Science Benchmark: 04:02

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Shared Reading

Weather

How do you decide what to wear each morning? Do look outdoors and see what the *atmosphere* is doing? Do you look for clouds, rain or snow? Have you ever watched a *meteorologist* on television to see if he/she will predict rain or good weather for your birthday party? If you have, you are not alone.

A Meteorologist

People have studied weather for thousands of years to help them grow crops, plan trips and make accurate forecasts. Sometimes even our safety depends on knowing the weather. Consider this story:

It was 12:15 p.m. on August 11, 1999. Fourth grade students at Rosamond Elementary School in West Jordan Utah went outdoors to observe the weather for their school's Web site. Today's report would be different. a strange *phenomenon* was about to occur. The air temperature was 21° Celsius (70° F) under very windy conditions. Looking to the west, the students noticed dark clouds over Herriman, Utah.

They took two pictures of the dark clouds. The students returned to class and entered their information into the computer. An hour later, the students were shocked to hear that a thunderstorm and a tornado had struck downtown Salt Lake City causing much damage. As they watched the news, they realized the storm had begun over Herriman at about 12:00 p.m. Their pictures showed the beginning of the thunderstorm that formed the tornado.

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atmosphere: air around Earth
meteorologist: a scientist who studies weather
phenomenon: an unusual event or fact that can be seen or sensed

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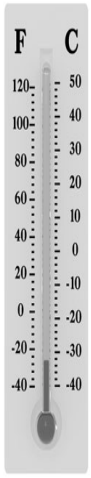
Cirrus Clouds **Stratus Clouds** **Cumulus Clouds**

Clouds are an important *component* of weather. When water evaporates from Earth's surface it turns into water vapor in the atmosphere. Clouds form when the temperature of the air gets cooler. the water vapor condenses on dust particles into tiny water droplets.

There are three main types of clouds: *cirrus, stratus, and cumulus.* Each of these cloud types is found with different types of weather. Cirrus clouds often appear when there is going to be a change in the weather. Stratus clouds are often gray and usually signal rainy weather. Cumulus clouds are called "fair weather" clouds because they appear on nice days. Sometimes cumulus clouds can grow into huge clouds that cause thunderstorms. Look at the pictures above and see if you recognize the three types of clouds.



A thermometer showing both Fahrenheit and Celsius degrees

Meteorologists measure the basic components of weather so they can predict what the weather will be. They measure *air temperature, wind speed, precipitation,* and *air pressure.* Let's think about each of these basic components.

Air temperature is measured using a *thermometer.* Two types of thermometers May be used. A metric thermometer measures in degrees Celsius. Room temperature Is about 20° Celsius. The Fahrenheit thermometer measures temperature in degrees Fahrenheit. Room temperature is about 70° F. Scientists use Celsius to measure temperature. Sudden changes in temperature help meteorologists predict what the Weather will be in the near future.

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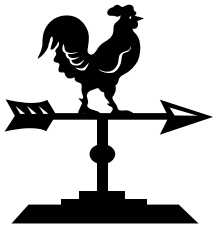
air pressure: the weight of air on Earth's surface
air temperature: how hot or cold it is
cirrus: thin, wispy clouds
component: a part of something
cumulus: thick, puffy clouds
precipitation: water that falls from clouds in the form of rain, snow hail, or sleet
stratus: layered clouds
thermometer: device used to measure temperature
wind speed: how fast the air is moving

Wind direction is defined by the direction from which the wind is coming. Weather vanes (sometimes called wind vanes) are the most common devices used to find wind direction. Perhaps you have seen weather vanes on top of barns. They point in the direction from which the wind is coming. Another way to find wind direction is to stand with your face toward the wind. If the wind is in your face and you are facing south, the wind is a south wind. Knowing from which direction the wind is coming can help predict what kind of storm to expect.



A weather vane shows the direction from which the wind is coming

Wind speed is measured by instruments that are moved by the wind. Below are different tools to measure wind speed. Strong winds often tell us there is a change in the atmosphere. Typically in Utah, a strong south wind in the autumn, winter and spring tells us that a storm may be approaching, bringing colder temperatures.

Anemometer

Wind meter

Flag waving in the wind

We like to know how much precipitation we get from storms. We measure precipitation in inches with a *rain gauge*. By putting a straight-sided cup outside with the side marked in ¼ inches, we can tell how many inches (or part of an inch) it rains during storms. If it snows, a ruler can be used to measure the snow in inches. Usually, in Utah, the amount of rainfall in our valleys varies from 1/8 of an inch to one inch per storm. The amount of snowfall will vary from one inch to 12 inches. The mountains will get much more rain or snow than the Valleys. Measuring rainfall and snowfall tells us how big a storm is Compared to other storms of the past. You may even remember a big Snowstorm when snow was measured in feet, not inches!

Rain Gauge

Rain gauge: a container set outside to measure the amount of precipitation during a storm

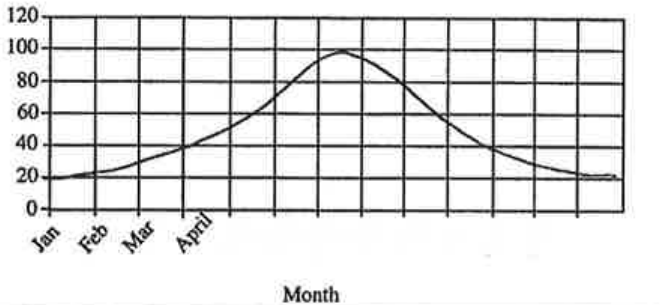
Air pressure can be hard to understand. One reason is because air is invisible most of the time. You need to remember that air takes up space, moves as wind, and has a measureable temperature. prove to yourself that air is a substance by fanning your face with your hand. What you feel on your cheek is air. Air comes in handy for us. We fill our lungs, tires, school balls, and balloons with air.

Since air above Earth is several miles thick, it is heaviest near the surface. The bottom layer of air, closest to Earth's surface, is like being the bottom person under a pile of people. While the bottom person feels everyone's weight, the people near the top don't feel as much weight. Therefore, the air closest to Earth has greater air pressure because of the weight of the air on top of it. We don't notice the weight because we are used to it.

Air pressure changes in the atmosphere. We don't notice it because the change is too small. But even the slightest change in air pressure affects our weather. A *barometer* is used to measure air pressure changes. If the air pressure is less than usual, it is called a low. A low pressure usually brings a storm. If the air pressure is greater than usual, it is called a high. High air pressure often brings clear skies. Barometers help us forecast what the weather will be in the next few days.

Measuring the air helps us compare mild weather to *severe* weather. Meteorologists have collected weather information for many years and know what weather is *seasonal*. Generally, we get high temperatures, some wind, rain, and lightning during the summer. Weather can be beautiful to watch and listen to. Occasionally during the summer huge thunderclouds bring in strong winds, huge lightning bolts, larger-sized hail, and a lot of rain. The wind may uproot trees and blow off roofs. Lightning can strike trees and houses. Sometimes fires are started. Hail can strip trees and crops of their leaves, pits cars, and ruins shingles on roofs. Rain can cause flash flooding that damages homes, yards, crops and roads. Weather that is hotter or colder, or more wet or dry than usual can have a big effect on people. Some years, farmers lose their crops because of *freezing* air temperatures. Other times farmers may lose their crops because it is too hot and there has not been enough rain. Fortunately, these weather phenomena do not happen very often.

Over the years as meteorologists have Recorded weather data, they have noticed patterns. You probably recognize this pattern:



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barometer: instrument that measures the air pressure
freezing: temperatures at or below 0° C or 32° F
seasonal: normal for the time of year
severe: harsh or unusual

We could make a similar graph for rainfall. During what month do you think Utah receives the most rainfall? This rhyme might help: April showers bring May flowers. It's true!

Weather Phenomenon

1

2

3

Picture 1 – Tornado
Picture 2 – Blizzard
Picture 3 – Drought

Part of a meteorologist's job is to make *forecasts.* A meteorologist notes all the weather information available. By looking at patterns and past weather conditions, a forecast is made. The people who watch the forecast hope it is *accurate.* People make plans according to the forecast. Sometimes a meteorologist's forecast is wrong! For example, cirrus clouds, winds from the south, rising temperatures and a low air pressure usually come before a storm in Utah. But sometimes at the last minute, the storm takes a different path and misses us. Meteorologists do not like these types of storms. They make people who cancel plans to be outdoors feel frustrated about the forecast.

People sometimes make forecasts based on non-scientific evidence, such as how their knees or other body joints feel. Sometimes they are right, but most of the time, knees are not accurate scientific tools.

In this unit you will be doing weather-related activities. You will use some of the weather tools meteorologists use.
Then you will write down the information you collect. By using these tools and observing weather patterns, you can make weather predictions just as a meteorologist does. The way you will always be prepared for what the weather brings. Won't you look smart having an umbrella with you on the only rainy day of the week?

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accurate: correct
forecasts: predictions

Science Language that Students Should Know and Use

1. **accurate:** correct
2. **air pressure:** the weight of air on Earth's surface
3. **air temperature:** how hot or cold it is
4. **atmosphere:** at around Earth
5. **barometer:** an instrument that measures air pressure
6. **cirrus:** thin, wispy clouds
7. **component:** a part of something
8. **cumulus:** thick, puffy clouds
9. **freezing:** temperatures at or below 0°C or 32°F
10. **forecast:** predictions
11. **meteorologist:** a scientist who studies weather
12. **phenomenon:** an unusual event or fact that can be seen or sensed
13. **precipitation:** water that falls from clouds in the form or rain, snow, hail or sleet
14. **rain gauge:** a container set outside to measure the amount of precipitation during a storm.
15. **severe:** harsh or unusual
16. **seasonal:** normal for the time of the year
17. **stratus:** layered clouds
18. **thermometer:** device used to measure temperature
19. **wind speed:** how fast the air is moving