FOCUS ON SCIENCE

Observing and Predicting Weather

Basic Level

Earth Science
Weather

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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.

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

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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, winds grow stronger. The swirling winds heads for land. People prepare for the worst. They nail boards over their windows to protect their houses from wind. People who live on the beach move inland. The weather is about to become very bad. Being prepared can mean the difference between life and death.

Table of Contents

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.

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		

Starting Points

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**.

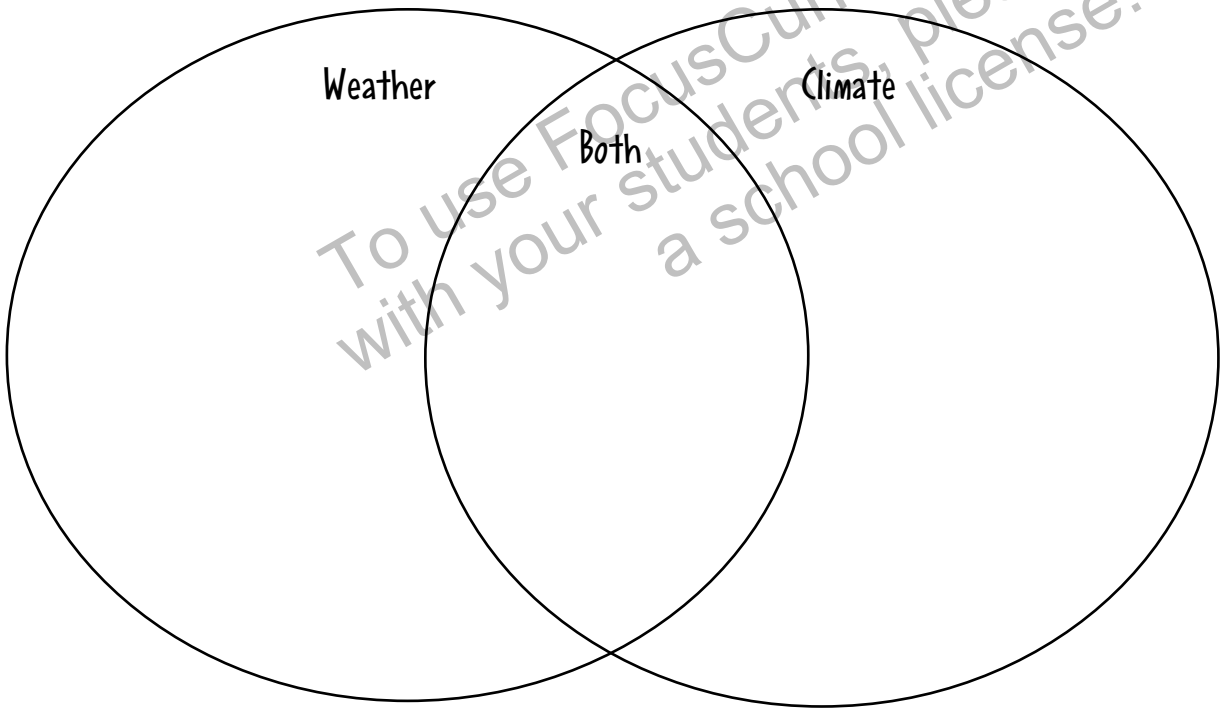
Starting Points

Key Concepts

What is the difference between **climate** and weather? Weather is the outside conditions in a given location at a point in time. The weather outside 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 amount of rain or snow that usually falls in each 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.



ACTIVE READER

1 Describe *List words from this page that you might use when talking about climate and weather. Then list at least one other word not included here.*

_____

_____

_____

_____

_____

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.

Chapter 1 What Causes Extreme Weather?

FOCUS

This chapter describes extremes. Read the first section to find out about two kinds of extreme weather events. How they are alike and different?

Extreme Winds

Weather takes place within the Earth's **hydrosphere**. The hydrosphere includes the part of Earth's surface and **atmosphere** that contains all Earth's water. Every year wind storms smash buildings, rip out trees, and take lives. These storms are related to the **water cycle.**

Tornadoes

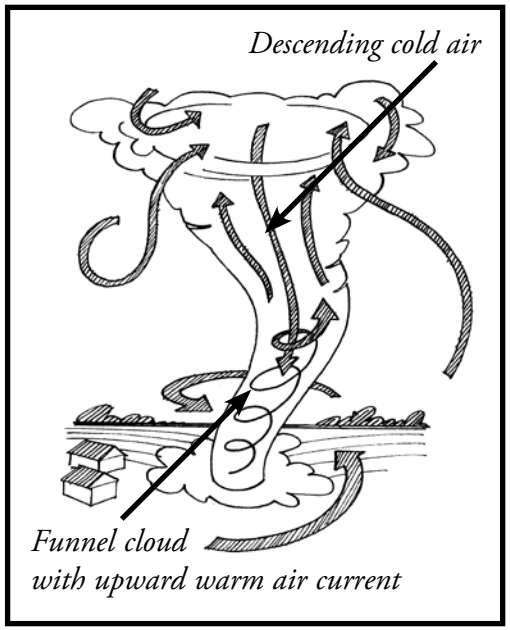
One of the most destructive types of storms is the tornado. Tornadoes create the strongest winds known. The winds can reach up to 300 mph. Tornadoes can lift cars, animals, and even mobile homes into the air.

A tornado is born from a column of air that spins rapidly. Warm, humid air rises during the evaporation phase of the water cycle. When this air meets cold, dry air, the cold air moves down quickly. The warm air moves upward rapidly. This builds a thundercloud. Then, water vapor condenses. Rain or hail begins to fall.

Sometimes 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 Earth, it becomes a tornado.

ACTIVE READER

1 Recall *What is a vortex?*



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

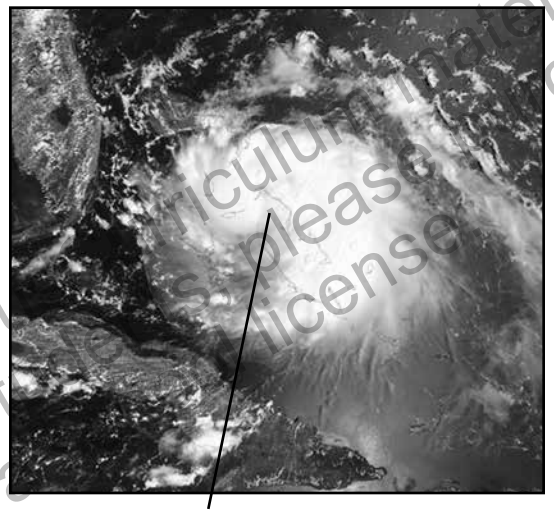
Hurricanes

Hurricanes form in the tropics, the area near the equator. They have winds of at least 74 mph. Hurricane winds are weaker than tornado winds. Even so, hurricanes cause more damage. That's because they are larger and last longer than tornadoes.

Hurricanes form over the ocean. They create huge waves that can destroy beach areas far away. Their heavy rains can cause severe flooding. Strong winds cause extensive damage.

These large storms begin with evaporation from the ocean near the equator. Heat energy from the ocean transfers to the rising water vapor.
A current of upward moving warm air is formed.
Air from surrounding areas swirls in to take its place.

The warm, moist air cools as it rises. Clouds form. The clouds and wind spin and grow around a calm, clear center. This is the eye of the hurricane. Winds 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 *Check the three things associated with hurricanes that cause destruction on land.*

____ *strong winds*

____ *heavy rains*

____ *high pressure*

____ *huge waves*

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

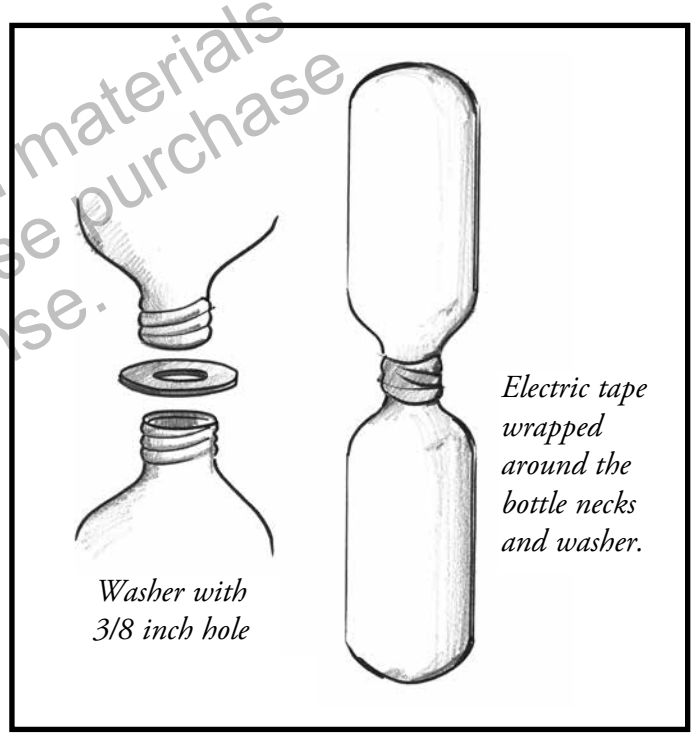
Both hurricanes and tornadoes have a swirling vortex. You can observe a vortex in action by creating one in a bottle. Then, record your observations on the next page.

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.

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** bring damage and destruction. Floods and droughts are not individual weather events, like tornadoes or hurricanes. They happen because of weather, climate, and the water cycle.

Floods

Flooding happens when a body of water overflows onto the land. For example, hurricanes can push ocean waves inland. This floods streets and homes. Heavy rains can add more water than a river can handle. When a river or stream suddenly overflows, it's known as a flash flood.

During a rainstorm, water seeps into the ground. This can **saturate** the ground. It can no longer absorb any more water. Runoff has no place to go. So it collects on the surface of land and flooding occurs.

When snow and ice melt too quickly, they can fill streams and rivers. The streams and rivers overflow and water floods the land.

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

A **drought** happens when an area receives less precipitation than normal over time. Droughts can last for months or for years. Even a short drought can change the ecosystem, agriculture, and economy of a region.

Droughts are normal. They are often caused by a change in global wind patterns. Sometimes, a high-pressure system **hovers** over the land for a long time. In a high-pressure system, air sinks. This prevents water vapor from rising.

Since moisture doesn't rise, clouds can't form. No clouds means no rain.

The water cycle stops producing precipitation. Without precipitation and **infiltration**, the land becomes dry.

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 elsewhere.

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

Chapter 2 Watching, Measuring, and Modeling

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.

Everyone depends on the weather forecast to plan ahead. Some forecasts are based on science and computer models. Others are made by looking at the clouds.

Clouds and Weather Prediction

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

Cirrus Clouds

Cirrus clouds are wispy and thin. They sometimes look like feathers. They form high in the sky. At this level, water 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 sometimes form because of a warm front. In a warm front, a mass of warm air moves fast. It overtakes a mass of cold air. As the warm air rises, it cools and clouds form. The weather after a warm front may be warm and humid.

Stratus Clouds

Stratus clouds look like a gray blanket covering the sky. They also form when warm air passes over cooler air. The clouds that form 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. They signal fair weather when they are not very tall. But some cumulus clouds grow taller and larger. They can produce wet, stormy weather. These large towers are called cumulonimbus. Thunderstorms can develop from them.

Cumulus clouds are formed by a cold front. 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. The moisture in the warm air may fall as heavy rain or snow. Once the cold front passes, the weather may become clear, dry, and colder.

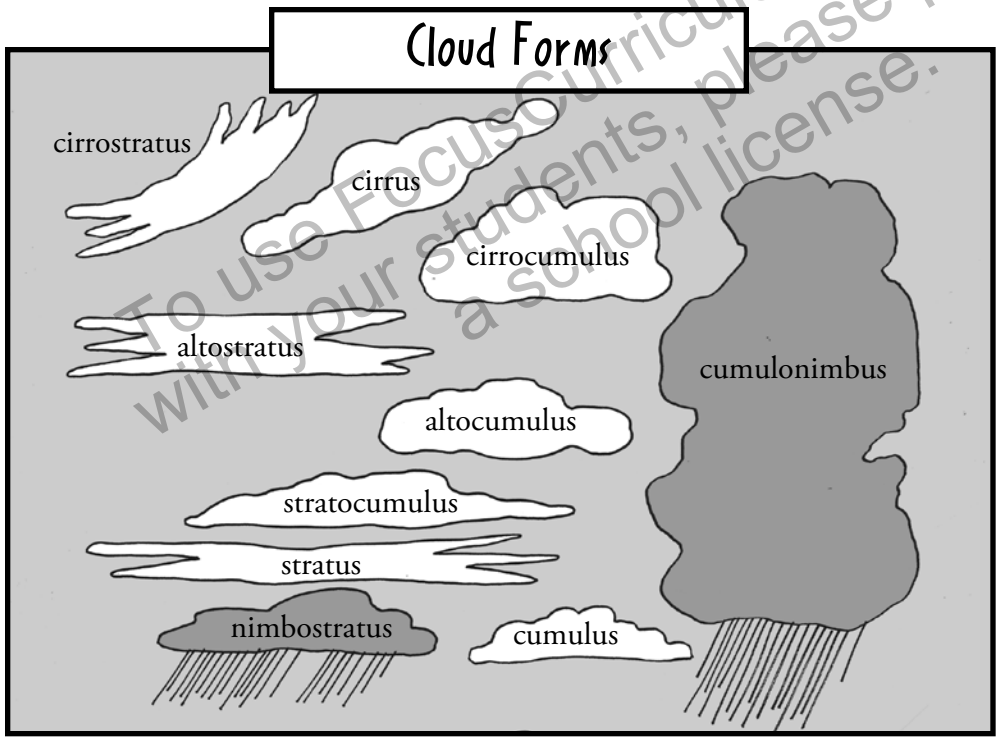
Combinations of Clouds

Many clouds are combinations of the basic types. 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)



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"

Hands On Science

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

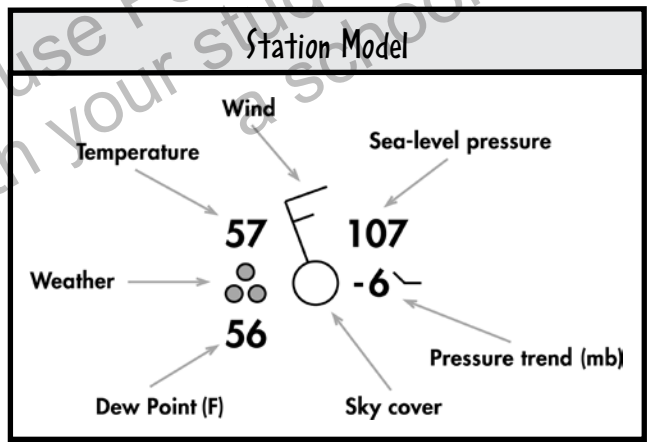
Clouds in the sky can tell you about the weather that is coming soon. However, most people listen to weather forecasts. They also read weather maps. But do you ever wonder where the forecast comes from?

Station Models

Meteorologists collect information from thermometers and barometers. They get more information from radar and satellites. They have so much information they can't fit it all on a weather map. So, they use **station models**.

A station model is an illustration showing the conditions at a specific reporting station at a given time. The graphic below 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.



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.

Weather Maps

Weather maps show information from many station models at once. On a weather map, 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 show the air pressure in **millibars**. Areas of high and low pressure are marked with H or L.

A weather map also shows warm and cold 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. These half circles also show which way the warm front is moving.

A line with both triangles and half circles pointing the same way is 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. It brings clouds and light precipitation.

The line on the weather map that has triangles going one way alternating with half circles going the other way is a **stationary front**. This is 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 predict weather in the future.

ACTIVE READER

1 Summarize *What does a weather map show?*

_____

_____

2 Recall *What are station models used for?*

_____

_____

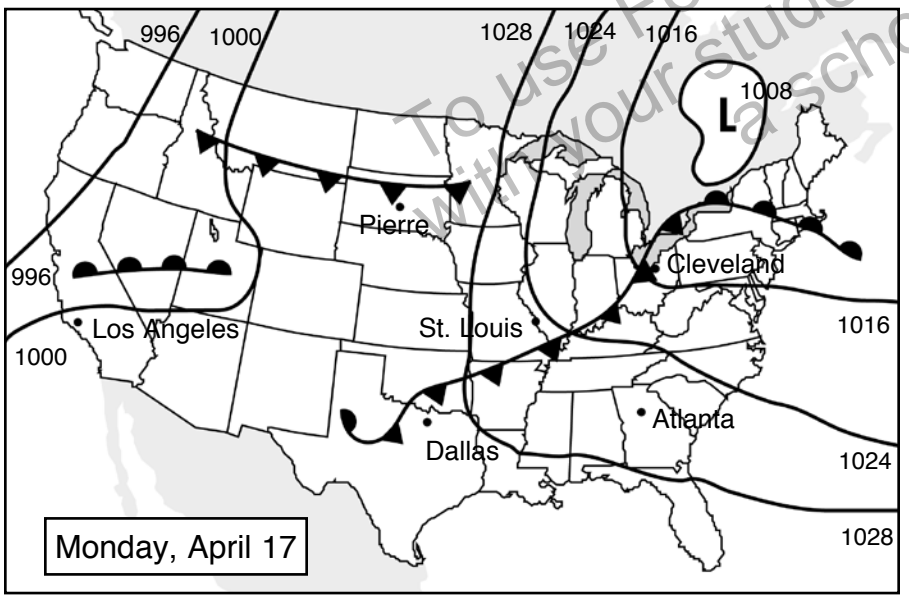
Analyze Weather Data The table of weather conditions and the maps on the next page show information about the weather on Monday the 17th of April and Wednesday the 19th of April. Study the table and maps and use them to answer the Focus Questions on page 26.

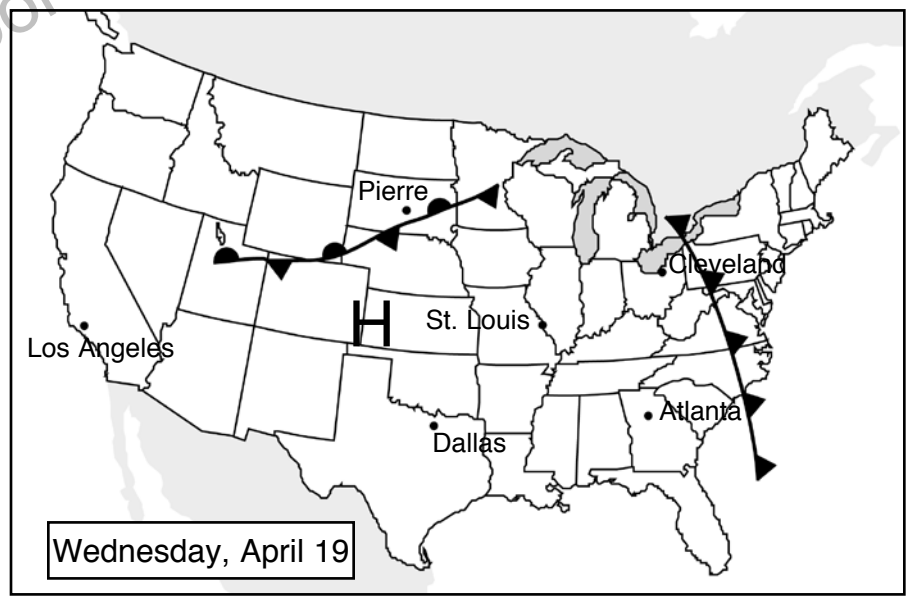
Think Like A Scientist

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





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?**

_____

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?

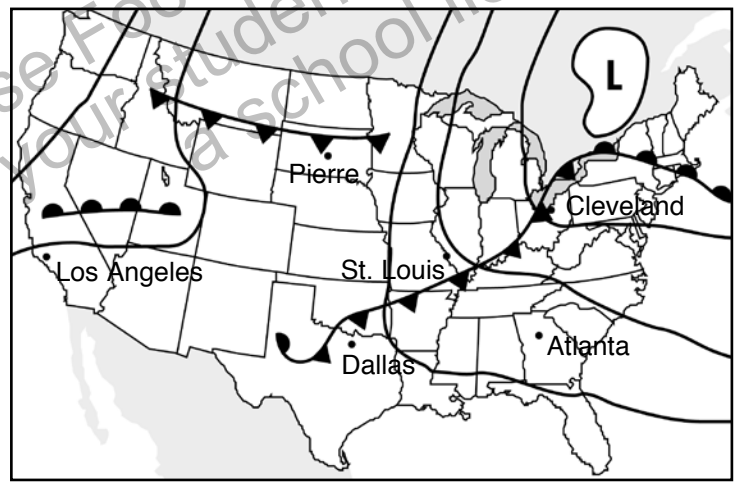
(1) a change is coming
(2) fair weather is on the way
(3) a thunderstorm is coming
(4) freezing temperatures are expected

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

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

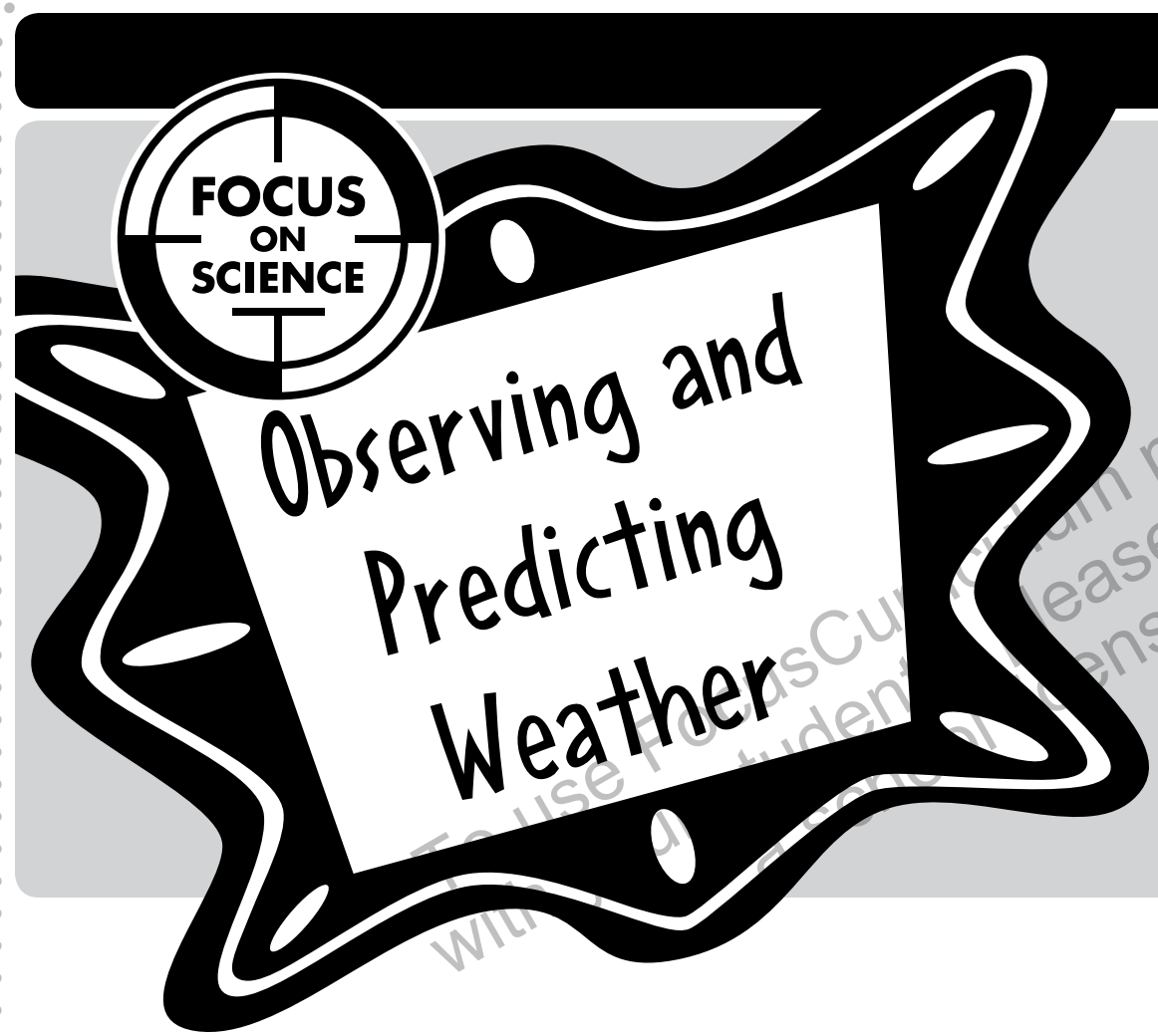
station models – illustrations using symbols to represent weather data (e.g. temperature, barometric pressure, cloud cover, wind speed and direction) reported from a given weather station

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



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

Answer Document

1.	①	②	③	④		3.	①	②	③	④
2.	①	②	③	④						

Check Understanding

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

Answer Document

4. ① ② ③ ④

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?

_____

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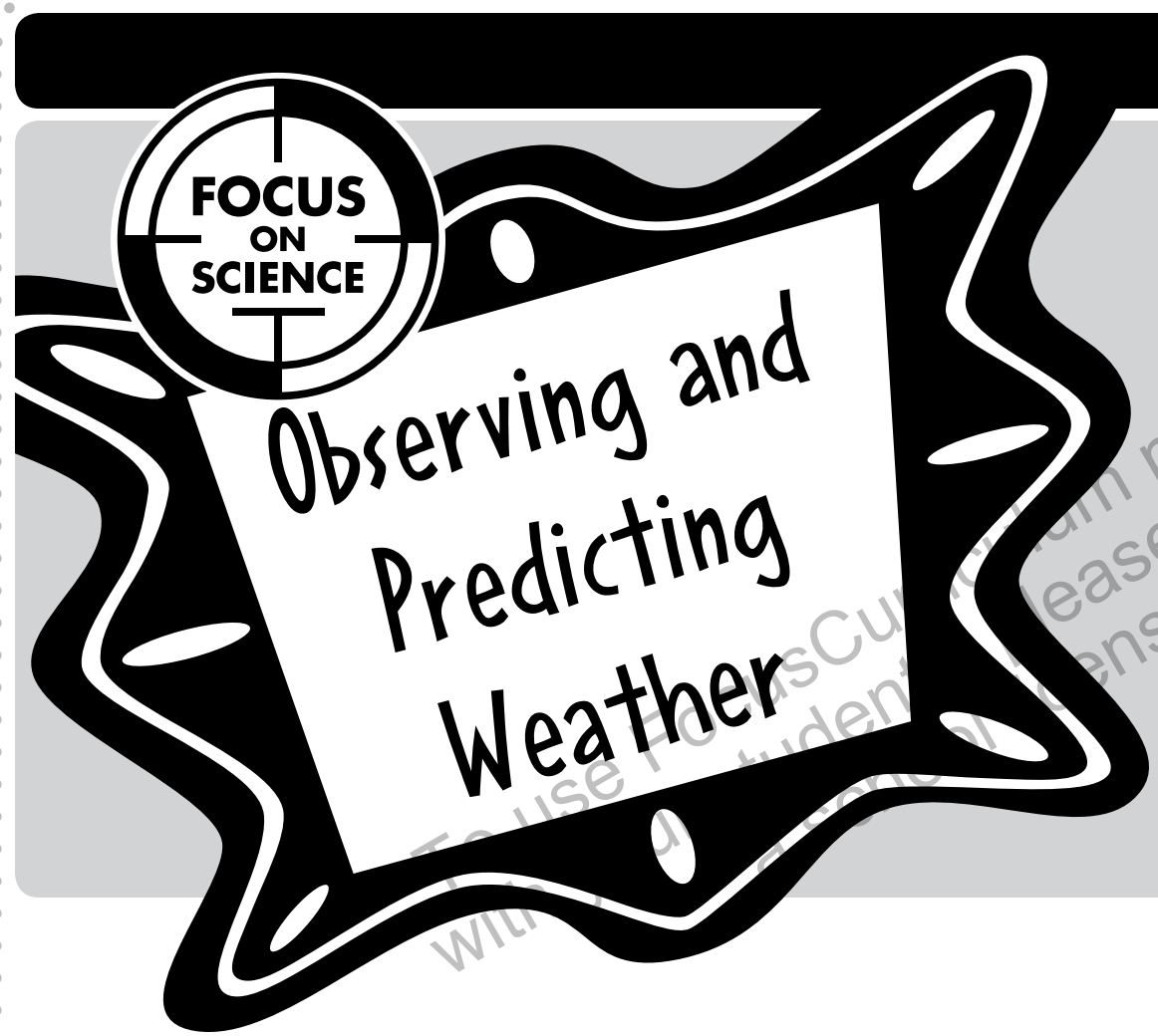

Answer Key

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 precipitation; 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 precipitation 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 introduces 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 weather 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.