperature range during the different seasons. It is the typical amount of rain or snow that falls in a certain month. Climate is the way the sky often looks, and the way the winds often blow. It's how you describe a place. For example, you might say that New York City is warm and humid in the summers, and cold and snowy in the winters.

Use the information in the paragraphs above and what you know to fill in the Venn Diagram showing the relationship between weather and climate.

Weather   Both   Climate
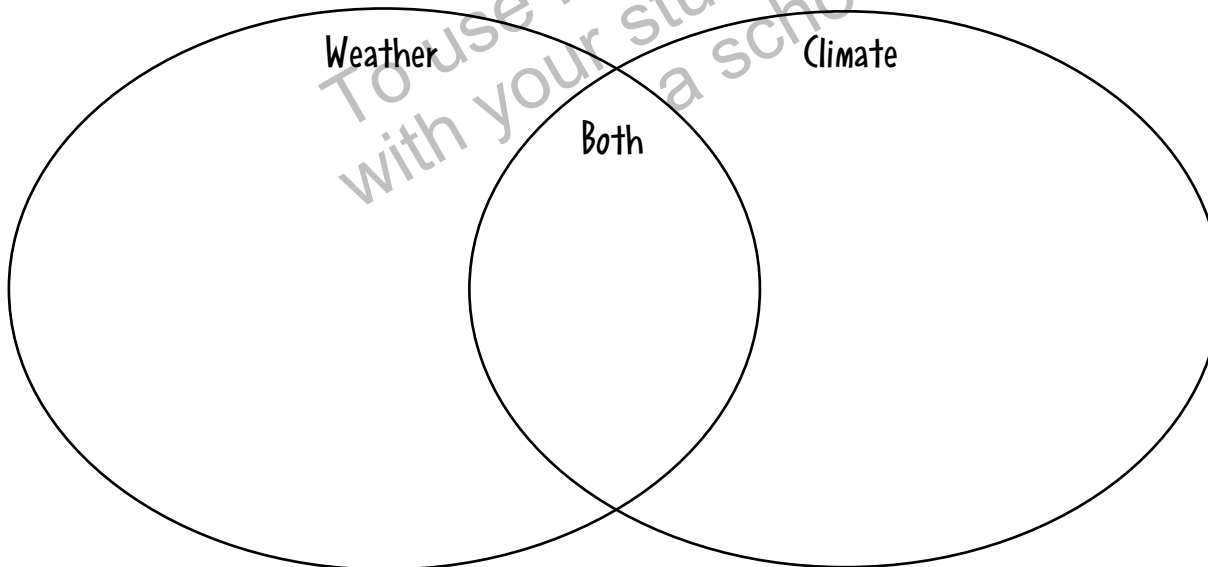
ACTIVE READER

1 Research *Use the Internet to find the average precipitation in your community during January, April, July, and October.*

Month	Average Precipitation
January	
April	
July	
October	

Good to Know

The National Oceanic and Atmospheric Administration (NOAA) is a government agency that monitors and predicts changes in Earth's environment. You can go to their Web site at http://www.nws.noaa.gov to get daily weather forecasts, severe storm warnings, and climate information for locations across the country.

FOCUS This chapter is a story about extremes. Read the first section to find out about two kinds of extreme weather events and how they are alike and different.

Extreme Winds

All weather takes place within the **hydrosphere**, the area of Earth's surface and **atmosphere** that contains all Earth's water. Some weather events are so extreme that they are given names, such as the Johnstown Flood of 1889 that caused more than 2,000 deaths.

Every year, extreme wind storms smash buildings, rip out trees, and take lives. These extreme weather events are related to the **water cycle**.

Tornadoes

One of the most frightening and destructive types of storms is the tornado. Tornadoes generate the strongest winds known. The winds can reach close to 300 mph. Tornadoes can lift cars, animals, and even mobile homes into the air. A tornado is born from a rapidly spinning column of air that bulges downward from a storm cloud.

Warm, humid air rises during the evaporation phase of the water cycle. When the warm, wet air meets a cold, dry air mass, the cold air is forced downward quickly. The warm air explodes upwards. It punctures the layer above and builds a thundercloud. Then, water vapor condenses, and rain or hail begins to fall.

The rising air begins to rotate. Soon it becomes a tube of spinning air called a **vortex**. A heavy, low cloud called a wall cloud forms at the base of the thundercloud. When this funnel-shaped cloud descends from the wall cloud and touches the Earth, it becomes a tornado.

Air pressure is the force exerted by the atmosphere. Air flows from areas of higher pressure to areas of lower pressure. The air pressure inside a tornado is lower than the pressure outside. Therefore, surrounding air is pulled into the tornado, creating destructive winds.

ACTIVE READER

1 Define *Explain what a vortex is.*

_____

_____

2 Research *What is the Fujita Scale, and how does it work?*

Descending cold air

Funnel cloud with upward warm air current
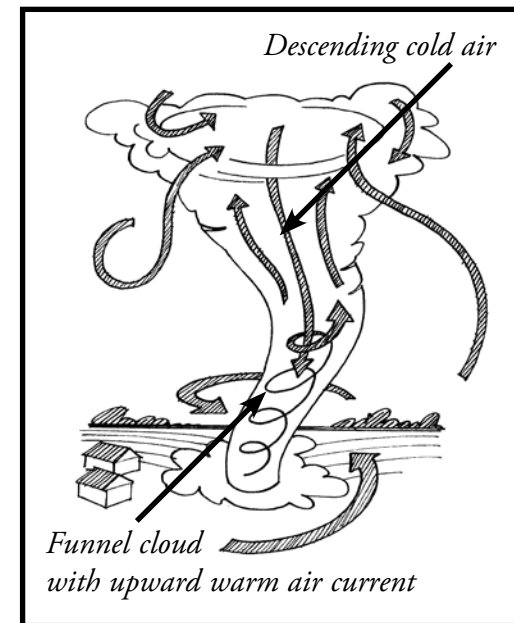
Tornados form over land when a mass of cold air collides with a mass of warm air and the two begin to spin.

Observing and Predicting Weather OL

Hurricanes

A **hurricane** is a tropical cyclone that forms in the North Atlantic Ocean, Northeast Pacific Ocean, or South Pacific Ocean. If it forms elsewhere it's called a typhoon or a cyclone. A hurricane has winds of at least 74 mph. Hurricane winds are much weaker than tornado winds. Even so, hurricanes cause much more damage than tornadoes. That's because they are larger, last longer, and cover far greater areas.

Hurricanes form over the ocean but cause a lot of damage when they reach land. They create huge waves that can cause destruction on beaches hundreds of miles away. The heavy rains associated with hurricanes can cause severe flooding, while the strong winds cause extensive damage.

These monster storms begin with the evaporation of water from the surface of the ocean near the equator. As heat energy from the ocean transfers to the rising water vapor, a current of upward moving warm air is formed with an area of lower pressure beneath it. Air from surrounding areas with higher pressure swirls into the low pressure area to take its place.

The warm, moist air cools as it rises and condenses into clouds. The clouds and wind spin and grow around a calm, clear center. This is the eye of the hurricane. The air pressure in the eye is very low, which causes winds to blow faster and faster toward the center.
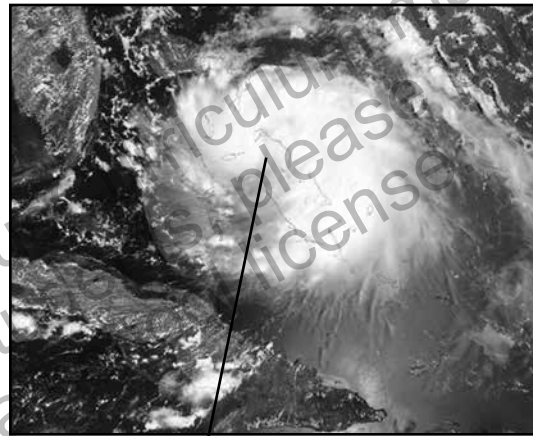
This is how a hurricane looks from space. Note the spinning clouds around the eye of the hurricane.

FOCUS QUESTIONS

1. **How are tornadoes and hurricanes alike?**

   _____

2. **How are tornadoes and hurricanes different from each other?**

   _____

ACTIVE READER

1 List *What three things associated with hurricanes cause destruction on land?*

a. _____

b. _____

c. _____

Good to Know

Can you imagine flying a plane directly into a hurricane? That's what a group of Air Force Reserve pilots known as "The Hurricane Hunters" do. They collect information from within hurricanes and transmit it to the National Hurricane Center.

Hands On Science

Vortex in a Bottle Both hurricanes and tornadoes have a swirling vortex. You can observe a vortex in action by creating one in a bottle. Then, record your observations on the next page.

Materials:

- Two plastic soda bottles (2-liter size)
- Water
- A Tornado Tube™—this plastic connector can be purchased at an educational science store. Or make your own connector using a washer with a 3/8 inch hole and electrical tape.
- Food coloring or glitter

Assembly:

1. Remove the caps and labels from the plastic bottles.
2. Fill one bottle about 2/3 full of water. You can add food coloring and/or glitter to the water.
3. Screw the Tornado Tube™ to the top of the water-filled bottle. Then screw the other bottle onto the open end of the Tornado Tube™. Or, tape the bottles together with the washer between them.

Procedure:

4. Hold the bottles vertically so they look like an hourglass. The filled bottle should be on top.
5. Rapidly rotate the bottles in a circle a few times. Then place the assembly on a table and observe what happens as the bottle drains.

Electric tape wrapped around the bottle necks and washer.

Washer with 3/8 inch hole

Hands On Science
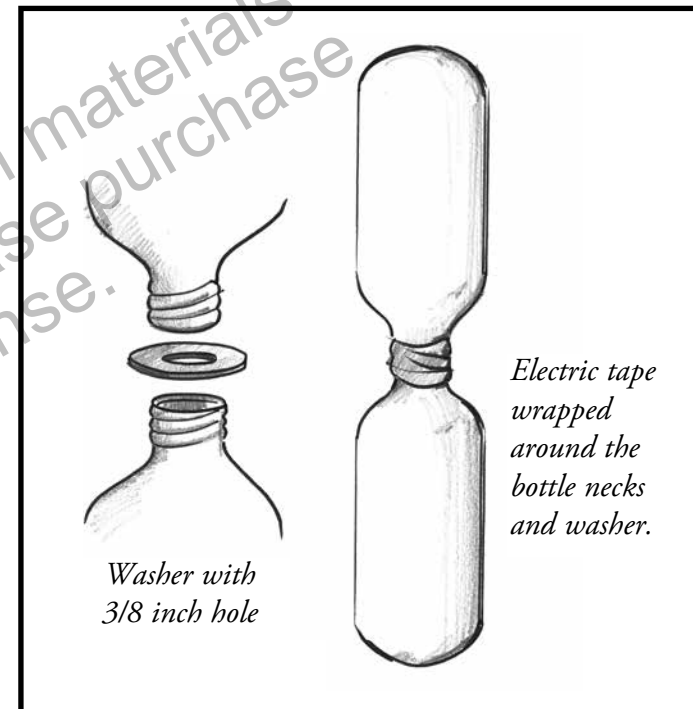
Questions and Conclusions

6.   **Draw a picture of the vortex that forms in the bottles.**

7. **Describe the movement of the water.**

_____

_____

_____

_____

_____

_____

_____

_____

_____

8.   **How was the movement of the water in the bottles similar to what happens during a tornado? How was it different?**

_____

_____

_____

_____

FOCUS Read this section to find out about extreme weather events that involve too much or too little water.

Too Much Water/Too Little Water

Floods and **droughts** damage the environment and affect human populations. Floods and droughts are not individual weather events. However, they are linked to weather, climate, and the water cycle.

Floods

Humans have always lived near bodies of water, including rivers, lakes, and oceans. People use these sources for drinking water, agriculture, transportation, and industry. Living near water has many benefits. But it has drawbacks when flooding occurs.

Flooding happens when a body of water overflows and covers the surrounding land. Hurricanes and other tropical storms can push ocean waves inland. Monster waves can surge into low-lying areas near the coast. This floods streets and homes. Heavy rains can add more water than a river or stream can handle. When a river or stream suddenly overflows, it's known as a flash flood.

During a rainstorm, huge amounts of water can seep into the ground. This heavy **infiltration** can **saturate** the ground so that it can't absorb any more water. Runoff has no place to go and flooding occurs.

When snow and ice melt too quickly, they can fill streams and rivers. The water spills over the banks and floods the land. Dams and levees can fail. When they do, sudden flooding can happen, leading to loss of life and property.

Devastating floods destroy life and property.

ACTIVE READER

1 Identify *Underline the weather events that can cause flooding.*

2 Infer *What would cause ice and snow to melt too quickly?*

_____

_____

_____

_____
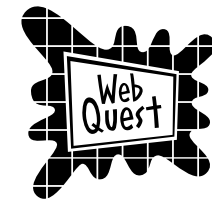
Web Quest The Earth's average temperature rose by over half a degree Celsius during the last century. Some scientists say that flooding will occur more often if the world gets warmer by even a few degrees. What other effects do scientists think global warming might have on the environment?

Droughts

Floods are the result of too much water. Droughts occur when there is not enough water. A drought happens when a region receives less precipitation than normal over a period of time. Droughts can last for months or for years. Even a short drought can have an effect on the ecosystem, agriculture, and economy of a region.

Droughts are a normal feature of the climate. They are often caused by a shift in global wind patterns. Sometimes, a high-pressure system hovers over the land for a long period of time. In a high-pressure system, air sinks, preventing water vapor from rising.

Since moisture doesn't rise, clouds can't form. No clouds means no rain. The water cycle ceases to produce precipitation. Without precipitation and infiltration, the land becomes dry, resulting in drought.

America's corn crop suffered much damage because of drought in 2007.

FOCUS QUESTIONS

1. **How does the weather affect the formation of droughts and floods?**

   droughts: _____

   _____

   floods: _____

   _____

2. **Why is drought not a weather event?**

   _____

   _____

ACTIVE READER

1 Identify *Underline the sentence that defines what a drought is.*

2 Extend *What are the potential effects of drought on people, animals, and the environment? List as many possible effects as you can think of.*

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

Stop and Think

This page will help summarize what you have learned so far. Use the tip to help you answer the questions.

Base your answers to questions 1 and 2 on the information below and your knowledge of science.

Flooding can happen for several reasons.

1. What are two causes of flooding? _____

_____

2. What is the effect of flooding? _____

_____

3. In what way are hurricanes and tornadoes alike?

    (1) both form near the equator
    (2) both contain powerful swirling air
    (3) both have a calm center called an eye
    (4) both cause flooding in low-lying areas

4. Which process could help to prevent flooding?

    (1) saturation
    (2) infiltration
    (3) precipitation
    (4) condensation

Tip:

To answer question 4, visualize the process each answer choice describes. Three answer choices describe processes that add water to Earth's surface. Only one answer choice describes a process whereby water leaves Earth's surface and travels else-where.

Dear Ms. Understanding,

I saw photos of New Orleans after Hurricane Katrina. I noticed that some places were flooded while other places nearby were not. Why is that?

Wondering in Watertown

Dear Wondering,

Some areas have a higher elevation than others. The low-lying areas acted like bowls that collected the flood water. People on higher ground were safe.

Ms. Understanding

FOCUS The underlined sentences name the main ways in which people can predict the weather. As you read this section, find out how predictions can be made based on observing clouds.

Farmers, pilots, and picnic-goers all depend on weather predictions, or forecasts. <u>Some forecasts are based on weather instruments, measurements, and computer models. But predictions can be made by simply looking at the clouds in the sky.</u>

Clouds and Weather Prediction

Clouds form at different levels in the sky. There are high-level clouds, mid-level clouds, and low-level clouds. The ten principal cloud forms are divided into three basic types. Each type tells us something about the weather.

Cirrus Clouds

Cirrus clouds are wispy, thin clouds that sometimes resemble feathers. They form high in the sky, often several miles above Earth's surface, where the temperature is colder. At this level, water vapor condenses and freezes into ice crystals. Ice crystals make up these clouds. If cirrus clouds are curved, it shows that the direction of the wind has changed. This can mean that the weather is going to change.

Cirrus clouds can form because of a warm front. A warm front is a fast-moving mass of warm air that overtakes a cold air mass. The warm air moves over the cold air. As it rises, it cools and condenses into clouds. The weather after a warm front may be warm and humid.

Stratus Clouds

Stratus clouds look like a flat white or gray blanket covering the sky. They also form when warm air passes over cooler air. The warm air cools and condenses, forming clouds that are lower in the sky than cirrus clouds. Stratus clouds can bring mist, drizzle, or light snow. When stratus clouds touch the ground, we call them fog.

ACTIVE READER

1 Identify What are three different ways in which clouds are categorized?

a. _____

b. _____

c. _____

2 Analyze Which kind of cloud could be called an "ice cloud"?

_____

_____

_____

3 Explain What is fog?

_____

_____

_____

_____

_____

_____

Cumulus Clouds

Cumulus clouds are puffy clouds that look like cotton. When these clouds are not very tall, they are called "fair weather clouds." They indicate good weather. But cumulus clouds that grow taller and larger can produce wet, stormy weather. These large towers are called cumulonimbus. Thunderstorms and even tornadoes can develop from cumulonimbus clouds.

Cumulus clouds are formed by a cold front. When a fast-moving mass of cold air overtakes a warm air mass, the warm air gets pushed up along the edge of the cooler air. If there is a lot of moisture in the warm air, it may condense and fall as heavy rain or snow. Once the cold front passes, the weather may become clear, dry, and colder.

Combinations of Clouds

Many clouds are combinations of the basic types described above. For example, nimbostratus is a rain cloud that occurs in layers. The chart below shows the ten principal cloud forms.

High-Level Clouds above 20,000 ft (6,000 m)

Mid-Level Clouds 6,500 to 20,000 ft (2,000 to 6,000 m)

Low-Level Clouds below 6,500 ft (2,000 m)

cirrostratus · cirrus · cirrocumulus · altostratus · cumulonimbus · altocumulus · stratocumulus · stratus · nimbostratus · cumulus

---
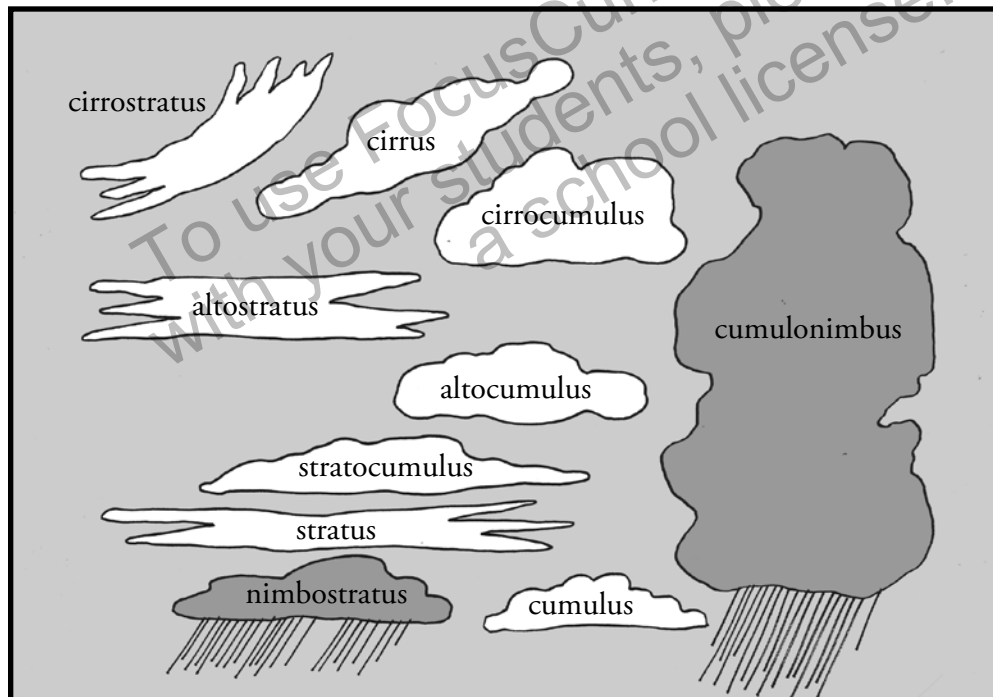
ACTIVE READER

1 Compare *What's the difference between a cumulus cloud and a cumulonimbus cloud?*

_____

_____

2 Analyze *Use the cloud chart to answer these questions.*

a. What is the lowest type of cloud?

_____

b. At what level is an altocumulus cloud?

_____

c. Which cloud forms a tall tower?

_____

FOCUS QUESTIONS

1. Complete the chart below to identify the three basic types of clouds, describe what each looks like, and explain what each tells about coming weather.

Cloud Type	What It Looks Like	What It Tells

Good to Know

Cloud names come from Latin words:

• Cirrus is Latin for "curl of hair"

• Stratus is Latin for "layer"

• Cumulus is Latin for "heap"

• Nimbus is Latin for "violent rain"

Analyze Clouds and Weather Use the chart below to record the type of cloud you see each day for two weeks. In the column at the right, tell whether there is precipitation, and, if so, what kind it is. Record the information at the same time each day.

Hypothesize

1. Which type of cloud do you expect to see the most? Why? _____

_____

2. Which type or types of cloud do you predict will occur on days that have precipitation? _____

Observe

Day	Type of Cloud Cover	Precipitation	Day	Type of Cloud Cover	Precipitation
1			8		
2			9		
3			10		
4			11		
5			12		
6			13		
7			14		

Conclude

3. Which type of cloud did you see the most? _____

4. Which type or types of cloud occurred on days that had precipitation?

_____

5. What can you conclude about the relationship between type of clouds and weather?

_____

_____

FOCUS
Read this section to find out how station models and weather maps are used to gather and present weather information.
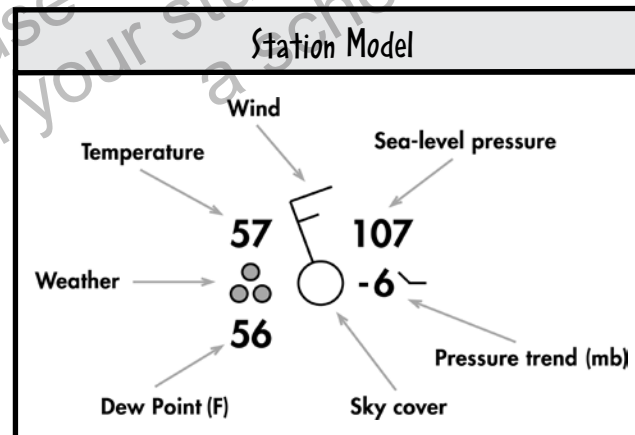
Station Models and Weather Maps

Clouds in the sky can tell you what the weather might be like. However, most people rely on weather forecasts and weather maps. You can find weather information on a computer, television, radio, or newspaper. But do you ever wonder where the data that is used to present weather information and forecasts comes from?

Station Models

Meteorologists collect data from instruments such as thermometers and barometers, and from radar and satellites. Because so much data would make a weather map difficult to read, **station models** are used. A station model is an illustration showing the weather conditions at a specific weather reporting station at a given time.

The graphic at the right shows the symbols in a station model and how they are used. Station models use symbols to show:
- temperature and **dew point**
- cloud cover and visibility
- wind speed and direction
- present weather conditions
- air pressure and changes in air pressure.

Station Model

Wind

Temperature

Sea-level pressure

57

107

Weather

-6

56

Dew Point (F)

Sky cover

Pressure trend (mb)

ACTIVE READER

1 Summarize   What does a station model show?

_____

_____

2 Analyze   Use the station model to answer these questions.

a. What information does the symbol that looks like a flag pole give?

_____

b. What information does the middle circle give?

_____

c. Where can you find data about the present weather?

_____

d. Circle the numbers that give information about air pressure.

Observing and Predicting Weather OL

Weather Maps

Weather maps show data from many station models at once. They often present some of the information in different ways. For example, air pressure is often shown in **isobars**. These are curved lines that connect places that have similar air pressure. The numbers on the isobars on the map on page 25 show the air pressure in **millibars**, a unit of atmospheric pressure. Areas of high and low pressure are marked with H or L.

A weather map also shows different kinds of weather fronts. The symbol for a cold front is a line with small triangles. The triangles point in the direction the front is moving. A warm front is shown with half circles instead of triangles. These half circles show which way the warm front is moving.

A line with both triangles and half circles pointing the same way depicts an **occluded front**. An occluded front is the boundary where a cold front merges with a warm front. This type of front can move slowly, bringing clouds and light precipitation.

The line on the weather map that has triangles going one way alternating with half circles going the other way represents a **stationary front**. This is an area where the warm air and cool air have met and stalled. A stationary front can bring days of clouds and precipitation.

When you look at a weather map you can see the current weather conditions. You can also get an idea of how the weather might be changing. For example, a cold front that is moving east might indicate that cloudiness and showers are on the way.

Meteorologists studying a series of weather maps can see how the weather has changed over time. They can then make predictions about what the weather will be like in the future.

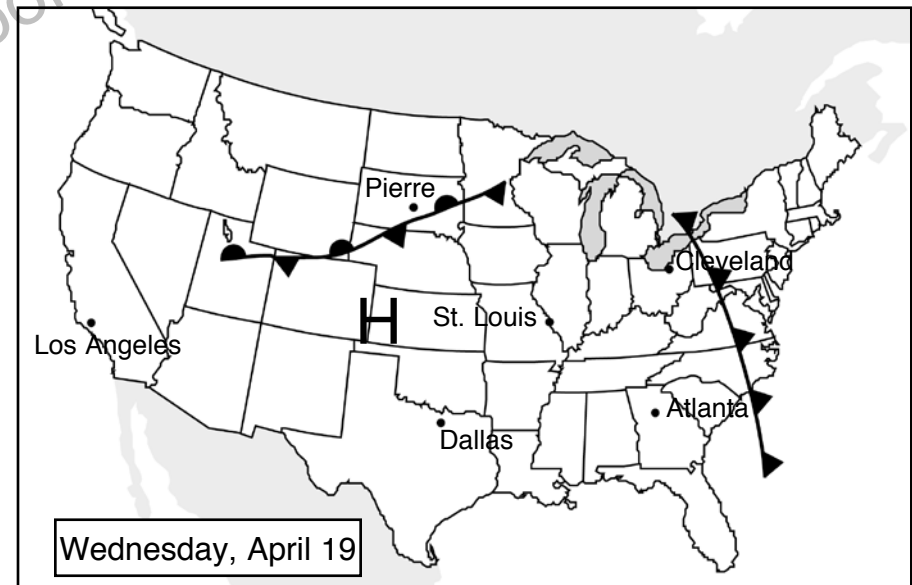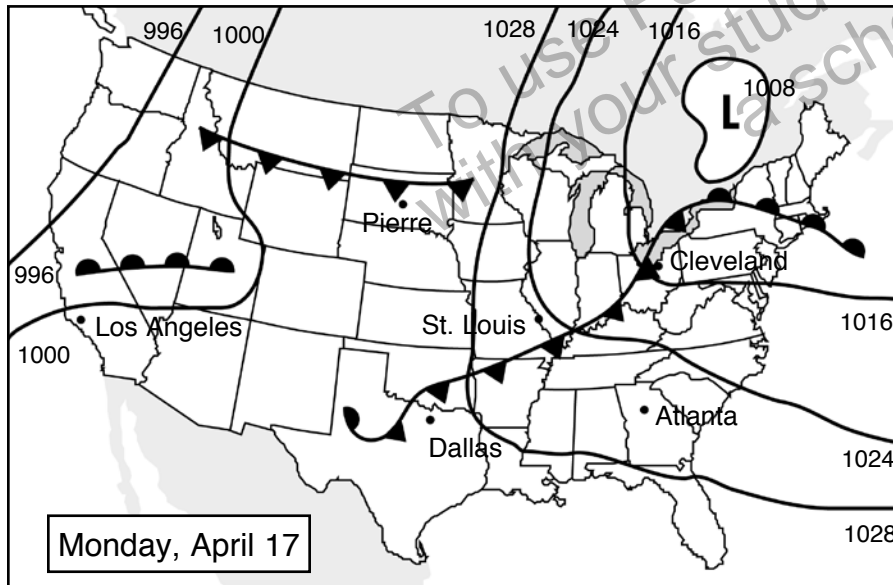Analyze Weather Data The table of weather conditions and the maps on the next page show information about the weather on Monday the 17th of April and Wednesday the 19th of April. Study the table and maps and use them to answer the Focus Questions on page 26.

ACTIVE READER

1 Summarize *What does a weather map show?*

_____

_____

_____

2 Recall *What are station models used for?*

_____

_____

_____

Analyze Weather Data

Weather Conditions for Monday at 7:00 a.m. and for Previous 24 Hours

City	Previous 24 Hour High (degrees Fahrenheit)	Previous 24 Hour Low (degrees Fahrenheit)	Barometric Pressure 7:00 a.m. (millibars)	Relative Humidity 7:00 a.m. (percent)
Atlanta	80	58	1026	65
Cleveland	86	63		100
Dallas	81	62	1032	55
Pierre	44	26	998	85
Los Angeles	64	53	1004	68
St. Louis	86	67	1024	93

Monday, April 17

Wednesday, April 19

FOCUS QUESTIONS

Use the weather data table and maps on the previous page to answer these questions.

1. **According to the table of weather conditions, what was the average temperature in Atlanta, Georgia during the 24 hours preceding Monday at 7:00 a.m.?**

   _____

2. **Describe the location of a stationary front on Wednesday.**

   _____

   _____

3. **According to the weather map for Monday, what is the approximate barometric pressure reading at Cleveland, Ohio on Monday at 7:00 a.m.?**

   _____

4. **Look at the weather map and the table for Monday at 7:00 a.m. Fog was reported for one city on Monday morning at 7:00 a.m. Which city was it?**

   _____

Web Quest

Go to the National Weather Service Web site at http://www.nws.noaa.gov to find out about the weather where you live. Click on New York on the national weather map. Navigate around the site. List three interesting facts you find out.

1. _____

_____

2. _____

_____

3. _____

_____

Stop and Think

This page will help summarize what you have learned in Chapter 2.

1. What can cirrus clouds indicate about the weather?

(1) a change is coming
(2) fair weather is on the way

(3) a thunderstorm is coming
(4) freezing temperatures are expected

2. What does a station model show?

(1) what tomorrow's weather will be like
(2) weather conditions at a specific place and time

(3) the location of weather satellites
(4) what a TV weather station looks like

Base your answers to questions 3 and 4 on the weather map below and your knowledge of science.

3. What symbols are used to indicate cold fronts and warm fronts?

_____

_____

_____

4. Explain how meteorologists use weather maps and predict the weather for a city shown on the map.

_____

_____
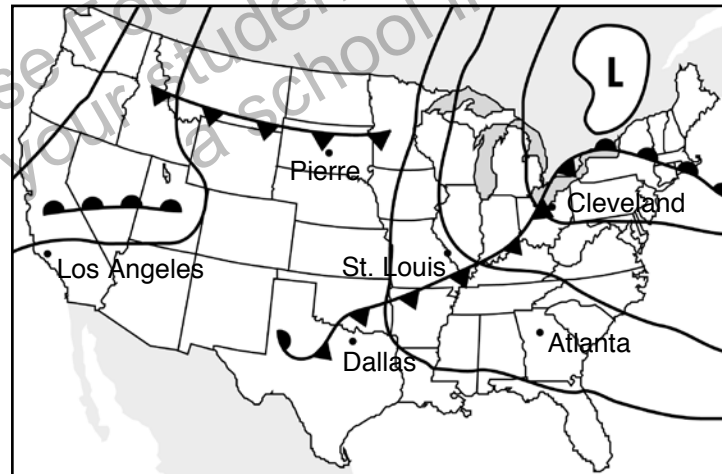
Dear Ms. Understanding,

I just heard a weather forecaster say the temperature is 0 degrees Fahrenheit but the wind chill factor makes it -19 degrees. How can it be two different temperatures at the same time?

Shivering in Shelter Island

Dear Shivering,

Your question gives me the chills! Wind chill temperature reflects how cold you feel when you're outside on a windy day. It's based on the rate at which your body loses heat when the wind is blowing. As wind increases, it draws heat from your body and drives down your temperature! No wonder windy winter days seem so terribly cold!

Ms. Understanding

Observing and Predicting Weather OL

Glossary

air pressure – the force exerted by the atmosphere

atmosphere – the mass of air that surrounds the Earth

cirrus clouds – wispy, high, thin clouds

climate – the average condition of weather over a period of many years

cumulus clouds – puffy piles of clouds

dew point – the temperature at which water vapor begins to condense

droughts – long periods of dryness

hurricane – a tropical cyclone with high winds

hydrosphere – all the waters of the Earth, including the water vapor in the atmosphere

infiltration – a process in which water on the ground filters down through rock and soil

isobars – lines that connect places on a weather map with similar air pressure

mesocyclone – a vertical tube of spinning air bulging downward below a thundercloud

millibars – units of atmospheric pressure

occluded front – the boundary where a cold front merges with a warm front

saturate – to fill with moisture such that the ground is unable to hold any more

station models – illustrations using symbols to represent weather data (e.g. temperature, barometric pressure, cloud cover, wind speed and direction) reported from a given weather station

stationary front – an area where warm air and cool air have met and stalled

stratus clouds – low gray or white blanket-like clouds

vortex – a whirling funnel of air or fluid

water cycle – the process in which water changes form and moves within the hydrosphere

FOCUS ON SCIENCE

Observing and Predicting Weather

Assessments

Check Understanding

In the Answer Document on this page, mark your answer in the row of circles for each question by filling in the circle that has the same number as the answer you have chosen.

1. A student studying a weather map in today's newspaper notices a line on the map with half circles and triangles pointing in the same direction.

   Which type of weather is likely to occur in the area ahead of the line?

   (1) clouds and light precipitation

   (2) thunderstorms and high winds

   (3) continued warm and sunny weather

   (4) heavy precipitation over several days

2. Which can occur because infiltration ceases due to saturated conditions?

   (1) flood

   (2) drought

   (3) tornado

   (4) hurricane

3. You are cloud-watching and you notice that the puffy, whipped cream clouds in the sky are starting to grow vertically, piling up into towers.

   What kinds of clouds are you seeing, and what will happen next?

   (1) Cirrostratus clouds have become nimbostratus clouds, and snow is on the way.

   (2) Nimbostratus clouds have become cumulus clouds, and the weather will become hot and clear.

   (3) Cumulus clouds have become cumulonimbus clouds, and a storm is on the way.

   (4) Altocumulus clouds have become stratocumulus clouds, and the weather will stay about the same.

Answer Document

1. ① ② ③ ④   3. ① ② ③ ④

2. ① ② ③ ④

Base your answers to questions 4, 5, and 6 on the weather table and maps on page 26 and on your knowledge of science.

4. The weather report calls for precipitation, with the possibility of snow, beginning on Monday the 17th of April and continuing for a couple of days.

   According to the weather maps, in which city do you most likely live?

   (1) Pierre, South Dakota
   (2) Los Angeles, California
   (3) Cleveland, Ohio
   (4) Atlanta, Georgia

5. What will sky conditions (cloud cover) and precipitation be like in Cleveland, Ohio on Monday?

   _____

   _____

   _____

   _____

6. What will sky conditions (cloud cover) and precipitation be like in Cleveland, Ohio on Monday?

   _____

   _____

   _____

   _____

   _____

Answer Document

4. ①   ②   ③   ④

FOCUS ON SCIENCE

Observing and Predicting Weather

Answer Key

Answer Key

Page 8: Starting Points
Build Background
Use Your Knowledge: Answers will vary.
Hands On Science: Analyze Weather
Forecasts: Answers will vary.

Page 11: Starting Points
Key Vocabulary
Rate Your Knowledge: Answers will vary.
Use Roots to Unlock Meaning:
1. thermometer – the word means to
measure heat 2. a person who studies
events that occur in the sky

Page 12: Starting Points
Key Concepts
Venn Diagram: Weather: the outside
conditions in a given location at a point
in time, always changing; Both: Described
using terms about temperature and pre-
cipitation; Climate: the average pattern of
weather in a given location year after year,
the typical weather events, how you describe
a place;
Active Reader: 1. Answers will vary.

Page 13: Chapter 1
Active Reader: 1. A rapidly spinning funnel
of air or fluid; 2. The Fujita Scale is used to
rate the intensity of a tornado based on the
damage it causes.

Page 14: Chapter 1
Active Reader: 1. strong winds, heavy rains,
huge waves

Focus Questions: 1. Both tornadoes and
hurricanes begin with evaporation of water.
Both have a vortex. The low pressure in
the storms draws in air from areas of higher
pressure outside the storm. 2. Hurricanes
form over the ocean but cause more damage
than tornadoes. Tornadoes have destructive
winds but hurricanes produce destructive
winds, rain, and waves.

Page 16: Chapter 1
Hands On Science: Vortex in a Bottle:
7. Sample answer: The water swirled rapidly
downward. 8. Answers will vary.

Page 17: Chapter 1
Active Reader: 1. Underline: hurricanes,
tropical storms, heavy rains; 2. A quick rise
in air temperature

Page 18: Chapter 1
Active Reader: 1. Underline: A drought
happens when a region receives less precipi-
tation than normal over a period of time. 2.
Sample answers: Animals and people do not
get enough water to drink; some may die.
Plants may die from lack of water. Crops
that people need for food may die.

Focus Questions: 1. Droughts: A shift in
wind patterns causes air to sink so water
vapor cannot rise and clouds cannot form.
Floods: An increase in precipitation intro-
duces too much water to the land.
2. Drought does not have a clear beginning
or end like other weather events.

Page 19: Chapter 1
Stop and Think: 1. Sample answers:
Causes: heavy rains, saturation, runoff;
2. Effects: property is damaged, crops are
destroyed, dams and levees fail; 3. (2); 4. (4)

Page 20: Chapter 2
Active Reader: 1. high-level, mid-level,
low-level; 2. cirrus clouds; 3. Fog is made
of stratus clouds that touch the ground.

Page 21: Chapter 2
Active Reader: 1. A cumulonimbus cloud is
a tower of cumulus clouds. 2. a. fog; b. mid;
c. cumulonimbus

Page 22: Chapter 2
Focus Questions: 1. Cloud Type: cirrus;
What It Looks Like: wispy, thin, resembles
a feather; What It Tells: A warm front has
come through, making the air warm and
humid. If the clouds are curved, the weath-
er may change soon. Cloud Type: stratus;
What It Looks Like: flat white or gray
blanket; What It Tells: The weather may
bring mist, drizzle, or light snow. Cloud
Type: cumulus; What It Looks Like: puffy
piles resembling cotton; What It Tells: If
the clouds are not too tall, they bring good
weather. If they are stacked up, they can
bring storms.

Answer Key

Page 23: Chapter 2
Hands On Science: Analyze Clouds and Weather: Answers will vary.

Page 24: Chapter 2
Active Reader: 1. A station model shows the weather conditions at a certain place and time. 2. a. Wind direction and speed; b. Cloud cover; c. The three dots on the middle left; d. Circle: -6, 107

Page 25: Chapter 2
Active Reader: 1. Data from many station models at once; 2. Station models show the weather conditions at a specific time and place.

Page 27: Chapter 2
Focus Questions: 1. 69 degrees Fahrenheit; 2. The front is running southwest to northeast between Pierre and St. Louis. 3. 1016; 4. Cleveland

Page 28: Chapter 2
Stop and Think: 1. (1); 2. (2); 3. Cold fronts are indicated with triangles. Warm fronts are indicated with half circles.; 4. Meteorologists use weather maps to predict the weather. This map suggests that cold fronts are heading toward Pierre, Dallas, and Cleveland.

Page 33
Check Understanding
1. (1); 2. (1); 3. (3)

Page 34
Check Understanding
4. (1); 5. Monday: There is likely to be some precipitation and cloud cover because the cold front is approaching Cleveland.; 6. Wednesday: There is likely to be little to no precipitation with few clouds because the cold front has passed Cleveland.