KEY CONCEPT

17.4 Weather forecasters use advanced technologies.

BEFORE, you learned

- Weather changes when air masses move
- High-pressure systems bring fair weather
- Fronts and low-pressure systems bring stormy weather

NOW, you will learn

- How weather data are collected
- How weather data are displayed
- How meteorologists forecast the weather

VOCABULARY

meteorologist p. 594
isobar p. 597

EXPLORE Weather Maps

What does a weather map show?

PROCEDURE

1. Look at the weather outside. Write down the conditions you observe.
2. Use the map to check the weather conditions for your region.

MATERIALS

newspaper
weather map

WHAT DO YOU THINK?

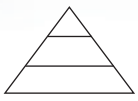
- What symbols on the map do you recognize?
- How does the information on the weather map compare with the weather you observed outside?

Weather data come from many sources.

Looking at the weather outside in the morning can help you decide what to wear. Different things give you clues to the current weather. If you see plants swaying from side to side, you might infer that it is windy. If you see a gray sky and wet, shiny streets, you might decide to wear a raincoat.

You might also check a weather report to get more information. A weather report can show conditions in your area and also in the region around you. You can look for weather nearby that might move into your area during the day. More detailed predictions of how the weather will move and change may be included in a weather report by a meteorologist. A **meteorologist** (MEE-tee-uh-RAHL-uh-jihst) is a scientist who studies weather.

VOCABULARY
Make a word triangle for *meteorologist*.



CHECK YOUR READING What information can a weather report show?

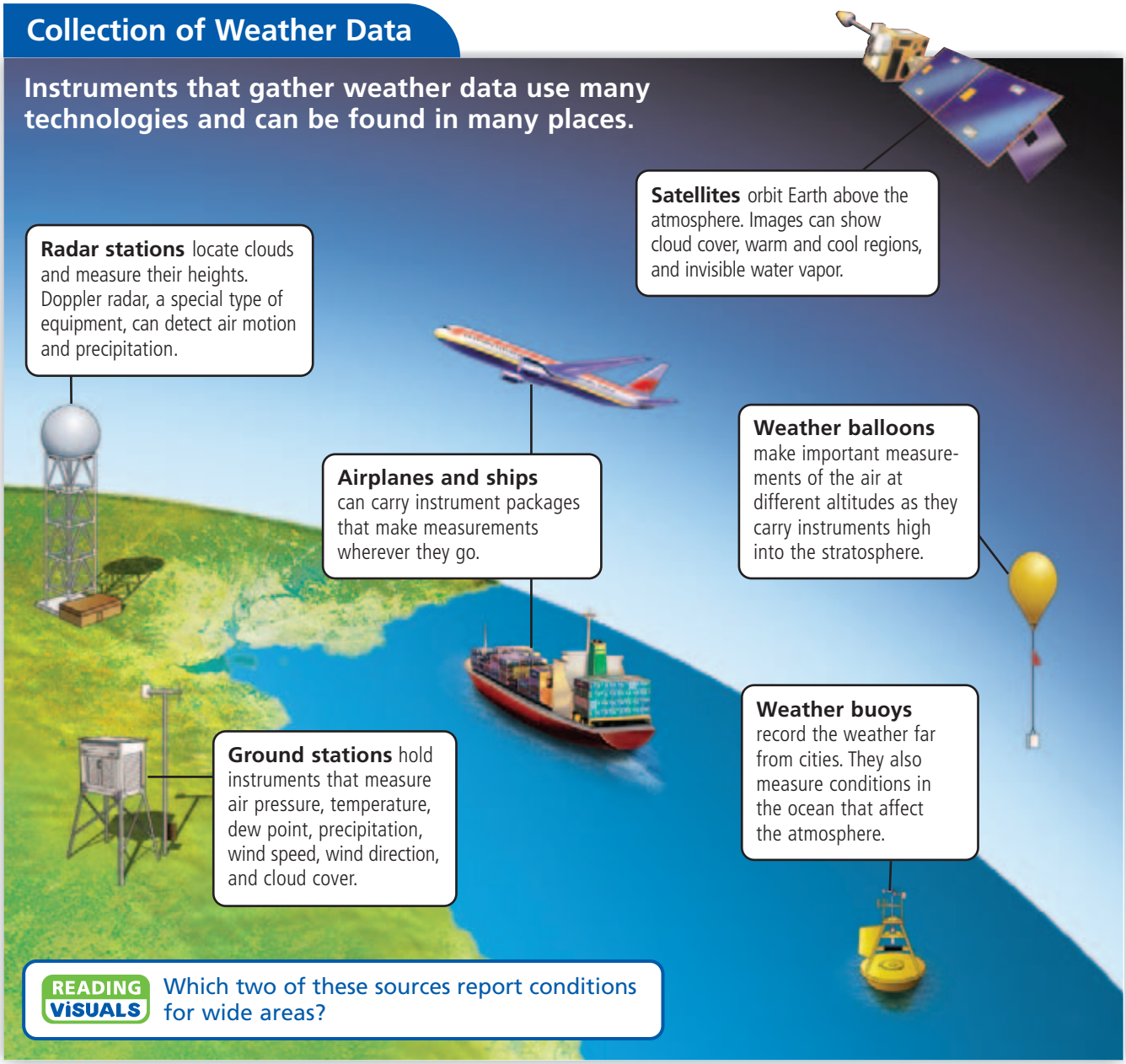
In order to predict the weather, meteorologists look at past and current conditions. They use many forms of technology to gather data. The illustration below shows how weather information is gathered. For example, radar stations and satellites use advanced technologies to gather data for large areas at a time.

Instruments within the atmosphere can make measurements of local weather conditions. Newer instruments can make measurements frequently and automatically and then report the results almost instantly. Instruments are placed in many ground stations on land and weather buoys at sea. Instruments can also be carried by balloons, ships, and planes. These instruments report a series of measurements along a path within the atmosphere.

RESOURCE CENTER
CLASSZONE.COM
Learn more about weather forecasting and your local weather.

Collection of Weather Data

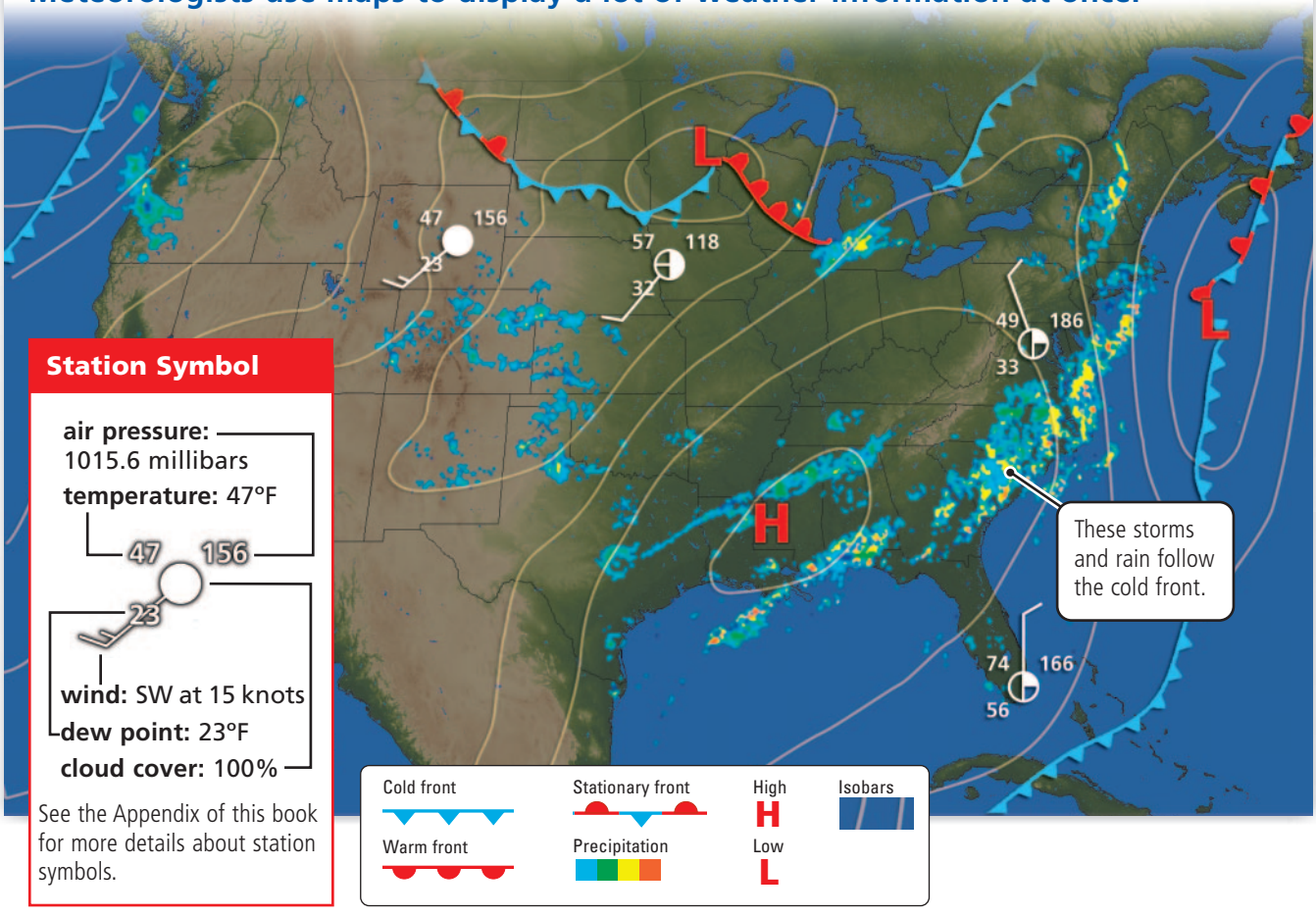
Instruments that gather weather data use many technologies and can be found in many places.



READING VISUALS Which two of these sources report conditions for wide areas?

Information on a Weather Map

Meteorologists use maps to display a lot of weather information at once.



Weather data can be displayed on maps.

MAIN IDEA WEB
Add to your notebook information about weather data.

Automatic measurements from many sources constantly pour in to the National Oceanic and Atmospheric Administration. Scientists use computers to record and use the enormous amount of data gathered. One way to make the information easier to understand is to show it on maps. A single map can show many different types of data together to give a more complete picture of the weather. The map above combines information from ground stations with Doppler radar measurements of precipitation.

- Precipitation is shown as patches of blue, green, yellow, and red. The colors indicate the amounts of rain or other precipitation.
- Station symbols on the map show data from ground stations. Only a few stations are shown.
- Symbols showing fronts and pressure patterns are added to the map to make the overall weather patterns easier to see.

CHECK YOUR READING How is information from Doppler radar shown?

Computer programs are used to combine information from many ground stations. The resulting calculations give the highs, lows, and fronts that are marked on the map. The cold front near the East Coast has triangles to show that the front is moving eastward. This cold front produced the heavy rain that is visible in the Doppler radar data.

Air Pressure on Weather Maps

The map below shows conditions from the same date as the map on page 596. Thin lines represent air pressure. An **isobar** (EYE-suh-BAHR) is a line that connects places that have the same air pressure. Each isobar represents a different air pressure value. All the isobars together, combined with the symbols for highs and lows, show the patterns of air pressure that produce weather systems.

READING TiP

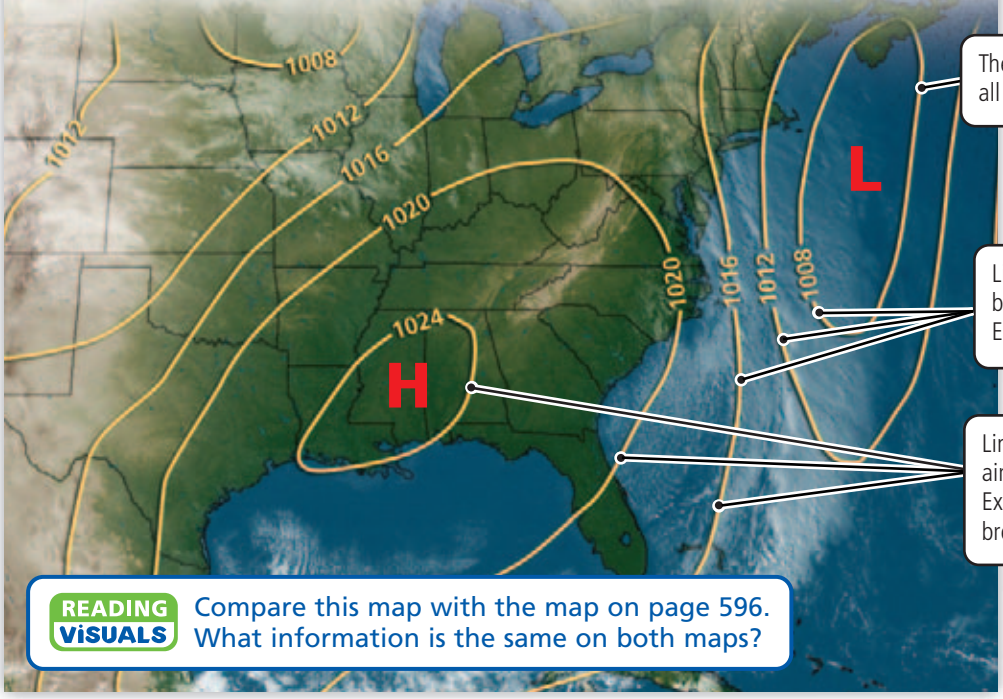
Iso- means "equal," and *bar* means "pressure."

Each isobar is labeled with the air pressure for that whole line in units called millibars (MIHL-uh-BAHRZ). A lower number means a lower air pressure. As you read earlier, differences in pressure cause air to move. Meteorologists use isobars to understand air motion.

Sometimes air-pressure measurements are listed in inches of mercury. This unit comes from an old type of barometer that measures how high the air pressure pushes a column of mercury, a liquid metal. Computer-controlled instruments are used more often today, but the measurements may be converted to inches of mercury.

Understanding Isobars

Isobars show pressure patterns, which determine winds.



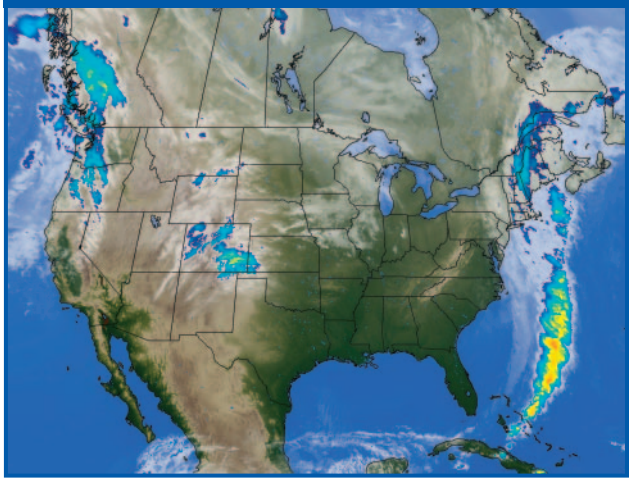
READING VISUALS Compare this map with the map on page 596. What information is the same on both maps?

Satellite Images

Visible Light

This visible-light satellite image shows clouds from above. The patches of white are clouds.

Infrared Radiation



This infrared satellite image also shows clouds, but uses colors to show where there are tall clouds.

READING VISUALS Find a location on these maps and the map on page 596. What were the weather conditions?

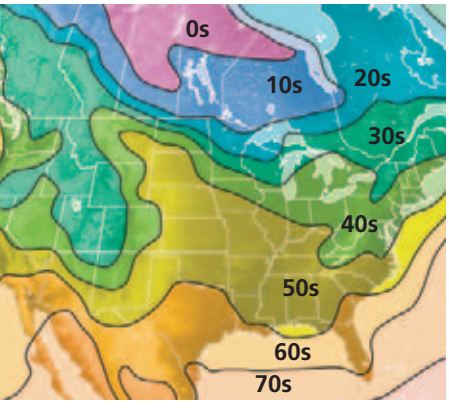
Satellite Images and Special Maps

Satellites take different types of images from space. Some images record the visible light that reflects off clouds and Earth's surface. Clouds and snow-covered land look white in sunlight. Unfortunately, visible-light images do not show much at night.

Another type of image shows infrared radiation given off by the warm surface and cooler clouds. These infrared images can show cloud patterns even at night because objects with different temperatures show up differently. Air temperatures change with altitude, so infrared images also show which clouds are low and which are high or tall. You can see in the maps above how visible and infrared satellite images show similar clouds but different details. Outlines of the states have been added to make the images easier to understand.

Data from ground stations and other sources can be used to make other types of maps. The map at left shows the pattern of temperatures on the same date as the images above and the map on page 596. Other maps may show winds or amounts of pollution. A map can be made to show any type of measurement or weather prediction. Different types of maps are often used together to give a more complete picture of the current weather.

The colors on this map represent different ranges of temperature (°F).



CHECK YOUR READING Why would a weather report show more than one map?

Forecasters use computer models to predict weather.

Instruments can only measure the current weather conditions. Most people want to know what the weather will be like in the future.

Forecasters can make some predictions from their own observations. If they see cirrus clouds above and high stratus clouds to the west, they might infer that a warm front is approaching. They would predict weather typical for a warm front—more clouds, then rain, and eventually warmer weather. If they also have information from other places, the forecasters might be able to tell where the warm front is already and how fast it is moving. They might be able to predict how soon it will arrive and even how warm the weather will be after the front passes.

Forecasters use maps and satellite images to communicate weather conditions and predictions.

Computers have become an important tool for forecasting weather. When weather stations send in data, computers can create maps right away. Computer models combine many types of data to forecast what might happen next. Different computer models give different types of forecasts. Scientists study the computer forecasts, then apply their knowledge and experience to make weather predictions.

Forecasting the weather is complicated. As a result, some forecasts are more dependable than others. The farther in advance a forecast is made, the more time there is for small differences between the predicted and the actual weather to add up. For this reason, short-range forecasts—up to three days in advance—are the most accurate. Forecasts of fast-changing weather, such as severe storms, are less accurate far in advance. It is best to watch for new predictions close to the time the storm is forecast.

17.4 Review

KEY CONCEPTS

1. List three of the sources of weather data.
2. What does a map with isobars show?
3. How do meteorologists use computers?

CRITICAL THINKING

4. **Draw Conclusions** Why do meteorologists not combine all their weather information into one map?
5. **Analyze** How is the information from radar and satellites different from the information from ground stations?

CHALLENGE

6. **Apply** Suppose you are planning an afternoon picnic a week in advance. Fair weather is forecast for that day, but a storm is expected that night. What will you do? Explain your reasoning.