

### Terms to Learn

thermometer      wind vane  
barometer      anemometer  
windsock      isobars

### What You'll Do

- ◆ Describe the different types of instruments used to take weather measurements.
- ◆ Explain how to interpret a weather map.
- ◆ Explain why weather maps are useful.

## Forecasting the Weather

Have you ever left your house in the morning wearing a short-sleeved shirt, only to need a sweater in the afternoon? At some time in your life, you have been caught off guard by the weather. Weather affects how you dress and your daily plans, so it is important that you get accurate weather forecasts. A *weather forecast* is a prediction of weather conditions over the next 3 to 5 days. Meteorologists observe and collect data on current weather conditions in order to provide reliable predictions. In this section you will learn about some of the methods used to collect weather data and how those data are displayed.

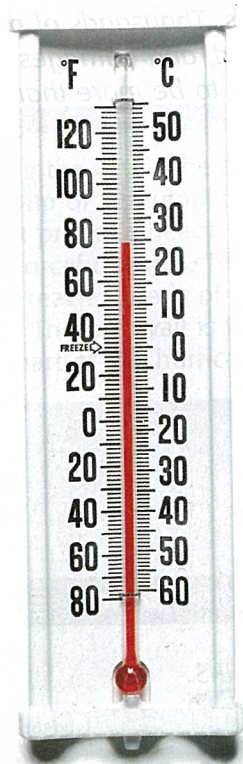


### Weather Forecasting Technology

In order for meteorologists to accurately forecast the weather, they need to measure various atmospheric conditions, such as air pressure, humidity, precipitation, temperature, wind speed, and wind direction. Meteorologists use special instruments to collect data on weather conditions both near and far above the Earth's surface. You have already learned about two tools that meteorologists use near the Earth's surface—psychrometers, which are used to measure relative humidity, and rain gauges, which are used to measure precipitation. Read on to learn about other methods meteorologists use to collect data.

**Measuring Air Temperature** A **thermometer** is a tool used to measure air temperature. A common type of thermometer uses a liquid sealed in a narrow glass tube, as shown in **Figure 26**. When air temperature increases, the liquid expands and moves up the glass tube. As air temperature decreases, the liquid shrinks and moves down the tube.

Air temperature is measured in both degrees Celsius and degrees Fahrenheit. In the United States, television weather forecasters generally report air temperature in degrees Fahrenheit.

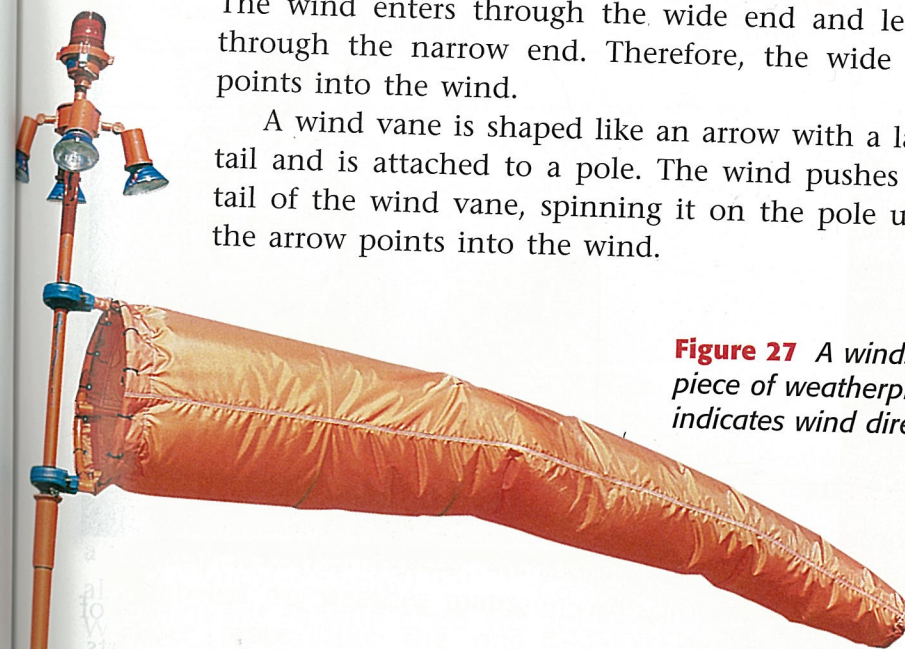


**Figure 26** A liquid thermometer is usually filled with alcohol that is colored red, or mercury, which is silver.

**Measuring Air Pressure** A **barometer** is an instrument used to measure air pressure. The mercurial barometer provides the most accurate method of measuring air pressure. A mercurial barometer consists of a glass tube sealed at one end that is placed in a container full of mercury. The air pressure pushes on the mercury inside the container, causing the mercury to move up the glass tube. The greater the air pressure is, the higher the mercury will rise.

**Measuring Wind Direction** Wind direction can be measured using a **windsock** or a **wind vane**. A windsock, as shown in **Figure 27**, is a cone-shaped cloth bag open at both ends. The wind enters through the wide end and leaves through the narrow end. Therefore, the wide end points into the wind.

A wind vane is shaped like an arrow with a large tail and is attached to a pole. The wind pushes the tail of the wind vane, spinning it on the pole until the arrow points into the wind.



**Figure 27** A windsock is a cone-shaped piece of weatherproof material that indicates wind direction.

**Measuring Wind Speed** Wind speed is measured by a device called an **anemometer**. An anemometer, as shown in **Figure 28**, consists of three or four cups connected by spokes to a pole. The wind pushes on the hollow sides of the cups, causing them to rotate on the pole. The motion sends a weak electrical current that is measured and displayed on a dial.

**Measuring Weather in the Upper Atmosphere** You have learned how weather conditions are recorded near the Earth's surface. But in order for meteorologists to better understand weather patterns, they must collect data from higher altitudes. Studying weather at higher altitudes requires the use of more-sophisticated equipment.

**Figure 28** The faster the wind speed is, the faster the cups of the anemometer spin.





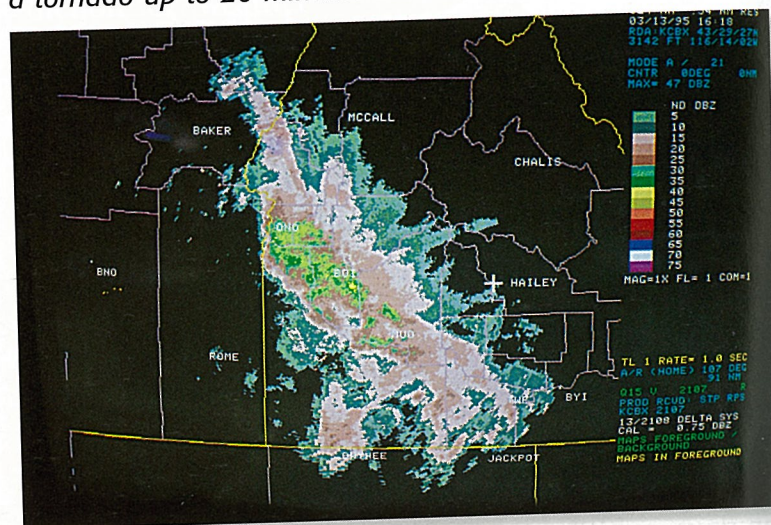


**Figure 29** Weather balloons carry radio transmitters that send measurements to stations on the ground.

**Eyes in the Sky** Weather balloons carry electronic equipment that can measure weather conditions as high as 30 km above the Earth's surface. Weather balloons, such as the one in **Figure 29**, carry equipment that measures temperature, air pressure, and relative humidity.

Radar is used to find the location, movement, and intensity of precipitation. It can also detect what form of precipitation a weather system is carrying. You might be familiar with a type of radar called Doppler radar. **Figure 30** shows how Doppler radar is used to track precipitation.

**Figure 30** Using Doppler radar, meteorologists can predict a tornado up to 20 minutes before it touches the ground.



## Activity

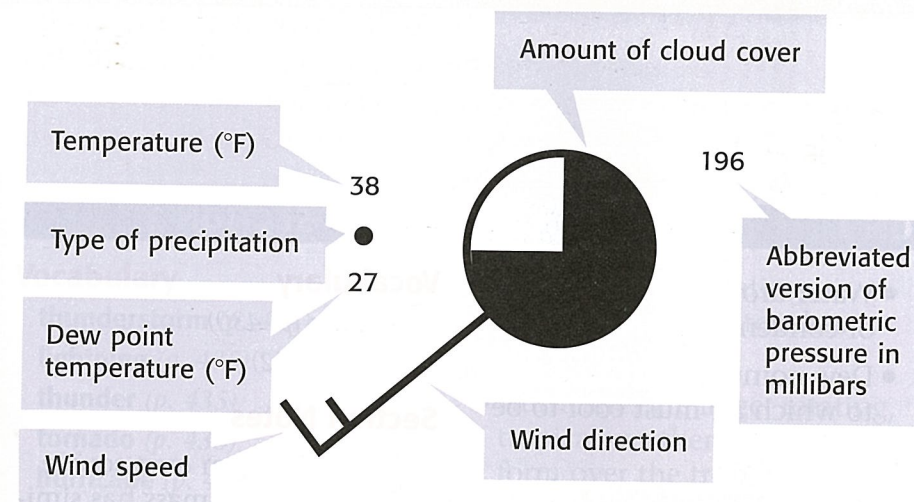
Throughout history, people have predicted approaching weather by interpreting natural signs. Animals and plants are usually more sensitive to changes in the atmosphere, such as air pressure, humidity, and temperature, than humans. To find out more about natural signs, research this topic at the library or on the Internet. Try searching using key words and phrases such as "weather and animals" or "weather and plants." Write a short paper on your findings to share with the class.

Try at Home

## Weather Maps

Weather satellites orbiting the Earth provide the images of the swirling clouds you can see on television weather reports. Satellites can measure wind speeds, humidity, and the temperatures at various altitudes.

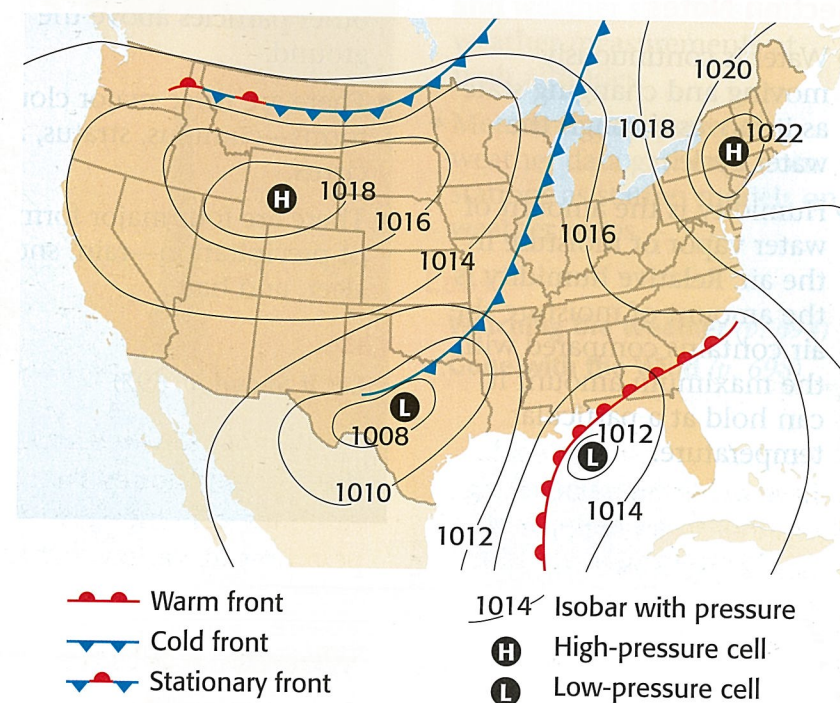
As you have learned, meteorologists base their forecasts on information gathered from many sources. In the United States, the National Weather Service (NWS) and the National Oceanic and Atmospheric Administration (NOAA) collect and analyze weather data. The NWS produces weather maps based on information gathered from about 1,000 weather stations across the United States. On these maps, each station is represented by a station model. A *station model*, as shown in **Figure 31**, is a small circle, which shows the location of the weather station, with a set of symbols and numbers surrounding it, which represent the weather data.



**Figure 31** Weather conditions at a station are represented by symbols.

**Under Pressure** Weather maps also include lines called isobars. Isobars are similar to contour lines on a topographical map, except **isobars** are lines that connect points of equal air pressure rather than equal elevation. Isobar lines that form closed circles represent areas of high or low pressure. These areas are usually marked on a map with a capital *H* or *L*. Fronts are also labeled on weather maps. Weather maps, like the one shown in **Figure 32**, provide useful information for making accurate weather forecasts.

**Figure 32** Can you identify the different fronts on the weather map?



## REVIEW

1. What are three methods meteorologists use to collect weather data?
2. What are weather maps based on?
3. What does a station model represent?
4. **Inferring Conclusions** Why would a meteorologist compare a new weather map with one 24 hours old?

internetconnect

SCILINKS  
NSTA

TOPIC: Forecasting the Weather  
GO TO: [www.scilinks.org](http://www.scilinks.org)  
sciLINKS NUMBER: HSTE395

